### **RESOLUTION 44 OF 2021**

## RESOLUTION OF THE COMMON COUNCIL OF THE CITY OF KINGSTON, NEW YORK, RECOMMENDING APPROVAL FOR 2021 A BUDGETARY AMENDMENT IN THE SHADE TREE ACCOUNT TO REPLACE A STREET TREE ALONGSIDE OF ST. JOSEPH'S CHURCH

Sponsored By: Finance/Audit Committee: Alderman Scott-Childress, Tallerman, Davis, Hirsch, Schabot

WHEREAS, the Planning Department has requested a transfer in the amount of \$3,675.00 to cover the cost of replacing a street tree alongside of St. Joseph's Church and;

WHEREAS, the Finance/Audit Committee has received, reviewed and approved this request.

# NOW, THEREFORE, BE IT RESOLVED BY THE COMMON COUNCIL OF THE CITY OF KINGSTON, NEW YORK, AS FOLLOWS:

**SECTION 1-** That the following sums be transferred as follows:

TO:	A1.8560.5472	Expenditure Budget Line	e \$3,675.00
FROM:	A1.8560.4268	0 Revenue Budget Line	\$3,675.00

**SECTION 2-** That this resolution shall take place immediately

Submitted to the Mayor this \_\_\_\_\_ day of

Approved by the Mayor this \_\_\_\_\_ day of

\_\_\_\_\_, 2021

\_\_\_\_\_, 2021

Elisa Tinti, City Clerk

Steven T. Noble, Mayor

Adopted by Council on	,	2021

### FINANCE AND AUDIT COMMITTEE REPORT

		REOUEST I	ESCRIPTION		
	INTERNAL TRANSFER AUTHORIZATION CLAIMS	CONTINGENCY BUDGET MODI ZONING	TRANSFER FICATION _ X	TRANSFER BONDING REQU OTHER	Jest
	DEPARTMENT: Planning (St	nade Tree)	DATE: 2-24-21		
	Description: Authorize FY 2021 Budd	et Amendmeri	t as follows:		
	INCREASE Expenditure Budge CREATE Revenue Budge	t line Al	1 8560 5472 Бу 8560 42680 Бу	¤3,675,00 ≈3,675,00	
	Estimated Financial Impact: \$ Signature				
Μ	otion by				
Sę	conded by		<b>Committee</b>	Vote	YES NO
Ac	ction Required:	-			
			Reynolds Scott Childre Chairman	ss, Ward 3,	
SE( Typ Typ	QRA Decision: De I Action De II Action		Don Tallerman, W	/ard 5	
Neo	native Degleration of Device and a set		Anthony Davis, W	/ard 6	
Cor	ditioned Negative Declaration of Environmental Signific	ance:			
Sac	k Lead A comment Status		Michele Hirsch, W	/ard 9	
Dee	the Decker in the status:				
ros	uve Declaration of Environmental Signification	nce:	Steven Schabot, W	ard 8	

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CITY OF KINGSTON Kingston Planning (F+A)

planning@kingston-ny.gov

Suzanne Cahill, Planning Director Kyla Dedea, Assistant Planner



Steven T. Noble, Mayor

February 24, 2021

Ald. At Large Andrea Shaut, President City of Kingston Common Council City Hall – 420 Broadway Kingston, New York 12401

Re: FY 2021 Budget Amendment - Shade Trees A1-8560

Dear Pre. Shaut:

Unfortunately, in late 2020, a street tree alongside of St. Joseph's Church was damaged by a private vehicle. The City pursued and has just recently recouped an insurance payment to cover the costs of replacing the damaged tree. The work has been bid out and we anticipate that it will be completed by mid-May. The following FY 2021 Budget modification is requested to provide for acceptance of the payment and then expenditure to replace the tree.

INCREASE EXPENDITURE BUDGET LINE A18560 5472 (Shade Trees - Contracted Expenses) by \$3,675.00 ADD REVENUE BUDGET LINE A18560 42680 (Shade Trees – Insurance Recovery) by \$3,675.00

If there are any questions, please do not hesitate to contact our office to discuss.

Be well and stay safe.

Sincerely,

Bryanne Cahill

Suzanne Cahill Planning Director

CC: S. Noble, Mayor Ald. R. Scott-Childress, W3 Chairman F&A J. Tuey, Comptroller

### **RESOLUTION 45 OF 2021**

## RESOLUTION OF THE COMMON COUNCIL OF THE CITY OF KINGSTON, NEW YORK, RECOMMENDING APPROVAL FOR A 2021 BUDGETARY TRANSFER IN THE DEPARTMENT OF PUBLIC WORKS FROM CONTINGENCY IN THE AMOUNT OF \$10,770.00 TO COVER THE COST OF UNFORESEEN RETIREMENT PAYOUT FOR A DPW EMPLOYEE

Sponsored By:

Finance/Audit Committee: Alderman Scott-Childress, Tallerman, Davis, Hirsch, Schabot

WHEREAS, the Department of Public Works has requested a transfer from contingency in the amount of \$10,770.00 to cover the cost of unforeseen retirement of a DPW employee, and;

WHEREAS, the Finance/Audit Committee has received, reviewed and approved this request.

## NOW, THEREFORE, BE IT RESOLVED BY THE COMMON COUNCIL OF THE CITY OF KINGSTON, NEW YORK, AS FOLLOWS:

**SECTION 1-** That the following sums be transferred as follows:

FROM:	A1.1990.14.5404	Contingency	\$10,770.00

**TO:** A1.8160.11.5105 Retirement Accumulation \$10,770.00

**SECTION 2-** That this resolution shall take place immediately

Submitted to the Mayor this \_\_\_\_\_ day of

Approved by the Mayor this \_\_\_\_\_ day of

\_\_\_\_\_, 2021

, 2021

Elisa Tinti, City Clerk

Steven T. Noble, Mayor

Adopted by Council on \_\_\_\_\_, 2021

#### FINANCE AND AUDIT COMMITTEE REPORT

#### REQUEST DESCRIPTION

INTERNAL TRANSFER \_\_\_\_\_ AUTHORIZATION \_\_\_\_\_ CLAIMS \_\_\_\_\_ CONTINGENCY TRANSFER × BUDGET MODIFICATION \_\_\_\_\_ ZONING

TRANSFER BONDING REQUEST \_\_\_\_ OTHER \_\_\_\_

DEPARTMENT: Public Works	DATE: 2/12/2021
Description:	
\$10,770.00 FROM A1199014.5404	1 Contingency
\$10,770.00 TO A1816011.5105 Re	etirement Accumulation
Estimated Financial Impact: \$10,770.6 Signature	Queller

Motion by

Seconded	by	
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Action Required:

SEQRA Decision: Type I Action Type II Action Unlisted Action

Negative Declaration of Environmental Significance:

Conditioned Negative Declaration:

Seek Lead Agency Status:

Positive Declaration of Environmental Significance:

Committee Vote	YES	NO
Reynolds Scott Childress, Ward 3, Chairman		
Don Tallerman, Ward 5		
Anthony Davis, Ward 6		
Michele Hirsch, Ward 9		
Steven Schabot, Ward 8		

#### Tinti, Elisa

From:Shaut, AndreaSent:Monday, February 15, 2021 1:20 PMTo:Topple, Maureen; Scott-Childress, Reynolds; Tinti, ElisaCc:Tuey, John; Norman, EdwardSubject:RE: Contingency Transfer

Thank you, Maureen. I'm assuming there is no rush, and this can go through to our next Finance & Audit meeting in March, and full council 4/6.

F+A

Elisa - can you please include the below communication in my folder?

Thank you! Andrea

From: Topple, Maureen Sent: Friday, February 12, 2021 2:17 PM To: Shaut, Andrea <ashaut@kingston-ny.gov>; Scott-Childress, Reynolds <rscott-childress@kingston-ny.gov> Cc: Tuey, John <jtuey@kingston-ny.gov>; Norman, Edward <enorman@kingston-ny.gov> Subject: Contingency Transfer

Good Afternoon President Shaut,

Attached you will find a Finance & Audit Committee Report for a contingency transfer for the Department of Public Works.

This transfer will cover the cost of an unforeseen retirement payout for a DPW employee. We respectfully request this be submitted to the Council for review.

Thank you.

Kind Regards,

Maureen K. Topple

Principal Account Clerk City of Kingston Dept. of Public Works 25 East O'Reilly Street Kingston, NY 12401 845/331-0682, ext. 1980 845/331-0295 fax

P Go Green! Print this email only when necessary. Thank you for helping the City of Kingston be environmentally responsible.

#### **RESOLUTION 46 OF 2021**

RESOLUTION OF THE COMMON COUNCIL OF THE CITY OF KINGSTON, NEW YORK, RECOMMENDING APPROVAL FOR A 2021 BUDGETARY TRANSFER IN THE DEPARTMENT OF PUBLIC WORKS FROM CONTINGENCY IN THE AMOUNT OF \$33,100.00 TO COVER THE COST OF UNFORESEEN RETIREMENT PAYOUTS OF TWO PARKS MAINTENANCE EMPLOYEES

> Sponsored By: Finance/Audit Committee: Alderman Scott-Childress, Tallerman, Davis, Hirsch, Schabot

**WHEREAS**, the Department of Public Works has requested a transfer from contingency in the amount of \$33,100.00 to cover the cost of unforeseen retirement payout of two Parks Maintenance employees, and;

**WHEREAS**, the Finance/Audit Committee has received, reviewed and approved this request.

## NOW, THEREFORE, BE IT RESOLVED BY THE COMMON COUNCIL OF THE CITY OF KINGSTON, NEW YORK, AS FOLLOWS:

**SECTION 1-** That the following sums be transferred as follows:

FROM:	A1.1990.14.5404	Contingency	\$33,100.00
TO:	A1.7110.11.5105	Retirement Accumulation	\$33,100.00

**SECTION 2-** That this resolution shall take place immediately

Submitted to the Mayor this day of	Approved by the Mayor this day of
, 2021	, 2021
Elisa Tinti, City Clerk	Steven T. Noble, Mayor

Adopted by Council on \_\_\_\_\_, 2021

#### FINANCE AND AUDIT COMMITTEE REPORT

#### **REQUEST DESCRIPTION**

INTERNAL TRANSFER \_\_\_\_\_ AUTHORIZATION \_\_\_\_ CLAIMS \_\_\_\_\_ CONTINGENCY TRANSFER × BUDGET MODIFICATION \_\_\_\_\_\_ ZONING \_\_\_\_\_ TRANSFER \_\_\_\_\_ BONDING REQUEST \_\_ OTHER

DEPARTMENT: Public Works/Park

DATE: 02/24/2021

Description: \$33,100.00 FROM A1199014.5404 Contingency

\$33,100.00 TO A1711011.5105 Retirement Accumulation

Estimated Financial Impact: \$33100.00 Signature

Motion by\_\_\_\_\_

Seconded by

Action Required:

SEQRA Decision: Type I Action Type II Action Unlisted Action

Negative Declaration of Environmental Significance:

Conditioned Negative Declaration:

Seek Lead Agency Status: \_\_\_\_

Positive Declaration of Environmental Significance:

Committee Vote	YES	NO
Reynolds Scott Childress, Ward 3, Chairman		
Don Tallerman, Ward 5		
Anthony Davis, Ward 6		
Michele Hirsch, Ward 9		
Steven Schabot, Ward 8		

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<u>\*</u>

#### Tinti, Elisa

From:	Topple, Maureen
Sent:	Wednesday, February 24, 2021 2:52 PM
To:	Shaut, Andrea; Scott-Childress, Reynolds
Cc:	Tuey, John; Norman, Edward; Tinti, Elisa
Subject:	Contingency Transfer
Attachments:	2.24.21 Contingency Transfer Parks Maintenance.pdf

Good Afternoon President Shaut,

Attached you will find a Finance & Audit Committee Report for a contingency transfer for the Department of Public Works Parks Maintenance Division.

This transfer will cover the cost of two unforeseen retirement payouts for Parks Maintenance employees.

Apologies for not including this on the 2.12 transfer request, but we were not made aware of these until after the previous request was submitted.

We respectfully request this go through March's Finance & Audit meeting, and be submitted to Council for review on 4/6.

Thank you.

Kind Regards,

Maureen K. Topple

Principal Account Clerk City of Kingston Dept. of Public Works 25 East O'Reilly Street Kingston, NY 12401 845/331-0682, ext. 1980 845/331-0295 fax

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m Go\ Green!\ Print\ this\ email\ only\ when\ necessary.\ Thank\ you\ for\ helping\ the\ City\ of\ Kingston\ be\ environmentally\ responsible.}$ 

#### **RESOLUTION 47 OF 2021**

### RESOLUTION OF THE COMMON COUNCIL OF THE CITY OF KINGSTON, NEW YORK, RECOMMENDING APPROVAL FOR A 2020 GENERAL FUND TRANSFER IN THE AMOUNT OF \$181,389.00 TO BALANCE ACCOUNTS

Sponsored By:

Finance/Audit Committee: Alderman Scott-Childress, Tallerman, Davis, Hirsch, Schabot

**WHEREAS**, the Comptroller's Department has requested a transfer in the amount of \$181,389.00

WHEREAS, the Finance/Audit Committee has received, reviewed and approved this request.

## NOW, THEREFORE, BE IT RESOLVED BY THE COMMON COUNCIL OF THE CITY OF KINGSTON, NEW YORK, AS FOLLOWS:

**SECTION 1-** That the following sums be transferred as follows:

FROM:	A1.3.3410.18.5821	Hospital & Medical	\$25,369.00
	A1.8.8160.18.5821	Hospital & Medical	\$28,342.00
	A1.3.3311.18.5821	Hospital & Medical	\$29,730.00
	A1.1.1410.18.5821	Hospital & Medical	34,364.00
	A1.7.7110.18.5821	Hospital & Medical	\$37,430.00
	A1.5.5110.18.5821	Hospital & Medical	\$26,154.00
TO:	A1.1.1430.18.5822	Dental Insurance	\$2,176.00
	A1.3.3320.18.5822	Dental Insurance	\$90.00
	A1.4.4010.185822	Dental Insurance	\$4.00
	A1.5.5132.18.5822	Dental Insurance	\$3,494.00
	A1.6.6990.18.5822	Dental Insurance	\$255.00
	A1.9.9060.18.5822	Dental Insurance	\$87.00
	A1.1.1130.18.5821	Hospital & Medical	\$18.00

A1.1.1330.18.5821	Hospital & Medical	\$440.00
A1.1.1420.18.5821	Hospital & Medical	\$10,445.00
A1.4.4020.18.5821	Hospital & Medical	\$1,073.00
A1.8.8161.18.5821	Hospital & Medical	\$26,016.00
A1.5.5630.18.5812	NYS Retirement	\$26,528.00
A1.1.1345.18.5812	NYS Retirement	\$147.00
A1.1.1420.18.5812	NYS Retirement	\$1,116.00
A1.1.1621.18.5812	NYS Retirement	\$3,332.00
A1.3.3310.18.5812	NYS Retirement	\$2,502.00
A1.3.3410.18.5812	NYS Retirement	\$5,479.00
A1.5.5651.18.5812	NYS Retirement	\$326.00
A1.7.7110.18.5812	NYS Retirement	\$608.00
A1.7.7140.18.5812	NYS Retirement	\$454.00
A1.7.7141.18.5812	NYS Retirement	\$1,753.00
A1.7.7143.18.5812	NYS Retirement	\$746.00
A1.7.7180.18.5812	NYS Retirement	\$2,070.00
A1.8.8170.18.5812	NYS Retirement	\$29,594.00
A1.1.1440.18.5826	Optical Insurance	\$69.00
A1.1.1650.18.5826	Optical Insurance	\$123.00
A1.3.3320.18.5826	Optical Insurance	\$104.00
A1.3.3620.18.5826	Optical Insurance	\$33.00
A1.4.4020.18.5826	Optical Insurance	\$15.00
A1.7.7020.18.5826	Optical Insurance	\$30.00
A1.7.7141.18.5826	Optical Insurance	\$57.00
A1.8.8020.18.5826	Optical Insurance	\$226.00
A1.9.9050.18.5850	Unemployment Insurance	e \$61,979.00

A1.1.1330.18.5821	Hospital & Medical	\$440.00
A1.1.1420.18.5821	Hospital & Medical	\$10,445.00
A1.4.4020.18.5821	Hospital & Medical	\$1,073.00
A1.8.8161.18.5821	Hospital & Medical	\$26,016.00
A1.5.5630.18.5812	NYS Retirement	\$26,528.00
A1.1.1345.18.5812	NYS Retirement	\$147.00
A1.1.1420.18.5812	NYS Retirement	\$1,116.00
A1.1.1621.18.5812	NYS Retirement	\$3,332.00
A1.3.3310.18.5812	NYS Retirement	\$2,502.00
A1.3.3410.18.5812	NYS Retirement	\$5,479.00
A1.5.5651.18.5812	NYS Retirement	\$326.00
A1.7.7110.18.5812	NYS Retirement	\$608.00
A1.7.7140.18.5812	NYS Retirement	\$454.00
A1.7.7141.18.5812	NYS Retirement	\$1,753.00
A1.7.7143.18.5812	NYS Retirement	\$746.00
A1.7.7180.18.5812	NYS Retirement	\$2,070.00
A1.8.8170.18.5812	NYS Retirement	\$29,594.00
A1.1.1440.18.5826	Optical Insurance	\$69.00
A1.1.1650.18.5826	Optical Insurance	\$123.00
A1.3.3320.18.5826	Optical Insurance	\$104.00
A1.3.3620.18.5826	Optical Insurance	\$33.00
A1.4.4020.18.5826	Optical Insurance	\$15.00
A1.7.7020.18.5826	Optical Insurance	\$30.00
A1.7.7141.18.5826	Optical Insurance	\$57.00
A1.8.8020.18.5826	Optical Insurance	\$226.00
A1.9.9050.18.5850	Unemployment Insurance	e \$61,979.00

**SECTION 2-** That this resolution shall take place immediately

Submitted to the Mayor this day of	Approved by the Mayor this day of
, 2021	, 2021
Elisa Tinti, City Clerk	Steven T. Noble, Mayor
Adopted by Council on	, 2021

#### FINANCE AND AUDIT COMMITTEE REPORT

REQUEST DESCRIPTION				
INTERNAL TRANSFER AUTHORIZATION CLAIMS	CONTINGENCY TRANSFER BUDGET MODIFICATIONX ZONING	TRANSFER BONDING REQUEST OTHER		
DEPARTMENT: COmptol	DATE: A AYIA			
Description:	,			
Request approval of 2020 General Fund employee benefit transfers totaling \$181,389 to balance the accounts for the year. There is no financial impact from these transfers.				
Estimated Financial Impact: \$ 0 Signature				
Motion by				
Seconded by	Committ	$\frac{\mathbf{YES}}{\mathbf{NO}}$		
Action Required:				
	Reynolds Scott Ch Chairr	nildress, Ward 3, man		
SEQRA Decision: Type I Action Type II Action	Don Tallerma	an, Ward 5		
Unlisted Action	Anthony Dav	vis, Ward 6		
Negative Declaration of Environmental Significance:				
Conditioned Negative Declaration:	Michele Hirs	ch, Ward 9		
Seek Lead Agency Status:				
Positive Declaration of Environmental Signific	sance: Steven Schab	pot, Ward 8		

то:	
A1 -1-1430-18-5822 -	DENTAL INSURANCE
A1 -3-3320-18-5822 -	DENTAL INSURANCE
A1 -4-4010 <b>-18-5822</b> -	DENTAL INSURANCE
A1 -5-5132-18-5822 -	DENTAL INSURANCE
A1 -6-6990-18-5822 -	DENTAL INSURANCE
A1 -9-9060-18-5822 -	DENTAL INSURANCE
A1 -1-1130-18-5821 -	HOSPITAL & MEDICAL
A1 -1-1330-18-5821 -	HOSPITAL & MEDICAL
A1 -1-1420-18-5821 -	HOSPITAL & MEDICAL
A1 -4-4020-18-5821 -	HOSPITAL & MEDICAL
A1 -8-8161-18-5821 -	HOSPITAL & MEDICAL
A1 -5-5630-18-5812 -	N.Y.S. RETIREMENT
A1 -1-1345-18-5812 -	NYS RETIREMENT
A1 -1-1420-18-5812 -	NYS RETIREMENT
A1 -1-1621-18-5812 -	NYS RETIREMENT
A1 -3-3310-18-5812 -	NYS RETIREMENT
A1 -3-3410-18-5812 -	NYS RETIREMENT
A1 -5-5651-18-5812 -	NYS RETIREMENT
A1 -7-7110-18-5812 -	NYS RETIREMENT
A1 -7-7140-18-5812 -	NYS RETIREMENT
A1 -7-7141-18-5812 -	NYS RETIREMENT
A1 -7-7143-18-5812 -	NYS RETIREMENT
A1 -7-7180-18-5812 -	NYS RETIREMENT
A1 -8-8170 <b>-18-5</b> 812 -	NYS RETIRÉMENT
A1 -1-1440-18-5826 -	OPTICAL INSURANCE
A1 -1-1650-18-5826 -	OPTICAL INSURANCE
A1 -3-3320-18-5826 -	OPTICAL INSURANCE
A1 -3-3620-18-5826 -	OPTICAL INSURANCE
A1 -4-4020-18-5826 -	OPTICAL INSURANCE
A1 -7-7020-18-5826 -	OPTICAL INSURANCE

OPTICAL INSURANCE

OPTICAL INSURANCE

UNEMPLOYMENT INSURANCE

ACCOUNT DESCRIPTION

#### FROM:

A1 -7-71**41-18-5826** -

A1 -8-8020-18-5826 -

A1 -9-9050-18-5850 -

A1 -3-3410-18-5821 -	HOSPITAL & MEDICAL	25,369
A1 -8-8160-18-5821 -	HOSPITAL & MEDICAL	28,342
A1 -3-3311-18-5821 -	HOSPITAL & MEDICAL	29,730
A1 -1-1410-18-5821 -	HOSPITAL & MEDICAL	34,364
A1 -7-7110-18-5821 -	HOSPITAL & MEDICAL	37,430
A1 -5-5110-18-5821 -	HOSPITAL & MEDICAL	26,154
		181,389

AMOUNT

2,176

3,494

255

87

18

440

10,445

1,073

26,016

26,528

147

1,116

3,332

2,502

5,479

326

608

454

746

2,070

29,594

69

123

104

33

15 30

57

226

61,979 181,389

1,753

90

4

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ACCOUNT

## **CITY OF KINGSTON** Office of the Comptroller

comptroller@kingston-ny.gov

John Tuey, Comptroller



Steven T. Noble, Mayor

February 24, 2021

Alderman At Large Andrea Shaut, President City of Kingston Common council City Hall, 420 Broadway Kingston, NY 12401

RE: General Fund Employee Benefit Year End Budgetary Transfers

Dear President Shaut,

I am submitting the attached 2020 budgetary transfers for the City's General Fund Employee Benefits so that I may balance the accounts on a year to date basis. There is no overall financial impact from these transfers.

Respectfully John R. Tuey, CPA

Comptroller, City of Kingston

#### **RESOLUTION 48 OF 2021**

### RESOLUTION OF THE COMMON COUNCIL OF THE CITY OF KINGSTON, NEW YORK, RECOMMENDING APPROVAL FOR A 2020 TRANSFER IN THE SEWER FUND IN THE AMOUNT OF \$68,003.00 TO BALANCE ACCOUNTS

Sponsored By:

Finance/Audit Committee: Alderman Scott-Childress, Tallerman, Davis, Hirsch, Schabot

**WHEREAS**, the Comptroller's Department has requested a transfer in the amount of \$68,003.00 to balance the accounts in the Sewer Fund employee benefits, and;

WHEREAS, the Finance/Audit Committee has received, reviewed and approved this request.

## NOW, THEREFORE, BE IT RESOLVED BY THE COMMON COUNCIL OF THE CITY OF KINGSTON, NEW YORK, AS FOLLOWS:

**SECTION 1-** That the following sums be transferred as follows:

FROM:	G1.8.8120.18.5821	Hospital & Medical	\$68,003.00
TO:	G1.9.9060.18.5821	Hospital & Medical	\$46,221.00
	G1.9.9060.18.5823	Med. Reimbursement	\$20,352.00
	G1.8.8120.18.5822	Dental Ins.	\$1,236.00
	G1.8.8110.11.5811	Social Security	\$186.00
	G1.8.8110.18.5826	Optical Ins.	\$8.00

**SECTION 2-** That this resolution shall take place immediately

Submitted to the Mayor this \_\_\_\_\_ day of

Approved by the Mayor this \_\_\_\_\_ day of , 2021

\_\_\_\_\_, 2021

Steven T. Noble, Mayor

Elisa Tinti, City Clerk

Adopted by Council on \_\_\_\_\_, 2021

#### FINANCE AND AUDIT COMMITTEE REPORT

REQUEST DESCRIPTION					
INTERNAL TRANSFER AUTHORIZATION CLAIMS	CONTINGENCY TRANSFER BUDGET MODIFICATIONX ZONING	TRANSFER BONDING REQUEST OTHER			
DEPARTMENT: Comptoller	DATE: 2/24(2)				
Description:	Description:				
Request approval of 2020 Sewer Fund employee benefit transfers totaling \$68,003 to balance the accounts for the year. There is no financial impact from these transfers.					
Estimated Financial Impact: \$ 0 Signature					
Motion by					
Seconded by	Commit	tee Vote <u>YES</u> <u>NO</u>			
Action Required:					
	Reynolds Scott C Chai	hildress, Ward 3, rman			
SEQRA Decision:	Don Tallern	nan, Ward 5			
Type I Action Type II Action					
Unlisted Action	Anthony Da	ivis, Ward 6			
Negative Declaration of Environmental Significance:					
Conditioned Negative Declaration:	Michele Hir	sch, Ward 9			
Seek Lead Agency Status:					
Positive Declaration of Environmental Signifi	cance: Steven Scha	ibot, Ward 8			

ACCOUNT	ACCOUNT DESCRIPTION	AMOUNT
TO:		
G1 -9-9060-18-5821 -	HOSPITAL & MEDICAL	46,221
G1 -9-9060-18-5823 -	MEDICARE REIMBURSEMENT	20,352
G1 -8-8120-18-5822 -	DENTAL INSURANCE	1,236
G1 -8-8110-11-5811 -	SOCIAL SECURITY	186
G1 -8-8110-18-5826 -	OPTICAL INSURANCE	8
		68,003
FROM:		
G1 -8-8120-18-5821 -	HOSPITAL & MEDICAL	68,003
# CITY OF KINGSTON

Office of the Comptroller

comptroller@kingston-ny.gov

John Tucy, Comptroller



Steven T. Noble, Mayor

February 24, 2021

Alderman At Large Andrea Shaut, President City of Kingston Common council City Hall, 420 Broadway Kingston, NY 12401

RE: Sewer Fund Employee Benefit Year End Budgetary Transfers

Dear President Shaut,

I am submitting the attached 2020 budgetary transfers for the City's Sewer Fund Employee Benefits so that I may balance the accounts on a year to date basis. There is no overall financial impact from these transfers.

Respectfully,

John R. Tuey, CPA Comptroller, City of Kingston

#### **RESOLUTION 49 OF 2021**

#### **Ordinance: NYStretch Code**

## ORDINANCE OF THE COMMON COUNCIL OF THE CITY OF KINGSTON, NEW YORK, RECOMMENDING APPROVAL OF THE NYSTRETCH CODE AS PER ATTACHED

Sponsored By:

Laws & Rules Committee: Alderman Ventura Morell, Scott-Childress, Tallerman, Hirsch, O'Reilly

WHEREAS, the City of Kingston seeks to protect and promote the public health, safety, and welfare of its residents by mandating energy efficient building standards; and

WHEREAS, on May 12<sup>th</sup>, 2020 the 2020 Energy Conservation Construction Code of New York State (ECCCNYS), updated by the New York State Fire Prevention and Building Code Council, became effective and must be complied with for residential and commercial buildings; and

WHEREAS, pursuant to NY Energy Law § 11-109, the City of Kingston is authorized to adopt energy standards that are more efficient that those provided in 2020 ECCCNYS in order to ensure reduced energy costs for its residents and businesses; and

WHEREAS, in order to prevent a statewide patchwork of more efficient energy codes, the New York State Energy Research and Development Authority (NYSERDA) developed the NYStretch Energy Code – 2020 (NYStretch); and

WHEREAS, in 2019, the New York State Energy Research and Development Authority (NYSERDA) developed and published the NYStretch Energy Code 2020, a more energy efficient building code than the 2020 ECCCNYS; and

WHEREAS, this proposed amendment seeks to modify the City Code to adopt NYStretch and to enact more energy efficient regulations as they relate to new or substantially renovated buildings.

WHEREAS, a stretch energy code is an energy code that is a more energy efficient Code than the minimum base energy code that can be voluntarily adopted by local jurisdictions; and

WHEREAS, NYStretch is a model stretch code that will be ten to twelve percent (10-12 %) more efficient than the minimum requirements of the base energy code, the 2020 Energy Conservation Construction Code of New York State (2020 ECCCNYS); and therefore, be it

**SECTION I. BE IT HEREBY RESOLVED,** that the Common Council of the City of Kingston is declared Lead Agency for the purposes of environmental review with respect to the proposed resolution, in accordance with Article 8 of the Environmental Conservation\_Law of the State of New York, and the regulations promulgated thereunder at 6 NYCRR 617 (collectively, "SEQRA"); and

**RESOLVED,** that the Common Council of the City of Kingston, as Lead Agency, hereby finds that the proposed action meets the criteria of a "Type II Action" under SEQRA; and

**RESOLVED,** that the Common Council hereby adopts the annexed Short Form Environmental Impact Statement, now, therefore; and

**SECTION II BE IT HEREBY RESOLVED,** that Chapter 172-3 "Definitions" be amended to replace the current definition of "Energy Code" with the following:

"The NYStretch Energy Code – 2020, as currently in effect and as hereafter amended from time to time, provided that those sections of the 2020 Energy Conservation Construction Code of New York State not amended by NYStretch Code shall continue in full force and effect.

**SECTION III** The proposed local law is enacted pursuant to New York Energy Law §11-109(1), and Municipal Home Rule Law §10 and in accordance with the procedures detailed in Municipal Home Rule § 20.

**SECTION IV** If any section or subdivision, paragraph, clause, phrase of this law shall be adjudged invalid or held unconstitutional by any court of competent jurisdiction, any judgment made thereby shall not affect the validity of this law as a whole or any part thereof other than the part or provision so adjudged to be invalid or unconstitutional.

**SECTION V** This ordinance shall take effect upon filing with the Secretary of State within 30 days of adoption and publication as provided by New State Law, pursuant to New York Energy Law §11-109(1) and the Municipal Home Rule Law.

**<u>SECTION VI</u>** All ordinances and parts thereof inconsistent herewith are hereby appealed.

**<u>SECTION VII</u>** This ordinance shall take effect immediately after passage, approval and publication as provided.

Submitted to the Mayor this \_\_\_\_\_ day of

\_\_\_\_\_, 2021

Approved by the Mayor this \_\_\_\_\_ day of

\_\_\_\_\_, 2021

Elisa Tinti, City Clerk

Steven T. Noble, Mayor

Adopted by Council on \_\_\_\_\_, 2021

r

## Short Environmental Assessment Form Part 1 - Project Information

#### Instructions for Completing

Part 1 – Project Information. The applicant or project sponsor is responsible for the completion of Part 1. Responses become part of the application for approval or funding, are subject to public review, and may be subject to further verification. Complete Part 1 based on information currently available. If additional research or investigation would be needed to fully respond to any item, please answer as thoroughly as possible based on current information.

Complete all items in Part 1. You may also provide any additional information which you believe will be needed by or useful to the lead agency; attach additional pages as necessary to supplement any item.

Part 1 – Project and Sponsor Information		
Name of Action or Project:		
City of Kingston NYStretch Energy Code-2020 Adoption		
Project Location (describe, and attach a location map):		
City of Kingston, NY		
Brief Description of Proposed Action:		
The proposal is for the City of Kingston to adopt the NYStretch Energy Code-2020 by amend 172-3 with the following: "The NYStretch Energy Code – 2020, as currently in effect and as h sections of the 2020 Energy Conservation Construction Code of New York State not amende	ing the definition of Energy C ereafter amended from time t d by NYStretch Code shall cc	ode in City Code Chapter o time, provided that those ontinue in full force and effect.
Name of Applicant or Sponsor:	Telephone: 845-481-733	9
Julie Noble, Sustainability Coordinator, City of Kingston	E-Mail: julielnoble@kings	ston-ny.gov
Address:		
467 Broadway		
City/PO:	State:	Zip Code:
	NY	12401
<ol> <li>Does the proposed action only involve the legislative adoption of a plan, loca administrative rule, or regulation?</li> </ol>	l law, ordinance,	NO YES
If Yes, attach a narrative description of the intent of the proposed action and the e	nvironmental resources th	
may be affected in the municipality and proceed to Part 2. If no, continue to ques	tion 2.	
2. Does the proposed action require a permit, approval or funding from any other	er government Agency?	NO YES
in res, ist agency(s) hame and permit or approval:		
3. a. Total acreage of the site of the proposed action?	acres	
b. Total acreage to be physically disturbed?	acres	
or controlled by the applicant or project sponsor?	acres	
4. Check all land uses that occur on, are adjoining or near the proposed action:		
🗌 Urban 🔲 Rural (non-agriculture) 🔲 Industrial 🔲 Commercia	l 🗌 Residential (subur	ban)
Forest Agriculture Aquatic Other(Spec	ifv):	
Parkland	····	
—		

5. Is the proposed action,	NO	YES	N/A
a. A permitted use under the zoning regulations?			
b. Consistent with the adopted comprehensive plan?			
6. Is the proposed action consistent with the predominant character of the existing built or natural landscape?		NO	YES
7. Is the site of the proposed action located in, or does it adjoin, a state listed Critical Environmental Area?		NO	YES
11 Pos, Identify			
8. a. Will the proposed action result in a substantial increase in traffic above present levels?		NO	YES
b. Are public transportation services available at or near the site of the proposed action?			┢┝
c. Are any pedestrian accommodations or bicycle routes available on or near the site of the proposed action?			
9. Does the proposed action meet or exceed the state energy code requirements?		NO	YES
If the proposed action will exceed requirements, describe design features and technologies:	Ì		
10. Will the proposed action connect to an existing public/private water supply?		NO	YES
If No, describe method for providing potable water:		-	_
11. Will the proposed action connect to existing wastewater utilities?		NO	YES
If No, describe method for providing wastewater treatment:	[		
12. a. Does the project site contain, or is it substantially contiguous to, a building, archaeological site, or district which is listed on the National or State P	,	NO	YES
Commissioner of the NYS Office of Parks, Recreation and Historic Preservation to be eligible for listing on the State Register of Historic Places?	-		
b. Is the project site, or any portion of it, located in or adjacent to an area designated as sensitive for archaeological sites on the NY State Historic Preservation Office (SHPO) archaeological site inventory?			
13. a. Does any portion of the site of the proposed action, or lands adjoining the proposed action, contain wetlands or other waterbodies regulated by a federal, state or local agency?		NO	YES
b. Would the proposed action physically alter, or encroach into, any existing wetland or waterbody?	F		$\exists$
If Yes, identify the wetland or waterbody and extent of alterations in square feet or acres:			
		H.	
			5 S

14. Identify the typical habitat types that occur on, or are likely to be found on the project site. Check all that apply:		
Shoreline Forest Agricultural/grasslands Early mid-successional		
Wetland 🔲 Urban 🗆 Suburban		
15. Does the site of the proposed action contain any species of animal, or associated habitats, listed by the State or Federal government as threatened or endangered?		YES
16. Is the project site located in the 100-year flood plan?	NO	VEQ
17. Will the proposed action create storm water discharge, either from point or non-point sources? If Yes,	NO	YES
a. Will storm water discharges flow to adjacent properties?		
b. Will storm water discharges be directed to established conveyance systems (runoff and storm drains)? If Yes, briefly describe:		
18. Does the proposed action include construction or other activities that would result in the impoundment of water or other liquids (e.g., retention pond, waste lagoon, dam)?	NO	YES
If Yes, explain the purpose and size of the impoundment:		
19. Has the site of the proposed action or an adjoining property been the location of an active or closed solid waste management facility? If Yes, describe:	NO	YES
20. Has the site of the proposed action or an adjoining property been the subject of remediation (ongoing or completed) for hazardous waste?	NO	YES
I CERTIFY THAT THE INFORMATION PROVIDED ABOVE IS TRUE AND ACCURATE TO THE BE MY KNOWLEDGE	EST OF	
Applicant/spansor/name: Julie L. Noble Date: 3/16/2021		
Signature: Julie Dildle		
0		

Agency Use Only [If applicable]

Project: Date:

## Short Environmental Assessment Form Part 2 - Impact Assessment

#### Part 2 is to be completed by the Lead Agency.

Answer all of the following questions in Part 2 using the information contained in Part 1 and other materials submitted by the project sponsor or otherwise available to the reviewer. When answering the questions the reviewer should be guided by the concept "Have my responses been reasonable considering the scale and context of the proposed action?"

		No, or small impact may occur	Moderate to large impact may occur
1.	Will the proposed action create a material conflict with an adopted land use plan or zoning regulations?	~	
2.	Will the proposed action result in a change in the use or intensity of use of land?	~	
3.	Will the proposed action impair the character or quality of the existing community?	~	
4.	Will the proposed action have an impact on the environmental characteristics that caused the establishment of a Critical Environmental Area (CEA)?		
5.	Will the proposed action result in an adverse change in the existing level of traffic or affect existing infrastructure for mass transit, biking or walkway?	~	
6.	Will the proposed action cause an increase in the use of energy and it fails to incorporate reasonably available energy conservation or renewable energy opportunities?	~	
7.	Will the proposed action impact existing: a. public / private water supplies?	~	
	b. public / private wastewater treatment utilities?		
8.	Will the proposed action impair the character or quality of important historic, archaeological, architectural or aesthetic resources?		
9.	Will the proposed action result in an adverse change to natural resources (e.g., wetlands, waterbodies, groundwater, air quality, flora and fauna)?	~	
10,	Will the proposed action result in an increase in the potential for erosion, flooding or drainage problems?		
11.	Will the proposed action create a hazard to environmental resources or human health?	V	

Agen	cy Use Omy [11 appricable]
Project:	
Date:	

## Short Environmental Assessment Form Part 3 Determination of Significance

For every question in Part 2 that was answered "moderate to large impact may occur", or if there is a need to explain why a particular element of the proposed action may or will not result in a significant adverse environmental impact, please complete Part 3. Part 3 should, in sufficient detail, identify the impact, including any measures or design elements that have been included by the project sponsor to avoid or reduce impacts. Part 3 should also explain how the lead agency determined that the impact may or will not be significant. Each potential impact should be assessed considering its setting, probability of occurring, duration, irreversibility, geographic scope and magnitude. Also consider the potential for short-term, long-term and cumulative impacts.

Check this box if you have determined, based on the information and analysis above, and any supporting documentation, that the proposed action may result in one or more potentially large or significant adverse impacts and an environmental impact statement is required.											
Check this box if you have determined, based on the info that the proposed action will not result in any significant	rmation and analysis above, and any supporting documentation, adverse environmental impacts.										
Common Council of the City of Kingston	3/16/2021										
Name of Lead Agency	Date										
Print or Type Name of Responsible Officer in Lead Agency	Title of Responsible Officer										
Signature of Responsible Officer in Lead Agency	Signature of Preparer (if different from Responsible Officer)										

LAW COMMI	'S & RULES TTEE REPORT	
DEPARTMENT: Description: <u>Resolution to ado</u> <u>per strached</u> .	DATE: <u>3-17-21</u> at WY Stratch Cod	r 02
Motion by <u>RSC</u> Seconded by <u>MH</u> Action Required:	Committee Vote	YES NO
Motion by <u>PSC</u> Seconded by <u>MH</u> Action Required: SEQRA Decision: Type I Action Unlisted Action	Committee Vote Jeffrey Venfura Morell, Chairman Patrick O'Reilly Ward 7 Rennie Scott-Childress, Ward 3	YES NO
Motion by       Respective Declaration of Environmental Significance:         Seconded by       M H         Action Required:          SEQRA Decision:          Type I Action          Vulsted Action	Committee Vote Jeffrey Ventura Morell, Chairman Patrick O'Reilly Ward 7 Rennie Scott-Childress, Ward 3 Don Tallerman, Ward 5	YES NO

X

# NYStretch Energy Code–2020



## NYSERDA



The NYStretch Energy Code–2020 (NYStretch) is a voluntary, readily adoptable energy code that calls for higher efficiency standards in new and renovated building construction projects.

When buildings are built above and beyond the minimum code requirements of the 2020 Energy Conservation Construction Code of New York State (ECCCNYS), they can make meaningful strides in mitigating climate change. The efforts pay off—buildings that are built to NYStretch requirements save **10–12%** in energy costs over those built to the 2020 ECCCNYS. Those energy cost savings will pay back the additional cost of construction in less than 10 years.

# NYStretch Energy Code-2020

## What are the benefits?

Save money and energy: Use less energy and reduce living and operational costs for your constituents with lower utility bills and better building envelopes.

NEW YORK

IE OF ORTUNITY NYSERDA

- Help the environment: Reduce your greenhouse gas emissions and reliance on fossil fuels.
- Boost the local economy: Develop your existing workforce, build expertise in newer technologies, and create more green jobs.
- Improve community growth: Increase community attractiveness and property values as more home and business owners are looking for green and energy-efficient buildings.
- Increase property values: Encourage the use of NYStretch locally so future occupants (renters, tenants, and owners) of new and renovated buildings that meet this code will benefit from the long-term energy and cost savings.

## Where does NYStretch go beyond the 2020 ECCCNYS?

- Building envelope: Improved insulation and window performance, air barrier commissioning, air leakage testing, and mandatory mechanical ventilation
- **Lighting:** Reduced interior and exterior lighting power and lighting controls
- Electrical: Whole-building energy monitoring
- Compatibility: Renewable and electric vehicle readiness

### What resources are available?

- Code Manual: NYSERDA provides a single-volume code manual that aids in consistent interpretation among code officials and offers reliable standards.
- **Template Legislation:** A NYStretch Adoption Guide with a resolution/legislation template is available to help facilitate local adoption of NYStretch.
- NYStretch Training for Code Officials, Architects, and Builders
- Updated RESCheck<sup>™</sup> and COMCheck<sup>™</sup> tools
- FAQs Document

# For assistance with adoption, contact NYSERDA's outreach coordinators at <u>nyserda.ny.gov/cec-coordinators</u>.

Learn more and access resources at nyserda.ny.gov/stretchenergy2020.

# 2020 NYStretch Energy Code Commercial Cost Effectiveness Analysis

Final Report | Report Number 19-34 | July 2019



# NYSERDA's Promise to New Yorkers:

NYSERDA provides resources, expertise, and objective information so New Yorkers can make confident, informed energy decisions.

## **Mission Statement:**

Advance innovative energy solutions in ways that improve New York's economy and environment.

## Vision Statement:

Serve as a catalyst – advancing energy innovation, technology, and investment; transforming New York's economy; and empowering people to choose clean and efficient energy as part of their everyday lives.

# 2020 NYStretch Energy Code Commercial Cost Effectiveness Analysis

Final Report

Prepared for:

#### New York State Energy Research and Development Authority

Albany, NY

Marilyn Dare Senior Project Manager

Prepared by:

Vidaris, Inc.

New York, NY

NYSERDA Report 19-34

NYSERDA Contract 137652

## Notice

This report was prepared by Vidaris Inc. in the course of performing work contracted for and sponsored by the New York State Energy Research and Development Authority (hereafter "NYSERDA"). The opinions expressed in this report do not necessarily reflect those of NYSERDA or the State of New York, and reference to any specific product, service, process, or method does not constitute an implied or expressed recommendation or endorsement of it. Further, NYSERDA, the State of New York, and the contractor make no warranties or representations, expressed or implied, as to the fitness for particular purpose or merchantability of any product, apparatus, or service, or the usefulness, completeness, or accuracy of any processes, methods, or other information contained, described, disclosed, or referred to in this report. NYSERDA, the State of New York, and the contractor make no representation that the use of any product, apparatus, process, method, or other information will not infringe privately owned rights and will assume no liability for any loss, injury, or damage resulting from, or occurring in connection with, the use of information contained, described, disclosed, or referred to in this report.

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Information contained in this document, such as web page addresses, are current at the time of publication.

## Abstract

This report summarizes the energy savings and cost-effectiveness analysis of the commercial provisions of the 2020 NYStretch Energy Code of New York State. For this study, cost effectiveness means comparing the annual energy cost and first costs of complying with NYStretch versus the commercial provisions of the 2020 ECCC NYS to determine the incremental cost of design and construction as compared to the annual energy cost savings. NYStretch includes overlays of both the 2018 IECC and ASHRAE 90.1-2016. This analysis is limited to the overlay of ASHRAE 90.1-2016. The report includes the methodology used in the analysis, assumptions, and results at the applicable climate design zones for New York State.

# Keywords

Energy code, stretch energy code, cost effectiveness, NYSERDA

# **Table of Contents**

Notice		
Abstra	act	
Keywo	ords	
Definit	tions	iv
Summa	ary	S-1
1 Co	ost Effectiveness Study	1
1.1	Background	
1.2	Energy Analysis Results	
1.3	Cost-Effectiveness Analysis	
Appen	dix A	A-1
Appen	dix B	B-1
Appen	dix C	C-1
Appen	dix D. Cost Estimates	D-1

# **List of Tables**

. 1
. 3
. 4
. 4
. 5
. 6
. 7
. 8

# Definitions

- Climate Zones: The three climate zones of New York State: 4A, 5A, and 6A. For purposes of these analyses, the weather files used are New York City (CZ 4A), Buffalo (CZ 5A), and Watertown (CZ 6A).
- **Prototypes:** Prototypes developed by the Department of Energy for modeling purposes for the following building types: Large Office, Stand-alone Retail, Secondary School, Large Hotel, Full-Service Restaurant, Outpatient Healthcare, Warehouse, 10-Story High-Rise Apartment, and 20-Story High-Rise Apartment. The 10- and 20-Story High-Rise Apartment prototypes were developed by PNNL based on New York City building permit data for multifamily buildings for use in the NYStretch Code analysis.
- **2020 Energy Conservation Construction Code of New York State (2020 ECCC NYS):** An energy code based on the *2018 International Energy Conservation Code*, published by the International Code Council and subsequently modified by New York State.

## Summary

With guidance from a 25-member advisory group composed of public and private stakeholders, the New York State Energy Research and Development Authority (NYSERDA) developed the NYStretch Energy Code-2020 (draft dated January 2019) (NYStretch) as a voluntary, locally adoptable stretch energy code. It is intended that NYStretch will overlay the 2020 Energy Conservation Construction Code of New York State (2020 ECCC NYS) resulting in an energy code that is roughly 7% more efficient than the commercial provisions of ASHRAE 90.1-2016.

To assist communities in adopting NYStretch, NYSERDA contracted Vidaris to provide a costeffectiveness analysis of the commercial provisions of NYStretch. For this study, cost effectiveness means comparing the annual energy cost and first costs of complying with NYStretch versus the 2020 ECCC NYS to determine the incremental cost of design and construction as compared to the annual energy cost savings. NYStretch includes overlays of both the 2018 IECC and ASHRAE 90.1-2016. The analysis presented in this report is limited to the overlay of ASHRAE 90.1-2016.

The NYStretch overlay for 90.1-2016 includes a new requirement for choosing an additional set of increased efficiency requirements. For this analysis, the option for reduced lighting power was included for all buildings. A summary of results is presented in Tables ES-1 through ES-6.

The differences between ASHRAE 90.1-2016 and NYStretch vary by building type and climate zone with site energy savings ranging from 2.3 to 14%, source energy savings ranging from 3.0 to 15.3%, and energy cost savings ranging from 3.0 to 16.4%. Incremental costs range from \$0.28 to \$5.59 per square foot and simple payback ranges from 3.0 to 18.4 years.

In aggregate, this analysis indicates that versus ASHRAE 90.1-2016, the NYStretch yields savings statewide for each building in each climate zone with site energy savings of 5.4%, source energy savings of 6.7%, and energy cost savings of 7.1%. These savings are achieved with an average additional cost of \$1.14 per square foot with a 10.5-year simple payback.

### Table ES-1. Aggregate Summary of Results

	Construction	Site	Energy [kBtu/f	t2/yr]	Source	Energy [kBtu	/ft2/yr]	Energy Cost [\$/ft2]					In F	cremental First Cost	Simple Payback
Prototype	[%]	90,1-2016	NYStretch	% Savings	90 1-2016	NYStretch	% Savings	90,3	-2016	NY	NYStretch % Savings		\$/ft2		years
Large Office	8.8%	60,5	58.5	3,4%	179.5	172_4	4.0%	\$	2,26	\$	2,16	4.1%	\$	0.31	3,27
Standalone Retail	14.6%	46.2	40.9	11.6%	130.7	111.2	14.9%	\$	1,62	\$	1,36	15.8%	\$	3,39	13,25
Secondary School	9.8%	37,4	34,3	8.3%	102.7	94.3	8.2%	\$	1,26	\$	1,16	8.1%	\$	0,55	5.36
Large Hotel	7.8%	83,1	77,4	6.9%	185,6	170.4	8.2%	\$	2,13	\$	1_94	8_7%	\$	1.64	8.84
Full-Service Restaurant	0.5%	414,9	378.2	8.8%	741.0	659,6	11,0%	\$	7.65	\$	6.72	12,1%	\$	4.29	4_60
Outpatient Healthcare	5.4%	113,0	108.2	4_3%	313,2	295,2	5,7%	\$	3.86	\$	3,62	6.1%	\$	2_85	12.03
Warehouse	7,5%	21.5	18.6	13,7%	41.8	36.3	13,2%	\$	0.45	\$	0,39	12.9%	\$	0_77	13.26
10-Story High-Rise Apartment	21.9%	48 4	47_1	2.8%	96.0	93.1	3.0%	\$	1.04	\$	1.01	3.0%	\$	0_43	11.45
20-Story High-Rise Apartment	23.7%	48.5	47_4	2,4%	106.4	103.2	3,1%	\$	1.21	\$	1.17	3.4%	\$	0.47	13_50
Weighted Average	100.0%	54.1	51.2	5.4%	129.4	120.7	6.7%	s	1.52	s	1.41	7.1%	\$	1.14	10.50

	Construction	Site E	energy [kBtu/	ft2/yr]	Source	Energy [kBt	u/ft2/yr]		Energy Cost [\$/ft2]			Inc.	First Cost	Simple Payback
Prototype	Weight	90.1-2016	NYStretch	% Savings	90,1-2016	NYStretch	% Savings	90.	1-2016	NYStretc	% Savings		\$/ft2	years
Large Office	7.5%	60,0	58.0	3.4%	179.3	172.2	3.9%	\$	2.26	\$ 2.1	4.1%	\$	0.28	3.1
Standalone Retail	4.9%	44.5	39.1	12.1%	130.1	111.0	14.7%	\$	1,63	\$ 1,3	15,4%	\$	3,89	15.6
Secondary School	5.0%	37.0	33.9	8.5%	104.0	95.6	8.1%	\$	1.29	\$ 1.1	8.0%	\$	0.61	6.0
Large Hotel	3.5%	81.7	75.9	7.1%	187.4	172.2	8.1%	\$	2.17	\$ 1.9	8.5%	\$	1, 77	9.6
Full-Service Restaurant	0.1%	380.3	341_6	10,2%	717.1	629.0	12,3%	\$	7.62	\$ 6.6	13.3%	\$	5.59	5.5
Outpatient Healthcare	2.0%	111.7	106,7	4.5%	314.6	296.5	5.8%	\$	3,90	\$ 3.6	6.2%	\$	3,10	12.9
Warehouse	2.5%	17.7	15.2	14.0%	37.4	32.4	13.5%	\$	0,42	\$ 0.3	13,3%	\$	1,03	18.4
10-Story High-Rise Apartment	21.9%	48.4	47.1	2.8%	96.0	93.1	3.0%	\$	1.04	\$ 1.0	3.0%	\$	0.43	13.5
20-Story High-Rise Apartment	23.5%	48.4	47.3	2.4%	106.4	103.1	3.1%	\$	1.21	\$ 1,1	3.4%	\$	0.47	11.5
Weighted Average (CLIMATE ZONE 4A)	70.9%	51.4	49.2	4.2%	120.6	114.5	5.1%	s	1.41	\$ 1.3.	5.5%	s	0.85	11.0

## Table ES-2. Summary of Results for Climate Zone 4A

	Construction	Site E	nergy [kBtu/i	ft2/yr]	Source	Energy [kBt	ı/ft2/yr]		Energy Cost J				Inc. First Cost		Simple Payback
Prototype	Weight	90.1-2016	NYStretch	% Savings	90.1-2016	NYStretch	% Savings	90.	-2016	NYStr	etch	% Savings		\$/ft2	years
Large Office	1_0%	63.4	61.2	3.4%	180.6	173.1	4.1%	\$	2,24	\$ 2	2,15	4,3%	\$	0.47	4.8
Standalone Retail	7.1%	46,5	41,2	11.6%	129.9	110.0	15.3%	\$	1,60	\$	1.34	16.4%	\$	3,08	11.7
Secondary School	3.7%	37.7	34.6	8.1%	101.2	92.9	8.2%	\$	1.24	\$	1.13	8.3%	\$	0.43	4.3
Large Hotel	2.5%	83.3	77.7	6.8%	183.4	168.1	8.4%	\$	2.09	\$	1,90	9.0%	\$	1,55	8,3
Full-Service Restaurant	0.3%	418.0	381,9	8,6%	741.4	661.8	10.7%	\$	7.63	\$	6.72	11,9%	\$	3,90	4.3
Outpatient Healthcare	2.4%	112.9	108,2	4,2%	310.6	292.8	5.7%	\$	3.82	\$	3.58	6.2%	\$	2,70	11.5
Warehouse	3.8%	23.9	20.6	13.8%	43.9	38.2	13.0%	\$	0.46	\$	0.40	12,6%	\$	0,60	10.4
10-Story High-Rise Apartment	0.0%	54.5	52.5	3.6%	99.8	96.3	3.5%	\$	1.04	\$	1.01	3.5%	\$	0,38	10.5
20-Story High-Rise Apartment	0.1%	54.4	53.2	2.3%	112.2	103.1	8.1%	\$	1.24	\$	1.17	6.0%	\$	0,43	10.3
Weighted Average (CLIMATE ZONE 5A)	20.9%	59.1	54.2	8.2%	147.5	132.8	10.0%	s	1.76	S	1.57	10.5%	\$	1.81	9.8

### Table ES-3. Summary of Results for Climate Zone 5A

	Construction	Site I	Site Energy [kBtu/ft2/yr]			Source Energy [kBtu/ft2/yr]				Energ	y Cost	Inc. First Cost		Simple Payback		
Prototype	Weight	90,1-2016	NYStretch*	% Savings	90.1-2016	NYStretch*	% Savings	90.	1-2016	NYStretch*		% Savings		\$/ft2	years	
Large Office	0.3%	64.4	62.1	3.5%	181.7	174.1	4.2%	\$	2.25	\$	2.15	4.4%	\$	0.30	3.0	
Standalone Retail	2.6%	48.6	43.4	10,7%	133,9	115.0	14.1%	s	1.65	\$	1.40	15.1%	\$	3,27	13,2	
Secondary School	1.1%	38.2	35.0	8,3%	101.8	93.3	8,3%	\$	1,24	\$	1.14	8.3%	\$	0.65	6,3	
Large Hotel	1.8%	85.4	79.9	6.5%	185.1	170.0	8.2%	\$	2.09	\$	1.91	8,8%	\$	1,49	8.1	
Full-Service Restaurant	0,1%	439.9	403.5	8.3%	763.7	683.6	10.5%	\$	7.76	\$	6.85	11.7%	\$	4.18	4.6	
Outpatient Healthcare	1.0%	116.0	111.3	4.0%	316,4	298.6	5.6%	\$	3.88	\$	3,64	6.1%	\$	2,71	11.5	
Warehouse	1,2%	22.0	19.1	13.2%	44.2	38.3	13.4%	\$	0,48	\$	0.42	13.5%	\$	0,75	11,6	
10-Story High-Rise Apartment	0.0%	54,5	52.6	3.6%	99.8	96.2	3.5%	\$	1.04	\$	1.01	3.5%	\$	0,42	11.6	
20-Story High-Rise Apartment	0.1%	55.1	53.3	3.3%	113.0	108.7	3.8%	\$	1.25	\$	1.20	4.0%	\$	0.40	8, 1	
Weighted Average (CLIMATE ZONE 6A)	8.2%	65.0	60.2	7.4%	159.1	144.3	9.3%	\$	1.88	\$	1.70	9.9%	\$	1.96	10.5	

#### Table ES-4. Summary of Results for Climate Zone 6A

Life-cycle cost savings were calculated based on a 10- and 30-year period. The results for these analyses are in Tables ES-5 and ES-6. Over the 10-year period, the present value of the energy savings are more than the incremental costs of \$0.85/sq.ft., \$1.81/ sq.ft., and \$1.96/ sq.ft. for climate zones 4A, 5A, and 6A, respectively. Net energy savings over 10 years are \$0.18/sf in aggregate statewide.

Over the 30-year period, the net present value of the energy savings also accounts for replacement and residual value, and yields savings of \$0.52/sq.ft., \$1.57/ sq.ft., and \$1.38/ sq.ft. for climate zones 4A, 5A, and 6A, respectively. Net energy savings over 30 years are \$0.81/sf in aggregate statewide.

	Construction		Annual Energy Cost			10 Year Life Cycle Energy Cost					Inoromontol		Residual		Net Savings over 10 Years				
Prototype	Weight	90.1-2016		NYStretch		90.1-2016		NYStretch S		Savings	First Cost		Value at 10yrs		Total			\$/sf	
4A Totals	70.9%	\$	253,616	\$	242,215	\$	2,365,240	\$ 2,259,659	\$	105,581	\$	83,955	\$	25,162	\$	46,788	\$	0.11	
5A Totals	20.9%	\$	167,142	\$	154,337	\$	1,556,783	\$ 1,438,147	\$	118,636	\$	1,558,123	\$	24,902	\$	781,498.62	\$	0.37	
6A Totals	8.2%	\$	170,912	\$	157,469	\$	1,595,414	\$ 1,470,838	\$	124,576	\$	1,252,578	\$	30,782	\$	617,704	\$	0.30	
AGGREGATE VALUES	100.0%	\$	228,761	2	216,899	\$	2,133,146	\$ 2,023,280	\$	109,867	\$	88,326	\$	25,568	\$	47,109	\$	0.18	

Table ES-5. Summary of 10-year Life-Cycle Cost Analysis

Table ES-6. Summary of 30-year Life-Cycle Cost Analysis

	Construction	07		Replacement		Residual	Energy Cost	30 Year Net Present Value of Savings			
Prototype	Weights	CZ	First Cost	Costs	Maintenance	Value	Savings	S	\$/sf		
4A Totals	70.9%	4A	\$83,955	\$40,133	\$0	\$1,671	\$260,157	\$137,741	\$0.52		
5A Totals	20,9%	5A	\$94,765	\$41,112	\$0	(\$107)	\$292,323	\$156,339	\$1.57		
6A Totals	8.2%	6A	\$109,714	\$50,027	\$0	\$1,211	\$305,970	\$147,441	\$1.38		
AGGREGATE VALUES			\$88,326	\$41,149	\$0	\$1,262	\$270,636	\$142,423	\$0.81		

# 1 Cost Effectiveness Study

### 1.1 Background

The PNNL report *Final Energy Savings Analysis of the Proposed NYStretch-Energy Code 2018*, February 2019 (*PNNL-ACT-10073 Rev. 1*) presents the energy and energy cost savings for nine prototype buildings, which represent more than 73% of the projected new construction by floor-space accounted for in the full suite of 16 DOE prototypes. *PNNL-ACT-10073 Rev. 1* identifies 15 Energy Efficiency Measures (EEMS) required by the NYStretch. The PNNL analysis and report compare the provisions of the NYStretch against ASHRAE Standard 90.1-2013 to determine savings.

To determine the cost effectiveness of NYStretch relative to ASHRAE 90.1-2016, Vidaris quantified the difference in annual energy performance between NYStretch and ASHRAE 90.1-2016 using Energy Plus models for nine prototype buildings in three New York cities representing the climates zones shown in Table 1.

DOE Prototype	Climate Zone: City (Weather file)
Large Office Building	
Stand-alone Retail	
Secondary School	CZ 4A: New York (USA_NY_New .York-
Large Hotel	J.F.Kennedy.Intl.A P.744860_TMY3.epw )
Full-service Restaurant	CZ 5A: Buffalo (USA NY Buffalo-
Outpatient Healthcare	Greater.Buffalo.Intl.AP.725280_TMY3.epw)
Warehouse	CZ 6A: Watertown
10-Story High-rise Apartment	(00A_141_vvale10w1.AF.720227_11013.epw)
20-Story High-rise Apartment	

#### Table 1. Prototypes and New York Climate Zones

The cities selected for CZs 4A and 5A are the same cities used by PNNL in its most recent national analysis of ASHRAE 90.1-2016: Energy Savings Analysis: ANSI/ASHRAE/IES Standard 90.1-2016, October 2017 (PNNL 2017); namely, New York City and Buffalo, NY.

Changes to the climate zone map in ASHRAE 90.1-2016 reclassified some cities in CZ 6A to CZ 5A, including Buffalo, NY. Consequently, for CZ 5A Buffalo supplanted Albany, which had been used in previous State-specific analyses for CZ 5A. Moving Buffalo meant selecting another city for CZ 6A as PNNL 2017 used Rochester, MN to represent CZ 6A in the national analysis. Based on consultation with NYSERDA, Watertown, NY was selected to represent CZ 6A for this analysis. Weather files were downloaded directly from the DOE's EERE website for this analysis.<sup>1</sup>

Note that the cities used for this analysis are the same cities used in support of the New York State Department of State rulemaking process for adopting the 2020 ECCC NYS.

### 1.2 Energy Analysis Results

PNNL developed the EnergyPlus prototype models specifically for the NYStretch analysis done for NYSERDA. NYSERDA provided PNNL's nine prototype building types to be used by Vidaris in this analysis. Vidaris started with the NYStretch models and modified them as necessary to create the ASHRAE 90.1-2016 baseline models for each prototype appropriate to each climate zone. A list of the differences between the NYStretch and 90.1-2016 models is provided in Appendix A.

To determine the statewide savings that the NYStretch offers beyond ASHREA 90.1-2016, weighting factors for each result were applied to determine the aggregate savings. The weighting factors used in this analysis were developed by PNNL based on construction volume by building type and climate zone and are presented in *PNNL-ACT-10073 Rev. 1*.

Vidaris used the same energy prices used for the 2020 ECCC NYS cost-effectiveness and are shown in Table 4. These rates are based on commercial energy price information available from the U.S. Energy Information Administration (EIA) for the 2017 calendar year.<sup>2</sup>

<sup>1</sup> www.energycodes.gov/development/commercial/90.1\_models

<sup>&</sup>lt;sup>2</sup> The year 2017 was the most current year for which complete data for electricity and natural gas rates and heat content for natural gas was available as of January 2019 when the 2020 NYS ECC cost-effectiveness analysis was started.
Vidaris used EnergyPlus v8.0.0 and generated the results for each prototype under both codes and for each climate zone. Based on the prototype buildings, 2020 NYStretch has been shown to be 7.1% more efficient than ASHRAE 90.1-2016 on a cost per square foot basis. With respect to site and source energy, NYStretch yields savings of 5.4% and 6.7%, respectively. The aggregated results by code and by climate zone are presented in Table 2 (See Appendix B for more detailed results by building type.)

 Table 2. Aggregated Differences in Annual Energy Use and Annual Energy Cost between ASHRAE

 90.1-2016 and 2020 NYStretch

		Total (kBtu)		NY	S Energy C	Cost	t	En	ergy Cost	EUI (kE	B tu/s f)	 ECI	Weighting
	Site Source		Electricity Gas			Gas		Total	Site	Source	\$/sf	Factors	
<u>e</u>	ASHRAE 90 1-2016	65,273,116	156,127,787	\$	1,655,039	\$	179,661	\$	1,834,701	54,2	129,6	\$ 1,52	
egal	NYStretch	61,721,089	145,682,605	\$	1,528,231	\$	175,543	\$	1,703,773	51.2	120,9	\$ 1.41	
Val	Savinge	3,552,026	10,445,183	\$	126,809	\$	4,118	\$	130,927	2.9	8.7	\$ 0.11	
•	Savings	5.44%	6.69%		7.66%		2.29%		7.14%	5,44%	6,69%	7.14%	
	4A	2,618,314	7,452,920	\$	88,826	\$	3,752	\$	92,578	2,2	6.2	\$ 0,0768	70,8%
CZ	5A	5,815,539	17,673,722	\$	218,408	\$	5,081	\$	223,490	4.8	14.7	\$ 0,1855	21.0%
Sav by	6A	5,828,422	17,805,195	\$	220,633	\$	4,824	\$	225,457	4.8	14.8	\$ 0.1871	8,2%
	Combined	3,552,026	10,445,183	\$	126,809	\$	4,118	\$	130,927	2.9	8.7	\$ 0.11	100.0%

#### 1.3 Cost-Effectiveness Analysis

As part of its analysis, Vidaris included statewide-average utility rates available from the EIA. Additionally, Vidaris modified the cost data to reflect city-specific cost factors from RS Means. For consistency, the EIA rate data and RS Means cost factors were selected from 2017, the most recent year for which complete annual average utility data was available from the EIA.

Cost-effectiveness analysis was not included in *PNNL-ACT-10073 Rev. 1*. Consequently, Vidaris developed incremental cost data based predominantly on the following sources:

- 2018 Building Construction Costs with RSMeans Data (RSMeans 2018),
- 2018 Mechanical Costs with RSMeans Data (RSMeans 2018), and
- cost data used by PNNL in their national cost-effectiveness analysis of ASHRAE 90.1-2016

Where these sources were insufficient, Vidaris obtained estimates based on data from the internet (e.g., electric vehicle charging stations), or its own experience supplemented as needed with conversations with other practitioners (e.g., infiltration testing, lighting).

The life of energy efficiency measures was determined from NYSERDA's *Whole Building Incentive Calculator* and are summarized in Table 3. Detailed cost estimates by building type and climate zone are included in Appendix D.

#### Table 3. Measure Life Assumptions

Measure Description	Life (years)
Energy Star Kitchen Equipment	7
Lighting System	15
Motor/drives	15
Gas fired DHW	15
HVAC- Air handlers	15
Building Shell/Glazing-Windows	20
HVAC - Electric chillers	20
HVAC - Boilers	20
Building Shell/Roof, Wall, Slab	30

Regarding the life-cycle costing, PNNL's latest analysis of ASHRAE 90.1-2016 is based upon Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis published by the National Institute of Standards and Technology (NIST). NIST data for 2017 was selected to be consistent with the other cost data being used. NIST identifies the real discount rate for non-energy related expenses (i.e., maintenance and replacement costs) and delineates Uniform Present Value Factors (UPV Factors) to be used for life-cycle periods from one to 30 years, by energy type, for Census Region 1 (which includes New York State) and based on a real DOE discount rate of 3.0%. The UPV Factor is multiplied by the annual energy cost to determine the life-cycle value of energy cost over the life-cycle period. The city cost factors, utility cost data, and life-cycle parameters used in the analysis are presented in Table 4.

		Valu	ie	Source
	Electricity	0.1475	\$/kWh	
NYS Energy - 2017	Natural Gas	6.87	\$/1000 cf	U.S. Energy Information Administration
	Heat Content of Natural Gas	1,032	Btu/cf	
	Uniform Present Value Factors	: Commercial		
Ensure Duise Escalation		<u>10 yr</u>	<u>30 yr</u>	Table Ba.1: Energy Price Indices and Discount Factors
Energy Price Escalation	Electricity	9.22	22.72	for Life-Cycle Cost Analysis - 2017, (Lavappa, et.al.)
	Natural Gas	10.57	26.00	
Discount Rate (Real)		3.00%		Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis – 2017, (Lavappa, et.al.)
City Code Index	4A. New York	1.346		RS Maana Building Construction Cost Data (2017)
City Code Index	5A.Buffalo	1.057		KS Means Building Construction Cost Data (2017)
	6A. Watertown	0.995		

#### Table 4. Life-Cycle Cost Analysis Parameters

The life of a measure does not necessarily equal the life-cycle study period. Measures may have longer or shorter lives than the 10- and 30-year periods used for this analysis, as detailed in Table 3. Consequently, a residual value of the measures was included in the analysis to account for the value of the measure associated with the remaining life of the materials installed as part of the measure. The residual values used are based on straight line depreciation of the present value of the measure over the life of the measure. For example, if a measure has a 20-year life, then at the end of 10 years it has a residual value equal to 50% of the first cost to install the measure.

Economic analysis results based on annual energy savings and simple payback are presented in Tables 5 and 6. The payback period varies from 3.0 years for Large Office in CZ6A to 18.4 years for Warehouse in CZ4A. In aggregate, the statewide area weighted payback period is 10.5 years.

Prototype	cz	Construction	Site	Energy [kBtu/l	ît2/yr	Source	e Energy  kBti	ı∕ît2/yrj			Ene	rgy Cost		ľn F	cremental irst Cost	Simple Payback
		weight [%]	90.1-2016	NYStretch	% Savings	90,1-2016	NYStretch	% Savings	90,	90_1-2016 NYStretch % Si			% Savings		\$/ft2	years
Large Office	4A	7.5%	60,0	58,0	3.4%	179.3	172.2	3,9%	\$	2,26	\$	2,16	4,1%	\$	0,28	3_1
	5A	1.0%	63.4	61,2	3_4%	180,6	173 1	4.1%	\$	2.24	\$	2,15	4,3%	\$	0.47	4_8
	6A	0.3%	64.4	62.1	3.5%	181,7	174,1	4.2%	\$	2.25	\$	2.15	4.4%	s	0,30	3.0
Standalone Retail	4A	4.9%	44_5	39.1	12.1%	130,1	111.0	14,7%	S	1,63	\$	1,38	15_4%	5	3,89	15_6
	5A	7.1%	46.5	41.2	11.6%	129,9	110.0	15.3%	s	1,60	\$	1.34	16.4%	\$	3.08	11.7
	6A	2,6%	48,6	43.4	10_7%	133,9	115.0	14.1%	s	1,65	\$	1.40	15.1%	\$	3.27	13.2
Secondary School	4A	5,0%	37.0	33,9	8.5%	104.0	95,6	8,1%	S	1,29	\$	1,18	8,0%	s	0.61	6.0
	5A	3.,7%	37,7	34.6	8.1%	101_2	92.9	8.2%	s	1,24	\$	1.13	8,3%	s	0,43	4,3
	6A	1.1%	38.2	35 0	8.3%	101.8	93.3	8.3%	5	1.24	\$	1,14	8.3%	s	0,65	6,3
Large Hotel	4A	3.5%	81.7	75.9	7_1%	187.4	172.2	8.1%	\$	2.17	\$	1.99	8.5%	\$	1.77	9.6
	5A	2.5%	83,3	77.7	6.8%	183.4	168.1	8,4%	\$	2,09	\$	1.90	9.0%	\$	L.55	8,3
	6A	1.8%	85.4	79.9	6.5%	185.1	170.0	8.2%	s	2,09	\$	1,91	8,8%	\$	1,49	8,1
Full-Service	4A	0_1%	380.3	341,6	10.2%	717	629,0	12,3%	s	7,62	\$	6,60	13,3%	s	5.59	5.5
Restaurant	5A	0.3%	418.0	381.9	8_6%	741,4	661,8	10,7%	\$	7.63	\$	6,72	11,9%	s	3,90	4,3
	6A	0.1%	439.9	403.5	8.3%	763.7	683,6	10.5%	\$	7.76	\$	6.85	11.7%	s	4.18	4.6
Outpatient Healthcare	4A	2.0%	111.7	106.7	4.5%	314.6	296,5	5,8%	\$	3_90	\$	3.66	6.2%	s	3_10	12.9
	5A	2.4%	112.9	108.2	4.2%	310,6	292,8	5.7%	s	3_82	\$	3.58	6.2%	s	2.70	11.5
í	6A	1.0%	116.0	111,3	4.0%	316,4	298,6	5.6%	\$	3.88	s	3.64	6.1%	s	2.71	11.5
Warehouse	4A	2,5%	17.7	15,2	14.0%	37.4	32_4	13.5%	\$	0,42	\$	0.36	13,3%	\$	1.03	18,4
	5A	3.8%	23.9	20.6	13.8%	43_9	38.2	13,0%	\$	0_46	S	0.40	12,6%	\$	0.60	10.4
	6A	1.2%	22.0	19.1	13.2%	44.2	38.3	13.4%	\$	0.48	\$	0.42	13.5%	\$	0.75	11.6
10-Story High-Rise	4A	21.9%	48.4	47.1	2.8%	96.0	93.1	3,0%	\$	1:04	\$	1.01	3.0%	\$	0.43	13.5
Apartment	5A	0.0%	54.5	52.5	3.6%	99.8	96.3	3,5%	\$	1.04	\$	1.01	3.5%	\$	0.38	10.5
	6A	0.0%	54,5	52,6	3.6%	99.8	96.2	3.5%	\$	1.04	\$	1.01	3.5%	\$	0.42	11.6
20-Story High-Rise	4A	23.5%	48.4	47.3	2.4%	106,4	103.1	3.1%	\$	1.21	\$	1.17	3_4%	\$	0.47	11.5
Apartment	5A	0,1%	54.4	53.2	2,3%	112.2	103_I	8,1%	\$	1.24	\$	1.17	6,0%	\$	0.43	10.3
	6A	0.1%	55.1	53,3	3,3%	113.0	108.7	3.8%	\$	1.25	\$	1.20	4.0%	\$	0,40	8.1
4A Totals	4A	70.9%	51.4	49.2	4.2%	120.6	114.5	5.1%	\$	1.41	\$	1.33	5.5%	\$	0.85	11.0
5A Totals	5A	20.9%	59.1	54.2	8.2%	147.5	132.8	10_0%	\$	1.76	\$	1.57	10.5%	\$	1.81	9.8
6A Totals	6A	8.2%	65.0	60.2	7.4%	159_1	144.3	9.3%	\$	1.88	\$	1.70	9,9%	\$	1.96	10.5
AGGREGATE VALUE	s	100.0%	54.1	51.2	5.4%	129.4	120.7	6.7%	\$	1.52	\$	1.41	7.1%	\$	1.14	10.5

Table 5. Energy Savings and Simple Payback for By Building Type and Climate Zone

	Construction	Site	Energy  kBtu/l	ft2/yr	Source	e Energy [kBtu	/ft2/yr		E	nergy	Cost [\$/ft	2	חז נ	icrem First (	ental Cost	Simple Payback
Prototype	[%]	90,1-2016	NYStretch	% Savings	90,1-2016	NYStretch	% Savings	90	1-2016	NY	(Stretch	% Savings		\$/ft	2	years
Large Office	8,8%	60.5	58.5	3_4%	179,5	172.4	4_0%	\$	2,26	\$	2.16	4.1%	\$		0.31	3.27
Standalone Retail	14_6%	46,2	40,9	11,6%	130_7	111.2	14.9%	\$	1,62	\$	1.36	15.8%	\$		3,39	13,25
Secondary School	9.8%	37,4	34.3	8,3%	102.7	94.3	8.2%	\$	1,26	\$	1,16	8.1%	\$		0,55	5,36
Large Hotel	7 8%	83_I	77.4	6.9%	185_6	170.4	8.2%	\$	2.13	\$	1.94	8.7%	\$		1,64	8,84
Full-Service Restaurant	0.5%	414.9	378.2	8,8%	741.0	659.6	11.0%	\$	7.65	\$	6.72	12,1%	\$		4.29	4,60
Outpatient Healthcare	5.4%	113_0	108,2	4,3%	313.2	295,2	5,7%	\$	3_86	\$	3.62	6.1%	\$		2,85	12,03
Warehouse	7.5%	21.5	18,6	13.7%	41,8	36.3	13.2%	\$	0.45	\$	0,39	12.9%	s		0,77	13.26
10-Story High-Rise Apartment	21,9%	48.4	47, i	2,8%	96.0	93_1	3.0%	s	1,04	\$	1,01	3.0%	\$		0 43	11,45
20-Story High-Rise Apartment	23.7%	48.5	47.4	2.4%	106.4	103.2	3.1%	\$	1.21	\$	1.17	3.4%	\$		0,47	13,50
Weighted Average	100.0%	54.1	51.2	5.4%	129.4	120.7	6.7%	\$	1.52	\$	1.41	7.1%	\$		1.14	10,50

#### Table 6. Energy Savings and Simple Payback by Building Type

Additionally, the results of the 10- and 30-year life-cycle analyses are presented in Tables 7 and 8, respectively. The results show that the 10-year present value of energy savings between NYStretch and ASHRAE 90.1-2016 is greater than the installed cost of materials for most building types in each of the climate zones examined with the exception of Standalone Retail, Outpatient Healthcare and Warehouse in CZ4A. The net savings are aggregated based on the floor space-based weighting factors. The resulting aggregated energy cost savings, for all climate zones and prototypes, is greater than the installed cost of materials to achieve the savings of \$0.18/sf over the 10-year period.

Table 7. 10-Year Present Values of Energy (	Cost Savings between A	SHRAE 90.1-2016 and
NYStretch		

			Construction		Annual E	nerş	y Cost		10 Year L	ife	Cycle Ener	gy (	Cost	In	cremental	R	esidual	Net Savings o Years	over 10
Prototype	Area	cz	Weight [%]	9	0,1-2016	N	YStretch		90,1-2016	7	YStretch	:	Savings	First Cost		at	Value 10 years	Total	\$/s f
Large Office	497,337	4A	7.5%	\$	1,122,721	\$	1,076,703	\$	10,392,669	\$	9,968,956	\$	423,714	\$	141,187	\$	37,036	\$319,563	\$0,64
		5A	1_0%	\$	1,115,954	\$	1,067,460	\$	10,349,779	\$	9,903,163	\$	446,616	\$	234,656	\$	40,924	\$252,884	\$0_51
		6A	0,3%	\$	1,119,808	\$	1,070,785	\$	10,389,609	\$	9,937,763	\$	451,846	\$	148,621	\$	23,746	\$326,971	\$0,66
Standalone Retail	24,630	<b>4</b> A	4,9%	\$	40,095	\$	33,936	\$	371,457	\$	314,777	s	56,679	\$	95,821	\$	25,882	(\$13,259)	(\$0.54)
		5A	7_1%	\$	39,525	\$	33,042	\$	366,882	\$	307,296	\$	59,586	\$	75,788	\$	18,591	\$2,389	\$0_10
		6A	2.6%	\$	40,555	\$	34,425	\$	376,676	\$	320,293	S	56,383	\$	80,645	\$	21,594	(\$2,668)	(\$0.11)
Secondary School	210,357	<b>4A</b>	5.0%	\$	270,675	\$	249,133	\$	2,511,847	\$	2,311,520	\$	200,327	\$	128,629	\$	54,590	\$126,288	\$0,60
		5A	3.7%	\$	260,020	\$	238,559	\$	2,417,702	\$	2,218,244	s	199,458	\$	91,266	\$	35,287	\$143,479	\$0_68
		6A	1.1%	\$	260,845	\$	239,071	\$	2,426,145	\$	2,223,689	s	202,456	\$	137,223	\$	55,849	\$121,082	\$0,58
Large Hotel	121,813	<b>4</b> A	3,5%	\$	264,267	\$	241,853	\$	2,477,276	\$	2,268,602	\$	208,673	\$	215,819	\$	58,057	\$50,912	\$0.42
		<b>5A</b>	2.5%	\$	254,323	\$	231,509	s	2,390,220	\$	2,178,138	\$	212,083	\$	189,061	\$	46,283	\$69,305	\$0,57
		6A	1_8%	\$	255,157	\$	232,605	s	2,400,350	\$	2,190,813	\$	209,537	\$	182,079	\$	45,577	\$73,035	\$0,60
Full-Service	5,488	4A	0.1%	\$	41,811	\$	36,233	\$	397,393	\$	345,075	\$	52,318	\$	30,670	\$	9,805	\$31,453	\$5,73
Kestaurant		5A	0.3%	\$	41,857	\$	36,882	\$	400,005	\$	353,253	\$	46,751	\$	21,387	\$	7,721	\$33,085	\$6 03
		6A	0,1%	\$	42,607	\$	37,601	\$	408,012	\$	360,965	\$	47,046	\$	22,967	\$	8,675	\$32,754	\$5,97
Outpatient	40,843	<b>4A</b>	2,0%	\$	159,158	\$	149,351	\$	t,476,791	\$	1,386,620	\$	90,171	\$	126,695	\$	30,589	(\$5,934)	(\$0.15)
Healthcare		5A	2,4%	\$	155,998	\$	146,402	\$	1,448,966	s	1,360,775	\$	88,191	\$	110,444	\$	24,158	\$1,905	\$0_05
		6A	1.0%	\$	158,498	\$	148,849	\$	1,472,744	S	1,384,110	\$	88,634	\$	110,741	\$	25,228	\$3,121	\$0,08
Warehouse	51,914	<b>4</b> A	2,5%	\$	21,760	s	18,870	\$	205,049	\$	177,741	\$	27,308	\$	53,254	\$	14,315	(\$11,631)	(\$0.22)
		5A	3 8%	\$	23,926	\$	20,919	\$	227,895	s	199,092	\$	28,803	\$	31,272	\$	10,203	\$7,734	\$0_15
		6A	1.2%	\$	25,092	\$	21,707	\$	237,340	\$	205,358	\$	31,982	\$	39,118	\$	14,592	\$7,455	\$0,14
10-Story High-	84,140	4A	21 9%	\$	87,838	\$	85,168	\$	831,581	\$	806,423	\$	25,157	\$	36,040	\$	12,192	\$1,310	\$0.02
Rise Apartment		5A	0.0%	\$	87,886	\$	84,824	\$	837,400	\$	808,170	\$	29,230	\$	32,095	\$	11,372	\$8,507	\$0_10
		6A	0_0%	\$	87,795	\$	84,762	\$	836,627	\$	807,645	\$	28,982	\$	35,330	\$	13,443	\$7,094	\$0,08
20-Story High-	168,279	<b>4A</b>	23.5%	\$	203,645	\$	196,793	\$	1,914,173	\$	1,850,628	\$	63,545	\$	78,578	\$	22,905	\$7,872	\$0.05
Rise Apartment		5A	0.1%	\$	209,293	\$	202,329	\$	1,975,537	\$	1,910,836	\$	64,701	\$	71,908	\$	21,836	\$14,629	\$0.09
		6A	0.1%	\$	210,112	\$	201,789	\$	1,984,121	\$	1,906,196	\$	77,926	s	67,193	\$	20,681	\$31,414	\$0.19
4A Totals		4A	70.9%	\$	253,616	\$	242,215	\$	2,365,240	\$	2,259,659	\$	105,581	\$	83,955	\$	25,162	\$46,788	\$0.11
5A Totals		5A	20.9%	\$	167,142	\$	154,337	\$	1,556,783	\$	1,438,147	\$	118,636	\$	1,558,123	\$	24,902	\$781,499	\$0.37
6A Totals		6A	8.2%	\$	170,912	\$	157,469	\$	1,595,414	\$	1,470,838	\$	124,576	\$	1,252,578	\$	30,782	\$617,704	\$0,30
AGGREGATE VA	LUES		100,0%	\$	228,761	:	216,899	\$	2,133,146	\$	2,023,280	\$	109,867	\$	88,326	\$	25,568	\$47,109	\$0.18

Table 8 shows that over 30 years, the present value of the energy savings is worth more than the first, maintenance and replacement costs for each of the buildings in each of the climate zones examined, with the exception of Standalone Retail in CZ4A. The resulting aggregated energy cost savings, for all climate zones and prototypes, is greater than the installed cost of materials to achieve the savings of \$0.81/sf over the 30-year period.

# Table 8. 30-Year Present Values of Energy Cost Savings between ASHRAE 90.1-2016 and NYStretch

Brototuno	67	Construction	Incremental	Replacement	Maintenance	Residual	Energy Cost	30 Year Net Pres Saving	ent Value of s
rowype	CL.	Weights	First Cost	Costs	Costs	Value	Savings	Total	\$/sf
	4A	7.5%	\$141,187	\$72,568	\$0	(\$5,456)	\$1,044,138	\$824,927	\$1,66
Large Office	5A	1,0%	\$234,656	\$90,142	\$0	(\$6,118)	\$1,100,573	\$769,657	\$1,55
	6A	0.3%	\$148,621	\$35,951	\$0	(\$3,995)	\$1,113,447	\$924,879	\$1.86
	4A	4,9%	\$95,821	\$49,532	\$0	(\$458)	\$139,674	(\$6,138)	(\$0.25)
Standalone Retail	5A	7.1%	\$75,788	\$36,331	\$0	(\$1,298)	\$146,839	\$33,422	\$1.36
	6A	2,6%	\$80,645	\$38,657	\$0	(\$420)	\$138,944	\$19,222	\$0,78
	4A	5,0%	\$128,629	\$54,294	\$0	\$6,911	\$493,589	\$317,577	\$1,51
Secondary School	5A	3.7%	\$91,266	\$31,305	\$0	\$1,169	\$491,451	\$370,049	\$1,76
	6A	1.1%	\$137,223	\$44,735	\$0	\$6,162	\$491,451	\$315,656	\$1.50
	4A	3,5%	\$215,819	\$135,226	\$0	\$2,880	\$514,145	\$165,980	\$1_36
Large Hotel	5A	2.5%	\$189,061	\$107,301	\$0	\$2,495	\$522,556	\$228,690	\$1.88
	6A	1.8%	\$182,079	\$107,446	\$0	\$2,407	\$516,287	\$229,169	\$1.88
	4A	0.1%	\$30,670	\$31,248	\$0	\$3,649	\$128,892	\$70,624	\$12.87
Full Service Restaurant	5A	0.3%	\$21,387	\$24,554	\$0	\$2,871	\$115,174	\$72,105	\$13.14
	6A	0.1%	\$22,967	\$24,552	\$0	\$2,703	\$115,901	\$71,084	\$12.95
	4A	2.0%	\$126,695	\$62,998	\$0	\$519	\$222,209	\$33,035	\$0.81
Outpatient Healthcare	5A	2.4%	\$110,444	\$49,572	\$0	\$452	\$217,331	\$57,766	\$1.41
	6A	1.0%	\$110,741	\$51,869	\$0	\$395	\$218,424	\$56,209	\$1:38
	4A	2.5%	\$53,254	(\$2,443)	\$0	\$28	\$67,271	\$16,487	\$0.32
Warehouse	5A	3.8%	\$31,272	(\$781)	\$0	\$22	\$70,939	\$40,470	\$0,78
	6A	1.2%	\$39,118	(\$1,274)	\$0	\$21	\$78,783	\$40,960	\$0.79
	4A	21,9%	\$36,040	\$11,036	\$0	\$1,015	\$61,974	\$15,914	\$0,19
10 Story Highrise Apartment	5A	0.0%	\$32,095	\$9,033	\$0	\$937	\$71,995	\$31,805	\$0.38
	6A	0.0%	\$35,330	\$8,116	\$0	\$551	\$71,382	\$28,488	\$0,34
	<b>4</b> A	23.5%	\$78,578	\$40,382	\$0	\$3,972	\$156,575	\$41,587	\$0.25
20 Story Highrise Apartment	5A	0,1%	\$71,908	\$36,963	\$0	\$5,132	\$159,420	\$55,681	\$0,33
	6A	0.1%	\$67,193	\$35,250	\$0	\$4,213	\$191,984	\$93,754	\$0,56
4A Totals	4A	70.9%	\$83,955	\$40,133	\$0	\$1,671	\$260,157	\$137,741	\$0,52
5A Totals	5A	20.9%	\$94,765	\$41,112	\$0	(\$107)	\$292,323	\$156,339	\$1,57
6A Totals	6A	8,2%	\$109,714	\$50,027	\$0	\$1,211	\$305,970	\$147,441	\$1.38
AGGREGATE VALUES			\$88,326	\$41,149	\$0	\$1,262	\$270,636	\$142,423	\$0.81

## Differences between 2020 NYStretch Energy Code and ASHRAE 90.1-2016

#### by DOE Prototype and Climate Zone

Note: This appendix adopts the EEM numbering convention used in the PNNL report, Final Energy Savings Analysis of the Proposed NYStretch-Energy Code 2018, February 2019 (PNNL-ACT-10073, Rev. 1).

The following EEMs were not included in Vidaris' analysis as they are not considered stretch measures with respect to ASHRAE 90.1-2016:

- EEM 5 Occupancy Sensors and Automatic Lighting Controls
- EEM 6 Exterior Lighting Controls
- EEM 8 Hotel Guestroom HVAC Vacancy Control
- EEM 14 ERV for Apartment Makeup Air Units

The following EEMs were not included in the final version of the 2020 NYStretch Energy Code:

- EEM 9 High-efficiency SHW (Refer to Appendix C for further discussion)
- EEM 15 Demand-based Controls for Recirculated SHW systems

### EEM 1 Enhanced Insulation for Roofs and Walls

This measure amends Table C402.1.4 with more stringent U-factors for opaque thermal envelope assemblies. The ASHRAE compliance path is required to comply with this revision per section C401.2.1.a of NYStretch.

Cost data for this measure was developed by determining an insulation cost per R-value from RSMeans and applying this to the additional insulation required to achieve the improved U-values specified in table C402.1.4. It was assumed that continuous mineral fiber would be used to meet the required thermal performance for walls; additional extruded polystyrene was used to meet the increased performance for roofs. This requirement applies to each of the building prototypes as follows.

OPAQUE THERMAL ENVELOPE (U-factor)	NYStretch	ASHRAE 90.1 -2016
Large office, Stand-alone retail		
	CLIMATE ZONE 4	
Roofs: insulation entirely above deck	0.030	0.032
Walls, above grade: mass (non-res)	0.099	0.104
	CLIMATE ZONE 5	
Roofs: insulation entirely above deck	0.030	0.032
Walls, above grade: mass (non-res)	0.086	0.090
	CLIMATE ZONE 6	
Roofs: insulation entirely above deck	0.029	0.032
Walls, above grade: mass (non-res)	0.076	0.080
Full-Service Restaurant <sup>3</sup>	N DO THE DOLLARS IN DO THE DO THE	INTER MEMORIPHIC
	CLIMATE ZONE 4	
Roofs: attic and other	0.020	0.021
Walls, above grade: steel framed (non-res)	0.061	0.064
	CLIMATE ZONE 5	
Roofs: attic and other	0.020	0.021
Walls, above grade: steel framed (non-res)	0.052	0.055
	CLIMATE ZONE 6	
Roofs: attic and other	0.019	0.021
Walls, above grade: steel framed (non-res)	0.047	0.049
Secondary School, Outpatient Healthca	are	
	CLIMATE ZONE 4	
Roofs: insulation entirely above deck	0.030	0.032
Walls, above grade: steel framed (non-res)	0.061	0.064
	CLIMATE ZONE 5	
Roofs: insulation entirely above deck	0.030	0.032
Walls, above grade: steel framed (non-res)	0.052	0.055
	CLIMATE ZONE 6	
Roofs: insulation entirely above deck	0.029	0.032
Walls, above grade: steel framed (non-res)	0.047	0.049

<sup>&</sup>lt;sup>3</sup> U-factor for attic roof in the NYStretch model was revised to reflect updated draft requirements

OPAQUE THERMAL ENVELOPE (U-factor)	NYStretch	ASHRAE 90.1 -2016
Large Hotel	Design ter and the structure of	
	CLIMATE ZONE 4	
Roofs: insulation entirely above deck	0.030	0.032
Walls, above grade: mass (residential)	0.086	0.090
	CLIMATE ZONE 5	
Roofs: insulation entirely above deck	0.030	0.032
Walls, above grade: mass (residential)	0.076	0.080
	CLIMATE ZONE 6	
Roofs: insulation entirely above deck	0.029	0.032
Walls, above grade: mass (residential)	0.067	0.071
Warehouse <sup>4</sup>		
	CLIMATE ZONE 4	
Roofs: metal building	0.035	0.037
Walls, above grade: metal building	0.048	0.060
	CLIMATE ZONE 5	
Roofs: metal building	0.035	0.037
Walls, above grade: metal building	0.048	0.050
	CLIMATE ZONE 6	
Roofs: metal building	0.028	0.031
Walls, above grade: metal building	0.048	0.050
10-Story Apartment, 20-Story Apartment		
	CLIMATE ZONE 4	
Roofs: insulation entirely above deck	0.030	0.032
Walls, above grade: steel framed (residential)	0.061	0.064
	CLIMATE ZONE 5	
Roofs: insulation entirely above deck	0.030	0.032
Walls, above grade: steel framed (residential)	0.052	0.055
	CLIMATE ZONE 6	
Roofs: insulation entirely above deck	0.029	0.032
Walls, above grade: steel framed (residential)	0.044	0.049

<sup>&</sup>lt;sup>4</sup> U-factor for metal building walls and roof in the NYStretch model were revised to reflect updated 2020 NYStretch requirements.

#### **EEM 2 Enhanced Fenestration**

This measure amends Table C402.2.4 with more stringent U-factors and SHGCs for building envelope fenestration assemblies. The ASHRAE compliance path is required to comply with this revision per section C401.2.1.b of NYStretch. Currently under the 2020 NYS ECCC, there is a proposed revision to 2018 IECC such that north-facing vertical fenestration will be required to meet the SHGC requirements applicable to south, east and west facing fenestration. Consequently, this analysis assumes all orientations will meet the SHGC requirements for the south, east, and west orientations. Window performance in the energy models is based on weighting factors provided by PNNL for fixed, operable, and non-metal framing for each of the building prototypes. This requirement applies to all the building prototypes. Vidaris revised the U-factors in the PNNL NYStretch models to reflect the current NYStretch requirements.

Cost data for this measure was developed based on the incremental costs between windows with respect to decreased U-factor in PNNL's national cost effectiveness analysis.

VERTICAL FENESTRATION (U-Factor)	NYStretch	ASHRAE 90.1-2016
Large Office, Stand-alone Retail, Second Healthcare, Warehouse, 10-Story High-Ri	ary School, Large Hotel, Full-Servi se Apartment, and 20-Story High-I	ce Restaurant, Outpatient Rise Apartment
	CLIMATE ZONE 4	
Fixed fenestration (metal)	0.36	0.38
Operable fenestration (metal)	0.43	0.46
Non-metal	0.30	0.31
SHGC	0.36	0.36
Skylight U	0.48	0.50
Skylight SHGC	0.38	0.40
	CLIMATE ZONE 5	
Fixed fenestration (metal)	0.36	0.38
Operable fenestration (metal)	0.43	0.46
Non-metal	0.27	0.31
SHGC	0.38	0.38
Skylight U	0.48	0.50
Skylight SHGC	0.38	0.40
	CLIMATE ZONE 6	
Fixed fenestration (metal)	0.34	0.36
Operable fenestration (metal)	0.41	0.45
Non-metal	0.27	0.30
SHGC	0.40	0.40
Skylight U	0.48	0.50
Skylight SHGC	0.38	0.40

#### EEM 3 Air Leakage Testing for Mid-sized Buildings

This measure amends section 5.4.3.1.3 to add a requirement for buildings 25,000 to 50,000 square feet and less than or equal to 75 feet in height to comply with whole building pressurization testing and air barrier requirements. Previously, testing was not required.

For this analysis, the new testing requirement applied only to the Outpatient Healthcare and Warehouse prototypes. The difference between 90.1-2016 and NYStretch are as follows:

AIR LEAKAGE [cfm/sf]	NYStretch	90.1-2016
Outpatient Healthcare	0.40	1.00
Warehouse	0.40	1.00

Infiltration testing was assumed to be done once to confirm compliance. Any additional testing would be optional since it would not necessarily be required for compliance but would be an aid during construction. Costing for this measure was based on Vidaris experience with this work and feedback from industry professionals. For CZ 5A and 6A the size of the Outpatient Healthcare allows for a cost of \$3,200, and \$8,500 for climate CZ 4A due to complexity related testing in locations like New York City.

The Warehouse was considered more complex due to the volume and height of a typical warehouse with greater cost of testing equipment and more effort to do the work. Ultimately, the cost was judged to be twice that of the Outpatient Healthcare, or about \$17,000 for CZ 4A and \$6,400 for CZs 5A and 6A.

#### **EEM 4 Reduced LPD for Interior Lighting**

This measure amends Tables C405.3.2(1) and C405.3.2(2) with reduced lighting power densities (LPD). The ASHRAE compliance path is required to comply with this revision per section C401.2.1.c of NYStretch. The ASHRAE compliance path is also directed to follow the requirements of section C406—Additional Efficiency Package Options. Per direction from NYSERDA, the analysis is based on Option 2—reduced lighting power in accordance with section C406.3, which specifies an additional 10% reduction in connected lighting power. This requirement applies to all the building prototypes.

Previous cost estimates from PNNL associate a lower first cost for buildings with lower LPD; based on feedback from lighting design professionals, it is anticipated there will be no cost associated with this measure. LPDs are based on the space-by-space method unless indicated otherwise.

INTERIOR LIGHTING POWER DENSITY (W/ft <sup>2</sup> )	NYStretch	NYStretch less 10%	90.1-2016
Large Office			
Office (building area method)	0.69	0.62	0.79
Stand-Alone Retail	konturaçı bir çaya il		
BOH (area w eighted average)	0.50	0.45	
Sales Area	1.06	0.95	1.22
Lobby <sup>5</sup>	0.90	0.81	1.00
Display lighting - type 1,2,3 (area weighted average)	0.32	0.29	
Secondary School	S. 44. 197 - 3		
Classroom	0.74	0.67	0.92
Corridor	0.58	0.52	0.66
Lobby <sup>5</sup>	0.90	0.81	1.00
Mechanical <sup>5</sup>	0.39	0.35	0.43
Restroom	0.75	0.68	0.85
Office	0.85	0.77	0.93
Gymnasium/exercise area <sup>5</sup>	0.50	0.45	0.50
Kitchen/Food Preparation Area	0.92	0.83	1.06
Cafeteria/Dining	0.53	0.48	0.63
Library/reading area (Building Area Method)	0.78	0,70	0.82
Audience seating area – auditorium <sup>5</sup>	0.63	0.57	0.63
Large Hotel			
Office (Building Area Method)	0.69	0.62	0.79
Retail (Building Area Method)	0.91	0.82	1.06
Mechanical rooms <sup>5</sup>	0.39	0.35	0.43
Storage	0.43	0.39	0.46
Laundry Room	0.43	0.39	0.43
Dining Area - family dining <sup>5</sup>	0.54	0,49	0.71
Lobby – hotel	0.68	0.61	1.06
Guest rooms	0.75	0.68	0.77
Corridor	0.58	0.52	0.66
Kitchen/Food Preparation Area	0.92	0.83	1.06
10-story Apartment	t y le manne	a line of the second	Cardina States
Office - enclosed <sup>5</sup>	0.85	0.77	0.93
Corridor	0.58	0.52	0.792
Stairw ell	0.50	0.45	0.58
Mechanical rooms <sup>5</sup>	0.39	0.35	0.43

<sup>&</sup>lt;sup>5</sup> LPDs in PNNL's NYStretch model were revised to reflect current NYStretch code requirements.

INTERIOR LIGHTING POWER DENSITY (W/ft2)	NYStretch	NYStretch less 10%	<u>90.1-2016</u>
20-story Apartment			
Office - enclosed <sup>6</sup>	0.85	0.77	0.93
Corridor	0.58	0.52	0.792
Stairw ell	0.50	0.45	0.58
Mechanical rooms <sup>7</sup>	0.39	0.35	0.43
Sales Area <sup>7</sup>	1.06	0.954	1.22
Display lighting - retail type 3 <sup>7</sup> (weighted average)	1.05	0.945	1.05
Display lighting - retail type 2 <sup>7</sup> (weighted average)	0.45	0,405	0.45
Display lighting - retail type 1 <sup>7</sup> (weighted average)	0.45	0.405	0.45
Additional retail allow ance [Watts] <sup>7</sup>	1,000	900	1,000
Outpatient Healthcare			
Conference/Meeting/Multipurpose	0.93	0.84	1.07
Corridor	0.58	0.52	0.792
Dining Area - cafeteria/fastfood	0,53	0.48	0.63
Healthcare Facility - nurse station	0,75	0.68	0.81
Healthcare Facility - patient room	0.45	0.41	0.62
Healthcare Facility - physical therapy	0.84	0.76	0.84
Healthcare Facility - recovery room	0.89	0.80	1.03
Healthcare Facility - exam/treatment	1_16	1.04	1.68
Healthcare Facility - imaging room	0.98	0.88	1.06
Healthcare Facility - operating room	1.87	1.68	2:17
Lobby - all other <sup>7</sup>	0.90	0,81	1.00
Lounge/breakroom – healthcare <sup>7</sup>	0.53	0.48	0.78
Office - enclosed >250 sf <sup>7</sup>	0.85	0.77	0.93
Restroom <sup>7</sup>	0.75	0.68	0.85
Storage room, 50-100 sf	0.43	0.39	0.46
Full-service Restaurant			
Dining Area - family dining	0.54	0.49	0.71
Kitchen/Food Preparation Area	0.92	0.83	1.06
Warehouse			
Office (Building Area Method)	0.69	0.62	0.79
Warehouse - storage- medium to bulky	0.27	0.24	0.35
Warehouse - storage - small hand carried items	0.65	0.59	0.69

<sup>&</sup>lt;sup>6</sup> LPDs in PNNL's NYStretch model were revised to reflect current NYStretch draft code requirements

#### **EEM 7 Reduced Fan Power Allowances**

This measure found in Tables C403.8.1(1) and 6.5.3.1-1 limits the fan energy used by heating, ventilation, and air-conditioning (HVAC) equipment. It requires that variable air volume (VAV) systems use no more than 0.0010 bhp/cfm and constant air volume (CAV) systems use no more than 0.00088 bhp/cfm for fan power. These limits only apply to fan motors larger than 5 nameplate horsepower; smaller fan sizes are not regulated in either code. This requirement applies to the large office, standalone retail, secondary school, large hotel, and outpatient healthcare building prototypes. Vidaris revised the PNNL NYStretch models to reflect current NYStretch code requirements for these fan systems.

Costing for this measure was based on increased system capacities for larger air handling equipment that would result in increased cross-sectional areas of the unit and components (e.g., coils, filters, ducts, unit housings, etc.) that would reduce the static pressure, and thus the brake horsepower, for the affected systems. For constant volume fans, this required an increased capacity of 3.2%; variable volume systems required a 13.4% increase in capacity.

Fan Power Allowance	NYStretch	90.1-2016
Large Office, Standalone Retail, Sec	ondary School, Large Hotel, a	nd Outpatient Healthcare
CV (bhp/cfm)	0.00088	0.00094
VAV (bhp/cfm)	0.00100	0.00130

#### **EEM 10 High-efficiency Commercial Kitchen Equipment**

EEM10 reduces plug load energy usage. This measure upgrades major commercial kitchen appliances to ENERGY STAR<sup>®</sup>.

Costing for this measure was based on equipment lists from previous projects and the incremental costs from the Savings Calculator for ENERGY STAR<sup>®</sup> Commercial Kitchen Equipment developed by the U.S. EPA and DOE.<sup>7</sup> To account for the variation of kitchen sizes in the affected prototypes, an incremental cost per square foot was used.

Affected prototypes: secondary school, full-service restaurant, and large hotel.

7 The Savings Calculator for Energy Commercial Kitchen Equipment is available at https://www.energystar.gov/sites/.../commercial\_kitchen\_equipment\_calculator.xlsx

#### **EEM 11 Thermal Bridging Reduction**

EEM11 addresses the mandatory provision in NYStretch to include a minimum R-3 thermal break at penetrations, including parapet walls and balcony projections. None of the prototypes include balconies. Each building with a flat roof is assumed to have a parapet that is 42 in. high and follows the perimeter of the roof.

This analysis assumes that each prototype meets prescriptive requirements of the code. This measure simply requires that elements of the envelope that are noncompliant have an R-value no less than R-3, which is itself less than code compliant. Consequently, the remainder of the envelope systems would have to be improved to reach overall code compliance.

Consequently, this measure does not result in any energy savings. Additional insulation is included in the lifecycle cost analysis to address the additional cost of meeting the prescriptive requirements for opaque envelope assemblies.

Costing for this measure was based on the assumption of additional mineral wool insulation at the parapet to eliminate thermal bridging. It was assumed that this will require 12in at wall + 42in of parapet height + 12in wide parapet + 42in of parapet height to roof deck = 9 ft of total insulation of R-4.2/in for entire perimeter of roof.

Affected prototypes: large office, standalone retail, secondary school, large hotel, outpatient healthcare, 10-story high-rise apartment, and 20-story high-rise apartment.

#### **EEM 12 Exterior Lighting Power Reduction**

This measure modifies Table C405.4.2(2) with reduced exterior lighting power allowances. As allowances vary by lighting zone, the model uses an average of lighting zones for each protype building; these averages were developed by PNNL for the national analysis of ASHRAE 90.1-2016. Following the methodology used by PNNL's analysis of NYStretch, it is assumed there are no parking lots for prototypes in climate zone 4A. PNNL also excluded exterior lighting for 10-story and 20-story apartment prototypes as the majority of these buildings are in climate zone 4A and have no or limited exterior lighting.

At the time of this analysis, this measure is only included in the IECC overlay of the NYStretch draft. Vidaris included this measure in the analysis at NYSERDA's direction as the final version of the code is anticipated to include it in the ASHRAE path as well. Based on an analysis of typical parking lot lighting, it was determined that standard metal halide lamps could be used to achieve the LPD limits for NYStretch. As there is only a minimal reduction in façade and entryway lighting, it was assumed there is no incremental cost for this measure.

	Façade	e W/sf]	Doors [\	N/If]	Parking lot	[W/sf] *
Lighting Zone	NYStretch	90.1-2016	NYStretch	2016	NYStretch	2016
1	0.000	0.000	12.6	14.0	0.03	0.03
2	0,075	0.100	12.6	14.0	0,04	0.04
3	0,113	0.150	20.0	21.0	0.05	0.06
4	0.150	0.200	20.0	21.0	0.05	0.08

\*Parking lot lighting is only included in climate zones 5A and 6A

Lighting	Logical of the solution law it	Façade	W/sf]	Doors [V	V/Ifj	Parking lot [W/sf] *			
Zone	Prototype	NYStretch	90.1- 2016	NYStretch	2016	NYStretch	2016		
4	Large Office	0.150	0.200	20.0	21.0	0.050	0.080		
2,3	Stand-alone Retail	0.094	0,125	16.3	17.5	0.045	0.050		
2,3	Secondary School	0.094	0.125	16.3	17.5	0.045	0.050		
3,4	Large Hotel	0.132	0.175	20.0	21.0	0.050	0.070		
2,3,4	Full-service Restaurant	0.113	0.150	17.5	18.7	0.050	0.060		
2,3	Outpatient Healthcare	0.094	0.125	16.3	17.5	0.045	0.050		
2,3	Warehouse	0.094	0.125	16.3	17.5	0.045	0.050		
3,4	10 Story Mid-Rise Apt.	n/a		n/a		n/a			
3,4	20 Story High-Rise Apt.	n/a		n/a		n/a			

Parking lot lighting is only included in climate zones 5A and 6A

### EEM 13 Efficient Elevator, Regenerative Drives

This measure requires regenerative drives for elevator motors with a rise of 75 feet or greater. The PNNL NYStretch models included this as a 5% power reduction for the elevator motors.

Costing for this measure was based on data from previous projects.

Prototype Building	NYStretch [W, total]	90.1-2016 [W, total]
LARGE OFFICE – (12) 30hp motors	232,222	244,444
10-STORY APARTMENT – (1) 30hp motor	19,352	20,371
20-STORY APARTMENT - (2) 30hp motors	19,352	20,371

### **Appendix B**

## Differences in Energy Performance, and Annual Energy Cost between 2020 NYStretch Energy Code and ASHRAE 90.1-2016

by Climate Zone and Building Type

	12	Energy Us	age	Total (I	kBtu)	1	Energy Cost		EUI (k	Btu/sf)	E	CI (\$/sf)		Weighting
		kWh	therms	Site	Source	Electricity	Gas	Total	Site	Source	Dectricity	Gas	Total	Factors
Large Offi	ce	497,337 s	quare feet											
4A	ASHRAE 90 1-2016	7,404,873	45,821	29,847,478	89,183,930	1,092,219	30,503	1,122,721	60.01	179 32	2.196	0.061 5	\$ 2.26	
4A	NYStretch	7,090,011	46,458	28,836,870	85,662,437	1,045,777	30,927	1,076,703	57,98	172.24	2,103	0.062 5	\$ 2.16	
4A	Savings	314,861	(637)	1,010,608	3,521,492	46,442	(424)	46,018	2,03	7.08	0,093	10.0011	\$ 0.09	7.5%
5A	ASHRAE 90 1-2016	7,261,025	67,527	31,527,310	89,817,293	1,071,001	44,953	1,115,954	63,39	180,60	2 153	0.090 \$	\$ 2.24	
5A	NYStretch	6,929,778	68,076	30,452,005	86,099,862	1,022,142	45,318	1,067,460	61,23	173,12	2,055	0.091 \$	\$ 2.15	/
5A	Savings	331,247	(\$49)	1,075,306	3,717,431	48,859	(306)	48,493	2,16	7,47	0,098	(0.001) \$	\$ 0,10	1.0%
6A	A SHRAE 90 1-2016	7,265,584	72,306	32,020,810	90,369,650	1,071,674	48,134	1,119,808	64.38	181.71	2 155	0.097 \$	\$ 2.25	
6A	NYStretch	6,932,525	72,462	30,900,009	86,590,416	1,022,547	48,238	1,070,785	62.13	174,11	2.056	0.097 5	\$ 2.15	/
6A	Savings	333,059	(156)	1,120,801	3,779,234	49,126	(104)	49,022	2.25	7,60	0.099	(0.000) 5	S 0,10	0.3%
Standalone	Retail	24,630 s	quare feet					- La service -				- Andrew -		
4A	ASHRAE 90.1-2016	262,889	1,981	1,095,100	3,203,339	38,776	1,319	40,095	44 46	130.06	1 574	0.054	1 63	
4A	NYStretch	220,589	2,102	962,803	2,733,881	32,537	1,399	33,936	39.09	111.00	1.321	0.057 \$	5 1.38	/
4A	Savings	42,300	(120)	132,297	469,458	6,239	(80)	6,159	5.37	19.06	0.253	10.0031 \$	6 0.25	4.9%
5A	ASHRAE 90,1-2016	255,586	2,742	1,146,310	3,199,822	37,699	1,826	39,525	46.54	129.91	1.531	0.074 \$	\$ 1.60	4,270
5A	NYStretch	210,720	2,946	1,013,551	2,709,799	31,081	1,961	33,042	41,15	110.02	1.262	0.080 \$	§ 1.34	
5A	Savings	44,867	(203)	132,759	490,023	6,618	(135)	6,483	5,39	19.90	0.269	(0.005) \$	6 0.26	7.1%
6A	ASHRAE 90.1-2016	261,103	3,068	1,197,708	3,296,796	38,513	2,043	40,555	48.63	133.85	1 564	0.083 \$	§ 1.65	
6A	NYStretch	218,834	3,225	1,069,137	2,831,477	32,278	2,147	34,425	43.41	114.96	1.310	0.087 \$	§ 1.40	
6A	Savings	42,269	(157)	128,571	465,319	6,235	(104)	6,131	5.22	18.89	0.253	10.004) 5	6 0.25	2.6%
Secondary	School	210,357 s	quare feet											
4A	ASHRAE 90.1-2016	1,753,599	18,055	7,788,751	21,874,479	258,656	12,019	270,675	37.03	103.99	1.230	0.057 \$	1.29	
4A	NYStretch	1,616,146	16,151	7,129,347	20,108,691	238,381	10,751	249,133	33.89	95.59	1.133	0.051 \$	1.18	
4A	Savings	137,453	1,904	659,404	1,765,788	20,274	1,268	21,542	3,13	8.39	0.096	0.006 \$	6 0.10	5.0%
5A	ASHRAE 90.1-2016	1,660,790	22,612	7,927,850	21,294,010	244,967	15,053	260,020	37.69	101.23	1 165	0 072 \$	1.24	
5A	NYStretch	1,523,268	20,845	7,281,909	19,541,774	224,682	13,877	238,559	34.62	92.90	1.068	0.066 \$	5 1.13	
5A	Savings	137,522	1,767	645,941	1,752,236	20,285	1,176	21,461	3.07	8.33	0.096	0.006 \$	6 0.10	3.7%
6A	ASHRAE 90.1-2016	1,662,210	23,538	8,025,261	21,407,104	245,176	15,669	260,845	38.15	101.77	1 166	0.074 \$	5 1.24	
6A	NYStretch	1,523,135	21,645	7,361,422	19,623,981	224,662	14,409	239,071	34,99	93.29	1.068	0.068 \$	5 1.14	
6A	Savings	139,075	1,893	663,839	1,783,124	20,514	1,260	21,774	3.16	8.48	0.098	0.006 \$	\$ 0.10	1.1%

TABLE B1: Differences in Energy Performance, and Annual Energy Cost between ASHRAE 90.1-2016 and 2020 NYStretch by Climate Zone and Building Type (Part A)

\* Negative Savings indicate that NYStretch results in higher energy use or cost relative to ASHRAE 90.1 - 2016

		Energy Us:	age	Total (k	(Btu)	E	Energy Cost		EUI (k	Btu/sf)	E	CI (\$/sf)		Weighting
		kWh	therms	Site	Source	Electricity	Gas	Total	Site	Source	Electricity	Gas	Total	Factors
Large Hot	el	121,813 s	quare feet											
4A	ASHRAE 90 1-2016	1,587,057	45,330	9,947,992	22,832,229	234,091	30,176	264,267	81.67	187.44	1,922	0.248	\$ 2.17	
4A	NYStretch	1,445,229	43,085	9,239,607	20,980,929	213,171	28,681	241,853	75.85	172.24	1,750	0,235	<b>1.99</b>	
4A	Savings	141,828	2,245	708,385	1,851,300	20,920	1,494	22,414	5,82	15,20	0,172	0.012 5	6 0,18	3,5%
5A	ASHRAE 90 1-2016	1,496,437	50,472	10,153,016	22,337,909	220,725	33,599	254,323	83,35	183.38	1.812	0.276	\$ 2.09	
5A	NYStretch	1,350,487	48,539	9,461,786	20,472,318	199,197	32,312	231,509	77.67	168.06	1,635	0.265	\$ 1.90	
5A	Savings	145,950	1,932	691,231	1,865,591	21,528	1,286	22,814	5.67	15.32	0.177	0.011	5 0,19	2.5%
6A	ASHRAE 90 1-2016	1,489,832	53,188	10,402,112	22,547,031	219,750	35,407	255,157	85.39	185.10	1.804	0.291	\$ 2.09	
6A	NYStretch	1,345,009	51,399	9,729,110	20,709,350	198,389	34,216	232,605	79_87	170.01	1.629	0 281	\$ 1.91	
6A	Savings	144,822	1,789	673,001	1,837,681	21,361	1,191	22,552	5.52	15.09	0_175	0.010_	\$ 0.19	1.8%
Full Servi	ce Restaurant	5,488 s	quare feet											
4A	ASHRAE 90.1-2016	223,706	13,240	2,087,321	3,935,635	32,997	8,814	41,811	380.33	717.11	6.012	1.606	\$ 7.62	
4A	NYStretch	190,350	12,252	1,874,650	3,452,004	28,077	8,156	36,233	341.58	628.99	5.116	1.486	\$ 6.60	
4A	Savings	33,356	989	212,671	483,631	4,920	658	5,578	38.75	88.12	0.896	0.120	\$ 1.02	0.1%
5A	ASHRAE 90 1-2016	213,031	15,675	2,294,327	4,068,852	31,422	10,435	41,857	418.05	741.39	5 725	1.901	\$ 7.63	
5A	NYStretch	183,745	14,691	2,096,005	3,632,083	27,102	9,780	36,882	381.91	661.80	4.938	1.782	\$ 6.72	
5A	Savings	29,286	984	198,322	436,769	4,320	655	4,975	36.14	79.58	0,787	0,119	\$ 0.91	0.3%
6A	ASHRAE 90 1-2016	212,659	16,885	2,414,046	4,191,286	31,367	11,240	42,607	439.86	763.70	5.715	2.048	\$ 7.76	
6A	NYStretch	183,195	15,893	2,214,359	3,751,697	27,021	10,580	37,601	403_48	683.60	4.924	1.928	\$ 6.85	
6A	Savings	29,464	992	199,687	439,589	4,346	660	5,006	36.38	80.10	0,792	0,120	\$ 0.91	0.1%
Outpatien	t Healthcare	40,843 s	quare feet											
4A	ASHRAE 90 1-2016	1,032,065	10,408	4,562,204	12,851,209	152,230	6,929	159,158	111.70	314.65	3 727	0.170	\$ 3.90	
4A	NYStretch	964,334	10,684	4,358,667	12,108,201	142,239	7,112	149,351	106.72	296.46	3,483	0.174	\$ 3,66	
4A	Savings	67,731	(276)	203,537	743,009	9,990	(183)	9,807	4.98	18.19	0.245	(0.004)	\$ 0,24	2.0%
5A	ASHRAE 90 1-2016	1,004,067	11,865	4,612,345	12,684,663	148,100	7,898	155,998	112 93	310.57	3,626	0.193	\$ 3.82	
5A	NYStretch	937,570	12,183	4,417,320	11,960,217	138,292	8,110	146,402	108.15	292.83	3,386	0,199	\$ 3,58	
5A	Savings	66,497	(319)	195,025	724,447	9,808	(212)	9,596	4.77	17.74	0.240	(0.005)	\$ 0,23	2.5%
6A	ASHRAE 90.1-2016	1,017,373	12,672	4,738,507	12,920,854	150,063	8,436	158,498	116.02	316.35	3.674	0.207	\$ 3.88	
- 6A	NYStretch	950,276	13,044	4,546,734	12,195,118	140,166	8,683	148,849	111.32	298.58	3.432	0.213	\$ 3.64	
6A	Savings	67,097	(372)	191,773	725,736	9,897	(247)	9,649	4.70	17.77	0.242	(0.005)	\$ 0.24	1.0%

TABLE B1: Differences in Energy Performance, and Annual Energy Cost between ASHRAE 90.1-2016 and 2020 NYStretch by Climate Zone and Building Type (Part B)

\* Negative Savings indicate that NYStretch results in higher energy use or cost relative to ASHRAE 90.1 - 2016

	_	Energy Usage Total (k Btu) Energy Cost EUI (k Btu/sf) ECI (S/sf)						Weighting						
		kWh	therms	Site	Source	Electricity	Gas	Total	Site	Source	Dectricity	Gas	Total	Factors
Warehous	e	51,914 s	quare feet											
4A	ASHRAE 90 1-2016	125,317	4,921	919,663	1,943,329	18,484	3,276	21,760	17.72	37.43	0.356	0.063 \$	6 0.42	
4A	NYStretch	109,025	4,189	790,848	1,681,000	16,081	2,788	18,870	15,23	32.38	0.310	0.054 \$	6 0.36	
4A	Savings	16,292	732	128,814	262,330	2,403	487	2,890	2.48	5.05	0.046	0.009	6 0.06	2.5%
5A	ASHRAE 90 1-2016	125,589	8,115	1,240,006	2,280,859	18,524	5,402	23,926	23.89	43.94	0.357	0.104	6 0.46	
5A	NYStretch	110,586	6,921	1,069,439	1,984,898	16,311	4,607	20,919	20.60	38.23	0.314	0.089	5 0.40	
5A	Savings	15,003	1,194	170,567	295,961	2,213	795	3,008	3.29	5,70	0.043	0.015 \$	5 0.06	3.8%
6A	ASHRAE 90.1-2016	140,039	6,664	1,144,259	2,293,664	20,656	4,437	25,092	22.04	44.18	0.398	0.085 9	6 0.48	
6A	NYStretch	120,967	5,805	993,282	1,986,376	17,843	3,865	21,707	19.13	38,26	0.344	0.074 9	6 0.42	
6A	Savings	19,072	859	150,977	307,288	2,813	572	3,385	2,91	5,92	0.054	0.011 9	6 0.07	1,2%
10 Story H	lighrise Apt.	84,140 se	quare feet											
4A	ASHRAE 90.1-2016	486,453	24,164	4,076,188	8,073,640	71,752	16.086	87,838	48.45	95.96	0.853	0.191	6 104	
4A	NYStretch	471,098	23,557	3,963,044	7,835,041	69,487	15,682	85,168	47.10	93.12	0.826	0.186	5 1.01	
4A	Savings	15,356	608	113,144	238,599	2,265	404	2.669	1.34	2.84	0.027	0.005 \$	6 0.03	21.9%
5A	ASHRAE 90.1-2016	459,795	30,143	4,583,161	8,395,873	67,820	20,066	87,886	54.47	99.79	0.806	0.238 \$	5 1.04	
5A	NYStretch	444,061	29,030	4,418,150	8,100,014	65,499	19,325	84,824	52.51	96.27	0.778	0.230 \$	5 1.01	
5A	Savings	15,733	1,113	165,011	295,860	2,321	741	3,062	1.96	3.52	0.028	0.009 \$	6 0.04	0.0%
6A	ASHRAE 90.1-2016	458,814	30,223	4,587,788	8,393,046	67,675	20,119	87,795	54.53	99.75	0.804	0.239 \$	5 1.04	
6A	NYStretch	443,359	29,091	4,421,886	8,098,427	65,395	19,366	84,762	52.55	96.25	0.777	0.230 \$	5 1.01	
6A	Savings	15,456	1,132	165,902	294,620	2,280	753	3,033	1.97	3.50	0.027	0.009 \$	6 0.04	0.0%
20 Story H	lighrise Apt	168,279 st	quare feet											
4A	ASHRAE 90.1-2016	1,197,004	40,689	8,153,111	17,901,324	176,558	27,087	203,645	48.45	106.38	1.049	0.161 \$	5 1.21	
4A	NYStretch	1,152,409	40,277	7,959,762	17,349,994	169,980	26,813	196,793	47.30	103.10	1.010	0.159 \$	5 1.17	
4A	Savings	44,594	412	193,349	551,331	6,578	274	6,852	1.15	3.28	0.039	0.002 \$	0.04	23.5%
5A	ASHRAE 90 1-2016	1,188,626	51,029	9,158,537	18,888,461	175,322	33,970	209,293	54.42	112.24	1.042	0.202 \$	6 1.24	
5A	NYStretch	1,143,904	50,478	8,950,788	18,321,053	168,726	33,603	202,329	53.19	108.87	1.003	0.200 \$	5 1.20	
5A	Savings	44,722	552	207,749	567,408	6,597	367	6,964	1.23	3.37	0.039	0.002 \$	0.04	0.1%
6A	ASHRAE 90.1-2016	1,188,990	52,179	9,274,748	19,012,980	175,376	34,736	210,112	55.12	112.98	1 042	0.206 \$	1.25	
6A	NYStretch	1,138,529	50,857	8,970,389	18,299,523	167,933	33,856	201,789	53.31	108.75	0.998	0.201 \$	1.20	
6A	Savings	50,461	1,322	304,359	713,458	7,443	880	8,323	1.81	4,24	0.044	0.005 \$	0.05	0.1%

TABLE B1: Differences in Energy Performance, and Annual Energy Cost between ASHRAE 90.1-2016 and 2020 NYStretch by Climate Zone and Building Type (Part C)

\* Negative Savings indicate that NYStretch results in higher energy use or cost relative to ASHRAE 90.1 - 2016

Climate	ASHRAE	Energy Usas	ge	 Annual	NYS Energ	gy Cos	t		Annual S	avin	gs	1	ncremental	Firs	t Cost	Payback Period	Weighting
Zone	Standard	kWh	therms	 Electricity	Ga	5	Total	-	Total		(\$/sf)		Total		(\$/sf)	(Years)	Factors
Large Office		497,337 squ	lare feet														
4A	90.1-2016	7,404,873	45,821	\$ 1,092,219 \$	30,50	3 \$	1,122,721	1.	distant.	Ĩ.	-deh		40.00				
4A	NYStretch	7,090,011	46,458	\$ 1,045,777 \$	30,92	7 \$	1,076,703	\$	46,018	\$	0,093	\$	141,187	\$	0 284	3,1	7.5%
5A	90.1-2016	7,261,025	67,527	\$ 1,071,001 \$	44,95	3 \$	1,115,954										
5A	NYStretch	6,929,778	68,076	\$ 1,022,142 \$	45,31	<u>8</u>	1,067,460	\$	48,493	\$	0,098	\$	234,656	\$	0 472	4.8	1.0%
6A	90.1-2016	7,265,584	72,306	\$ 1,071,674 \$	48,134	4 \$	1,119,808									11 11 11 11 12	1
6A	NYStretch	6,932,525	72,462	\$ 1,022,547 \$	48,23	8 \$	1,070,785	\$	49,022	\$	0.099	\$	148,621	\$	0,299	3,0	0,3%
Standalone Re	tail	24,630 squ	are feet														
4A	90.1-2016	262,889	1,981	\$ 38,776 \$	1,31	9 \$	40,095										
4A	NYStretch	220,589	2,102	\$ 32,537 \$	1,39	9 \$	33,936	\$	6,159	\$	0,250	\$	95,821	\$	3,890	15,6	4,9%
5A	90.1-2016	255,586	2,742	\$ 37,699 \$	1,82	5\$	39,525									- ont	A 11512
5A	NYStretch	210,720	2,946	\$ 31,081 \$	1,96	1 \$	33,042	\$	6,483	\$	0,263	\$	75,788	\$	3.077	11.7	7,1%
6A	90.1-2016	261,103	3,068	\$ 38,513 \$	2,04	3 \$	40,555										
6A	NYStretch	218,834	3,225	\$ 32,278 \$	2,14	7 \$	34,425	\$	6,131	\$	0,249	\$	80,645	\$	3.274	13.2	2.6%
Secondary Sch	iool	210,357 sq	uare feet								_	_					
4A	90.1-2016	1,753,599	18,055	\$ 258,656 \$	12,01	9 \$	270,675										
4A	NYStretch	1,616,146	16,151	\$ 238,381 \$	10,75	1 \$	249,133	\$	21,542	\$	0,102	\$	128,629	\$	0.611	6.0	5.0%
5A	90.1-2016	1,660,790	22,612	\$ 244,967 \$	15,05	3 S	260,020									1 D. 557 1 1 2	and the second
5A	NYStretch	1,523,268	20,845	\$ 224,682 S	13,87	7 \$	238,559	\$	21,461	\$	0,102	\$	91,266	\$	0.434	4.3	3.7%
6A	90.1-2016	1,662,210	23,538	\$ 245,176 \$	15,66	9 \$	260,845									to the real of	1 2 3 3
6A	NYStretch	1,523,135	21,645	\$ 224,662 \$	14,40	9 \$	239,071	\$	21,774	\$	0,104	\$	137,223	\$	0.652	6.3	1,1%
Large Hotel		121,813 sq	uare feet														
4A	90.1-2016	1,587,057	45,330	\$ 234,091 \$	30,17	5 \$	264,267										
4A	NYStretch	1,445,229	43,085	\$ 213,171 \$	28,68	1 \$	241,853	\$	22,414	S	0.184	S	215,819	\$	1,772	9.6	3.5%
5A	90.1-2016	1,496,437	50,472	\$ 220,725 \$	33,59	9 \$	254,323										
5A	NYStretch	1,350,487	48,539	\$ 199,197 \$	32,31	2 \$	231,509	\$	22,814	\$	0.187	\$	189,061	\$	1.552	8.3	2.5%
6A	90,1-2016	1,489,832	53,188	\$ 219,750 \$	35,40	7 \$	255,157										
6A	NYStretch	1,345,009	51,399	\$ 198,389 \$	34,21	6 \$	232,605	\$	22,552	\$	0.185	\$	182,079	\$	1,495	8,1	1,8%
Full Service R	estaurant	5,488 sq	uare feet														
4A	90.1-2016	223,706	13,240	\$ 32,997 \$	8,81	4 \$	41,811									1 1 1 1 1 1 1	100
4A	NYStretch	190,350	12,252	\$ 28,077 \$	8,15	6 \$	36,233	\$	5,578	\$	1.016	\$	30,670	\$	5 588	5,5	0,1%
5A	90.1-2016	213,031	15,675	\$ 31,422 \$	10,43	5 \$	41,857				Sec Sec.						1.1.1.1.1.1.1.1.1
5A	NYStretch	183,745	14,691	\$ 27,102 \$	9,78	0 \$	36,882	\$	4,975	\$	0,906	\$	21,387	\$	3,897	4.3	0.3%
6A	90.1-2016	212,659	16,885	\$ 31,367 \$	11,24	0 \$	42,607									1.1.2.1.2.1.1.2	
6A	NYStretch	183,195	15,893	\$ 27,021 \$	10,58	0 \$	37,601	\$	5,006	\$	0.912	\$	22,967	\$	4.185	4.6	0.1%

TABLE B2: Payback Period of Incremental First Cost between ASHRAE 90.1-2016 and 2020 NYStretch by CZ and Building Type (Part A)

Climate	ASHRAE	Energy Usag	ge		Annual N	<b>VS Energy</b>	y Cost			Annual S	Savir	igs		Incremental	l Firs	st Cost	Payback Period	Weighting
Zone	Standard	kWh	therms		Electricity	Gas		Total		Total		(\$/sf)	-	Total		(\$/sf)	(Years)	Factors
Outpatient He	althcare	40,843 squ	iare feet										_					
4A	90.1-2016	1,032,065	10,408	\$	152,230 \$	6,929	\$	159,158		100		and the second			1	1000	1997 1998 199	
4A	NYStretch	964,334	10,684	S	142,239 \$	7,112	\$	149,351	\$	9,807	\$	0.240	S	126,695	\$	3.102	12.9	2.0%
5A	90.1-2016	1,004,067	11,865	\$	148,100 \$	7,898	\$	155,998		2224	28	200				1.1		
5A	NYStretch	937,570	12,183	\$	138,292 \$	8,110	\$	146,402	\$	9,596	\$	0.235	\$	110,444	\$	2.704	11.5	2.4%
6A	90.1-2016	1,017,373	12,672	\$	150,063 \$	8,436	\$	158,498		h., "		18/5		100		1.1.1.1.1.1.1.1	ALL STARS	
6A	NYStretch	950,276	13,044	\$	140,166 \$	8,683	\$	148,849	\$	9,649	\$	0.236	\$	110,741	\$	2 711	11.5	1.0%
Warehouse		51,914 squ	lare feet															
4A	90.1-2016	125,317	4,921	\$	18,484 \$	3,276	\$	21,760	10	A E MU	ċ.			100	12			
4A	NYStretch	109,025	4,189	\$	16,081 \$	2,788	\$	18,870	\$	2,890	\$	0.056	S	53,254	\$	1.026	18.4	2.5%
5A	90.1-2016	125,589	8,115	\$	18,524 \$	5,402	\$	23,926		12.13	a f	K.		5.00				1
5A	NYStretch	110,586	6,921	\$	16,311 \$	4,607	\$	20,919	\$	3,008	\$	0.058	\$	31,272	\$	0,602	10.4	3.8%
6A	90.1-2016	140,039	6,664	\$	20,656 \$	4,437	S	25,092	-	1999						1.1	121012.2	
6A	NYStretch	120,967	5,805	\$	17,843 \$	3,865	\$	21,707	\$	3,385	\$	0.065	\$	39,118	\$	0.754	11,6	1.2%
10 Story High	rise Apt.	84,140 squ	are feet															
4A	90.1-2016	486,453	24,164	\$	71,752 \$	16,086	\$	87,838		( 1 MA)			- III	Two etc.	P			
4A	NYStretch	471,098	23,557	\$	69,487 \$	15,682	\$	85,168	\$	2,669	\$	0.032	\$	36,040	\$	0.428	13.5	21.9%
5A	90.1-2016	459,795	30,143	\$	67,820 \$	20,066	\$	87,886										
5A	NYStretch	444,061	29,030	\$	65,499 \$	19,325	\$	84,824	\$	3,062	\$	0.036	\$	32,095	\$	0.381	10.5	0.0%
6A	90.1-2016	458,814	30,223	\$	67,675 \$	20,119	\$	87,795					3.4	1999				
6A	NYStretch	443,359	29,091	\$	65,395 \$	19,366	\$	84,762	\$	3,033	\$	0.036	\$	35,330	\$	0.420	11.6	0.0%
20 Story High	rise Apt	168,279 squ	are feet								_							
4A	90.1-2016	1,197,004	40,689	\$	176,558 \$	27,087	\$	203,645			1	al and				1		
4A	NYStretch	1,152,409	40,277	\$	169,980 \$	26,813	\$	196,793	\$	6,852	\$	0.041	\$	78,578	\$	0.467	11.5	23.5%
5A	90.1-2016	1,188,626	51,029	\$	175,322 \$	33,970	\$	209,293		70 C T 7	1.5		3.8			1.1		
5A	NYStretch	1,143,904	50,478	\$	168,726 \$	33,603	\$	202,329	\$	6,964	\$	0.041	\$	71,908	\$	0.427	10.3	0.1%
6A	90.1-2016	1,188,990	52,179	\$	175,376 \$	34,736	\$	210,112		1.0	1	1946	1		9		North Marine	-121-11
6A	NYStretch	1,138,529	50,857	\$	167,933 \$	33,856	\$	201,789	\$	8,323	S	0.049	\$	67,193	\$	0.399	8.1	0.1%
										4A	\$	0.077			\$	0.848	11.04	70.9%
					Weighted Aver	agos by C	limate	7080		5A	\$	0.185			\$	1.808	9.76	20.9%
					weighten weit	ages by C	midu	2011e		6A	\$	0.187			\$	1.962	10.48	8.2%
			L						Co	ombined	\$	0.109			\$	1.140	10.50	100.0%

### TABLE B2: Payback Period of Incremental First Cost between ASHRAE 90.1-2016 and 2020 NYStretch by CZ and Building Type (Part B)

Climate	ASHRAE	Energy Us	age	E	nergy Cost			10	) yr Life Cycl	le En	ergy Cost			Incremental First Cost		Res	idual Value	Net Savings of	over 10 yr	Weighting
Zone	Standard	kWh	therms		Total	F	dectricity		Gas		Total	5	Savings	F	irst Cost	At	10 Years	Total	Cost Index (\$/sf)	Factors
Large Office		497,337 s	quare feet																	
4A.	90,1-2016	7,404,873	45,821	S	1,122,721	\$	10,070,256	\$	322,413	\$	10,392,669	1		1.81	1. S.				8	
4A	NYStretch	7,090,011	46,458	\$	1,076,703	\$	9,642,061	\$	326,895	\$	9,968,956	\$	423,714	\$	141,187	\$	37,036	\$319,563	\$0.64	7.5%
5A	90 1-2016	7,261,025	67,527	\$	1,115,954	\$	9,874,631	\$	475,148	\$	10,349,779				- 2 2		124, 4.21			
5A	NYStretch	6,929,778	68,076	\$	1,067,460	\$	9,424,151	\$	479,012	\$	9,903,163	s	446,616	\$	234,656	\$	40,924	\$252,884	\$0.51	1.0%
6A	90 1-2016	7,265,584	72,306	\$	1,119,808	\$	9,880,830	S	508,778	\$	10,389,609			12.55		-	2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	5 1 AB 66 M		Domestic Mark
6A	NYStretch	6,932,525	72,462	\$	1,070,785	\$	9,427,887	\$	509,876	\$	9,937,763	\$	451,846	\$	148,621	\$	23,746	\$326,971	\$0,66	0,3%
Standalone Re	tail	24,630 s	quare feet																	
4A	90 1-2016	262,889	1,981	\$	40,095	\$	357,516	\$	13,941	\$	371,457			1000		100			- 18 Same	
4A	NYStretch	220,589	2,102	S	33,936	\$	299,990	\$	14,787	\$	314,777	\$	56,679	\$	95,821	\$	25,882	(\$13,259)	(\$0.54)	4.9%
5A	90.1-2016	255,586	2,742	\$	39,525	\$	347,585	\$	19,297	\$	366,882			1-11		1	100	62 F 1	inen en Pro	
5A	NYStretch	210,720	2,946	\$	33,042	\$	286,568	\$	20,728	\$	307,296	\$	59,586	\$	75,788	S	18,591	\$2,389	\$0_10	7.1%
6A.	90.1-2016	261,103	3,068	\$	40,555	\$	355,087	\$	21,589	\$	376,676		- Sile	1000		1		The second second	and a second second	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1
6A	NYStretch	218,834	3,225	\$	34,425	\$	297,603	\$	22,691	S	320,293	\$	56,383	\$	80,645	\$	21,594	(\$2,668)	(SU.11)	2.6%
Secondary Sc	hool	210,357 s	quare feet																	
4A	90.1-2016	1,753,599	18,055	\$	270,675	\$	2,384,806	\$	127,041	\$	2,511,847			1			S. S. M.	20 1 2 1 N	MULTER D	
4A	NYStretch	1,616,146	16,151	\$	249,133	\$	2,197,877	\$	113,642	\$	2,311,520	\$	200,327	\$	128,629	\$	54,590	\$126,288	\$0.60	5.0%
5A	90.1-2016	1,660,790	22,612	\$	260,020	\$	2,258,592	\$	159,110	\$	2,417,702			1.1			1.	N 19 3		
5A	NYStretch	1,523,268	20,845	\$	238,559	\$	2,071,568	\$	146,676	\$	2,218,244	\$	199,458	S	91,266	\$	35,287	\$143,479	\$0.68	3,7%
6A	90.1-2016	1,662,210	23,538	\$	260,845	\$	2,260,522	\$	165,623	\$	2,426,145					1.8	Sector Providence		1. 1.	S
6A	NYStretch	1,523,135	21,645	\$	239,071	\$	2,071,387	\$	152,302	\$	2,223,689	\$	202,456	\$	137,223	\$	55,849	\$121,082	\$0.58	1,1%
Large Hotel		121,813 s	quare feet																	
4A	90.1-2016	1,587,057	45,330	\$	264,267	\$	2,158,318	\$	318,958	\$	2,477,276			120				1.2.4	P 7. 241X	
4A	NYStretch	1,445,229	43,085	\$	241,853	\$	1,965,439	\$	303,163	\$	2,268,602	S	208,673	S	215,819	\$	58,057	\$50,912	\$0.42	3.5%
5A	90.1-2016	1,496,437	50,472	\$	254,323	\$	2,035,080	\$	355,140	\$	2,390,220					0.00	STORE OF STREET	2013 . 52 .		
5A	NYStretch	1,350,487	48,539	\$	231,509	\$	1,836,595	\$	341,543	\$	2,178,138	\$	212,083	\$	189,061	\$	46,283	\$69,305	\$0.57	2,5%
6A	90 1-2016	1,489,832	53,188	\$	255,157	\$	2,026,097	\$	374,254	\$	2,400,350			1				2 3 M 2 7		
6A	NYStretch	1,345,009	51,399	\$	232,605	\$	1,829,146	\$	361,668	\$	2,190,813	\$	209,537	\$	182,079	\$	45,577	\$73,035	\$0.60	1,8%
Full Service F	Restaurant	5,488 s	quare feet																	
4A	90 1-2016	223,706	13,240	\$	41,811	\$	304,229	\$	93,165	\$	397,393			1. 10		2.5.70	100 A 10 A	Mail and The		
4A	NYStretch	190,350	12,252	\$	36,233	\$	258,867	\$	86,209	\$	345,075	\$	52,318	S	30,670	\$	9,805	\$31,453	\$5.73	0.1%
5A	90.1-2016	213,031	15,675	\$	41,857	s	289,711	\$	110,294	\$	400,005					120	12 (15) S V	in pech	16 A	C TREAL S
5A	NYStretch	183,745	14,691	\$	36,882	\$	249,883	\$	103,370	\$	353,253	\$	46,751	\$	21,387	\$	7,721	\$33,085	\$6.03	0.3%
6A	90.1-2016	212,659	16,885	\$	42,607	\$	289,205	\$	118,807	\$	408,012	193		100					1 1 2 2 2 2 2 2 2	
6A	NYStretch	183,195	15,893	\$	37,601	\$	249,135	\$	111,830	\$	360,965	S	47,046	\$	22,967	\$	8,675	\$32,754	\$5.97	0.1%

TABLE B3: 10 Year Present value of differences in Annual Energy Performance, Energy Cost and First Cost between ASHRAE 90.1-2016 and 2020 NYStretch by CZ and Building Type (Part A)

\* Negative Savings indicate that NYStretch results in higher energy use or cost relative to ASHRAE 90.1-2016

Climate	ASHRAE	Energy Us	age	Er	nergy Cost	_		10	yr Life Cycle	Ener	gy Cost			Incremental	Incremental		Incremental		Incremental		Incremental		idual Value	Net Savings of	wer 10 yr	Weinheim
Zone	Standard	kWh	therms		Total	F	lectricity		Gas	I	Fotał	S	Savings	Fi	rst Cost	A	t 10 Years	Total	Cost Index (\$/sf)	Factors*						
Outpatient H	lealthcare	40,843 s	quare feet	_																						
4A	90_1-2016	1,032,065	10,408	\$	159,158	\$	1,403,556	\$	73,235 \$	\$	1,476,791				10000											
4A	NYStretch	964,334	10,684	\$	149,351	\$	1,311,446	\$	75,174 \$	\$	1,386,620	\$	90,171	\$	126,695	\$	30,589	(\$5,934)	(S0.15)	2.0%						
5A	90,1-2016	1,004,067	11,865	\$	155,998	\$	1,365,482	\$	83,485 \$	\$	1,448,966	13	- 100		1.20	1										
5A	NYStretch	937,570	12,183	\$	146,402	\$	1,275,049	\$	85,727 \$	S	1,360,775	S	88,191	\$	110,444	s	24,158	\$1,905	\$0.05	2.4%						
6A	90 1-2016	1,017,373	12,672	\$	158,498	\$	1,383,576	\$	89,168 \$	\$	1,472,744	13	1.1		25 - 1	100		< 11 mm		and the same						
6A	NYStretch	950,276	13,044	\$	148,849	\$	1,292,328	\$	91,783 \$	\$	1,384,110	\$	88,634	\$	110,741	\$	25,228	\$3,121	\$0.08	1.0%						
Warehouse		51,914 s	quare feet															1								
4A	90 1-2016	125,317	4,921	\$	21,760	\$	170.425	S	34.625 \$	\$	205.049			1		- 20		- 12 - PAG								
4A	NYStretch	109,025	4,189	\$	18,870	\$	148,269	s	29.472 \$	\$	177.741	s	27.308	s	53 254	s	14 315	1811/614	150.22	2 5%						
5A	90 1-2016	125,589	8,115	\$	23,926	\$	170,795	\$	57,100 \$	s	227,895		21,410		00,001		11,515	101115 11	1 × A ·	2,570						
5A	NYStretch	110,586	6,921	\$	20,919	\$	150,392	\$	48,700 \$	\$	199,092	\$	28,803	s	31.272	s	10 203	\$7 734	\$0.15	3.8%						
6A	90,1-2016	140,039	6,664	\$	25,092	\$	190.446	\$	46.894 \$	\$	237.340	13			1.1		10,205	51,151	00,15	5.676						
6A	NYStretch	120,967	5,805	\$	21,707	S	164,509	S	40,850 \$	\$	205,358	\$	31,982	s	39.118	\$	14 592	\$7.455	\$0.14	1.2%						
10 Story Hig	hrise Apt.	84,140 s	quare feet							_	2000 - Mag 1 494							0.1.00	40,00	11270						
4A	90 1-2016	486,453	24,164	\$	87,838	\$	661,552	\$	170.029 \$	\$	831,581		1.1.1	1		1.5		2.4		1.12.14						
4A	NYStretch	471,098	23,557	\$	85,168	\$	640,669	\$	165,754 \$	\$	806,423	\$	25,157	s	36,040	\$	12,192	\$1,310	\$0.02	21.9%						
5A	90.1-2016	459,795	30,143	\$	87,886	\$	625,298	\$	212.102 \$	\$	837,400	Ť		1		Ť		41,210	0.01							
5A	NYStretch	444,061	29,030	\$	84,824	\$	603,901	\$	204,268 \$	\$	808.170	\$	29.230	\$	32.095	s	11.372	\$8 507	\$0.10	0.0%						
6A	90.1-2016	458,814	30,223	\$	87,795	\$	623,964	\$	212,663 \$	\$	836.627								00110	0.070						
6A	NYStretch	443,359	29,091	\$	84,762	\$	602,946	\$	204,700 \$	\$	807,645	\$	28,982	\$	35,330	s	13.443	\$7.094	\$0.08	0.0%						
20 Story Hig	ghrise Apt	168,279 s	quare feet										201082		0.7.477.00	. ·				01070						
4A	90.1-2016	1,197,004	40,689	\$	203,645	\$	1,627,865	\$	286,307 \$	\$	1.914.173	13		1		155				1.2.5.8.1						
4A	NYStretch	1,152,409	40,277	\$	196,793	\$	1,567,219	\$	283,409 \$	S	1,850,628	\$	63,545	s	78,578	s	22.905	\$7.872	\$0.05	23.5%						
5A	90 1-2016	1,188,626	51,029	\$	209,293	\$	1,616,472	\$	359.065 \$	\$	1.975.537	1E		1					40.00	22.570						
5A	NYStretch	1,143,904	50,478	\$	202,329	\$	1,555,652	\$	355.184 \$	\$	1.910.836	S	64,701	s	71.908	s	21.836	\$14 629	\$0.09	0.1%						
6A.	90.1-2016	1,188,990	52,179	s	210,112	\$	1,616,967	\$	367,155 \$	\$	1,984,121	3.2	1.00	1.	- Core	1.2				3 - 1 S - 2 M						
6A	NYStretch	1,138,529	50,857	\$	201,789	\$	1,548,342	\$	357,853 \$	\$	1,906,196	s	77,926	s	67,193	\$	20.681	\$31,414	\$0.19	0.1%						
													, , , , , , , , , , , , , , , , , , , ,		,			4A	\$0.11	70.9%						
															5A	\$0.37	20.9%									
									Weighted Average Savings by Climate Zone					6A	\$0.30	8.2%										
																	-	Combined	\$0.18	100.0%						

TABLE B3: 10 Year Present value of differences in Annual Energy Performance, Energy (	Cost and First Cost between ASHRAE 90.1-2016 and 2020 NYStretch by CZ and Building Type (Part B)
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\* Negative Savings indicate that NYStretch results in higher energy use or cost relative to ASHRAE 90.1-2016

## Appendix C

### **EEM 9 High-efficiency SHW**

Based on concerns over possible preemption of this measure, the requirement was subsequently removed from NYStretch. The analysis of the impact of the measure is included to memorialize the findings.

This measure required a high-efficiency service water heating (SWH) system. A service water heating system with large input size for either individual water heater or aggregate capacity of all water heaters would be required to have minimum thermal efficiency (Et) of 94%. This requirement only applied to buildings with water heating equipment with an individual or aggregate input rating of 1,000,000 Btu/h or greater.

PNNL's analysis for this measure originally showed savings associated with the prototypes for large hotel, full-service restaurant, outpatient healthcare, 10-story apartments and 20-story apartments.

Upon review, Vidaris found only 20-story apartment building prototype had a SHW system meeting the 1,000,000 Btu/h threshold. Costing for this measure was based on the price differential for three 400 MBH boilers with the efficiencies in the following table.

Cold Summer St	2020 NYStretch	ASHRAE 90.1-2016
20-Story Apartment	High efficiency hot water heaters with 94% Et	Hot water heaters with 90% Et
· '훈리 · 신 기 : .	1,200 MBH total capacity	1,200 MBH total capacity

Based on Vidaris' analysis, savings and payback for this measure varies by climate zone as shown in the following table. Annual energy cost savings are between \$563 and \$633, and payback is between 8.58 and 5.65 years for CZs 4A and 6A, respectively.

20 Story	/ Highrise Apt	168,279	square feet	:					
		Energy	Usage	Annual	NYS Energy	Cost	Annual I Savings	Incremental First Cost	Payback Period
CZ	Description	kWh	therms	Electricity	Gas	Total	Total	Total	(Years)
4A	SHW 90% Eff.	1,152,409	40,277	\$169,980	\$26,813	\$196,793		PALES	
4A	SHW 94% Eff.	1,152,409	39,432	\$169,980	\$26,250	\$196,230	\$563	\$4,833	8.58
5A	SHW 90% Eff.	1,143,904	50,478	\$168,726	\$33,603	\$202,329	1111		
5A	SHW 94% Eff.	1,143,904	49,577	\$168,726	\$33,003	\$201,729	\$600	\$3,795	6.33
6A	SHW 90% Eff.	1,138,529	50,857	\$167,933	\$33,856	\$201,789			
6A	SHW 94% Eff.	1,138,529	49,907	\$167,933	\$33,223	\$201,156	\$633	\$3,572	5.65

Based on the limited savings for the measure and concerns regarding potential federal preemption of this section, NYSERDA elected not to include the SHW requirements in the final version of the 2020 NYStretch Energy Code.

## Appendix D.

### **Cost Estimates**

	EE	2020 NYStretch LARGE OFFICE - 4/ M Incremental Cost Wo Prepared by Vidaris In 19-Jun-2019	A Irksheet IIC.						
EEN	Description	Source of Item Cost	Number of EEM Units	Unit	Cost	/ Unit	Total Item Cost	Total Incremental Cost	Notes / Comments
EEM 1	Enhanced insulation for roofs and walls				0.0			16,034	
Standard	Standard G-9, G32, R-30 roor insulation (insulation entirely above deck) Standard wall insulation (nonresidential mass wall)		38,353	Area	3		5 .		
Starigard	4A: U-0.104, R-7.82		(4,849	Area	8	-	5 -		
EEM	4A U-0.030 R-32.2 (+ R-2.2)	RSMeans 07 22 16 10	38,353	Агеа	\$	0,3881	\$ 14,884		
EEM	Enhanced wall insulation (nonresidential mass wall)	RSMeans 07 21 13.10	74.849	Area	s	0.0154	\$ 1,150		
EEM 2	4A. U-0.099, R-8.30 (+ R-0.48) Enhanced fenestration	Constraint 77	Carl an Young and	Concerne of	0001110		and the second second	5 25 904	in the second
Standard	Standard windows, (J-0.38		49,899	Area	5		\$ .		
EEM 3	Ait leakage testing for mid-sized buildings	PNNL CE ANALYSIS	49,899	Area	5	0,52	\$ 25,904		A DECISION OF THE OWNER
Standard	n/a - does not apply to this building type			_	5	- 4	\$ .		
EEM 4	Reduced LPD for Interior lighting; high efficacy lights in dwelling units	and the second s	1.	Contraction of the	5	100	3 .		117.00 001.025
Slandard	Lighling per ASHRAE 90.1-2016		302,896	watts	5	6.75	5 -		No cost assumed for this
EEM	Reduced LPDs, ~20% more efficient	HBL	308,846	watts	\$		5 -		buidling type
Standard	I/va - IECC only			POOL IN IN	5		\$ .	A REAL PROPERTY AND INCOME.	promotion of the local states of the
EEM A	n/a - IECC only Exterior lighting control	and the second s	5 - 1 - 5 - 5 - 5 - 5 - 5 - 5 - 5 - 5 -		\$	-	5 -	in the second	the second second
Standard	n/a		1000		5		5 -	1000	
EEM 7	n/a - IECC only: already included in NYS amendments to 90 1-2016	The rest of the local division of the		and the second	5		5 -		
Slandard	CV fans: 0 00094 bhp/cfm	the second s	1		and the second division of		\$	* 110,092	
Stendard	VAV fens: 0 00130 bhp/cfm				-	-	\$		
FEM	CV fans: 0.00088 bbp/c/m	RSMeans 23 74 33 10	4.68	Inne	e	1.031	\$ 5137		Costed as increased system
FEM	VAV (ans: 0.00100 hbm/cfm	Reliance D3040 134	21,000	vorus -		1,001	¢ 0,137		size for reduction in static
EEMS	Hotel questroom HVAC variancy control	Kameens D3040 134	31,202	CIM	a de la mais	3,363	a 111,450	and the second s	pressure
Standard	n/a - already included in 90.1-2016	_			\$		\$ .		
EEM 9	h/a - al/8ady included in 50.1-2016 Nigh-efficiency SHW	and the second s	here and	No. of Concession, Name	15	and the second	5 -		STATISTICS.
Standard	n/a - does not apply to this building type	1			5		\$ -		
EEM 10	High-efficiency commercial kitchen equipment	CONTRACTOR OF CARD	and provide the local division of	the later of the later	1.5		5 -		A REAL PROPERTY AND INCOME.
Standard	iva - does not apply to this building type				5		s .		
EEM 11	Thermal bridging reduction	ATTA DE LA D	in a state	Sec. 1.	5	ACCURATE ON THE OWNER	5 -	\$ 2.440	10 - 10 - 10 - 10 - 10 - 10 - 10 - 10 -
Standard	Standard wall insulation		-		\$	÷.	\$ -		
EEM	parapet height to roof deck, 9 ft of total insulation of R-4,2/in for entire perimeter of roof.	RSMeans 07 22 16.10	7,200	Area	\$	0 3400	\$ 2,448		
EEM 12	Exterior Sighting power reduction				000000	1. Alexandre 1. Al	A DESCRIPTION OF THE OWNER OF THE		
Standard	Lighling per ASHRAE 90.1-2016	RSMeans 26 51 13.55	17,406	watts	\$	•	s =		met with MH
EEM 11	Reduced LPDs, -32% more efficient	RSMeans 28 51 13.55	in the second	_	\$	-	5 -		
Standard	Standard elevator motors, 30hp		-	each			s .	* 120,000	A PARTY OF THE OWNER OF THE OWNER
EEM	Elevator motors with regenerative drives, 30 hp	Previous projects	12	each		10,000	\$ 120,000		and the second s
Standard	n/a - already included in 90.1-2016		1. Co., 1840.01		5		s -		
EEM 15	n/a - already included in 90.1-2016 Demand-based regionulated SHM controls				5	- (*	5 -	100 CON 100 CO	THE R. LOCK CO.
Standard	n/a	1			5		\$ .		A REAL PROPERTY AND A REAL
ADDITION.	n/a - applies to IECC path only AL COST ADJUSTMENTS	WEATHING TO AN A STR		-	s		s -		
ACA 1	Reduced capacity for cooling equipment	State State of State of State		1000	N 31	n	at the first	\$ (32,749)	CONTRACTOR OF T
Standard	Cooling Jower, 1602 Ions	RSMeans 23 64 13 10 RSMeans 23 65 13 10	2	unita	5 3	18,147	\$ 636,295 \$ 369,079		
EEM	Watercooled chiller, 676 tons	RSMeans 23 64 13.10	2	units	\$ 3	08,568	\$ 617,136		
ACA 2	Cooling lower, 1543 tans Reduced capacity for heating equipment	RSMeans 23 65 13,10	2	units	5 1	17,744	\$ 355,488	\$ (12.832	the state of the s
Slandard	Hot water boiler, gas fired, 8877 MBH	RSMeans D3020 130	1	units	5 2	\$1,867	\$ 261,867	LIN/RYA	
ACAJ	Reduced capacity for air handling equipment	RSMeans D3020 130	la secondaria	units	5 2	49,034	\$ 249,034	\$ (133,107	Contractory of the local division of the loc
Standard	VAV with Reheat, 274865 cfm	RSMeans D3040 134	1	unis	\$ 2.7.	27,871	\$ 2,727,871		
ACA 4	Increased insulation to account for PTAC openings, thermal bridging requirements	Rameans D3040 134	A DECEMBER OF	Units	\$ 2,51	M,768	\$ 2,594,768		CONTRACTOR INCOME
Standard	n/a - does not apply to this building type			3.121	5		5		
ACAS	Electric vehicle charging station capable parking lots for 5% of spaces	and the second second	distant and the	-	3		• (43	\$ 2,600	Selection and
Standard	No charging stations, 325,080st parking lot, 300st per parking spot	abarashub	1	and the	5	1 100	\$		
ACAS	Solar-ready zone per Appendix GA of 2018 IECC	cna/ganuo.com	2	outets	-	1,300	s 2,600	ALC: NO. OF THE OWNER	27 - 110 - 17 Tool
Standard EEM					5	:	\$ .		No Cost
							Total	\$ 104.894	

	EEM	2020 NYStretch LARGE OFFICE - 5/ Incremental Cost Wo Prepared by Vidaris I 19-Jun-19	A irksheet nc.					
EEM	Description	Source of Item Cost	Number of EEM Units	Unit	Cost / linit	Total Item Cost	Total incremental Cost	Notas / Comments
EEM 1	Enhanced insulation for roots and walks	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	38 353	Area	5	5	\$ 16,130	AS TO HARDON TO BEEN
Standard	Standard U-0.032, K-30 Foor Insulation (Insulation entirely above deck) Standard wall insulation (nonresidential mass wall)		74 849	Area		5		
Standard	54 U-0.090 R-9.31 Enhanced read and deviation (opticities entropy above deck)	CARL FOR THE RECORD	,		-			
EEM	SA U-0.030 R-32.2 (+ R-2.2)	RSMeans 07 22 16.10	30,353	Area	\$ 0.3881	\$ 14,884		
EEM	Enhanced wall insulation (nonresidential mass wall) SA-11-0.085 B-8.83 (+ B-0.52)	RSMeans 07 21 13.10	74,849	Area	\$ 0.0166	5 1,245		
EEM 2	Enhanced tenestration	and the second second	1000		and the second	20	\$ 26,344	and the second se
Standard EEM	Standard windows, U-0.38 Enhanced windows, U-0.36	PNNL CE ANALYSIS	49,899	Area	\$ 0.53	5 26,344		
EEM 3	Air leakage testing for mid-sized buildings	THE REAL PROPERTY	ALL PROPERTY.		Spiss for and	Per Contraction		Participation and the second second
EEM	n/a - does not apply to this building type n/a - does not apply to this building type				\$	5		
EEM 4	Reduced LPD for Interior lighting: high efficacy lights in dwelling units		202.926	(Autto	. 0.75		ALL IN THE REAL	Ma cost accound for this
EEM	Reduced LPDs20% more efficient	HBL	308,846	watts	\$ .	5		building type
EEM 6	Occupancy sensors and automatic lighting controls including egress lighting	Printer of the	State of the second		The Lost of	A COLUMN TWO IS NOT	1	Deck III III III III III III III III III I
Standard EEM	n/a - /ECC only n/a - IECC only				5 -	5 -		
EEM 6	Exterior lighting control	and the state of the state	Martin State	units	Number of Lot	A STATISTICS		a state of the state of the
EEM	n/a - IECC only, already included in NVS amendments to 90.1-2016				\$	\$ .		
EEM 7	Reduce fan power allowances (based on improved fan efficiencies)		Streets Street	0-301 H I	10.00	A COLUMN TWO IS NOT	1 120,025	and the second second second
Standard	CV fanz 0.00094 bhpicfm	_				\$		
Standard	VAV fans: 0.00130 bhpictm	_				<b>S</b>		Contract of the second second second second second
EEM	CV fans: 0.00088 bhp/cfm	RSMeans 23 74 33 10	5.09	tons	\$ 1,031	\$ 5,250		size for reduction in static
EEM	VAV fans: 0.00100 bhp/c/m	RSMeans D3040 134	32,193	ctm	\$ 3.565	\$ 114,775		pressure
EEM 8 Standard	Hotel guestroom HVAC vacancy control	T. C.	and the second second	1000	5 .	5 -		the second s
EEM	n/a - already included in 90.1-2016			-	5 -	s -		
Standard	High-efficiency SHW			The state of the s		5 -		The second s
EEM	n/a - does not apply to this building type			_	\$ -	s -		the state of the s
Standard	r/a - does not apply to this building type				5 -	5 -	A CONTRACTOR OF A	
EEM	n/a - does not apply to this building type	-	1	-	5 -	\$ -		and the second second
Standard	Standard wall insulation	and the second second second			5 -	5 -	*	
EEM	Additional Parapet Insutation Assume 12in at wall + 42in of parapet height + 12in wide parapet + 42in of	RSMeans 07 22 16.10	7,200	Area	\$ 0.3400	\$ 2,448		
EEM 12	Exterior lighting power reduction	The second second second	and the secondary	-	100 million 100 million	Diff.	1 10 10 1 1 1 12	
Standard	Lighting per ASHRAE 90.1-2016	RSMeans 26 51 13:55 RSMeans 26 51 13:55	43,412	watts	1	5 -		
EEM 13	Efficient elevator, regenerative drives	100000000000000000000000000000000000000	S	- Barris	Address of	THE AND ADDRESS	\$ 120,000	a company
Standard	Standard elevator motors, 30hp Elevator motors with renenerative drives, 30 hp	Previous projects	12	each	\$ 10,000	5 120,000		
EEM 14	ERV for apartment makeup air units	Comparison and	A COLORED OF STREET	- Think	white white	A Distant	1	
Standard	n/a - already included in 90.1-2016 n/a - already included in 90.1-2018	-			1	5 .		
EEM 15	Demand-based recirculated SHW controls	3,020,040,010,000	2000	1.0	STORAGE ST	A BACK A DOCTOR		A SALES AND A
EEM	n/a - applies to IECC path only		-		5 -	5		
ADDITION	AL COST ADJUSTMENTS							in the second
Standard	Watercooled chiller, 583 Iona	RSMeans 23 64 13 10	2	unite	\$ 311,297	\$ 822,594	C. C	
Standard	Cooling tower, 1560 tons	RSMeans 23 65 13.10 RSMeans 23 64 13 10	2	units units	\$ 179,680	\$ 359,360		
EEM	Cooling tower, 1542 tons	RSMeans 23 55 13.10	2	unita	\$ 177,556	\$ 355,112		
ACA 2	Reduced capacity for heating equipment	RSMeans 03020 130		unite	\$ 292 309	\$ 292 309	\$ (44,204)	and the second
EEM	Hot water boller, gas fired, 8386 MBH	RSMeans 03020 130	1	units	\$ 246,105	\$ 248,105		
ACA 3	Reduced capacity for air handling equipment VAV with Reheat 276750 ctm	RSMeans D3040 134		units	\$ 2,748.345	\$ 2.746.345	» (78,938	
EEM	VAV with Reheat, 268782 cfm	RSMeans 03040 134		units	\$ 2,667,408	5 2,667,408		
ACA 4	Increased insulation to account for PTAC openings, thermal bridging requirements n/a - does not apply to this building type	The second s		units	1 1 1 2 1	5 .		A REAL PROPERTY AND A REAL
EEM	n/a - does not apply to this building type			units	1	\$ +	944/454	and the second states of the second
ACA 5	Electric vehicle charging station capable parking lots for 5% of spaces No charging stations, 325 080st parking lot, 300st per parking spot	A DATE STORES		and the second	\$ .	5 .	. 70,434	A CONTRACTOR OF TAXA
EEM	208/240V 40 amp outlets (zoneti SA and 6A only)	chargehub.com	54	autiets	\$ 1,300	\$ 70,434		and the second second second
Standard	Solar-ready zone per Appendix CA of 2018 IECC	the second s	1		\$ +	s .		A REAL PROPERTY AND INCOME.
EEM			1		3 :	\$ .		
						Total	\$ 222,002	

	I EEM In Pr	2020 NYStretch ARGE OFFICE - 6A cremental Cost Wor epared by Vidaris In 19-Jun-19	ksheet Ic.					
EEM	Description	flource of litern Coar	Number of EEM Units	Unit	CoM / URIT	Total Kem Cost	<b>Yotal Incremental Cost</b>	Notes / Comments
EEM 1 Standard	Enhanced Insulation for tools and walks Standard (J. 0.02, H. 10 mol mutuling (insulation entirely also a deck)		18 353	Aires	18		8 24,885	
Standard	Standard wall insulation (nonresidential mass wall)		74 840	Aura				
Cita Caro	6A: U-0.060, R-10.70 Enhanced and insulation entirely above deck)		14,040	PVC4		· · · ·		
EEM	5A U-0.029 R-33.4 (+ R-3.4)	RSMeans 07 22 16.10	38,353	Area	\$ 0.5998	\$ 23,003		
EEM	Enhanced wall insulation (nonresidential mass wall) EA_ULD 076- P.11.15 /A P.O.EO	R5Means 07 21 13,10	74,849	Area	\$ 0,0211	\$ 1,581		
EEM 2	Enlianced fenestration	2 1. 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		-	COLUMN T	PROPERTY AND	\$ 20,137	Contraction of the second
Stendard FFM	Standard windows, U-0.36 Exhapped windows, U-0.36	ONNI CE ANALVER	49,699	Area	5 053	\$ -		
EEM 3	Air leakage testing for mid-sized hulldings	FINIL GE NINETOIO	1 172041	N 24	and a	\$ 20,157		CITED IN CO. LOW H
Standard	n/a - does not apply to this building type				5 .	5		
EEM 4	Reduced LPD for Interior lighting: high afficacy lights in dwelling unit		in the second	NUM		-	A	
Standard	Lighting per ASHRAE 90.1-2016	UDI	392,896	watts	5 -	5 -		No cost assumed for this building type
EEM S	Occupancy sensors and automatic lighting controls including agress lightin	HDL	303,040	walle	COLUMN THE	<b>a</b>	STATISTICS.	Contraction and the second second
Standard	n/a - IECC anly		-		5 -	\$		
EEM 6	Exterior lighting contro	AND DESCRIPTION OF			No. of Concession, Name	Name of Concession, name	A CENTRAL END AND	
Standard	n/a pla - ECC only alwards included in NVS amandments to 00.1-2015				5 .	5		
EEM 7	Reduce fan power allowances (based on improved fan efficiencies)		CON STREET	M.2	COLUMN A	ALL DOUGHT M	8 115,148	END OF THE REAL PROPERTY OF
Standard	CV fans: 0 00094 bhp/cfm					\$ .		
Standard	VAV fans: 0.00130 bhp/cfm		and the second second		12	\$ .		
EEM	CV fans: D.00088 bhp/cfm	R5Means 23 74 33 10	4.95	tons	\$ 1,031	\$ 5,107		Costed as increased system size for
EEM	VAV fans: 0.00100 bhpldtm	RSMeans D3040 134	30.865	cím	\$ 3.665	\$ 110.041		reduction in static pressure
EEM 0	Hotel guestroom HVAC vacancy control	A Real Property and the Party	Conception of the local division of the loca	CIRCLAR OF	and the second state	340		Contraction of the second second
Standard	n/a - Already included in 90,1-2016		2	_	\$ .	ş .		
EEMO	High-efficiency Słów	to the second second	And in case of the local division of the loc	Sec. 2.	the second	April 10 million of	Stor Barrier	and the second se
Standard	n/a - does not epply to this building type			_	1.	s .		
EEN 10	High-efficiency commencial kitchen equipment	THE R. P. LEWIS CO., LANSING MICH.	CONTRACTOR OF		AND DESCRIPTION OF	(Shinese H	1	and the second
Slandard	n/a - does not epply to this building type				ş -	\$ .		
EEM 11	Thermal bridging reduction		1		1012	(Contraction)	\$ 2,448	and the second second second
Slandard	Standard wall insulation Additional Record Local Association (2000) 100 at wall + 40 a characteristic (2000) 100 and (2000) 100 at				5 -	5 .		
EEM	root deck. 9 ft of total insulation of R-4 2/n for entire perimeter of roof.	RSMeans 07 22 16 10	7,200	Area	\$ 0.3400	\$ 2,448		
EEM 12	Exterior lighting power reduction	0.01	10.110	1000	COLOR MARKED	States and States and States		
EEM	Reduced LPDs, -11% more efficient	R6Means 26 51 13.55	4.31.412	waits	\$ .	s .		
EEM 12 Standard	Efficient elevator, regenerative drives						\$ 120,000	Printer (
EEM	Elevator motors with regenerative drives, 30 hp	Previous projects	12	each	\$ 10,000	\$ 120,000		
EEM 14 Standard	ERV for spartment makeup air units		CONTRACTOR OF				8	
EEM	n/a - already included in 90,1-2016				\$	\$ .		
EEM 16	Demand-based recirculated 8HW controls	5. C		0.00			4 - I - I - I - I - I - I - I - I - I -	
EEM	n/a - applies to IECC path only		Constant Service		\$	\$		
ADDITION/	AL COST ADJUSTMENTS Reduced capacity for cooling equipment					the states	4 (71 691)	and the state of the
Standard	Watercooled chiller, 633 tons	R6Means 23 64 13.10	2	units	\$ 292,639	\$ 585,278	34114411	
Slandard FEM	Cooling fower, 1445 tons Watercooled chiller, 607 tons	RSMeans 23 65 13.10	2	units	3 156,445	\$ 332,890		
EEM	Cooling tower, 1392 tons	R5Means 23 65 13.10	2	units	\$ 150,340	\$ 320,680		
Standard	Reduced capacity for heating equipment Hot water boller, das fired, 9870 MBH	RSMeans D3020 130		100054	\$ 289,692	5 249 697	\$ (14,628)	
EEM	Hot water boiler, gas fired, 9348 MBH	RSMeana 03020 130	1	units	\$ 275,064	\$ 275,064		
Standard	isequent capacity for air naridling equipment VAV with Roheat, 275076 cfm	R5Means 03040 134		units.	\$ 2,729,760	\$ 2,729 780	\$ (163,754)	and the second second second
EEM	VAV with Rahaat, 258548 cfm	RSMeans D3040 134	i	units	\$ 2,565,006	\$ 2,566,006		
Standard	increased insulation to account for PTAC openings, litermal bridging requirements n/a - does not apply to this building type	CONTRACTOR OF	- State of the second	0	15 .	5		
EEM	n/a - does not apply to this building type			0	5 - 1	ŝ -		
Standard	execting vehicle energing station; capable parking lots for 5% of spaces No charging stations, 325,080sf parking lot, 300sf per parking spot			1	15 . 1	5	5 70,434	and the second
EEM	208/240V 40 amp outlets (zones 5A and GA only)	chargehub.com	54	outiets	\$ 1,300	\$ 70,434	-	
Standard	nover-many zone per Appendix CA of 2018 HCC	And in the other data and		1 7 8 - Ja	5 - 1	5	and the second se	NOT A CONTRACT STREET,
EEM					5 .	5 .		
						Total	\$ 149,368	

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2020 NYStretch STANDALONE RETAIL - 4A EEM Incremental Cost Worksheet Prepared by Vidaris Inc. 19-Jun-2019										
EEM Description Source of Item Cost Unit Cost / Unit C	al Item Cost Total Incremental Cost Notes / Comments									
EEM 1 Enhanced invaliation for cools and walls Standard I. (2012) - 9.0 conclusionilian (assuble) (24.892) Area 5 - 5	\$ 0,703									
Standard will insulation (nonresidential mass will) 11,766 Area 5 - 5	*									
AN: U-U-UV, K-7,62 EVA Enhanced root insulation (insulation entirely above deck) RSMeane 07.72 16 11 - 24.802 Area \$ 0.381 S	9 583									
LLM 4A L0.030 (R-322 (+R-22) Concerned automation (non-section and non-section	484									
EEM (A: U-0.089; R-8.30 (+ R-0.48) R-5.30 (+ R-0	181									
Etan 2 Entransee innertation Standard Standard windows, U-0.37 904 Area 5 - 5										
EEM Enhanced windows, U-0.35 PNNL CE ANALYSIS 904 Area \$ 0.50 \$	447									
Standard /v/a - does not apply to this building type - 0 \$ - 5										
EEM 4 Reduced LPD for Interior Ilighting; high efficacy lights in dwelling units	\$ 59,518									
Standard Lighling per ASHRAE 90 1-2016 35,767 watts \$ 6,75 \$	241,565 proportional to increased									
EEM Reduced LPDs, -25% more efficient HBL 25,970 watts \$ • \$ 30	1,063.28 efficiency									
Standard / view - CEC only - 0 5 - 5										
LELM n/ia-LECC only - U S - S ELM S Exterior lighting control	THE REPORT OF A DRIVE									
Standard /r/a - C \$ - 0 EFW n/a - ECC only already included in NYS amendments to 90.1-2016 - 0 \$ - 5	· · · · · · · · · · · · · · · · · · ·									
EEM 7 Reduce fan power allowances	960 State St									
	size for reduction in static									
EEM EV rans: (1,000/b8 bhp/cfm PGMeans 21 /4 35,10 0.83 tons \$ 1,03 \$	pressure									
EEM # Hotel guestroom KYAC vacancy control Standard m/w already included in 90.7.2016 - 0 \$ - \$										
EEM n/a - a/eady included in 80 1-2016 - 0 5 - 5	and the second									
Standard n/w - does not apply to this building type										
EEM p/a-doas not apply to his building type CEM 10 High-indicatory Commercial Statichen equipment										
Standard r/w - does not apply to this building type - 0 5 - 5 EFM r/w - does not apply to this building type - 3 5 - 5										
EEM 11 Thermal bridging reduction	Sector between overally over the root root									
Sandard we does not apply to this building type A sA sA sA s A sA s	÷									
EEM 12 Extended lighting power reduction Standard L-twinn per ASMeans 26 51 13 55 1.722 watte \$ \$										
EEM Reduced LPDs, -11% more efficient RSMoens 26 51 13 55 \$ - 5	and the second									
EEM 13 Embedies servator, regenerative anves Standard n/w - does not apply to this building type										
EEM n/a - does not apply to this building type - each \$ - \$	and the second se									
Standard Ma-alteady-included in 90.1-2016	•									
EEM 10 Demand-based reculated StW controls	IN FOR FRANK WE WAS DONED									
Standard         A/a         -         0         5         -         5           EFM         n.la - applies to IECC path only         -         0         5         5										
ADDITIONAL COST ADJUSTMENTS	12 400									
Aux 7 Additional Approximation of Approximate Approxim	72,373									
EEM Packaged single-sone AC, 53 tons ACA 2: Reduced espacially for heating equipment	70,2/3									
Stendard UNCLUCED WIPACKAGED UNITS IN ACA 1) - Units 5 - 5										
ACA 3 Reduced capacity for air handling equipment	NAME OF THE OWNER AND THE OWNER.									
Standard (INCLUCED WIPACRAGED UNITS IN ACA 1) UNITS IN ACA 1) UNITS \$ \$										
ACA 4 increased insulation to account for PTAC openings, thermal bridging requirements	The Mark Light, W. State president and street a									
EEN has does not apply to this building type - 0 \$	-									
AcA 5 Electric renicie charging auton capable parking fors for 6% of spaces	4,900									
EEM 2002/40/V4 amp suttints (zones 5A and 4A only) [chargehub.com 2 outlets \$ 1,300 \$ ACA A Reharmand young in the Amendment CA of 2013 IFCC	2,600									
Standard 0 \$ + 5										
	T-4-1 0 74 400									

	2020 NYStretch STANDALONE RETAIL - 5A EEM Incremental Cost Worksheet Prepared by Vidaris Inc. 19-Jun-2019										
EEM	Description	Source of Item Gost	Number of EEM Units	Unit	Co	st / Unit	Total Ite Cost	m T	otal Incremental Cost	Notes / Comments	
EEH 1	Enhanced insulation for roofs and wells	2/10/10/10/10/2000 10/WS	24 692	1000				\$	0,778		
Etandard.	Standard wall insulation (nonresidential mass wall)		24,682	Area			3				
on an or of the	54: U-0.090, R-9.31		11,700	Ave a	Φ			·			
EEM	5A U-0.030; R-32.2 (+ R-2.2)	RSMeans 07 22 16 10	24,692	Area	\$	0,3881	\$ 9	583			
EEM	Enhanced wall insulation (nonresidential mass wall)	RSMeans 07 21 13.10	11,766	Area	5	0.0166	5	196			
EEM 2	Enhanced fenestration		And in case of the local division of the loc	10000	100	-	ALC: NO	in its	817	NUMBER OF STREET	
Standard	Slandard windows, U-0.37		804	Area	\$	-	5				
EEM 3	Air leakage testing for mid-sized buildings	PNNL CE ANALYSIS	904	Area	5	0.57	5	517			
Standard	n/a - does not apply to this building type		1	0	5		5				
EEM 4	n/a - does not apply to this building type Reduced LPD for interior lighting; high afficacy lights in dwelling units		the state of the s	0	5		S.		50 51A	A CONTRACTOR OF A CONTRACTOR O	
Standard	Lighting per ASHRAE 90.1-2016		35,787	watts	5	6.75	\$ 241	565	and a star	Cost assumed to be	
FFM	Reduced I PDr. ~20% more efficient	LOI	26.070	un He	1		¢ 201	093		proportional to increased	
EEMA	Occupancy sensors and automatic lighting controls including agress lighting	Hac	20,070	Wall6		-	\$ 301	.003	V THE REAL PROPERTY AND A DESCRIPTION OF A DESCRIPTIONO OF A DESCRIPTION OF A DESCRIPANCON OF A DESCRIPTION OF A DESCRIPTION OF A DESCRIPTIONO	enciency	
Standard	n/a - IECC only			D	\$	1.1	\$				
EEM	n/a - IECC only		•	D	\$	•	\$			and the second second	
Standard	N/a	11111111111111111	1	0	5		5				
EEM	n/a - IECC only, already included in NYS amendments to 90.1-2016	CANADARCE CONTRACTOR	•	0	5		5		-	and the state of t	
Standard	CV fans 0.00094 bhp/cm	and the second se	1	tons	1		\$		/60	Costed as increased system	
EEM	CV fans 0,00088 bhp/cfm	RSMeans 23 74 33,10	0.76	tons	s	1,031	\$	780		size for reduction in static	
EEM 8	Notel guestroom HVAC vacancy control	TATE OF TRUE	11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			Trinks	1		01-01-01-00-0	Millered P.	
EEM	n/a - already included in 90.1-2016 n/a - already included in 90.1-2016			0	5	- 21	5				
EEM 9	High-efficiency SHW	A STATE OF A CALLER OF A	in the second	2.00			Catological Contraction	\$	STORY OF STR	E SETTRUCTURE	
EEM	n/a - does not apply to this building type n/a - does not apply to this building type			0	5		5	:			
EEM 10	High-afficiency commercial kitchen equipment	It was and	MI O'C.				(interior	1	K K	THE OWNER AND ADDRESS OF	
EEM	n/a - does not apply to this building type n/a - does not apply to this building type			0	s		S	-			
EEM 11	Thermal bridging reduction	PERMIT NO. 1	A Day In the	10 N.	1085	000 -	C. Carlot	3	ALC: NOT THE	N. SWELLER	
EEM	n/a - does not apply to this building type n/a - does not apply to this building type			0	5		5				
EEM 12	Exterior lighting power reduction	The second second	part I show	Alta	ALC: N	Contraction of the	Sec. Str.		S 100 - 10 - 1020		
Standard	Lighting per ASHRAE 90.1-2016 Reduced I PDs. = 11% more efficient	RSMouna 26 51 13 55 RSMouna 26 51 13 55	3,453	watts	5		S	-			
EEM 13	Efficient elevator, regenerative drives	11000 and 20 07 12:00	And Street of Street of Street	1000	and the second	and the second	- 11/2 C - 1-	100	1 10	And the second second second	
Standard	n/a - does not apply to this building type In/a - does not apply to this building type		·	each	5		s	•			
EEM 14	ERV for epartment makeup alr units	STATISTICS OF	ENTER OF	each			Sec. 1	1		THE CONTRACT	
Standard EEM	n/o - already included in 90.1-2016 N/o - already included in 90.1-2015			0	5		5	-			
EEM 16	Demand-based recirculated SHW controls	A STATE OF STA	and service of the local division of the loc			STREET, ST			WINDER NO.		
Standard	n/a - anning to IECC path only			0	5		S c	- 1			
ADDITIONA	L COST ADJUSTMENTS	SPACE AND DESCRIPTION OF	Contraction of the local division of the loc		ALC: N	Contraction of	1000	and a		CHILL CHILL PROPERTY	
ACA 1 Standard	Reduced capacity for cooling equipment	PSMagar 92 74 22 10	Colorado a Colorado	Zuesline 1	100	40.364	\$ 60	3	(6,479)	A state of the state of the	
EEM	Packaged single-zone AC, 46 tons	RSMeans 23 74 33.10	1	units	3	62,875	5 62	875	1. ····		
ACA 2	Reduced capacity for heating equipment	Contraction (13)	2000	in the second		Carter 1410		\$	10 Nov - 10		
EEM	Indiced ministration of the			units	5		5				
ACA 3	Reduced capacity for air handling equipment		MUSAL	LAC COL	1000	100		3	THE R. P. LEWIS CO.	MUSISTER N	
EEM	Internets in tensors of data sin ten il		-	units	s	-	5	-			
ACA 4	Increased insulation to account for PTAC openings, thermal bridging requirements	We contraction and	1	0	-	10.07	eff.	5	ST PARA	No. 1 Decision of the	
EEM	n/a - does not apply to this building type		-	0	5	1	5	-			
ACA 5	Electric vehicle charging station capable parking lots for 5% of spaces	A P CONTRACTOR	the second second	11		100	1000		7,586		
EEM	205/240V 40 amp outlets (zones 5A and 6A only)	chargehub.com		outlets	5	1,300	5 7	586			
ACAS	Solar-ready zone per Appendix CA of 2018 IECC	A ADDINE AND A ADDING TO A ADDING	Non a colo	- LEANE AND -	and the second	1.00	111	1000	and the state	THE REAL PROPERTY AND	
EEM				0	5	1	5				
							Tot	al S	5 71,701		

	2020 NYStretch STANDALONE RETAIL - 6A EEM Incremental Cost Worksheet Prepared by Vidaris Inc. 19-Jun-2019											
EED	Description	Source af Item Cost	Number of EEM Units	Unit	Cost / Unit	Total Item Gost	Total Incremental Cost	Notes / Comments				
EEM 1	Enhanced insulation for roofs and walls		24.692	Area	The second second	Contraction of the local	\$ 15,058					
Standard	Standard 0-0.032, H-30 root instaation (insulation entring above beck) Standard wall insulation (nonresidential mass wall)		11 788	Area		5						
Standard	6A. U.O.080; R-10.70	a a contra a	11,100	Area		·						
EEM	Enhanced root insulation (insulation entitely above deck) 6A. U-0.029, R-33.4 (+ R-3.4)	RSMeans 07 22 16.10	24,692	Area	6 0,5998	\$ 14,809						
EEM	Enhanced wall insulation (nonresidential mass wall)	R5Means 07 21 13.10	11,766	Area	\$ 0.0211	\$ 248						
EEM 2	Enhanced fenestration	Station States	Concession of the local division of the loca	I MARTIN	All and a local division of	A	\$ 496	E ADD I HAVE BEEN AND A STATE OF A				
Standard	Standard windows, U-0.35	and an analysiste	904	Area	\$ .	5 4						
EEM 3	Enhanced windows, U-0.33 Atr leakage texting for mid-street buildings	PNNL CE ANALYSIS	904	Area	\$ 0.65	\$ 495	A DECEMBER OF STREET, STRE	Contract (Strengthered)				
Standard	n/a - does not apply to this building type			0	5 -	5 -						
EEM	n/a - does not apply to this building type Reduced LPD for Interior Liphting: blob efficacy lights in dwelling units	A DECK DECK DECK	the second	0	5	15 -	\$ 59.518	AND DESCRIPTION OF THE OWNER OF T				
Standard	Lighting per ASHRAE 90 1-2016		35,787	watte	\$ 6.75	\$ 241,565		Cost assumed to be				
		UD	50.070	welle		£ 301.083		proportional to increased				
EEM	Reduced LPDs, -20% more emcient	HBL	20,070	Walls	14 5	\$ 301,083		enciency				
Standard	n/a - IECC only			0	S .	5 -						
EEM	n/a - IECC only			0	5 -	\$ .	· ·	and the second se				
Standard	n/a		1	0	\$ -	5 -						
EEM	n/a - IECC only, already included in NYS amendments to 90.1-2016	and the second second		0	5 .	\$ -		AND ADDRESS AND ADDRESS				
Standard	CV fans 0 00094 bho/chm			tons	and the second second	5 -	**************************************	Costed as increased system				
EEM	CV fans: 0.00088 bhp/cfm	RSMeans 23 74 33.10	0.91	tons	\$ 1,031	\$ 936		size for reduction in static				
EEM 0	Hotel guestroom HVAC vacancy control	Contraction (10)	ALL ST. MILLING		Constanting of	CEVE DOLED	CONTRACTOR OF SERVICE	NUMBER OF				
Standard	n/a - already included in 90.1-2016		-	0	\$	5 .						
EEM 9	High-efficiency SHW	A CANCELLAND AND AND	Distance of the	Chille	Tel-Suma	A DESCRIPTION OF THE OWNER	Water and an all					
Standard	n/a - does not apply to this building type			0	5 .	3 -						
EEM 10	High-efficiency commercial sitchen equipment	A DATE OF THE OWNER	Contraction of the local division	in the local distance of the	Alex and the	No. of Concession, Name	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	EX ACCUPATION AND				
Standard	n/a - does not apply to this building type		1 2	0	\$	5						
EEM 11	Infa - does not apply to this building type Thermal bridging reduction	CONTRACTOR OF STREET	the second second	U	Vice in an	Committee		State No. of Lot				
Standard	n/a - does not apply to this building type			0	\$ .	5						
EEM 12	n/a - does not apply to this building type Exterior lighting power reduction	A PROPERTY AND A PROPERTY AND A	and the second states	Area	a contraction of the local division of the l	3 .	5	Contraction of the local division of the loc				
Standard	Lighting per ASHRAE 90 1-2018	RSMeans 26 51 13 55	3,453	watts	\$ .	5 1						
EEM IS	Reduced LPDs. ~11% more efficient	RSMeans 26 51 13 55	Charles to the	No. of Concession, Name	1 Stanting	15		of the local day in the local day				
Standard	n/a - does not apply to this building type			each	4 -	\$ .						
EEM	n/a - does not apply to this building type	COLUMN TWO IS NOT		each	5 .	5 -		Concerning and the second				
Stendard	n/a - already included in 90.1-2016		10000	Ö	5 .	3 -	the second s					
EEM	n/a - already included in 90.1-2016	Contraction of the local division of the loc	+	0	5 .	S -	A COLORADO DE C	and the second second second				
Standard	n/a	a fearment of the second s		0	\$ -	3 -						
EEM	n/a - applies to IECC path only			0	\$ -	\$ -						
ACA 1	Reduced capacity for cooling equipment			Anglingt			\$ (2,543					
Standard	Packaged single zone AC, 50 tons	RSMeans 23 74 33 10	1	units	5 56,577	\$ 66,677						
ACA 2	Packaged single-zone AC, 48 lons Reduced capacity for heating equipment	RSMeans 23 74 33.10	1000	Units	3 64,13	5 64,134	1	CONFIGN STR				
Stendard	(INCLUCED WIPACKAGED UNITS IN ACA 1)			units	5 .	5 -						
EEM	Badurad capacity for all bandling souloment	and do not see the set of the set	de la casilia	units	5	5 -						
Standard	INCLUCED WIPACKAGED UNITS IN ACA 1)		1 Factor 1	units	\$ +	s .						
EEM	Increased invitation to account for BTAC openings, thermal bridging requirements	and the second second	in march	units	5 .	5 .	and the second se	and and a second second				
Standard	In/a - does not apply to this building type		- 1	0	5 -	5 .						
EEM	n/a - does not apply to this building type	and places with the		0		15	5 7.685	and the second second second				
Standard	creative statistic energing station capacite perking tots for any or spaces			0	5 -	5 -	7,000					
EEM	208/240V 40 amp outlets (zones 5A and 6A only)	chargehub.com	6	outlets	\$ 1,300	\$ 7,586		Statement of the same				
Standard	adiatemedy zone per Appendix CA or zona IECC	and the second day		0	5 -	5 .	and the second second second	A REAL PROPERTY AND INCOME.				
EEM				0	5 -	\$ .						
						Total	\$ 81,051					

Control         Description         Description         Part of the probability of the probabili		S EEN	2020 NYStretch SECONDARY SCHOOL I Incremental Cost Wor Prepared by Vidaris In 19-Jun-2019	- 4A rksheet c					
Bit Marcel in a location of a location location of a location of a location of a lo	EEM	Description	Source of Item Cost	Number of EEM Units	Unit	Cost / Unit	Total Item Cost	Total Incremental Cost	Notes / Comments
Busined of Structure for Number of Structure for Number of Structure for Str	EEM 1	Enhanced insulation for roots and walls	a charge a sub-	198 149	Area	April 199		\$ 50,747	
Image         A. U. 4. 200, P. 3.2 / P. 3.2	Chandred	Standard wall insulation (nonresidential steel-frame wall)		160,116	Area				
EAU       All A Mark 20.32 (C + 2) (C	Diangain	4A: U-0.064, R-13.4	1907	41,700	Area	10		· · · · · · · · · · · · · · · · · · ·	
Control induction provide interfactor with the interfactor wi	EEM	4A. U-0.030; R-32.2 (+ R-2.2)	RSMeans 07 22 16 10	128,112	Area	\$ 0.3661	\$ 49,718		
Table 2000 (1112 - 100 / 100 / 112 - 100 / 100 / 112 - 100 / 100 / 112 - 100 / 100 / 112 - 100 / 100 / 110 / 110 / 100 /	EEM	Enhanced wall insulation (nonresidential steel-frame wall)	RSMeans 07 21 13.10	41,755	Area	\$ 0.0248	\$ 1.029		
Shorter         Special of a set of a grant material state dif grant material state dif grant material state dif gra	EEM 2	4A 0-0.001; H-14.2 (+ H-0.77) Enhanced fenestration		and south	100 100	dennin and	The second second	5 /12.004	and the second second second
Difference interview         Protect interview	Standard	Slandard windows, U-0.39		22,484	Area	s -	s -	A Parties	
Shorted         One	EEM 3	Enhanced windows, U-0.37 Air leakage testing for mid-sized buildings	PNNL CE ANALYSIS	22,484	Area	\$ 0.53	\$ 12,004	1	Construction in the second
B10       mix-data is depired in the block by 200       Mix-data is depi	Standard	n/a - does not apply to this building type			0	5 -	5 -	-	
Share i         [j] girls girls girls dig of 25 Jold i         [j] girls girls girls dig of 25 Jold i         [j] girls girls girls dig of 25 Jold i         [j] girls girls girls dig of 25 Jold i         [j] girls girls girls dig of 25 Jold i         [j] girls girls girls dig of 25 Jold i         [j] girls girls girls dig of 25 Jold i         [j] girls girls girls dig of 25 Jold i         [j] girls girls girls dig of 25 Jold i         [j] girls dig dig di         [j] girls di	EEM A	Infa - does not apply to this building type Reduced LPD for Interior lighting: birth efficacy lights to dwelling units	Statement in the local division of the		0	5 -	5 -	A CONTRACTOR OF STREET, STREET	and the second second second
EDA         Reduced LUDs004 more afficient         MBL         122 220         wats         5         .         Loading type           EDA         Reduced LUDs004 more afficient	Standard	Lighting per ASHRAE 90.1-2016		157,768	watts	\$ 6,75	5 -	· · · · · · · · · · · · · · · · · · ·	No cost assumed for this
Barley Model         Display	EEM	Reduced LPDs ~20% more efficient	HBL	127,268	watts	5 -	\$ -		building type
EEM         M. H. ECC anj	Standard	rva - rECC only			0	5 -	s -		A REAL PROPERTY AND INCOME.
Bit Main	EEM	n/a - IECC only		2	0	5 -	s -		
EEM         Mon. EEC. prov. phases of unknowners to 30 1.2016         No. EEC. prov. phases of unknowners to 30 1.2016         No. EEC. prov. phases of unknowners to 30 1.2016         No. EEC. prov. phases of unknowners to 30.12016         No. EEC. prov. phases of unknowners to 31.4016         No. EEC. phases of unknowners to unknowners to 31.4016         No. EEC. phases of	Standard	tatenor lighting control	Distanting of the local distance of the loca	1	0	5 -	5 .	<ul> <li>Dru Ricks</li> </ul>	a local de la caracteria d
BLR 2       Revise in power allowation prove than still densities? <ul> <li></li></ul>	EEM	n/a - IECC only, already included in NYS amendments to 90, 1-2016			Ö	\$ .	5		
Output         Control         Control <thcontrol< th=""> <thcontrol< th=""> <thco< td=""><td>EEM7</td><td>Reduce fun power allowances (based on improved fan efficiencies)</td><td></td><td>1</td><td></td><td></td><td></td><td>\$ 36,643</td><td>- Contraction</td></thco<></thcontrol<></thcontrol<>	EEM7	Reduce fun power allowances (based on improved fan efficiencies)		1				\$ 36,643	- Contraction
Submate         Submate <t< td=""><td>Standard</td><td>Contract of course of cour</td><td></td><td>1</td><td></td><td>-</td><td>3 (*)</td><td></td><td></td></t<>	Standard	Contract of course of cour		1		-	3 (*)		
EEM         CV function         COURD bit plotfind         End of a start of a sta	Standard	VAV fans: 0.00130 bhp/cfm		francisco est		Land Val	5 -		
EEM         W/W fuex 0.010 holdmår         W/W fuex 0.0210 holdmår         S d. 58 §         3 4.611         (m) pressum           State M         Ar - state of pressioner MAC varienty construct         -         0         5         -         7<	EEM	CV fans: 0.00088 bhp/cfm	RSMeans 23 74 33 10	1.97	tons	\$ 1,031	\$ 2,032		Size for reduction in static
EER A         Hold guisticou III ALC values control         Image: Control of the state of the	EEM	VAV fans_0,00100 bhp/c/m	RSMeans D3040 134	9,708	cfm	\$ 3,585	\$ 34,611		pressure
EdM       Mail	EEM &	Hotel guestroom HVAC vacancy control		Contraction in the	0	1.5	Constanting of the	The second second second	
ELM A         Might Higher direction SMM         Image: Star Second apprive to the building type manual for the building type manual for the building type manual for the second apprive to the building type manual for the second apprive to the building type manual for the second apprive to the building type manual for the second apprive to the building type manual for the second apprive to the building type manual for the second apprive to the building type manual for the second apprive to the building type manual for the second apprive to the building type manual for the second apprive to the building type manual for the second apprive to the building type manual for the second apprive to the building type manual for the second apprive to the building type manual for the second apprive to the building type manual for the second apprive to the building type manual for the second apprive to the building type manual for the second apprive to the building type manual for the second apprive to the second	EEM	n/a - already included in 90.1-2016			0	5	5 -		
War-doors not apply to this binding type:	EEM 9	High-efficiency BHW	I Greden a series	State State			Contraction of the local division of the loc		2 10 2 2 20 20
EEN 10 high-efficiency connected kitcher southered in the	EEM	n/a - does not apply to this building type			0	\$ .	\$ .		
Sandard ministery yeers, admand ministery yeers, admand right, admand 2000 administ EEM 15 (Figs. Startings, admand right, administ, administration, administration	EEM 10	High-efficiency commercial kitchen equipment	Sept. 187		CA HA	1.0	A DESCRIPTION OF TAXABLE PARTY.	\$ 14,280	
Caling Charling Control       Caling Control       A.11       A.M2       S       5       10, 10       S       1, 10       A	Standard	Standard encouncy ryers, disnwashers, ovens, and holding cabinets	Energy Star Savings		0		3		
Eak 11 Instrume Undergreen Provide Fead-Coole Dergreen heights root dook 9 ft of tabal insultion of R-4 20n for entre partmeter of root. EEM 12 EEM 12 EEM 12 EEM 12 EEM 12 EEM 12 EEM 12 EEM 14 EEM 14 EEM 15 Construct Class 0.4 gety to this building type EEM 14 EEM 15 Construct Class 0.4 gety to this building type EEM 15 Construct Class 0.4 gety to this building type EEM 14 Construct Class 0.4 gety to this building type EEM 14 Construct Class 0.4 gety to this building type EEM 15 Construct Class 0.4 gety to this building type EEM 14 Construct Class 0.4 gety to this building type EEM 15 Construct Class 0.4 gety to this building type EEM 14 Construct Class 0.4 gety to this building type EEM 14 Construct Class 0.4 gety to this building type EEM 14 Construct Class 0.4 gety to this building type EEM 15 Construct Class 0.4 gety to this building type EEM 14 Construct Class 0.4 gety to this building type Class 0.4 gety to this building type Class 0.4 gety to this building type Class 0.4 gety to this building type EEM 14 Construct Class 0.4 gety to this building type EEM 14 Construct Class 0.4 gety to this building type Class 0.4 gety to this building type Class 0.4 gety to this building type EEM 14 Construct 0.4 gety to this building type Class 0.4 gety t	CCM	chegy star rivers, dishwashers, ovens, and holding cabinets	Calculator	2,316	Area	\$ 6,10	5 14,280		
EEM       Additional Paraget Insulation 134 will + 42m of paraget 1+20m of paraget + 42m of paraget height + 12m wild paraget height + 12m wild paraget + 42m of paraget height + 12m wild paraget + 42m of paraget height + 12m wild paraget + 42m of paraget height + 12m wild paraget + 42m of paraget height + 12m wild paraget + 42m of paraget height + 12m wild paraget + 42m of paraget height + 12m wild paraget + 42m of paraget + 42m of paraget + 42m of paraget height + 12m wild paraget + 42m of paraget height + 12m wild paraget + 42m of paraget height + 12m wild paraget + 42m of paraget height + 12m wild paraget + 42m of p	Standard	Standard wall insulation				5 -	5	\$ 7,344	
paraget neght negh	EEM	Additional Parapet Insulation. Assume 12in at wall + 42in of parapet height + 12in wide parapet + 42in of	RSMeans 07 22 16 10	21,600	Area	\$ 0.3400	\$ 7.344		
Standard II. Lophing per ASHRAE (90.1-2016) EEM Reduced LDBs10% more efficient EEM Reduced LDBs10% more efficient EEM AT EEM Case of LDBs10% more efficient EEM AT EEM AT EEM Case of LDBs10% more efficient EEM AT EEM AT EEM Case of LDBs10% more efficient EEM AT EEM AT EEM AT EEM Case of LDBs10% more efficient EEM AT EEM AT EEM Case of LDBs10% more efficient EEM AT EEM AT EEM AT EEM Case of LDBs10% more efficient EEM AT EEM AT EEM Case of LDBs10% more efficient EEM AT EEM AT EEM AT EEM Case of LDBs10% more efficient EEM AT EEM AT EEM AT EEM AT EEM AT EEM CASE of LDBS10% more efficient EEM AT EEM AT EEM AT EEM AT EEM CASE of LDBS10% more efficient EEM AT E	EEM 52	parapet height to roof deck. If it of total insulation of R-4 2/in for entire perimeter of roof.	O COMPANY ON WORK	AND IN COLUMN	Contractory of	Contraction of the local division of the loc			AND INCOMENTATION OF TAXABLE
EEM 1       Reduced LPDs, -10% more efficient       RSMeans 28 51 13.55       \$	Standard	Lighting per ASHRAE 90.1-2016	RSMeans 26 51 13 55	3,549	wotta	5 -	5 -		
Standard no - dees not apply to this building type EEM 14. EtW for apprintment makeup air units EEM 14. EtW for apprintment makeup air units EEM 14. EtW for apprintment makeup air units EEM 15. Orenand-based major culated 81W controls EEM 16. Orenand-based major culated 81W controls EEM 17. Orenand-based major culated 81W controls EEM 18. Orenand-based major culated 81W controls EEM 19. Orenand-Based major culated 810.00 EE	EEM 13	Reduced LPDs, ~10% more efficient Efficient elevator, recenerative drives	RSMeans 26 51 13.55	a second second		\$ *	\$ .		Company of the local data
EEM inter- deek not apply to this building type EEM interval apply of this building type EEM interval interv	Standard	n/a - dows not apply to this building type			each	s -	5 -		
Standard       Ar Amady included in 90, 1-2016       -       0       \$ -       5       -         EEM       in/s - already included in 90, 1-2016       -       0       \$ -       5       -         Standard       in/s       -       0       \$ -       5       -       -         Standard       in/s       -       0       \$ -       5       -       -         Standard       in/s       -       0       \$ -       5       -       -         Standard       in/s       -       0       \$ -       5       -       -         Standard       in/s       -       0       \$ -       5       -       -       -       -       0       \$ -       5       -	EEM 14	n/a - does not apply to this building type ERV for apartment makeup air units	and a second sec	1 million	each	S	s -	Contraction of the local division of	Contraction of the local division of the
EEM       int - already included in 90.1-2016       -       0       3       -       3       -         Standard in/a       -       0       6       -       5       -       -         Standard in/a       -       0       6       -       5       -       -         ADDITIONAL COST ADJUSTMENT3       -       0       5       -       5       -         ADACA 1       Reduced capacity for fractooling aquipment       -       0       5       201784       5       -         Standard Arecooled chiller, 300 tons       RSMeans 23 64 19.10       1       units       5       206.960       5       206.960       5       201.784	Standard	n/a - already included in 90.1-2016			0	5 -	5		
Standard       VA       0       6       -       0       5       -         ADDITIONAL COST ADJUSTMENT3       -       0       5       -       5       -         ADDITIONAL COST ADJUSTMENT3       -       0       5       -       5       -         ADDITIONAL COST ADJUSTMENT3       -       0       5       -       5       -         Standard       Arcooled chiler, 300 tons       RSMeans 23 64 19 10       1       units       5       206,980       5       206,980       206,980       5       206,980       5       201,784       201,	EEM 15	in/a - already included in 90.1-2016 Demand-based regizculated SHW controls	The second strends	A CONTRACT	D	\$ -	5 -		the second se
EEM     Infa - apples to IECC path only     -     0     \$ - \$ -\$     -     0     \$ - \$ -\$     -     0     \$ - \$ -\$     -     0     \$ - \$ -\$     -     0     \$ - \$ -\$     -     0     \$ - \$ -\$     -     0     \$ - \$ -\$     -     0     \$ - \$ -\$     -     0     \$ - \$ -\$     -     0     \$ - \$ -\$     -     0     \$ - \$ -\$     -     0     \$ - \$ -\$     -     0     \$ - \$ -\$     -     0     \$ - \$ -\$     -     0     \$ - \$ -\$     -     0     \$ - \$ -\$     -     0     \$ -\$ -\$     -     0     \$ -\$ -\$     -     0     \$ -\$ -\$     0     \$ -\$ -\$     0     \$ -\$ -\$     0     \$ -\$ -\$     0     \$ -\$ -\$     0     \$ -\$ -\$     0     \$ -\$ -\$     0     \$ -\$ -\$     0     \$ -\$ -\$     0     \$ -\$ -\$     0     \$ -\$ -\$ -\$     0     \$ -\$ -\$     0     \$ -\$ -\$     0     \$ -\$ -\$     0     \$ -\$ -\$     0     \$ -\$ -\$     0     \$ -\$ -\$ -\$     0     \$ -\$ -\$     0     \$ -\$ -\$ -\$     0     \$ -\$ -\$     0     \$ -\$ -\$ -\$     0     \$ -\$ -\$ -\$ -\$     0     \$ -\$ -\$ -\$ -\$ -\$     0     \$ -\$ -\$ -\$ -\$ -\$ -\$ -\$ -\$ -\$ -\$ -\$     0     \$ -\$ -\$ -\$ -\$ -\$ -\$ -\$ -\$ -\$ -\$ -\$ -\$ -\$	Standard	n/a			D	8 -	\$ -		
ACA 1       Reduced separity for cooling aquipment       (5,185)         Standard An-cooler driver, 300 fors       R5Means 23 64 19,10       1       units       \$ 201,784       \$ 201,784         Standard An-cooler driver, 300 fors       R5Means 23 64 19,10       1       units       \$ 201,784       \$ 201,784         Standard An-cooler driver, 300 fors       R5Means 23 64 19,10       1       units       \$ 201,784       \$ 201,784         Standard An-cooler driver, 300 fors       R5Means D3020 130       1       units       \$ 100,470       \$ 102,770       \$ (2,314)         Standard An-cooler driver, 300 fors       R5Means D3020 130       1       units       \$ 101,456       \$ 102,770       \$ (2,0,574)         Standard An-cooler driver, 300 for hasting aquipment.       R5Means D3020 130       1       units       \$ 646,519       \$ (2,0,574)         Standard An-cooler driver, 300 for hasting aquipment.       R5Means D3040 134       1       units       \$ 646,519       \$ (2,0,574)         Standard N-VW with Reheal, 6407 cfm.       R5Means D3040 134       1       units       \$ 646,519       \$ (2,0,674)         Standard N-VW with Reheal, 6407 cfm.       R5Means D3040 134       1       units       \$ 646,519       \$ (2,0,674)         RCA 4       forceased habiding type       0 <t< td=""><td>ADDITION</td><td>n/a - applies to IECC path only AL COST ADJUSTMENTS</td><td>C RANGE AND AND A</td><td></td><td>0</td><td>\$ +</td><td>\$</td><td>ALL DOG STATES</td><td>NON CONSTRUCTO</td></t<>	ADDITION	n/a - applies to IECC path only AL COST ADJUSTMENTS	C RANGE AND AND A		0	\$ +	\$	ALL DOG STATES	NON CONSTRUCTO
Standard         Air-cooled chiller, 306 (pois         P306/ears         P306/e	ACA 1	Reduced capacity for cooling equipment	the plate is a statistic part		1 710-0	15 - 20 M	Call Cold States	\$ (5,166)	
ACA 2:         Reduced especially for heating equipment         I </td <td>Standard</td> <td>Air-cooled chiller, 308 tons Air-cooled chiller, 300 tons</td> <td>RSMeans 23 64 19 10 RSMeans 23 64 19 10</td> <td></td> <td>units</td> <td>\$ 206,960</td> <td>\$ 206,960</td> <td></td> <td></td>	Standard	Air-cooled chiller, 308 tons Air-cooled chiller, 300 tons	RSMeans 23 64 19 10 RSMeans 23 64 19 10		units	\$ 206,960	\$ 206,960		
Standard         How water boler, gas fired, 3237 MBH         Itol, 770         \$ 103,770         \$ 103,770           ACA 3         Reduced capacity for all handling equipment.         Itol, 456         \$ 101,456         \$ 101,456         \$ 101,456         \$ (20,574)           ACA 3         Reduced capacity for all handling equipment.         Itol, 456         \$ 101,456         \$ 101,456         \$ (20,574)           Standard         VAV with Rehead, 6217 chm.         RSMeans D3040 134         1         units         \$ 946,519         \$ (20,574)           Standard         VAV with Rehead, 6217 chm.         RSMeans D3040 134         1         units         \$ 946,519         \$ 625,945         \$ 625,945         \$ 625,945           Standard         VAV with Rehead, 6217 chm.         RSMeans D3040 134         1         units         \$ 555,945         \$ 625,945         \$ 625,945         \$ 625,945         \$ 625,945         \$ 625,945         \$ 625,945         \$ 625,945         \$ 625,945         \$ 625,945         \$ 625,945         \$ 625,945         \$ 625,945         \$ 625,945         \$ 625,945         \$ 625,945         \$ 626,945         \$ 626,945         \$ 626,945         \$ 626,945         \$ 626,945         \$ 626,945         \$ 626,945         \$ 626,945         \$ 626,945         \$ 626,945         \$ 626,945         \$ 626,945	ACAZ	Reduced capacity for heating equipment	The second second second	diversity of the lot	AVA.	AN CHIMPSON		\$ (2,314)	CONTRACTOR OF STATE
ACA3     Reduced capsely for all hendling equipment     It     Units     *     It (20,574)       Standard     VAV with Reheal, 64077 ctm.     RSMeans D3040 134     1     units     \$ 946,519     \$ 646,519       EVA     VAV with Reheal, 64077 ctm.     RSMeans D3040 134     1     units     \$ 946,519     \$ 666,519       Standard     VAV with Reheal, 64077 ctm.     RSMeans D3040 134     1     units     \$ 946,519     \$ 625,945       Standard     VAV with Reheal, 64077 ctm.     RSMeans D3040 134     1     units     \$ 946,519     \$ 625,945       Standard     VAV with Reheal, 64077 ctm.     RSMeans D3040 134     1     units     \$ 525,945     \$ - 0       REM     VAV vith Reheal, 64077 ctm.     RSMeans D3040 134     1     units     \$ 525,945     \$ - 0       REM     -     0     \$ - \$     -     0     \$ - \$     -       REM     -     0     \$ - \$     -     -     -       Standard     -     0     \$ - \$     -     -     -       Standard     -     0     \$ - \$     \$ - \$     -     -       REM     -     0     \$ - \$     \$ - \$     -     -       Standard     -     0     \$ - \$     -	Standard EEM	Hot water boller, gas fired, 3237 MBH Hot water boller, gas fired, 3155 MBH	RSMeans D3020 130	1	Units	\$ 103,770 \$ 101,456	\$ 103,770		
Standard     V/W with Rehead, 64877 chm.     RSMeans D3040 134     1     units     \$ 946,519     5 646,519       EEM     V/W with Rehead, 64877 chm.     RSMeans D3040 134     1     units     \$ 562,945     5       ACA 4     Increased Insulation to account for PTAC openings, thermal bridging requirements     0     \$ -     \$ -       Standard     v/a - dees not apply to this building type     0     \$ -     \$ -       EEM     n/a - dees not apply to this building type     0     \$ -     \$ -       ACA 5     Electric vehicle charging station clapable parking lots for 5% of spaces     5     -       Standard     0     \$ -     \$ -     \$ -       ZOR240V 40 amp outlets (zones SA and 6A only)     chargehub.com     2     outlets     \$ 1,300     \$ 2,800       Standard     -     0     \$ -     \$ -     5     -       EEM     -     0     \$ -     \$ -     -     -       CACA 5     stotar-ready zone per Appendix CA of 2018 IECC     -     0     \$ -     5       Standard     -     0     \$ -     \$ -     -     -       EEM     -     0     \$ -     \$ -     -     -       CEA 5     station clapsible parking lots for 5% of spaces     -     -	ACAD	Reduced capacity for air handling equipment	Investments Davide 130	the second	unita	101,450	÷ 101,436	\$ (20,574)	the state of the second second
ACA 4 Increased insulation to secount for PTAC openings, themal bridging requirements in terminal score 0.5 in the second apply to this building type is a second apply is a second apply to this building type is a second apply is a second ap	Slandard	VAV with Reheat, 64817 chn VAV with Reheat, 62741 chn	RSMeans D3040 134 RSMeans D3040 134	1	units	\$ 546,519	\$ 646,519		
Standard     - dees not apply to this building type     -     0     \$     -     5       CACA 5     Electricity include charging station capable parking lots for 5% of spaces     -     0     \$     -     5       Standard     -     0     \$     -     5     -     -       EEM     0     \$     -     0     \$     -     -       ACA 5     Electricity include charging station capable parking lots for 5% of spaces     -     0     \$     -     0       Standard     -     0     \$     -     0     \$     -     -       EEM     -     0     \$     -     0     \$     -     -       ACA 5     Bolar-ready zone per Appendix CA of 2018 IEGC     -     -     -     -     -       EEM     -     0     \$     -     5     -     -	ACA 4	Increased Insulation to account for PTAC openings, thermal bridging requirements	Contracting Doorto 134	C.C. Stationer	unita	- 0x0,240	· 020,043		0.001 S
ACA 5 Electric vehicle charging station capable parting lots for 5% of spaces Chargehub.com Chargehu	Standard	n/a - does not apply to this building type		1	0	\$ .	5 .		
Standard EEM     208/240V 40 amp outlets (zones 5A and 6A only)     -     0     \$     -     0       ACA 5     Solar-ready zone per Appendix CA of 2018 EECC     -     0     \$     -     -       Standard EEM     -     0     \$     -     5     -	ACA 5	Electric vehicle charging station capable parking lots for 5% of spaces		Same and	5	ALC: NOT THE OWNER		\$ 2,600	and the second second second
ACA & Solar-ready zone per Appendix CA of 2018 IECC	Standard	208/240V 40 amp outlets (zones 54 and 64 only)	charachub com		0 Outlete	5 1 200	\$ 2000		
5         0         \$         5         -           0         \$         5         -         0         \$         0         \$	ACAS	Solar-ready zone per Appendix CA of 2018 IECC	(Sum Deuter com	ALL DATE OF THE		e 1,000	· 2,600	10 10 You - 10 10	Contra and a state
	Standard				0	4 .	5 -		
			-		2		Total	\$ 05 564	

	S EEM	2020 NYStretch ECONDARY SCHOOL Incremental Cost Wor Prepared by Vidaris Ind 19-Jun-2019	- 5A ksheet c.								
EEM	Description	Bource of form Cost	Number of EEM Units	UNI	Gost7 Molt	Total Item Cost	Total Incremental Cost	Notes / Comments			
EEM 1 Standard	Enhanced Insulation for roofs and wells Standard U.0.022, 8-30 roof insulation insulation entirely above deck)	0.000	128 112	Area	5	5 .	\$ 51,121				
Standard	Standard wall insulation (nonresidential start-frame wall)		41,755	Area	5 .	s .					
	(54: U-0.055, R-16.0 Enhanced roof insulation (insulation entirely above deck)	PSMaans 07 22 18 10	128 112	Area	5 0 9881	\$ 49.718					
EEM.	5A U-0.030 R-32.2 (+ R-2.2) Enhanced wall insulation (nonresidential steel-frame wall)		110,112	Allon				· · · · · · · · · · · · · · · · · · ·			
EEM	5A U-0.052 R-17.1 (+ R-1.05)	RSMeans 07 21 13.10	41,755	Area	\$ 0.0336	\$ 1,403		and the second second second			
EEM 2 Standard	Enhanced fenestration Standard windows, U-0.39		22,484	Area	5 .	s -	\$ 15,700				
EEM	Enhanced windows, U-0.36 Alt lankage testing for mid-street buildings	PNNL CE ANALYSIS	22,484	Area	\$ 0.70	\$ 15,786	1	LEST & V. SILVET			
Standard	n/e - does not apply to this building type			0	5 .	s -					
EEM 4	In/a - does not apply to this building type Reduced LPD for interior lighting; high afficacy lights in dwelling units	Contraction of the local division of the loc	ALC: NOT THE OWNER	0	Water and the second	3	1	TWICS HAR I THE			
Standard	Lighting per ASHRAE 90.1-2010		157,768	Watts	\$ 6.75	5 -		No cost assumed for this building byze			
EEM 6	Occupancy sensors and automatic lighting controls including egress lighting		141,200	Watta		(a.a.a.a.a.a.a.a.a.a.a.a.a.a.a.a.a.a.a.	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				
Standard	n/a - IECC only n/a - IECC only			0	5 .	5 .					
EEM 6	Exterior lighting control	and the second se	A Star Star	GRACES	No.	20 300	10 21 2 20 C 1 1 C 22 T 8				
EEM	n/a - IECC only, already included in NYS amendments to 90.1-2016			0	\$ <u>1</u>	s i					
EEM7	Reduce fan power allowances (based on improved fan efficiencies)	PERSONAL PROPERTY AND INCOME.	States and		And and a state of the		\$ 37,359				
Standard		_	100000		-	5 -					
Standard	Vav rans: 0 00130 pnpzcm	0.011	201					Costed as increased system			
EEM	CV fame 0.00088 bhp/cfm	Romeans 23 74 33,10	2,01	tons	3 1,001	\$ 2,070		size for reduction in static			
FEMA	How rans. 0.00100 bnp/cfm	RSMBans D3040 134	8,088	cim	a 3.305	a 33,269	State State State	pressure			
Standard	n/a - already included in 90.1-2016			0	5 -	5 .					
EEM 9	n/a - already included in 90,1-2016 High-efficiency SHW	CARLES & DE ALS	13 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5				ALTU DATE VICE				
Standard EEM	n/a - does not apply to this building type			0	\$ .	5 .					
EEM 10	High-efficiency commercial kitchen equipment	TRADE TO A	Contraction of the second	TRACT I	No. of Concession, Name	12 12 12 13	\$ 14,280	had the same of the			
Standard	Standard efficiency hyera, dishwashera, ovens, and holding cabinets	Energy Star Savings	2 2 4 0	0	\$	- 4 RC M 2					
EEM 11	Change star rivers, uninvasiters, overis, and notoing cacinets	Calculator	2,318	Porea.	a 0,10	3 14,200	1 7.344	VALUE AND ADDRESS OF			
Standard	Standard wall insulation	1			\$ -	5 -					
EEM	Additional Parapet Insulation: Assume 12in at wall + 42in of parapet height + 12in wide parapet + 42in of parapet height to roof deck. 9 It of total insulation of R-4.2/m for entire perimeter of roof.	RSMeans 07 22 16 10	21,600	Area	\$ 0,3400	\$ 7,344					
EEM 12	Exterior lighting power induction	DSMaana 26 51 13 55	6 525	watte	No. of Concession, Name	COLUMN TO A					
EEM	Reduced LPDs -10% more efficient	RSMeans 26 51 13.55	0,020	970112	5 -	1					
Standard	Efficient elevator, regenerative drives	Supersonal Supers	And in case of the local division of the loc	each	1 .	5 -					
EEM	n/a - does not apply to this building type			sach	\$ -	5 .	-	and the second second			
Standard	n/a - already included in 90 1-2016			0	8 -	\$ .					
EEM 15	n/a - already included in 90,1-2016 Demand-based recirculated SHW controls	The setting of the second	all at a first	0	5 -	S	5 .	EAN BOOL OF THE			
Standard				0	5 .	\$ ·					
ADDITION	AL COST ADJUSTMENTS	Contraction of the second	States and states	and the second	CONTRACTOR OF	Contraction of the local division of the loc	a state of the sta	10000			
ACA 1 Standard	Reduced sapacity for scoling equipment Air cooled chiler, 295 tons	RSMeans 23 64 19 10	7	units	\$ 198,755	\$ 198,755	\$ (30,626)				
EEM	Air-cooled chiller, 243 tons	RSMeans 23 64 19.10	1	units	\$ 158,129	\$ 168,129	. //623				
Standard	Heroceo capacity to reading equipment Her water boller, gas fired, 3420 MBH	RSMeans D3020 130	1	units	\$ 108,879	\$ 108,879					
EEM	Hot water boler, gas fired, 3413 MBH Reduced canacity for air handling equipment	RSMeans 03020 130	1	units	\$ 108,687	\$ 108,687	\$ (21,624)	CONTRACTOR OF A			
Standard	VAV with Reheat, 66152 cfm	RSMeans D3040 134	1	units	\$ 659,746	5 659,746					
ACA 4	Increased Insulation to account for PTAC openings, thermal bridging requirements	moments 03040 134	Streten 28	Units	• 030,122	0 030 122	States and	The second second second			
Standard	r/a - does not apply to this building type n/a - does not apply to this building type			0	\$ • \$ •	5 .					
ACA 5	Electric vehicle charging station capable parking lots for 5% of spaces	COLUMN 2 NO.				C PARTY AND	\$ 12,896	COMPLAY VERDER			
EEM	208/240V 40 amp outlets (zones 5A and 6A only)	chargehub.com	10	outlets	\$ 1,300	\$ 12,896					
ACA 6 Standard	Solat-ready zone per Appendix CA of 2018 IECC		1 2 1	0	S .	\$		C 10 0101 0 00			
EEM				Q	\$ .	5 .					
						Total	\$ 86,344				
	2020 NYStretch SECONDARY SCHOOL - 6A EEM Incremental Cost Worksheet Prepared by Vidaris Inc. 19-Jun-2019										
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EEN	Description	Source of Item Cost	Number of EEM Units	Unit	Cast/Unit	Total Item Cost	Total Incremental Cost	Notes / Comments			
EEM 1 Standard	Enhanced insulation for roots and walls Standard U.0.032, R-30 root insulation (insulation entirely above deck)	And the second second	128 142	Atea	1.8	1	\$ 78,907				
Standard	Standard wall insulation (nonresidential steel-frame wall)		41 755	Area		s .					
	6A: U-0.049; R-17.5 Enhanced roof insulation (insulation entirely above deck)				-						
EEM	6A U-0.029, R-33.4 (+ R-3.4)	RSMeans 07 22 16,10	128,112	Area	\$ 0.5998	\$ 76,836					
EEM	Enhanced wall insulation (nonresidential steel-frame wall) 6A: U-0.047; R-19.1 (+ R-1.55)	RSMeans 07 21 13,10	41,755	Area	\$ 0.0496	\$ 2,071					
EEM 2	Enhanced fenestration	the second second	d and the	10.00	A COLUMN TWO IS NOT	01000	1 16,119	CONTRACTOR OF T			
Standard	Standard windows, U-0.37 Enhanced windows, U-0.34	PNNI CE ANALYSIS	22,484	Area	\$ 0.72	\$ 16119					
EEM J	Air leakage testing for mid-sized buildings			- 53		10,110	A DATA NO.	1122 W			
EEM	n/a - does not apply to this building type			0	5	5					
EEM 4	Reduced LPD for interior lighting; high efficacy lights in dwelling units	E PLANT	distance of	I Contraction	A DECK	CONTRACTOR OF	A CONTRACTOR OF THE	March 19 - State of the			
Standard	Lighting per ASHRAE 90 1-2016 Reduced LPDs ~20% more efficient	LIDI	157,768	watts	\$ 6,75	\$ .		No cost assumed for this			
EEM S	Occupancy anniors and automatic lighting controls including egress lighting	ribc	121,200	Watta	And in case of the local division of the loc	Contract Lines	State State and	Doroning type			
Standard	In/a - IECC only			0	5 -	5 .					
EEM 6	Exterior lighting control	And in case of the local division of the loc	- sind	0	1	Contraction of	\$700 Store 1	And the second second second			
Stendard	n/a		1.1.1	0	5 -	5 .					
EEM 7	Reduce fan power allowances (based on improved fan efficiencies)	Contraction of the local division of the loc	and the second second	0	18	5	\$ 35,864	A 10/00/21 (1-12-0			
Standard	CV fens: 0 00094 bhp/clm					5 +					
Standard	VAV fans: 0.00130 bhp/cfm					\$ .					
EEM	CV fans: 0.00088 bhb/cfm	RSMeans 23 74 33 10	1.99	tons	\$ 1.031	\$ 2.054		Costed as increased system			
FEM	VAV tens 8 00100 Min/cfm	PSMpage D3040 134	0.704	ofm	E 9 505	¢ 24,810		size for reduction in static			
EEM &	Hotel guestroom HVAC vacancy control	Kawaana Dadad 134	0,704	Cim	\$ 3,363	3 34,010	1	preseure			
Standard	n/a - already included in 90.1-2016			0	5 -	\$ -					
EEM 9	n/a - already included in 90.1-2016 High-efficiency SHW	Statement of the local division in which the local division in the local division in the local division in the		0	5 -	5 .	C	No. of Concession, Name			
Standard	n/a - does not apply to this building type		1.0	Ö	5 -	s .					
EEM TO	n/a - does not apply to this building type High-efficiency commercial kitchen configurent	The local division in		0	\$ .	\$ +	e (6200	the second s			
Standard	Standard efficiency layers, dishwashers, ovens, and holding cabinets			0	\$ -	5 -	4. 14,400	and the second second second second			
EEM	Energy Star fryere, dishwashers, ovene, and holding cabinets	Energy Star Savings	2,319	Area	\$ 6.16	\$ 14,280					
EEM 11	Thermal bridging reduction	Carcolator	Contract State		State of the local division of the local div	Seattle	\$ 7,344	AND THE REAL PROPERTY.			
Standard	Standard well insulation Additional Paranet Insulation: Assume 17in at well + 17in of personal bainful + 17in wide paranet + 47in of		· · ·		5 -	\$					
EEM	parapet height to roof deck. 9 ft of total insulation of R-4.2/in for entire perimeter of roof.	RSMeans 07 22 16 10	21,600	Area	\$ 0,3400	\$ 7,344					
EEM 12	Exterior lighting power reduction	OFHness 35 51 17 55		-	Statute (SEA	a starter	and the second se	and the second second second			
EEM	Reduced LPDs, ~10% more efficient	RSMeans 26 51 13.55	0,040	wath	\$	5 .					
EEM 13 Standard	Efficient elevator, regenerative drives		W. S. Constanting	The state of				A STATE OF A			
EEM	n/a - does not apply to this building type		1	each	5	\$ .					
EEM 14 Slandaut	ERV for apartment makeup air units	AND INC. INC.	NER CONTRACTOR			CORE INTO		Surrey States			
EEM	n/a - already included in 90.1-2016			0	\$ .	\$ .					
EEM 15	Demand-based recirculated SHW controls	Contraction of the local division of the loc				Contraction of the		26 - 30 - X - 1 - 1			
EEM	n/a - applies to TECC path only			0	8	5 -					
ADDITION.	AL COST ADJUSTMENTS										
Slandard	Air-copied chiller, 230 lons	RSMeans 23 64 19 10		units	\$ 159,995	\$ 159,995	a. (J,919)				
EEM	Air-cooled chiller, 224 tons	RSMeans 23 64 19 10	i.	units	\$ 156,476	\$ 156,476					
Standard	Hot water boiler, gas fired, 2438 MBH	RSMeans D3020 130	1	units	5 81,357	\$ 81,357	¥ (2,935)	CONTRACTOR INCOME			
EEM	Hol water boiler, gas fired, 2333 MBH	RSMeans D3020 130	1	units	\$ 78,423	\$ 78,423					
Standard	VAV with Reheat, 55326 cfm	RSMeans D3040 134	1	units	\$ 651,558	\$ 651,558	e (x2,044)	THE REAL PROPERTY.			
EEM	VAV with Reheat, 63101 chn	RSMeans D3040 134	1	units	\$ 629,514	\$ 629,514					
Standard	n/a - does not apply to this building type	A DESCRIPTION OF THE PARTY OF T	1 . 1	Ó	5 .	s .					
EEM	n/a - does not apply to this building type			0	\$ +	s -	a communication	combined as a local structure of the second			
Standard	energine remote enorging autom capacits parking lots for any of apaces		The second se	0	5 -	\$ -	2. 12,696	Contraction of the second			
EEM	208/240V 40 amp outlets (zones 5A and 6A only)	chargshub.com	10	outlets	\$ 1,300	\$ 12,896					
Standard	exteriency consider Abbendix CA of 2018 ISCC	Station of the state	1 1	0	5 -	5 .					
EE.M			-	0	\$ .	s -					
						Total	\$ 137,912				

District of the sector of 2012, 402 and sector should be found and entry about design and about of 2012, 402 and should be found and entry about design and about of 2012, 402 and should be found and entry about design and about of 2012, 402 and should be found and entry about design and about of 2012, 402 and 502 and 500 and		2020 NYStretch LARGE HOTEL - 4A EEM Incremental Cost Worksheet Prepared by Videris Inc. 19-Jun-2019										
Image: 1 manual modulo in plane and model m	EEM	Description	Source of Item Cost	Number of EEM Units	Unit	Goat	/ Unit	Total Item Cost	Total incremental Cost	Notes / Comments		
Decide of a biologing and another stand sta	EEM 1 Standard	Enhanced Insulation for roots and walls Standard U-0.032, R-30 root insulation (insulation entirely above deck)		21,300	Area	5	141 3	5 -	\$ 8,770			
District of the output of t	Standard	Standard wall insulation (residential mass wall)		30,265	Area	\$		5 -				
Mark         Mark L 2000, Ph 32 J C PA 27 J J Mark Mark M 27 11 3.1 M 2000         Arcs         J E DOD N         J E DOD N<	FEM	Enhanced roof insulation (insulation entirely above deck)	RSMeans 07 22 16 10	21,300	Area	5 0	0.3861	6,266				
Basel Model       Machine Market		4A: U-0.030; R-32.2 (* R-2.2) Enhanced wall insulation (residential mass wall)	Dett	30.005	Aren		0.0468	e 504				
Diskupper         Diskupper <thdiskupper< th="">         Diskupper         <thdiskupper< th="">         Diskupper         <thdiskupper< th=""> <thdiskupper< th=""> <thdis< td=""><td>EEM</td><td>4A U-0.056 R-9.83 (+ R-0.52)</td><td>Plameans up 21 13.10</td><td>30,203</td><td>Area</td><td>4</td><td>0.0100</td><td>a 304</td><td>* 7.045</td><td>and the second second</td></thdis<></thdiskupper<></thdiskupper<></thdiskupper<></thdiskupper<>	EEM	4A U-0.056 R-9.83 (+ R-0.52)	Plameans up 21 13.10	30,203	Area	4	0.0100	a 304	* 7.045	and the second second		
Else         Distance at motions, 16, 23         Distance at motions, 16, 23         PARK CE ANALYCIS         13,060         Area         8         0.0         5         7         7           ELS         Constructions, 16, 23         Constructions, 16	Standard	Standard windows, U-0.39		13,058	Area	5	•	s -	*			
Stander         Note	EEM 3	Enhanced windows, U-0.37 All leakaon testing for mid-sized buildings	PNNL CE ANALYSIS	13,068	Area	3	0,54	\$ 7,042	a construction (on	Called Street Street or 1		
Link	Standard	n/a - does not apply to this building type			0	\$		5 -				
Sinder (Select Part Select Part Part Select Part Part Part Part Part Part Part Par	EEM 4	n/a - daes not apply to this building type Reduced LPD for interior lighting; high efficacy lights in dwelling units	and a set of the set of the			STATISTICS.	Citize In	Contraction of the	\$ 138,136	State State State		
Base Monometer Marketing Marketing Sections Including segress lighting         Num.         Num. <th< td=""><td>Standard</td><td>Lighting per ASHRAE 90.1-2018</td><td></td><td>95,014</td><td>watts</td><td>5.</td><td>6,75</td><td>S 641,345</td><td></td><td></td></th<>	Standard	Lighting per ASHRAE 90.1-2018		95,014	watts	5.	6,75	S 641,345				
Standar         No ECC only in - ECC only control         No ECC only contro <td>EEM 5</td> <td>Occupancy sensors and automatic lighting controls including egress lighting</td> <td></td> <td>14,550</td> <td>waita</td> <td>Constant of</td> <td>-</td> <td>5 110,401</td> <td>1 100 AV 1985</td> <td>NOT IN SOM</td>	EEM 5	Occupancy sensors and automatic lighting controls including egress lighting		14,550	waita	Constant of	-	5 110,401	1 100 AV 1985	NOT IN SOM		
End of Defining centred         Control (Marcel Printing Centred)	Standard EEM	n/a - IECC only		1	0	5		\$ .				
Control         Ord	ELMS	Exterior lighting control	MINIPAL SCILLON	00000000000	the all	1107	124	And A Mark		- Contraction of the		
EMP 7         Relation is power allowance of the power allo	Slandard EEM	n/a n/a - IECC only, already included in NYS amendments to 90,1-2016			0	5		5				
Database         Norwards         Distance	EEM 7	Reduce fan power allowances		State of the state of the		all a second	and the second s		\$ 21,952	Costeo as increased system		
Bit All         First glasstroom // All         Second // All         Seco	EEM	VAV rans: 0.00130 bhp/cfm	RSMeans D3040 134	6,157.34	cím	s	3.565	\$ 21,952		size for reduction in static		
Standard         n.         <	EEM 8	Hotel guestroom HVAC vacancy control	WELL ALL THE REAL	The States	1711 F. 1	2015	Carlor H		A STREET, STRE	Di Brendi B		
EER 8         Ingle-metrolency BIW         Ingle-metrolency BIW <td>Standard FEM</td> <td>n/a - already included in 90.1-2016</td> <td></td> <td>1</td> <td>0</td> <td>5</td> <td>2</td> <td>s •</td> <td></td> <td></td>	Standard FEM	n/a - already included in 90.1-2016		1	0	5	2	s •				
Sidnatury Mar. data and apply to This booling type:       -       0       5       -       5       -         Standard Research (Standards Thyres, dishwashers, some, and holding cabinots       -       0       5       -       5       -       0       5       -       0       5       -       5       -       0       5       -       -       0	EEM 9	High-efficiency SHW	A GALCOTTA	ALC: NO	10280 KW	1000	Stant	No. of Concession, Name	Anna Carlos			
EM 100         High-efficiency commental kitcher repuipment         G. 4.0           EXM 201         Energy Siar Nyne, dihwasher, oven, and holding cabinats         Energy Siar Savings         0         5         0.16         5         0.410           EXM 101         Thermal bridging cricitation         Energy Siar Savings         0         4         0         5         0.16         5         0.410           EXM 101         Thermal bridging cricitation         Face as 100000000000000000000000000000000000	Standard	n/a - does not apply to this building type n/a - does not apply to this building type			0	5		5				
Sambar Sa	EEM 10	High-efficiency commercial kitchen equipment	and the little of the little way want to be a state of the little way want to be a st	A REAL	10000		2.000	CONTRACTOR OF	\$ 6,610			
Late       Dring Yolin (jet)       Vicus       Vicus <td>Standard</td> <td>Standard efficiency ryers, dishwathers, ovens, and holding cabinets</td> <td>Energy Star Savings</td> <td>1 108</td> <td>Area</td> <td>e</td> <td>6 16</td> <td>\$ 6810</td> <td></td> <td></td>	Standard	Standard efficiency ryers, dishwathers, ovens, and holding cabinets	Energy Star Savings	1 108	Area	e	6 16	\$ 6810				
Standard Walk       Standard Walk<	ECM 11	Energy stal nyers, usinwashers, overis, and noising cabinets	Calculator	1,100	Люа	and the second second	0,10	¢ 0,818	\$ 2.197			
EEM       Additional Parapet Insulation Assume 12m at well + 21m of parapet height + 12m wide parapet + 42m of parapet + 12m wide parapet + 42m of parapet + 12m wide + 42m of parapet + 12m wide parapet + 12m wide parapet + 12m wide parapet + 12m wid	Standard	Standard wall insulation				\$		5 -				
EER 10 Extends lighting power reduction       RSMeans 26 51 73.55       12,801       watter       5       5       -         EEM 10 Efficient Gevoor, ngenerative drives       RSMeans 26 51 73.55       12,801       watter       5       5       -         Standard Lip/top op ASHARAGE (Separative drives       -       6       6       6       -       -         Standard V/v - does not apply to this building type       -       -       6       5       -       5       -       -         Standard V/v - does not apply to this building type       -       0       5       -       5       -       -       -       -       0       5       -       5       -       -       -       -       0       5       -       5       -       -       -       0       5       -       5       -       -       -       0       5       -       5       -       -       -       0       5       -       5       -       -       0       5       -       5       -       -       -       0       5       -       5       -       -       0       5       -       5       -       -       -       0       5       -	EEM	Additional Parapet Insulation. Assume 12in at wall + 42in of parapet height + 12in wide parapet + 42in of parapet height to roof deck. 9 ft of total insulation of R-4 2/in for entire parimeter of roof.	RSMeans 07 22 16.10	6,462	Area	\$	0.3400	\$ 2,197				
Slandard w/ color blow, 24% more efficient EEM Related blow, 24% more efficient EEM Relation Service Diverse and the building type EEM Relation Diverse	EEM 12	Exterior lighting power reduction		10.014	- 10 A A	10000	100 A.	Contraction of the local distance of the loc	ALCOUNT OF			
EEN 10       Efficient exerctor, responsative drives       -	EEM	Lighting per ASHRAE 90.1-2016 Reduced LPDs, ~24% more efficient	RSMeans 26 51 13 55	12,991	watts	5		\$				
Sindar m <sup>2</sup> does not apply to this building type EEM 16 does not apply to this building type EEM 16 Demand-based reflective to bis building type EEM 16 Demand-based reflective to bis building type EEM 16 Demand-based reflective to bis building type EEM 17 Demand-based reflective to bis building type EEM 18 Demand-based reflective to bis building type EEM 19 Demand-based reflective this building type EEM 19 Demand-based reflective this building type EEM 19 Demand-based reflective this building type EEM 19 Demand 19 Demand 19 Demand 19 Demand 19 Did	EEM 13	Efficient elevator, regenerative drives	THE REAL PROPERTY AND	A DECEMBER OF	each	and the second	1	Contraction of the local division of the loc		THE R. LEWIS CO.		
EEN 16       EEN 16 / EEN for spattment makeup air units.         Standard r/s       - sinearly included in 90 1-2016         EEN 10       - sinearly included in 90 1-2016         EEN 110       - sinearly included in 90 1-2016         Standard 110       - 0         Standard 110       - 1         Standard 110 <t< td=""><td>EEM</td><td>n/a - does not apply to this building type</td><td></td><td></td><td>each</td><td>\$</td><td>2</td><td>5 -</td><td></td><td></td></t<>	EEM	n/a - does not apply to this building type			each	\$	2	5 -				
EEM     nNs-already included in 90.1-2016     -     0     \$ -     5 -     -       EEM 15     Demand-based recirculated SHVA controls     -     0     \$ -     0     \$ -     -       EEM     nNs-applies to IECC path only     -     0     \$ -     5 -     \$ -     -       ACA 1     Reduced capacity for cooling squipment     -     0     \$ -     \$ -     5 -     \$ -       Standard no     -     0     \$ -     \$ -     \$ -     \$ -     \$ -     -       Standard No     -     0     \$ -     \$ -     \$ -     \$ -     -     -       Standard No     -     0     \$ -     \$ -     \$ -     -     -     -       Standard No     -     0     \$ -     \$ -     \$ -     -     -     -       Standard No water boler, gas find, 2197 MBH     -     0     \$ 74,604     \$ 74,	EEM 14	ERV for apartment makeup air units	The state of the s	and the second se	0	5	+ 1	5 - 2	THE REAL PROPERTY.	1		
ELM 15       Demand-based recirculated Profestated Networks         ELM 16       n/a - applies to IECC path only         ADDITIONAL COST ADJUSTINENTS       6         Standard n/a       -         Biological and n/a       -	EEM	n/a - already included in 90.1-2016	-	×1	0	\$		5 -				
EEM     n/a - applies to IECC putte only     -     0     \$     \$     -     0     \$     -     -     0     \$     -	Standard	Demand-based recirculated SHW controls		0.000	0	5		\$	PARTING ALL PROPERTY AND			
ACA 1 Reduced capacity for heading equipment Standard Accoled chiler, 255 fors Construction activity for heading equipment Reduced capacity for heading f	EEM	n/a - applies to IECC path only	- International Action	Acres March	0	5		5	who is the second	Contractor State		
Standard         Air-cooled chiler, 250 fons         (75, 162, 5         (75, 162,	ACA 1	Reduced capacity for cooling equipment	the second				anteres a	and the second	\$ (3,703)	CONTRACTOR NOT		
ACA 2       Relivesd capacity for Heating addigment       (2,477)         Blandard       Hot water boling gas find 2.107 MBH       (2,477)         EEM       Hot water boling gas find 2.107 MBH       (2,477)         ACA 3       Relivesd capacity for its funditing equipment       (2,477)         ACA 4       Restricted capacity for its funditing equipment       (20,734)         Standard       V/V writehed, 4195 cfm       (2,073)         CEA 4       Increased insultation to account for PTAC openings, thermal bridging requirements       (20,734)         Standard       V/V writehed, 4195 cfm       (20,734)         CEM       Infa - does not apply to this building type       (20,734)         EEM       Infa - does not apply to this building type       (20,734)         Standard       V/V writehed, 4195 cfm       (20,734)         Standard       V/V writehed, 4195 cfm       (20,734)         Standard       (20, does not apply to this building type       (20,734)         Standard       (20, does not apply to this building type       (20,734)         Standard       (20, does not apply to this building type       (20, does not apply to this building type         Standard       (20, does not apply to this building type       (20, does not apply to this building type         Standard       (20, does	Standard	Air-cooled chiller, 255 tons Air-cooled chiller, 249 tons	RSMeans 23 64 19 10 RSMeans 23 64 19 10	1	Units 0	5 1	75,162	\$ 175,162 \$ 171,459				
Standard     Mol water bolicy, gas find 2, 197 MBH     MONAGE IN DAVID 100     1     0     1 </td <td>ACA 2</td> <td>Reduced capacity for heating equipment</td> <td></td> <td>COLUMN STREET,</td> <td></td> <td>0.03.045</td> <td>and second</td> <td></td> <td>\$ (2,677)</td> <td>STATISTICS IN</td>	ACA 2	Reduced capacity for heating equipment		COLUMN STREET,		0.03.045	and second		\$ (2,677)	STATISTICS IN		
ACA 3       Reduced expandity for all handling equipment       Image: standard (W) where at 1993 cfm       Image: standard (W) where	EEM	Hot water boller, gas fired, 2197 AfdH Hot water boller, gas fired, 2101 MBH	RSMeans D3020 130	Î	Units 0	\$	71,926	\$ 71,926				
Standard V/L wirzbasic	ACA 3	Reduced capacity for air handling equipment	RSMaara 03040 134	and the second second	100.74		10 384	5 A10 764	\$ (20,784)	CHW CORNEL & THE		
ACA 4 Increased insulation to account for PTAC openings, thermal bridging requirements Standard job AcA 5 Distribution to account for PTAC openings, thermal bridging requirements EEM infa - does not apply to hits building type ACA 5 Distribution to account for PTAC openings, thermal bridging requirements Standard job AcA 5 Distribution to account for PTAC openings, thermal bridging requirements Standard Job AcA 5 Distribution to account for PTAC openings, thermal bridging requirements Standard Job AcA 5 Distribution to account for PTAC openings, thermal bridging requirements Standard Job AcA 5 Distribution to account for PTAC openings, thermal bridging requirements Standard Job AcA 5 Distribution to account for PTAC openings, thermal bridging requirements Standard Job AcA 5 Distribution to account for PTAC 9 D	EEM	VAV wireheat, 39793 cm	RSMeans D3040 134	1	units	\$ 3	98,580	\$ 398,580				
EEM     infa - does not apply to this building type     -     0     \$     -     2,000       ACA 5     Electric Vehicle charging station capable parting lots for 3% of spaces     -     0     \$     -     2,000       Scharderd     -     0     \$     -     5     -     2,000       EEM     -     0     \$     -     5     -     2,000       Scharderd     -     0     \$     -     5     -       Scharderd     -     0     \$     -     5     -       Scharderd     -     0     \$     -     5     -       EEM     -     0     \$     -     \$     -	ACA 4	Increased insulation to account for PTAC openings, thermal bridging requirements	The second second		0	5	. 1	5 -				
ACA 5 Execting versing charging station (deputie parsing jots for 3% of spaces Standard EXA 5 Solar/tendy zone per Appendix CA of 2016 IECC Standard CA or 2016 IECC Standa	EEM	nfa - does not apply to this building type		-	0	\$		s .		continue and the		
EEM         2001/240V 40 ang outlets (zones 5A and 6A only)         chargehub.com         2         outlets         \$         7,300         \$         2.600           ACA 5         Sofar/ready zone per Appendix CA of 2016 (ECC)         -         0         \$         -	ACA 5 Standard	Electric vehicle charging station capable parking lots for 5% of spaces		1	0	5	•	\$ -	2,600			
Investor         0         5         5           Standard         0         5         5           EEM         0         5         5	EEM	206/240V 40 amp outlets (zones 5A and 6A only)	chargehub.com	2	outiels	\$	1,300	\$ 2,600		CONTRACTOR DE CONTRACTOR		
	Standard	Screeksand roug her wholever are of so is the re-			0	5	•	5 -		Company of the local sectors o		
	EEM			+	0	\$		S	¢ 460.244			

	2020 NYStretch LARGE HOTEL - SA EEM Incremental Cost Worksheet Prepared by Vidaris Inc. 19-Jun-2019										
EEM	Resotiption	Bource of Item Cost	Number of EEM Units	Unit	Cost/Unit	Total Item Cost	Total Incremental Cost	Notes / Comments			
Standard	Enhanced insulation for roofs and walls Standard U-0.037, R-30 roof insulation finsulation entirely above deckt	and the second second	21 300	Area	1 1		\$ 8,905				
Standard	Standard wall insulation (residential mass wall)		30 265	Area	5 .	s +					
FEM	Enhanced roof insulation (insulation entirely above deck)	0.011 07.02.40.40	84,000								
S.C.M	5A U-0.030, R-32.2 (+ R-2.2)	Restitans 07 22 16 10	21,300	Area	\$ 0,3881	3 8,200					
EEM	5A U-0.076; R-11.3 (+ R-0.66)	RSMcans 07 21 13 10	30,265	Area	\$ 0.0211	\$ 639					
EEM 2 Standard	Enhanced funestration	14 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	13.068	Area	Contraction of the	and the second	8 8,212				
EEM	Enhanced windows, U-0.38	PNNL CE ANALYSIS	13,068	Area	\$ 0.63	\$ 8,212					
EEM 3 Standard	Air leakage tasting for mid-aized buildings	Will state and state and	NOT THE OWNER WATER	0	C. C	CLEAR AND	A ITTIL MARKED BASE	and the second second			
EEM	n/a - does not apply to this building type		10.00 (Ba)	ő	\$	5 -					
Standard	Reduced LPD for Interior lighting; high efficacy lights in dwelling units Lighting per ASHRAE 90 1-2016	And the second second	95.014	watte	5 0.75	\$ 641.245	\$ 138,136				
EEM	Reduced LPDs, ~20% more efficient	HBL	74,550	watts	\$ -	\$ 779,481					
EEM 5 Standard	Occupancy sensors and automatic lighting controls including agress lighting	A CONTRACTOR	State of the local division of the local div	0	1	A REAL PROPERTY.					
EEM	n/a - IECC only		1 A 1	ő	\$	s ·					
Standard	Exterior lighting control	and a second second second	A REAL PROPERTY AND INCOME.	0	1	8					
EEM	n/a - IECC only; already included in NYS amendments to 90 1-2016		÷	ő	\$ .	5					
Standard	VAV lans 0.00130 bhp/chn	DATE OF THE OWNER	Contraction of the local division of the loc	10018		. 2	\$ 22,502	Costed as increased system			
EEM	VAV fans: 0.00100 bhp/cfm	RSMeans D3040 134	6,311.43	cfm	\$ 3.565	\$ 22,502		size for reduction in static			
EEM 8	Hotel guestroom HVAC vacancy control	STREET, STREET	North State	12.112	No.	1001	10 C	pressure			
EEM	n/a - already included in 90.1-2016 n/a - already included in 90.1-2016		:	0	5 -	5 -					
EEM 9	rligh-efficiency SHW		11 20 010		STATISTICS.	Contraction of the	C. LO DE DURING I	-1000201000			
Standard EEM	n/a - does not apply to this building type n/a - does not apply to this building type		1 - 2 - 1	0	5 -	5					
EEM 10	High-efficiency commercial Michen equipment	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	MICHOL: NO.	1 - 20.20	San Ing	Carrier College	\$ 6,610				
Standard	Standard efficiency hyers, distiwashers, ovens, and holding cabinets	Energy Star Savinds		0	\$ -	\$ +					
EEM	energy star irvers, dishwashers, ovens, and holding cabinets	Calculator	1,108	Area	\$ 6,18	\$ 6,810					
Standard	Standard wall insulation	COLUMN STREET		1000	5 .	5	\$ 2,107	ALC: 1 1 1 1 1 1 1 1			
EEM	Additional Parapet Insulation: Assume 12in at wall + 42in of parapet height + 12in wide parapet + 42in of	RSM eans 07 22 16.10	6.462	Area	\$ 0.3400	\$ 2.197					
EEM 12	Exterior lighting power reduction	CALCULATION OF THE OWNER OF	1000000	N-000				and the last state of the last			
Standard	Lighting per ASHRAE 90 1-2016	RSMeana 26 51 13 55	12,951	watts	5 -	5 -					
EEM 13	Efficient elevator, regenerative drives	RSMeans 26 51 13 55	of the local division in the	Contra d	\$ -	3	5	States and showing the			
Standard	n/e - does not apply to this building type			each	5 -	s .					
EEM 14	ERV for apartment makeup air units	CONTRACTOR OF STREET	and the second	each	13 - 1	5	1	The second second second			
Standard	n/a - already included in 90 1-2016			0	8 -	\$ .					
EEM 16	Demand-based recirculated BHW controls	COLUMN STATES	COLUMN TRADE		18 . 1	Contraction of Contract	STOC DECK COCK	DIG PRIM LEAVE			
Standard	n/a n/a - sockus to IECC path only			0	3	5 -					
ADDITION	N. COST ADJUSTMENTS	(12, 12) (11, 12)	-	0	3		the little to be a set of the set				
ACA 1 Standard	Reduced capacity for cooling equipment	Dellana 33.64 10 10	States in the last			C	\$ (3,655)	A CONTRACTOR OF A			
EEM	Air-cooled chiller, 243 tons	RSMeans 23 64 19 10	1 1	0	\$ 168,129	\$ 168,129					
ACA 2 Standard	Reduced capacity for heating equipment	DSH-+	ALCONG DUCK	1000		E 83.642	\$ (2,925)				
EEM	Hot water boller, gas fred, 2379 MBH	RSMeans D3020 130	1 1	0	\$ 79,717	\$ 79,717					
ACA 3	Reduced capacity for air handling equipment	Distance Danie 124		11000		F (20.02)	\$ (20,674)				
EEM	VAV w/reheat, 40789 c/m	RSMeans D3040 134	1	units	\$ 408,447	\$ 408,447					
ACA 4 Standard	Increased insulation to account for PTAC openings, thermal bridging requirements	1924-27-2-21-2	span and the state		Server and	and the second	1	TALL IN THE OWNER WATER			
EEM	n/a - does not apply to this building type		0	0	5	5					
ACA 5	Electric vehicle charging station capable parking lots for 5% of spates	ALC: NOT THE OWNER OF	A REAL PROPERTY.		A CONTRACTOR		\$ 19,158	10 10 X 1 10			
EEM	208/240V 40 amp outlets (zones SA and 6A only)	chargehub.com	15	outlets	\$ 1,300	\$ 19,158					
ACA 6	Solar-ready zone per Appendix CA of 2018 IECC		Contraction of	0				A REAL PROPERTY OF			
EEM			1-31-01	ó		\$					
						Total	\$ 178,865				

2020 NYStretch LARGE HOTEL - 6A EEM Incremental Cost Worksheet Prepared by Vidaris Inc. 19-Jun-2019										
EEM	Description	Bource of Item Cost	Number of EEM Units	Unit	Cost / Un	II Tot	tal Item Gost	Total Incremental Cost	Notes / Comments	
EEM 1 Standard	Enhanced Insulation for roofs and walls Standard U-0.032, R-30 roof insulation (insulation entirely above deck)		21,300	Area	3 -	5		\$ 12,775	The second second second	
Standard	Standard wair insulation (residential mass wall)		30,265	Area	5	5	•			
EEM	Enhanced real insulation (insulation entirely above deck)	RSMeans 07 22 16 10	21.300	Area	\$ 0.56	198 S	12,775			
	6A: U-0.020, R-33.4 (+ R-3.4) Enhanced wall insulation (residential mass wall)									
EEM	6A: U-0.067 R-13.1 (+ R-0.84)	RSMeans 07 21 13.10	30,265	Area	\$ 0.02	269 \$	814			
EEM 2 Standard	Enhanced fenestration	Carlos and the second se	13.068	Area	5	5	Contraction of	s 0,470	ALC: NOT THE ARCES	
EEM	Enhanced windows, U-0.35	PNNL CE ANALYSIS	13,068	Area	\$ 0	85 \$	8,470	-		
EEM 3 Standard	Air leakage testing for mid-staed buildings	Children and the state of the s	1	0	3	. 5				
EEM	n/a - does not apply to this building type			0	\$	5			and the second se	
EEM 4 Standard	Reduced LPD for interior lighting; high efficacy lights in dwelling units Lighting per ASHRAF 90 1-2016	And the state of the second se	95,014	watte	15 6	75 S	641,345	3 136,130		
EEM	Reduced LPDs, -20% more efficient	HBL	74.550	watts	\$	- \$	779,481			
EEM 5 Standard	Occupancy sensors and autometic lighting controls including egress lighting	THE REACESCE SHOT IN		0	5	. 5				
EEM	n/a - IECC anly	the second second		0	\$	. 5	-			
EEM 6 Standard	Exterior lighting control	the second se	1 1	0	5	5	and the second second		SACING STREET, STREET, ST.	
EEM	n/a - IECC only: already included in NYS amendments to 90 1-2016			0	\$	- 5				
EEM 7 Standard	Reduce fan power allowanpes VAV fans: 0.00130 bho/cfm		1	ALC: NO.	1000	5		\$ 22,057	Costed as increased system	
EEM	VAV fans: 0.00100 bhp/cfm	RSMeans D3040 134	6,186.85	cfm	\$ 3.5	565 \$	22,057		size for reduction in static	
EEM &	Hotel guestroom HVAC vacancy control	1223 1 1 - State 1	1	-	100		1.2.2.1	1 A A A A A A A A A A A A A A A A A A A	A CONTRACTOR OF	
Standard	n/a - already included in 90.1-2016			0	5					
EEM 9	High-emclency SHW	A Part of the Part	1	1000	State of the	1000	1000	A REAL PROPERTY AND INC.	E.5 S/	
Standard	n/a - does not apply to this building type			0	5	- 5 5				
EEM 10	High-efficiency commercial litchen equipment	STATISTICS IN COMPANY	A STREET, DOG		Mar and	1.000		\$ 6,810	ALCONTRA STREET	
Standard	Standard efficiency hyers, dishwashers, ovens, and holding cabinets	Energy Star Savings Calculator	1 106	0 Area	5 6	16 5	6,810			
EEM 11	Thermal bridging reduction		10.000		4			\$ 2,107	THE R. LEWIS CO., N. LANSING MICH.	
Standard	Standard wall insulation Additional Breanst Insulation, Assume 17:n at wall + 47:n of naranet bright + 17:n wide parapet + 47:n of		in the second			• \$				
EEM	parapet height to roof deck. 9 ft of total insulation of R-4 2/n for entire perimeter of root.	RSMeans 07 22 16 10	6,482	Area	\$ 0,3	400 \$	2,197			
EEM 12 Standard	Extendor lighting power reduction	RSMeans 28 51 13 55	12 951	wells	5	. 5				
EEM	Reduced LPDs, ~11% more efficient	RSMeans 26 51 13 55		Wanto	5	. \$	÷		the statement of	
EEM 13	Efficient elevator, regenerative drives	and because the same	States and the second second	each	15				Contraction of the local division of the loc	
EEM	n/a - does not apply to this building type			each	\$	- 5			and the second second	
EEM 14	ERV for epartment makeup air units		1					5	heles the second	
EEM	n/a - already included in 90,1-2016		1	0	\$	- 5				
EEM 15 Standard	Demand-based recirculated SHW controls			0	15	5				
EEM	n/a - applies to IECC path only			0	\$	- 5	÷ 1			
ADDITION	AL COST ADJUSTMENTS			An internet	Sec. Pala			5 (3.510)	Children in Land Street	
Standard	Air-cooled chiller, 230 tons	RSMeans 23 64 19.10		units	\$ 159,	095 \$	159,995			
EEM	Air-cooled chiller, 224 tons	RSMeans 23 64 19 10	1	0	\$ 156,	476 5	156,476	\$ (2.935)	der a live wards	
Standard	Hot water baller, gas fired, 2438 MBH	RSMeans D3020 130	1	units	\$ 81.	357 S	81,357			
EEM	Hot water boiler, gas fired, 2333 MBH Reduced exception for all bandling equipment	RSMeans D3020 130	1	0	\$ 78,	423 5	78,423	5 (20, 154)	Address of the Address of the	
Standard	VAV w/reheal, 42018 cfm	RSMeans D3040 134	1	units	\$ 420,	623 5	420,623	(av) red		
EEM	VAV whetheat, 39984 cfm	RSMeans D3040 134	1	units	\$ 400,	469   \$	400,469	Contraction of the local states		
Standard	n/a - does not apply to this building type		1000	0	5	. 5	-			
EEM	n/a - dees not apply to this building type	And the second se	-	0	5	- 5		10.168	and the second se	
Standard	Langung, remore company station capacity persons for any or spaces		10000000	0	5	. 5		Carlow Carlow		
EEM	298/240V 40 amp outlets (zones 5A and 6A only)	chargehub.com	15	outlets	\$ 1.	300 \$	19,158	· ····································	the state of the state of the	
Stendard	overseevy some per supplication of or some ness			0	5	- 5				
EEM				0	\$	- 5	Tedal	¢ 400.004		
							Total			

Eth         Description         Montree of the interact inter		2020 NYStretch FULL-SERVICE RESTAURANT - 4A EEM Incremental Cost Worksheet Prepared by Vidaris Inc. 19-Jun-2019										
Eff 1       Description and the form of and tests       Image in the control of and tests       Image in the control of and tests       Image in the control of and tests         Reserved for and tests       Reserved for and tests       Reserved for and tests       Image in the control of and tests       Image in the control of and tests       Image in the control of and tests         Reserved for and tests       Reserved for and tests       Reserved for and tests       Image in the control of and tests       Image in the control of and tests       Image in the control of and tests         Reserved for and tests       Reserved for and tests       Reserved for and tests       Image in the control of and tests       Image in the control of and tests       Image in the control of and tests         Reserved for and tests       Reserved for and tests       Reserved for and tests       Image in the control of and tests       Image in the control of and tests       Image in the control of and tests         Reserved for and tests       Reserved for and tests       Reserved for and tests       Image in the control of and tests       Im	EEM	Description	Source of Nem Cost	Number of EEM Units	Unit	Gost/Unit	Total Itam Cost	Total Incremental Gost	Notes / Comments			
Binding with hole and provide base hole and the set of	EEM 1	Enhanced insulation for roofs and walls	and the second					\$ 2,602				
No.       N	Standard	Standard wall insulation (nonresidential steel-frame wall)		2.460	Area							
Call       A. L. 0. 200, Ro 1.4. (1, R. 1.3.2); A. L. 0. 200, Ro 1.4. (1, R. 2.3.2); A. L. 0. 200, Ro 1.4. (1, R. 2.4.2); A. L. 0. 200, Ro 1.4. (1, R. 2.4.2		4A: U-0.064, N+13.4 Enhanced roof insulation (attic roof)		-,								
Edits       All Log (2) (1 + 3.2 ) (1	CEM	4A: U-0.020; R-51.4 (+ R-2.35) Enhanced will insulation (concentrational stant/rame wall)	RSMeans 07 22 16,10	6,130	Area	\$ 0.4145	\$ 2,541					
Carbon of Inverse Names Name         Description         PRIL CE ANALYSE         P	EEM	4A U-0.061; R-14.2 (+ R-0.77)	RSMeans 07 21 13,10	2,460	Агеа	\$ 0.0246	\$ 61					
EAU       Enhanced worksom, UAD 35.       PPALE, DE AMALYSID       EQU       Apr. 30       8       0.000       6       2.000       6	EEM 2 Slandard	Enhanced Tenestration Standard windows, U-0.37	and the fail of the second second	508 (	Aree	15 - 13	5 -	\$ 251				
Stature         Noise - Stature apply the building point         Noise - Stature apply the	EEM	Enhanced windows, U-0.35	PNNL CE ANALYSIS	508	Área	\$ 0.50	\$ 251	(maintaining and the state				
121       00       0	Standard	n/a - does not apply to this building type		120.81	0	5 -	s .					
Standard         Digitizing our ASURAGE 00: 10:2161         Name         I define 00:0000000000000000000000000000000000	EEM 4	n/a - does not apply to this building type Reduced LPD for interior lighting; high afficacy lights in dwelling units	and the second s	ACCURATE NO.	0	5 - 1	S	8.372	ALC: NO. OF TAXABLE			
Eff 3         Decoupy sensor and ubitsets: bybing controls including senses lighting         Init:         A.110         Wms         P         S<	Standard	Liphting per ASHRAE 90.1-2016 Reduced I PDs = 2016 more attract	HDI .	4,418	watts	\$ 6.75	\$ 29,820					
Bandard Model	EEM 5	Occupancy sensors and automatic lighting controls including egrass lighting	HBL	2,178	wans	NUCLEO DATA	5 38,102	1	CALIFORNIA (STREET)			
Eff 4 M         Example lighting control         Image: Second Model Mode	Standard EEM	n/a - IECC only n/a - IECC only			0	\$ :						
Bit Market Bit Amerikan (Dis building Ups) <ul> <li></li></ul>	EEM 6	Exterior lighting control		100 C	1000	And I Real Property lies		1	AIV: A REAL			
ELAP Melios for a person develop in a melion of person of the source of person of pers	EEM	n/a - IECC only, already included in NYS amendments to 90.1-2016			0	\$						
EEN Hole general apply in the source spectral manual manua	EEM 7 Standard	Reduce fan power allowances n/a - does not apply to this building type	The second second second second	Constant of the other	tons	S 1001	and the second second	1 × 1				
Start Part And Par	EEM	n/a - does not apply to this building type		4	cîm	\$ 4						
EM         Indshrady incided is 00:1-2016         0         1         0	Standard	n/a - aiready included in 90.1-2016		-	D	S - 1	5	A CONTRACTOR OF				
Siendard market son not apply to this building type	EEMP	n/a - already included in 90.1-2016 High-afficiency SHW	and the second second second		0	5 - 1	5 -		in the second second second			
Carding and a control on point on the control of t	Slandard	n/a - does not apply to this building type		J	0	5 - 1	5 -					
Similar Simila	EEM 10	High-efficiency commercial Michen equipment	Local Content of the state of the	0.00000000	D.	CONTRACTOR OF CONTRACTOR	Martin Company	9,218	No. X. March 199			
ER H 1 Termed bridging pediation: In A - does not apply for this building type ERM In A - does not apply for this building type ERM In A - does not apply for this building type ERM In A - does not apply for this building type ERM In A - does not apply for this building type ERM In A - does not apply for this building type ERM In A - does not apply for this building type ERM In A - does not apply for this building type ERM In A - does not apply for this building type ERM In A - does not apply for this building type ERM In A - does not apply for this building type ERM In A - does not apply for this building type ERM In A - does not apply for this building type ERM In A - does not apply for this building type ERM IN A - does not apply for this building type ERM IN A - does not apply for this building type ERM IN A - does not apply for this building type ERM IN A - does not apply for this building type ERM IN A - does not apply for this building type ERM IN A - does not apply for this building type ERM IN A - does not apply for this building type ERM IN A - does not apply for this building type ERM IN A - does not apply for this building type ERM IN A - does not apply for this building type ERM IN A - does not apply for this building type ERM IN A - does not apply for this building type IN A - does not apply for this building type IN A - does apply for this building type IN A - does not apply for this building type IN A - does apply for this building type IN A - does not apply for this building type IN A - does not apply for this building type IN A - does not apply for this building type IN A - does not apply for this building type IN A - does not apply for this building type IN A - does not apply for this building type IN A - does not apply for this building type IN A - does not apply for this building type IN A - does not apply for this building type IN A - does not apply for this building type IN A - does not apply for this building type IN A - does not apply for this bu	Slandard EEM	Standard efficiency fryers, dishwashers, ovens, and holding cabinets Energy Star fryers, dishwashers, ovens, and holding cabinets	Eneroy Star Savings Calculator	1.497	0 Area	\$ 6.16	9 216					
End        min	EEM 11	Thermal bridging reduction	and the second state of the second state of the	the second second		Pice Contractor	State of the local division of the	\$/-				
Ele 1 2 Exercise lighting power reduction ELE 1 3 Exercise lighting power reduction ELE 1 4 Exercise lighting powe	EEM	n/a - does not apply to this building type		1	Area	\$ 0						
Eff       Reduced LPDs, 4% more efficient       RSMeans 26 of 13.59       Image: Source of the building type         Eff       13       Efficient Selvator, registerrative drives       \$	Standard	Exterior lighting power reduction Lighting per ASHRAE 90.1-2018	RSMeans 26 51 13 55	1.433	watte	5 - 1		1				
Standard Weight Standard Weight Standard Standard Weight Standa	EEM	Reduced LPDs, ~9% more efficient	RSMeans 26 51 13 55			5 - 1						
EM       In/a - does not apply to this building type       -	Standard	n/a - does not upply to this building type	and the second second second second		each	5 - 3	s - 1		CONTRACTOR OF THE OWNER.			
Standard in a eineady included in 90.1-2016 in a eineady include eineady einea	EEM 14	n/a - doss not apply to this building type ERV for apartment makeup air upits	a start a start of the start of	and the second second	each	15 - 11			Station wheels			
EM 15       Demand-dasker reclectulated SNV controls         Simular divis       -       0       5       5         Simular divis       -       0       5       5       -         Simular divis       -       0       5       5       -         Simular divis       -       -       0       5       5       -         Simular divis       -<	Standard	n/a - already included in 90.1-2016			0	5	5 -					
Standard (Aa Standard (Aa Aa apples to IECC path only Stondard (Aa apple to IECC path only Stondard (Aa apple to IECC path only Stondard (Aa apple to IECC path only Stondard (IECC DED WHACKAGED UNITS IN ACA 1) EM Stondard (Aa apple to Ints building type Stondard (Aa apple to Ints building type EM Stondard (Aa apple) Is this building type EM Stondard (Aa apple) Is this building type IEM Stondard (Aa apple) IS this	EEM 15	Demand-based recirculated SHW controls	THE REAL PROPERTY AND ADDRESS OF	2200102		TRANSPORT OF	ALC: NAMES OF	A COLOR DE LA CALLON AND				
NDOITIONAL COST A DUISTNEWTS VIOLAT Cost A Could capacity for fixe cooling equipment VIOLAT Cost A Could capacity for fixed cap	EEM	n/a - applies to IECC path only			0	5 . 5						
Standard     Packaged single-zone AC: 26 Stores       EMM     Packaged single-zone AC; 26 Stores       IAM J     Reduced capacity for heating equipment       Stondard     (IACLUCED WPACKAGED UNITS IN ACA 1)       EM     -       Units     \$ -       Stondard     -       URA J     Reduced capacity for air handling equipment       Stondard     -       URA J     Increased insulation to account for PTAC openings, Intermal bildging requirements       Stondard     -       EM     -       VCA J     Increased insulation to account for PTAC openings, Intermal bildging requirements       Stondard     -       Stondard     -       VCA J     Increased insulation to account for PTAC openings, Intermal bildging requirements       Stondard     -       UCA J     Stones of apply to init building type       EM     -     0       Stones of apply to init building type       EM     -     0       Stones of apply to init building type       EM     -     0       Stones of apply to init building type       EM     -       CDA S </td <td>ADDITION.</td> <td>AL COST ADJUSTMENTS Reduced capacity for cooling equipment</td> <td></td> <td>in a second</td> <td>an and</td> <td>D</td> <td>Section in</td> <td></td> <td>Street Street</td>	ADDITION.	AL COST ADJUSTMENTS Reduced capacity for cooling equipment		in a second	an and	D	Section in		Street Street			
EM     Paskaged single-sone AL, 20 tons       CRA 1     Reduced capacity for heating equipment       Standard (INCLUCED WPACKAGED UNITS IN ACA 1)       CEM       VCA 3       Reduced capacity for all handling equipment       Standard (INCLUCED WPACKAGED UNITS IN ACA 1)       CEM       VCA 4       Increased insulation to account for PTAC openings, thermal bridging requirements       VCA 4       Increased insulation to account for PTAC openings, thermal bridging requirements       VCA 4       VCA 4       Increased insulation to account for PTAC openings, thermal bridging requirements       VCA 4       VCA 4       Increased insulation to account for PTAC openings, thermal bridging requirements       VCA 4       VCA 4       Increased insulation to account for PTAC openings, thermal bridging requirements       VCA 4       Increased insulation to account for PTAC openings, thermal bridging requirements       VCA 4       Increased insulation to account for PTAC openings, thermal bridging requirements       VCA 4       Increased insulation to account for PTAC openings, thermal bridging requirements       VCA 4       VCA 4       Increased insulation to account for PTAC openings, thermal bridging requirements       VCA 5       VCA 6       VCA 7       VCA 7	Stendard	Packaged single-zone AC, 26.2 Ions	RSMeans 23 74 33 10	1	units	\$ 31,038	31,039	* (KDO)	and the second se			
Standard (INCLUCED WPACKAGED UNITS IN ACA 1)       -       units       \$ -       \$ -         VCA 3       Reduced capacity for all handling equipment       -       units       \$ -       \$ -         Tendard (INCLUCED WPACKAGED UNITS IN ACA 1)       -       units       \$ -       \$ -       \$ -         VCA 3       Reduced capacity for all handling equipment       -       units       \$ -       \$ -         VEM       Increased inviations to account for PTAC openings, thermal birliging requirements       -       -       0       \$ -       -         VEM       indo-dees not apply to this building type       -       0       \$ -       -       -       -         VEM       indo-dees not apply to this building type       -       0       \$ -       \$ -       - </td <td>ACAI</td> <td>Reduced capacity for heating equipment</td> <td>RSMeans 23 74 33 10</td> <td>1000</td> <td>units</td> <td>\$ 30,784</td> <td>30,784</td> <td>S IS NOT THE OWNER.</td> <td>E THUR REPORT</td>	ACAI	Reduced capacity for heating equipment	RSMeans 23 74 33 10	1000	units	\$ 30,784	30,784	S IS NOT THE OWNER.	E THUR REPORT			
Notes     Redised capacity for all handling equipment       imbaland informator (INCLUCED WMPACKAGED UMTR IN ACA 1)     -       EM     -       Units     \$ -       Standard informator (INCLUCED while chargely to finis building type via - does not apply to finis building type vi	Standard FEM	(INCLUCED WPACKAGED UNITS IN ACA 1)		•	units	5 - 1						
Standard (In/CLUCED UNITS IN ACA 1)       - units       - units	ACA 3	Reduced capacity for all handling equipment	TOWNER - AND ADDRESS	1	unita	and the state of the local	State States	CONTRACTOR OF STREET				
ACA 4 Increased insulation to account for PTAC openings, thermal bridging requirements Stondard into account for PTAC openings, thermal bridging requirements Stondard into account for PTAC openings, thermal bridging requirements EM into a does not apply to this building type CA 5	EEM	INCLUCED WIMMICKAGED UNITS IN ACA 17			units	5						
EM       v/a - does not apply to this building type       -       0       \$ - </td <td>Standard</td> <td>Increased insulation to account for PTAC openings, thermal bridging requirements n/a - does not apply to this building type</td> <td></td> <td>A STATE OF</td> <td>0</td> <td>1</td> <td>224 211 224</td> <td></td> <td></td>	Standard	Increased insulation to account for PTAC openings, thermal bridging requirements n/a - does not apply to this building type		A STATE OF	0	1	224 211 224					
Aux & Electric venice charging station capable parting fots for 5% of spaces     -     0     \$     -     2       Standard     -     0     \$     -     0     \$     -       Standard     -     0     \$     -     0     \$       EEM     -     0     \$     -     0     \$       Indiard     -     0     \$     -     -       Indiard     -     0     \$     -     -       Indiard     -     0     \$     -     -       EEM     -     0     \$     -     -	EEM	n/a - does not apply to this building type		1,500 201	ő	5						
EEM         208/240V 40 amp outlets (zones 5A and 6A only)         chargehub.com         2         outlets         \$         1,300         \$         2,600           Iondard EEM	Standard	Electric venicle charging station capable parking lots for 5% of apaces		Number of Street, or other	0	5 - 3		\$ 2,600	- 1 VA - 1 VA			
Immodule         0         5         5	EM	208/240V 40 amp cutlets (zones SA and GA only) Solar-ready room per Appendix CA of 2018 (FCC	chargehub.com	2	outlets	\$ 1,300 5	2,600		Contraction and the			
	Standard	TERRITOR AND A TOTAL PARTY AND			Û	5 - 5						
110-27 VAR	EM.			•	٥	15 - 3	Total	\$ 22.785				

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	2020 NYStretch FULL SERVICE RESTAURANT - 5A EEM Incremental Cost Worksheet Prepared by Vidaris Inc, 19-Jun-2019										
EEM	Description	Source al Item Gost	Number of EEM Units	Unit	Cost / Unit	Total Item Cost	Total Incremental Cost	Notes / Comments			
EEM 1	Enhanced Insulation for roofs and walls		6.120	A	argument of the Party		\$ 2,524				
Standard	Standard (J-0.021, K-49 roof insulation (aftic roof) Standard wall insulation (nonresidential steel-frame wall)		9,130	Aren							
Standard	5A: U-0.055; R-16.0	areas the second	2,400	Alte							
EEM	5A U-0.020, R-51.4 (+ R-2.35)	RSMeans 07 22 16.10	6,130	Area	\$ 0,4145	\$ 2,541					
EEM	Enhanced wall insulation (nonresidential steel-frame wall) 5A U-0.052 R-17.1 (+ R-1.05)	RSMeans 07 21 13.10	2,460	Area	\$ 0.0336	\$ 83					
EEM 2	Enhanced fenalitation	WE STORE STORE AND A STORE	808	Area	Contraction of the local division of the loc	INC.	\$ 291	And the second second			
EEM	Enhanced windows, U-0.37	PNNL CE ANALYSIS	608	Area	\$ 0.57	\$ 291					
EEM 3	Air leakage testing for mid-sized buildings	Strange of the second second		0	5 -	5 .		Children Street Soci			
EEM	n/a - does not apply to this building type			Q	\$ -	\$		and the second second			
Standard	Reduced LPD for Interior lighting; high efficacy lights in dwelling units Lighting per ASHRAE 90 1-2016	at the second	4,418	watts	\$ 6.75	\$ 29,820	3 0,372	Cold Statements and statements			
EEM	Reduced LPDs -20% more efficient	HBL	3,178	watte	\$ -	\$ 38,192		And in case of the local division of the loc			
Standard	Occupancy sensors and automatic lighting controls including egress lighting n/a - IECC only		-	0	5 -	s .	A DESCRIPTION OF A DESC				
EEM	n/a - IECC only	and the second se		0	5 -	\$ .	Contraction of the local division of the	the second second second			
Standard				0	5	s -					
EEM7	n/a - IECC only, already included in NYS amendments to 90.1-2016 Reduce fan power allowances	DAY INCOMENTATION OF TAXABLE	Le print	0	a second second	NOT NOT	5	South and south of the			
Standard	n/a - does not apply to this building type			tons	\$ 1,031	5 .					
EEM 0	Hotel guestroom HVAC vacancy control	I VARY CARD STREET OR OTHER	and the second second	Lann.	State of the second second	No. PARS		a strate and			
Standard	n/a - already included in 90.1-2016			0	3 -	5 .					
EEM 9	High-Miclency SHW	and the second second second		Rich	The Contraction	and the second	Carlos and any solution	the state of the s			
Standard EEM	n/a - does not apply to this building type n/a - does not apply to this building type			0	\$	5 -					
EEM 10	High-efficiency commercial kitchen equipment	and the second	State of State of State		100 10000	AND DESCRIPTION OF	\$ 9,215	and the state of t			
EEM	Energy Star fryers, dishwashers, ovens, and holding cabinets	Energy Star Savings Calculator	1,497	Area	\$ 6.16	\$ 9,216					
EEM 11 Standard	Thermal bridging reduction			0		5	States and a state of the	1 St 1 St 1			
EEM	n/a - does not apply to this building type			Area	\$ 0	5 .					
Standard	Exterior lighting power reduction Lighting per ASHRAE 90 1-2016	RSMeans 26 51 13 55	1,432	walts		s -		1111 NO 107 3			
EEM	Reduced LPDs ~9% more efficient	RSMeans 28 51 13 55			5 -	\$ -	*	and the second second			
Standard	n/a - does not apply to this building type		1.1.2	each	3	5 -					
EEM 14	n/a - does not apply to this building type FRV for apartment makeup air units		A CONTRACTOR OF	each	S	5 -	A CONTRACTOR OF A CONTRACTOR				
Standard	rva - already included in 90.1-2018			0	5	5 .					
EEM 15	n/a - siready included in 90.1-2016 Demand-based recirculated SHW controls	States and the states and	12 13 20	U	A CONTRACTOR	Tatat					
Standard	n/a of a strategy to IECC path anty			0	5 .	5 .					
ADDITION	IAL COST ADJUSTMENTS	Section of the sectio	and the second second	Territoria	line and	States and a	The second second	and the second second			
ACA 1 Standard	Reduced capacity for cooling equipment Packaged single-zone AC, 26 3 tons	RSMeans 23 74 33 10	1	units	\$ 31,155	\$ 31,156	\$ (255)	AND A DESCRIPTION OF A			
EEM	Packaged single-zone AC, 26.1 tons	RSMeans 23 74 33.10	1	units	\$ 30,887	\$ 30,887		In the second			
Standard	(INCLUCED W/PACKAGED UNITS IN ACA 1)		-	units	<b>š</b> -	5 .					
EEM	Reduced capacity for all handling equipment	and a second second second	h a comina	units	\$ -	15 -		C			
Standard	(INCLUCED W/PACKAGED UNITS IN ACA 1)			units	5 -	s -					
ACA 4	Increased insulation to account for PTAC openings, mermal bridging requirements	a version of good states and	in a strate	units				the state of the state of the			
Standard	n/a - does not apply to this building type			0	5 .	5 .					
ACA 6	Electric vehicle charging station capable parking lots for 5% of spaces	State of the second second second	A REAL WAREN	-Lease	Contraction of the local distance		1 10 10 10 10 10 10 10 10 10 10 10 10 10	The state part and			
Standard EEM	208/240V 40 emp outlets (zones 5A and 5A only)	chargehub com	1000	outlets	\$ 1,300	5					
ACAS	Solar-ready zone per Appendix CA of 2015 IECC	Section of the sectio	approved the		Contraction of the	C C		A REAL PROPERTY AND A REAL			
EEM				D	8	5					
						Total	\$ 20,234				

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Cut of another in a read and any and any			2020 NYStretch FULL SERVICE RESTAURA EEM Incremental Cost Wor Prepared by Vidaris In 19-Jun-2019	NT - 6A ksheet c.					
Edit 1       Advanced makedion of nonzon and wenig <ul> <li></li></ul>	EEM	Description	Source of Item Cost	Number of EEM Units	Unit	Cost / Unit	Total Item Cost	Total Incremental Cost	Notes / Comments
Description         Description <thdescription< th=""> <thdescription< th=""></thdescription<></thdescription<>	EEM I	Enhanced insulation for roofs and walls		- State		19182	Section 1	\$ 5,475	
Unique view       Uniqueview       Unique view       Unique view	Standard	Standard 0-0.021, H-49 root insulation (attic root) Standard wall insulation (nonresidential steel-frame wall)		6,130	Area	5	5 -		
Effect         MixLoging local sing local sin	Standard	6A: U-0.049; R-17.5		2,460	Area	5 NO	s -		
The induced will make in provision of display frame will)         Path mark 27 11 2, 10         Path mark 28 1, 20	EEM	6A U-0.019 R-53.9 (+ R-4.95)	RSMeans 07 22 16 10	6,130	Area	\$ 0,8732	\$ 5,353		
Bit       B	EEM.	Enhanced wall insulation (nonresidential steel-frame wall)	RSMeans 07 21 13 10	2.460	Area	\$ 0.0498	s 172		
Single All Problems (1.0.3)         Provi C C AVALUME         Source All Provide All	EEM 2	Enhanced ferrestration	(Marine and Carlos and Carlo	diameter and the second		1.0	COLUMN ADDRESS	278	And a subscription of the
Image of the product worker, U.S. 201 or building and the product worker, U.S. 201 or bu	Standard	Standard windows, U-0.35		508	Area	S -	5 .		
Standard         Inter- water and and y for the schedung games a just the schedung gameschedung games a just the schedung games a just the sch	EEM 3	Enhanced windows, U-0.33 All feakage testion for mid-uzed buildings	PNNL CE ANALYSIS	508	Area	\$ 0,55	\$ 278	Contraction of the local division of the loc	and the second second
BA       Int data and apply in the backing year.       Int data and apply in	Standard	n/a - does not apply to this building type			0	5 -	5 .		
Standar         Operating of standard and standard with an and standard and standard and standard with an and standard and standard with an an and standard with an and standard with an and standard with an	EEM A	n/a - does not apply to this building type Reduced LDD for Interfor Robins, block attended Robins to doubting units	and the second sec	La Lourd	0	8 -	\$ .		
EEM       Reduced UPb, ~30% more efficient       Number 10       3,173       watch 10       5,173       % <t< td=""><td>Standard</td><td>Lighting per ASHRAE 90.1-2016</td><td></td><td>4.410</td><td>watts</td><td>\$ 6.75</td><td>\$ 29,820</td><td>8 8,372</td><td></td></t<>	Standard	Lighting per ASHRAE 90.1-2016		4.410	watts	\$ 6.75	\$ 29,820	8 8,372	
Bits Bits Construction and automatic lighting controls including waters lighting         Construction and automatic lighting controls including waters lighting           EEA A         Exclusion fighting controls including waters lighting controls list lighting controls including waters lighting con	EEM	Reduced LPDs, ~20% more efficient	HBL	3,178	watts.	\$ -	\$ 38,192		
EAU         Inv: ECC only	Standard	Occupancy sensors and automatic lighting controls including egress lighting	of the second second second second		0		12 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	101 - 1	
EBA 1         District plating control         Unit of the plate and control         Unit of the plate and control with the plating by the plating the pl	EEM	n/a - IECC only		÷ 1	0	5	5		
EEM         m ECC andy, declardy multiced in WC amendments to 80,1-2019         i </td <td>EEM 6</td> <td>Extender lighting control</td> <td></td> <td>STREET, STREET, STREET</td> <td>0</td> <td>and the second second</td> <td></td> <td></td> <td>fatter fatter fatter fatter</td>	EEM 6	Extender lighting control		STREET, STREET	0	and the second second			fatter fatter fatter fatter
EMP.7       Relax 6 m lower adjustion for adjustic for adjustication for adjustication for adjustication for adjustication for adjustication for adjustication for adjusticatin for adjustication for adjustication for adjusticatin	EEM	n/a - IECC only, already included in NYS amendments to 90, 1-2016			0	\$ -	\$ -		
Barrie dam net and prive on the building from         Barrie dam free dam set point on the building from         Barrie dam free dam set point on the building from           Binded free dam syn maked of all 7-2016         Image dam set and free dam syn maked of all 7-2016         Image dam set and free dam syn maked of all 7-2016         Image dam set and free dam syn maked of all 7-2016           Binded free dam syn maked of all 7-2016         Image dam set and free dam syn maked of all 7-2016         Image dam set and free dam syn maked of all 7-2016         Image dam set and free	EEM 7 Standard	Reduce fan power allowances	A REAL PROPERTY AND				IN PORT		
ER.M. Motil guission in Mode wave, control <ul> <li>Motil guission in Mode wave, control</li> <li>Bit and Mode wave, control wa</li></ul>	EEM	n/a - does not apply to this building type			cfm	\$ 1,031	\$ .		
dire	EEM 8	Hotel guestroom HVAC vacancy control	had spectato e.	Colores Transit	LCI. V	Distant.	1	A PERSON NUMBER OF	1001 10121 X
EE M S.       Might-afficiency SMV         EE M S.       Might-afficiency SMV         EE M M.       Account on and apply in the building type         EE M M.       Account on a set of the building type         EE M M.       Constraints         Real Doce Not apply to hit building type       -         Real Doce Not apply to hit building type       -         Real Doce Not apply to hit building type       -         Real Doce Not apply to hit building type       -         Real Doce Not apply to hit building type       -         Real Doce Apply to hit building type       - <t< td=""><td>EEM</td><td>n/s - already included in 90.1-2016</td><td></td><td></td><td>0</td><td></td><td>\$ .</td><td></td><td></td></t<>	EEM	n/s - already included in 90.1-2016			0		\$ .		
Intel and and any program of the building yre       Image State And any program of the building yre       Image State And any program of the building active at the state at the	EEM 9	High-efficiency SHW	and the second sec	110871/101		and the second	near the second	Contraction of the second	and the second sec
EEM 10 High-efficiency commercial bitcher equipment Energy Star Types, diswasher, overn, and holding cabinets Energy Star Types, diswasher, overn, and holding cabinets Energy Star Types, diswasher, overn, and holding cabinets EEM 11 Thermal bitcher graduation Particle Star Graduation EEM 12 Thermal bitcher graduation Particle Star Graduation EEM 14 THX Star Types, diswasher, overn, and holding cabinets EEM 15 Thermal bitcher graduation Rescard and your star for the star f	EEM	n/a - does not apply to this building type			0	1	5 -		
Standard efficiency types, distances, const, and holding cabines  Eff. 51 Energy Star Savings  1, 467 Area \$ 0, \$ - 0, \$	EEM 10	High-efficiency commercial Altchen equipment	and the state of the second	State of Land	11111	Start States of	No. INCOME	\$ 9,216	Section in contraction
EAM       Ency Star Injury, damwahere, vorus, and holding calinols       Cadulator       1,407       Area       6,616       9,216         Varial Star Injury, damwahere, vorus, and holding calinols       Cadulator       0       5       5         Mark       dees not apply to this building type       -       0.8       5       -         Mark       dees not apply to this building type       -       0.8       5       -         Starting prover reduction       70.0       5       -       5       -         Starting prover reduction of provere reduction of provere reduction of prover	Standard	Standard efficiency tryers, distrivashers, ovens, and holding cabinets	Energy Star Savings		0	5 -	5 ~		
EER 1 Thermal Integrate Analysis and a sequence is a sequence of the building type and t	EEM	Energy Star fryers, dishwashers, ovens, and holding cabinets	Calculator	1,407	Area	\$ 6.16	\$ 9,216		
EM       Info- dearning tappy to this building type         EM       Info- dearning tappy to this building type         Standard Ir       Info- dearning tappy to this building type         Standard Ir       Info- dearned tappy to this building type         EM       Reduced FDSs 4%         Standard Ir       Info- dearned tappy to this building type         EM       Reduced FDSs 4%         Standard Ir       Info- dearned tappy to this building type         EM       Reduced FDSs 4%         Standard Ir       Info- dearned tappy to this building type         EM       Reduced FDSs 4%         Standard Ir       Info- dearned tappy to this building type         EM       Reduced FDSs 4%         Standard Ir       Info- dearned tappy to this building type         EM       A       Reduced FDSs 4%         Standard Ir       Info- dearned tappy to this building type         Standard Ir       Info- dearned tappy to this building type         EM       A       Reduced capacity for the dearned tappy to this building type         Standard Ir       Info- dearned tappy to this building type       Info- dearned tappy to this building type         EM       A       Reduced capacity for the dearned tappy to this building type         EM       Info- dearned ta	Standard	Thermel bridging reduction	The second se		and the second				and the second second
EEM 12 Exterior (ighting power reduction Reduced LPDA - 9% more efficient Reduced LPDA - 9% more efficient	EEM	n/a - does not apply to this building type			Area	. 0	5 -		
Balance of State (State (St	EEM 12	Exterior lighting power reduction	Inclusion and the sec	and the second	- 63	III.	1	\$	1. 1. 1. 1. 1. S. 1.
EEM 14 EEX does not apply to this building type IAA - A - D IAA	EEM	Reduced LPDs9% more efficient	RSMeans 26 51 13 55	1,433	warrs	\$ .	5		
Simular IV a das not apply to this building type in a das not apply to this bu	EEM 13	Efficient elevator, regenerative drives	A REAL PROPERTY OF	Contraction of the	S 8	111 11 11		1 ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) (	10 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
EEM 4.6       EEM 4.6       EEM 4.6       EEM 4.6       EEM 4.6       0       \$	EEM	n/a - does not apply to this building type n/a - does not apply to this building type			each	\$	5 -		
Standard       n/a - already included in 90.1-2016       -       0       \$       -<	EEM 14	ERV for apartment makeup air units	The second second	the state	Guoin	A CARLEN STATE	A CONTRACTOR OF	1 0 10 m 70 m	A CONTRACTOR OF THE OWNER
EEM 15 Demand/based recruited BHW controls.	EEM	n/a - already included in 90.1-2016 n/a - already included in 90.1-2016			0	1 .	5		
Standard Inde       0       \$       5       -         ADDITIONAL COST ADJUSTMENTS       0       \$       -       0       \$       -       5       -         ADDITIONAL COST ADJUSTMENTS       -       0       \$       -       0       \$       -       5       -         ADDITIONAL COST ADJUSTMENTS       -       0       \$       -       0       \$       -       5       -       -       0       \$       -       0       \$       -       0       \$       -       0       \$       -       0       \$       -       0       \$       -       0       \$       -       0       \$       -       0       \$       -       0       \$       -       0       \$       -       0       \$       -       0       \$       -       0       \$       0       \$       0       \$       0       \$       0       \$       0       \$       0       \$       0       \$       0       \$       0       \$       0       \$       0       \$       0       \$       0       \$       0       \$       0       \$       0       \$       0       \$ <t< td=""><td>EEM 15</td><td>Demand-based recirculated SHW controls</td><td></td><td>CHARLES OF STREET, STR</td><td></td><td></td><td>Summing the local division of the</td><td><ul> <li>Internet and a second second</li> </ul></td><td>CONTRACTOR OF THE OWNER.</td></t<>	EEM 15	Demand-based recirculated SHW controls		CHARLES OF STREET, STR			Summing the local division of the	<ul> <li>Internet and a second second</li> </ul>	CONTRACTOR OF THE OWNER.
ADDITIONAL COST ADJUSTMENTS Reduced capacity for ocolling equipment Standard Packaged surgit-cone AC, 25 Jons Packaged surgit-cone AC, 25 J	Standard.	n/a n/a - anolize to IEC/C path only			0		3 -		
ACA 1       Reduced capacity for cooling equipment.       \$ (25)         Sendard Packaged single-one AC, 25, 10ns       RSMeans 23,74,33,10       1       units       \$ 28,821         EEM       Packaged single-one AC, 25, 10ns       RSMeans 23,74,33,10       1       units       \$ 28,821         CAA 2       Reduced capacity for hashing equipment       -       units       \$ 28,821       \$         Stendard Packaged single-one AC, 25, 10ns       -       -       units       \$ 28,821       \$         Stendard (INCLUCED WPACKAGED UNITS IN ACA 1)       -       -       units       \$ -       -         Reduced capacity for braining equipment       -       -       units       \$ -       -         NRAA       Reduced capacity for braining equipment       -       -       -       -         NRAA       Reduced capacity for braining equipment       -       -       -       -         NRAA       Receased insulation to account for PTAC openings, thermal bridging requirements       -       -       -       -         TEM       -       -       0       \$ -       \$ -       -       -       -         TEM       -       -       0       \$ -       \$ -       -       -       -	ADDITION	AL COST ADJUSTMENTS	The second s			Contraction of the	LOOP IN MILLION	CONTRACTOR OF THE OWNER	States States
Packages     Packa	ACA 1	Reduced capacity for cooling equipment	DSM 22.74.22.40	COLUMN TWO IS NOT	200			\$ (258)	
CA 2       Reduced capacity for hashing salipment         Stondard (INCLUCED WPACKAGED UNITS IN ACA 1)       -         EEM       -         MCA 2       Reduced capacity for hashing salipment         EEM       -         MCA 2       Reduced capacity for hashing salipment         EEM       -         Increased insulation to account for PTAC openings, thermal bridging requirements         EEM       -         Increased insulation to account for PTAC openings, thermal bridging requirements         Increased insulation to account for PTAC openings, thermal bridging requirements         Increased insulation to account for PTAC openings, thermal bridging requirements         Increased insulation to account for PTAC openings, thermal bridging requirements         Increased insulation to account for PTAC openings, thermal bridging requirements         Increased insulation to account for PTAC openings, thermal bridging requirements         Increased insulation to account for PTAC openings, thermal bridging requirements         Increased insulation to account for PTAC openings, thermal bridging requirements         Increased insulation to account for PTAC openings, thermal bridging requirements         Increased insulation to account for PTAC openings, thermal bridging requirements         Increased insulation to account for PTAC openings, thermal bridging requirements         Increased insubing requirements	EEM	Packaged single-zone AC, 25.1 tons	RSMeans 23 74 33.10	1	units	\$ 29,821	\$ 29,821		
Address of apply of this building squipment     -     units     \$ -     -	ACA 2	Reduced capacity for heating equipment	and the second s	A DOWNER OF				\$	
ACA 3     Reduced capacity for all handling equipment       Stendard (IVLCED WPACKAGE DUINTS IN ACA 1)     -       EEM     -       IEM     -<	EEM	(INCLUCED WIPACKAGED UNITS IN ACA 1)			units	5 -	<u>s</u> .		
Standard (IVCLUCED WHACKAGED UNITS IN ACA 1) EM ACA 4 increased insulation to account for PTAC openings, thermal bidging requirements incomment (IVCLUCED bins building type EM infa - does not apply to this building type CCA 5 Electric vehicle charging station capable parking lots for 5% of spaces Endard 2022/20V 40 amp outlets (2006 54 - 5 - 5 - 5 - 5 - 5 - 5 - 5 - 5 - 5	ACA 3	Reduced capacity for air handling equipment		A DESCRIPTION OF		CONTRACTOR OF		1 2 . K 3 3400	CARCOLLER AN
ACA 4     more asset in sullation to account for PTAC openings, themas bridging requirements     0     \$ -     \$ -       Mind and invariant of the second apply to this building type     0     \$ -     \$ -       Invariant of the second apply to this building type     0     \$ -     \$ -       Invariant of the second apply to this building type     0     \$ -     \$ -       Invariant of the second apply to this building type     0     \$ -     \$ -       Invariant of the second apply to this building type     0     \$ -     \$ -       Invariant of the second apply to this building type     0     \$ -     \$ -       Invariant of the second apply to this building type     0     \$ -     \$ -       Invariant of the second apply to this building type     0     \$ -     \$ -       Invariant of the second apply to this building type     0     \$ -     \$ -       Invariant of the second apply to this building type     0     \$ -     \$ -       Invariant of the second apply to this building type     0     \$ -     \$ -       Invariant of the second apply to the secon	EEM	(INCLUCED WIPACKAGED UNITS IN ACA 1)			units	\$	<u> </u>		
Index of the second apply to this building type Index of apply to this building type Index of apply to this building type Index of the building type Index o	ACA 4	Increased insulation to account for PTAC openings, thermal bridging requirements	INCLOSED THE RELEASE	and the second second		State of the second	ALL CENT	Constraint State	ALCON, MERRING
AGA 5 Electric vehicle thanging station capable parking lots for 5% of spaces Idendard Idenda	EEM	n/a - does not apply to this building type h/a - does not apply to this building type			0	\$ .	s .		
Standard/     -     0     \$     -     0       EM     208/240V 40 amp outlets (zones 5A and 6A only)     chargehub.com     -     0     \$     -       CAS     Solarizedy zone per Appendix CA of 2018 (ECC     -     0     \$     -     -       Solarizedy zone per Appendix CA of 2018 (ECC     -     0     \$     -     -       EM     -     0     \$     -     -     -	ACA 5	Electric vehicle charging station capable parking lots for 5% of spaces	5 F L 3 COL 3 COL 11 1 3 A	Contraining of	4	State of the local division of the local div	2012/2011/1	1 mar 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	the second s
ICA 5     Solarineedy zone per Appendix CA of 2015 IECC     -     0     5     -       Standard     -     0     5     -     -       IEM     -     0     5     -	Standard	208/240V 40 amp outlets (20045 56 and 56 only)	We need the rest of		0	\$	5 -		
-         0         5         -           EM         -         0         5         -           Tridel         +         0         20000         -	ACAS	Solat-ready zone per Appendix CA of 2018 IEGO	Ichargenud.com	C TRATICAL	outlets	- 1,300		Section and the section of the secti	States of Concession, Name
	Standard				0	5 .	\$ -		
				•	d		Total	\$ 22.092	

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	2020 NYStretch OUTPATIENT HEALTHCARE - 4A EEM Incremental Cost Worksheet Prepared by Vidaris Inc. 19-Jun-2019										
EEM	Description	Source of Item Cost	Number of EEM Units	Unit.	Cost / Unit	Total Item Cost	Total Incremental Cost	Notes / Comments			
EEM 1 Standard	Entranced insulation for roots and walls Standard U-0.032, R-30 root insulation (insulation entirely above dock)	Colored States of the second s	14,782	Area	5 -	s -	\$ 6,067				
Standard	Standard wall insulation (nonresidential steel-frame wall)		13,402	Area	s -	s -					
EEM	Enhanced root insulation (insulation entirely above deck)	RSMeans 07 22 16.10	14,782	Area	\$ 0.3881	\$ 5,737					
FEM	4A: U-0.030, R-32.2 (* R-2.2) Enhanced wall insulation (nonresidential steel-frame wall)	PSMeans 07 21 13 10	13.402	Area	\$ 0.0248	\$ 330					
FRAS	4A: U-0.051; R-14.2 (+ R-0.77)		10,402	Villa	• • •••••		\$ 1,740	and the second second			
Standard	Standard windows, U-0.38	DANI CE AMALVEIE	3,318	Azea	\$ .	\$ 1740		· · · · · · · · · · · · · · · · · · ·			
EEM 3	Air leakage testing for mid-sized buildings	PINE CE MOLTOIS	0,010	7464	a 0,52	13 1,740	5 8,500	HOUTE MARK			
Standard	Not Required	BET, LLC	1	units	\$ 8,500	5 8,500					
EEM 4	Reduced LPD for interior lighting; high efficacy lights in dwelling units		20 626	Lang May	\$ 875	5 266 868	\$ 71,679	Alter an indealer and			
EEM	Reduced LPDs, -20% more efficient	HBL	28,917	watts	\$ .	\$ 338,548					
EEM 5	Occupancy sensors and automatic lighting controls including agress lighting			Ô	5 -	5 .		References and the second			
EEM	n/a - IECC only		× 1	0	s -	\$		Concerning and the second s			
Standard	Exterior lighting control			0	s -	5 -					
EEM 7	n/a - IECC only, already included in NYS amendments to 90, 1-2016 Reduce fan bower allowances	The state of the state		0	5 -	S .	\$ 17,767	Card and the state of the state of the			
Standard	VAV fans: 0.00130 bhp/cfm					\$		size for reduction in static			
EEM	VAV fans: 0.00100 bhp/cfm	RSMeans D3040 134	4,983,57	cim	\$ 3.565	\$ 17,767		pressure			
Standard	n/a - already included in 90.1-2016			0	s -	5 -					
EEM 9	n/a - already included in 90.1-2016 High-efficiency SHW	A DESCRIPTION OF THE OWNER	STATISTICS.	U.	ENGLAND COL	S	¥	AND A DESCRIPTION OF A			
Standard	n/a - does not apply to this building type	-		0	\$ .	\$ .					
EEM 10	High-efficiency commercial kitchen equipment	de and the second	ALL YOUND	h9	State of the local division of the local div	States and	Contraction of the local division of the loc	En State Contract			
EEM	n/a - does not apply to this building type n/a - does not apply to this building type			ů.	\$ .	5					
EEM 11	Thermal bridging reduction	State of the second second		AV NO.	5	5 .	\$ 1,596				
EEM	Additional Parapet Insulation Assume 12in at wall + 42in of parapet height + 12in wide parapet + 42in of	R5Means 07 22 16 10	4,694	Area	\$ 0.3400	\$ 1,596					
EEM 12	parapet height to root deck. 9 It of total insulation of H-4 Zkn for entire perimeter of root. Exterior lighting power reduction	A DAVE	A STATE OF	CRUMENT	ALC: NO.	10 mm - 13	A COLORADO STATE	11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			
Standard EEM	Lighting par ASHRAE 90.1-2016 Reduced LPDs -9% more efficient	RSMeans 26 51 13.55 RSMeans 26 51 13.55	1,619	watts	\$ .	\$ .					
EEM 13	Efficient elevator, regenerative drives		O HONORDAD	each		5	100 1 10 1 1 100	ALL OF THE SEC			
EEM	n/a - does not apply to this building type			each	\$ .	š .					
EEM 14 Standard	ERV for apartment makeup air units n/a - aiready included in 90.1-2016			Ö	\$ .	5					
EEM	n/a - already included in 90.1-2016 Demand has ad accirculated SHW controls	A CLOCKED IN	- Anno	0	3 .	5 .	4	CONTRACTOR OF TAXABLE DO			
Standard	n/a		*	0	\$ .	5 .					
ADDITION	AL COST ADJUSTMENTS	Stational Lines	A CONTRACTOR		C. C	-	Contract State State	and the second second			
ACA 1 Standard	Reduced capacity for cooling equipment INCLUDED WITH AHU IN ACA 3			units	5 .	5 -		And the second se			
EEM		and the second second second		unita	\$ 177,744	S -	s 133	And in case of the local division of the loc			
Standard	Hot water boller, gas fired, 302 MBH	RSMeans D3020 130	1 J	units	\$ 21,475	\$ 21,475					
ACA 3	Hot water boller, gan fired, 306 MBH Reduced capacity for air handling equipment	RSMeans D3020 130	Construction of the	0	\$ 21,608	1.5 21,008	\$ (15,955)	and the second second			
Standard	VAV AHU, J3816 cfm	RSMeans D3040 134 RSMeans D3040 134	1	units	\$ 339,376 \$ 323,421	\$ 339,376 \$ 323,421					
ACA 4	Increased insulation to account for PTAC openings, thermal bridging requirements	Company Party 104						DULCH STREET			
Standard EEM	n/a - does not apply to this building type n/a - does not apply to this building type		+ + + + +	0	\$ .	5					
ACA 5	Electric vahicle charging station capable parking lots for 5% of spaces		and the second	0	5 .	15 .	\$ 2,600	President altera II. M			
EEM	208/240V 40 amp outlets (zones SA and 6A only)	chargehub.com	2	outlets	\$ 1,300	\$ 2,600		in the second second			
Standard	Solar-ready zone per Appendix CA of 2018 IECC	No. of Concession, Name	A DO DO DO DO	0	5 -	5 -					
EEM				0	5 .	Total	\$ 04 127				
						70101	J J4,121				

	2020 NYStretch OUTPATIENT HEAL THCARE - 5A EEM Incremental Cost Worksheet Prepared by Vidaris Inc. 19-Jun-2019										
EEM	Description	Source of Item Cost	Number of EEM Units	Unit	Cost/Unit	Total Item Cost	Total Incremental Cost	Notes / Comments			
Standard	Enhanced insulation for roots and walls Standard U-0.032, R-30 root insulation (insulation entirely above deck)		14,782	Area	\$ .	s -	\$ 6,187				
Standard	Standard waii insulation (nonresidentiai steel-trame waii) 5A: U-0.055; R-16.0		13,402	Area	5 -	\$					
EEM	Enhanced roof insulation (insulation entirely above deck) 5A U-0.030 R-32.2 (+ R-2.2)	RSMeans 07 22 16.10	14,782	Area	\$ 0.3881	\$ 5,737					
EEM	Enhanced wall insulation (nonresidential steel-frame wall)	RSMeans 07 21 13 10	13,402	Area	\$ 0.0338	\$ 450					
EEM 2	Enhanced fenestration		and the second of	-	THE REAL	10000	\$ 1,972				
Standard EEM	Standard windows, U-0.38 Enhanced windows, U-0.35	PNNL CE ANALYSIS	3,318	Area Area	\$ - \$ 0.59	\$ - \$ 1.972	10				
EEM 3	Air leakage testing for mid-sized buildings		ALC: NO.	and the second	CONSTRUCTION AND	COLUMN I	\$ 3,200	The summer of the second			
EEM	Testing required	BET, LLC	3.	units	3 3,200	\$ 3,200					
EEM 4 Standard	Reduced LPD for interior lighting: high efficacy lights in dwelling units Lighting per ASHRAE 90.1-2018		39.536	watts	\$ 6.75	\$ 266 868	\$ 71,679	Contraction of the local sector			
EEM	Reduced LPDs, ~20% more efficient	HBL	28,917	watts	8 -	\$ 338,548					
Standard	Occupancy sensors and automatic lighting controls including egress lighting n/a - IECC only	Contraction of the local division of the	The second star	0	5 -	5 -					
EEM 6	n/a - IECC only Exterior lighting control	And in case of the same of	the section	0	3 .	5 -	Concession of the local division of the loca				
Standard	n/a			0	5 -	S		and the second se			
EEM 7	n/a - IECC only, already included in NYS amendments to 90,1-2016 Reduce fan power allowances	THE REAL PROPERTY AND INCOME.	And in case of	0	5 -	Contraction of the local division of the	\$ 10,375	Sector Sector Providence			
Standard	VAV fans: 0.00130 bhp/cfm					5 -		Conted an increased system size for reduction in static			
EEM 8	Note overstrange HVAC vectore control	RSMeans D3040 134	5,154.07	cîm	\$ 3,585	\$ 18,375	• · · · · · · · · · · · · · · · · · · ·	pressure			
Standard	r/a - already included in 90 1-2016			0	S -	5 -		Contra and Contractor			
EEM 9	nva - aiready included in 50.1-2015 High-efficiency SHW	and the second se	Volume and	0	S. Contractor	5	A Date of the Street of the				
Standard FEM	n/a - does not apply to this building type			0	s -	\$ .					
EEM 10	High-efficiency commercial kitchen equipment	HIGH COTT	100000	10000	Contraction of the local distance	Contraction of	\$	S 2 1 - 1 - 2 - 2			
Standard EEM	n/a - doas not apply to this building type n/a - doas not apply to this building type			0	s - s -	s .					
EEM 11	Thermal bridging reduction	ALC: NOT THE OWNER OF	And a second second second	ALC: NO	1000 C 1000	8	\$ 1,506				
EEM	Additional Parapet Insulation: Assume 12in at wall + 42in of parapet height + 12in wide parapet + 42in of	RSMeans 07 22 16 10	4 694	Area	\$ 0.3400	\$ 1.596					
EEM 12	parapet height to roof deck. 9 ft of total insulation of R-4.2/in for entire perimeter of roof. Exterior lighting power reduction	100000000000000000000000000000000000000	4,004	Allea	a 0.0400	φ 1,530		Contraction of the local division of the loc			
Standard	Lighting per ASHRAE 90.1-2016	RSMeans 26 51 13.55	5,764	walts	5	\$ .					
EEM 13	Efficient elevator, regenerative drives	R5MHINE 20 51 13 55	and the second second	a line	a second	Contraction of the	STATISTICS OF	STREET, DOOL OF ST			
Standard EEM	n/a - does not apply to this building type n/a - does not apply to this building type			each	\$ ·	s .		· · · · · · · · · · · · · · · · · · ·			
EEM 14	ERV for apartment makeup air units	The second second second	11	Conserver?	stan arts	April & The Party of the Party	<ul> <li>Martine 193</li> </ul>	and the second second			
EEM	n/a - already included in 50.1-2016 n/a - already included in 90.1-2016		10 D 10 D	0	s i	5 .					
EEM 15 Standard	Demand-based recirculated SHW controls	200		0		5 -	A DIGITION OF	CHARLES BOTH SALES			
EEM	n/a - applies to IECC path only	and the second second	1	0	5 -	\$ .	i mana and				
ACA 1	Reduced capacity for cooling equipment	and the second		1.00	1977 74		Contraction of the	the part of the state			
Standard EEM	INCLUDED WITH AHU IN ACA 3			units	5 177.744	5 .					
ACA 2	Reduced capacity for heating equipment	DeMaans D2020 120	11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		22,023		\$ 102	CARLES AND			
EEM	Hot water boller, gas fred, 368 MBH	RSMeans D3020 130	1	0	\$ 23,325	\$ 23,325					
ACA 3 Standard	Reduced capacity for air handling equipment VAV AHU, 34983 clm	RSMeans D3040 134		units	\$ 350,923	\$ 350,923	\$ (16,585)				
EEM	VAV AHU, 33309 clm	RSMeans D3040 134	1	units	\$ 334,338	\$ 334,338					
Stendard	n/a - does not apply to this building type			0	5 -	5 .		11 - 1 - 10 - WI			
ACA 5	n/a - does not apply to this building type Electric vehicle charging station capable parking lots for 5% of analysis	also and a second and	in a start	0	\$ .	5	\$ 17.003	and the local day of the			
Standard	2002/02/20 and a date frages 54 and 54 and 5	Company and		Ō	5	5	Auros				
ACA 6	Solar-ready zone per Appendix CA of 2018 IECC	chargenub.com	14	outlets	5 1,300	• 17,962	1 35 3 R H	1			
Standard EEM			1	0	\$ .	5 .					
					1.5.1	Total	\$ 104,489				

CDD         Objective         Output         Output<		2020 NYStretch OUTPATIENT HEALTNCARE - 6A EEM Incremental Cost Worksheet Prepared by Vidaris Inc. 19-Jun-2019									
Banker of 202 of 20 minutation from another intervent of 202 of 20 minutation from another intervent of 200 minutation from another inter	(EE.M	Description	Source of Item Cost	Number of EEM Units	Unit	Co	a/Unit	Total Item Co:	st Total In	cremental Cost	Notes / Comments
Bandward Concentration Concentration Concentration Concentration Concentration Concentration Concentration Concentration Concentration Concentration Concentration Concentration Concentration Concentration Concentration Concentration Concentration Concentration 	Standard	Enhanced insulation for roots and waits Standard U-0.032, R-30 root insulation Ensulation entirely above deck)	and the second se	14,782	Area	5		\$ .	1		
Union         Lik do do generation         Union         Union </td <td>Slandard</td> <td>Standard wall insulation (nonresidential steel-frame wall)</td> <td></td> <td>13 402</td> <td>Area</td> <td></td> <td></td> <td>\$</td> <td></td> <td></td> <td></td>	Slandard	Standard wall insulation (nonresidential steel-frame wall)		13 402	Area			\$			
Bit All Section Product (1) (1) (2) (2) (3) (3) (2) (3) (3) (3) (4) (3) (3) (4) (4) (3) (3) (4) (4) (4) (4) (4) (4) (4) (4) (4) (4	provincero	6A: U-0 049, R-17.5		10,402	Titta	Ψ		•			
Dist of a for a last in provide last in	EEM	Enhanced roof insulation (insulation entirely above deck) 6A: U-0.029, R-33.4 (+ R-3.4)	RSMeans 07 22 16,10	14,782	Area	\$	0.5998	\$ 8,86	5		
BLL 2         Channels for services         S <td>EEM</td> <td>Enhanced wall insulation (nonresidential steel-frame wall)</td> <td>RSMeans 07 21 13 10</td> <td>13,402</td> <td>Area</td> <td>5</td> <td>0.0496</td> <td>\$ 665</td> <td>5</td> <td></td> <td></td>	EEM	Enhanced wall insulation (nonresidential steel-frame wall)	RSMeans 07 21 13 10	13,402	Area	5	0.0496	\$ 665	5		
Subser	EEM 2	Enhanced federatization	Contraction of the local division of the loc	the state of the s	1.1	-14	ALC: NO.		5	1,831	
China Can Anna Can Control (Control (Contro) (Contro) (Control (Control (Control (Control (Contro)	Standard	Standard windows, U-0.36		3,318	Area	\$	1.5.1	s -			
BL3       All status get status get status get status gets and status bases       Image status gets and status bases       Image status gets and sta	EEM	Enhanced windows, U-0.34	PNNL CE ANALYSIS	3,318	Area .	\$	0.55	\$ 1,83	1	2.600	
CiteL       Nat cost or may in the halfing type       BET LLC       1       0       8       3.200       -	Standard	Air leakage testing for mid-sized buildings	1		0		the state	8		3,200	
III 44 A       Produced LPD is for incorregament, the means lapit in dealing unit       Unit       Subset LPD is for incorregament, the means lapit in dealing unit       Number level       Subset LPD is for incorregament, the means lapit in the mean lapit in t	FEM	n/a - does not apply to his building type	BET. LLC		0	5	3.200	\$ 3,20	0		
Statute         Upper part ASDRAGE 01-2016         Upper part ASDRAGE	EEM 4	Reduced LPD for interior lighting: high efficacy lights in dwelling unit	-boostieroor	Test to the second			10.11	and the second		71,679	
EAM         Reduct (Dr.,30 more afficient)         Reduct (Dr.,30 more afficient)         Image: Comparison of the state of the sta	Standard	Lighting per ASHRAE 90 1-2016		39,536	watts	\$	6.75	\$ 266,66	8		
EAR B.         Obviouslance rankes and automicik lighting controls including agrees lighting.         Image: second control including agrees lighting.	EEM	Reduced LPDs, -20% more efficient	HBL	28,917	Walls	\$		\$ 338,54	8		
and and any off in the loce any off	EEM 5	Occupancy sensors and automatic lighting controls including egress lightin		Carl Street Street	-		1	e		10 m 10 m	A STATE OF THE OWNER
Entry Processing         Image: Processing Processing Processing         Image: Processing Processing Processing         Image: Processing Processing Processing         Image: Processing Processing Processing Processing         Image: Processing Processing Processing Processing         Image: Processing Procesing Processing Processing Processing Processing Processing Process	EEM.	nra - IEGC only			0	2		s -			
Standar         Non-         O         S        S         S         S	EEM 6	Exterior lighting contro	ACCESSION OF THE OWNER	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		- Contraction	-		3	1 1 1 1 1	the second se
EM         No. = ICC coly_ allowy modules in NY3 amountants 19:0 1-2016         Image: Source allowy modules in NY3 amountants 19:0 1-2016         Image: Source allowy modules in NY3 amountants 19:0 1-2016         Image: Source allowy modules in NY3 amountants 19:0 1-2016         Image: Source allowy modules in NY3 amountants 19:0 1-2016         Image: Source allowy modules in NY3 amountants 19:0 1-2016         Image: Source allowy modules in NY3 amountants 19:0 1-2016         Image: Source allowy modules in NY3 amountants 19:0 1-2016         Image: Source allowy modules in NY3 amountants 19:0 1-2016         Image: Source allowy modules in NY3 amountants 19:0 1-2016         Image: Source allowy modules in NY3 amountants 19:0 1-2016         Image: Source allowy modules in NY3 amountants 19:0 1-2016         Image: Source allowy modules in NY3 amountants 19:0 1-2016         Image: Source allowy modules in NY3 amountants 19:0 1-2016         Image: Source allowy modules in NY3 amountants 19:0 1-2016         Image: Source allowy modules in NY3 amountants 19:0 1-2016         Image: Source allowy modules in NY3 amountants 19:0 1-2016         Image: Source allowy modules in NY3 amountants 19:0 1-2016         Image: Source allowy modules in NY3 amountants 19:0 1-2016         Image: Source allowy modules in NY3 amountants 19:0 1-2016         Image: Source allowy modules in NY3 amountants 19:0 1-2016         Image: Source allowy modules in NY3 amountants 19:0 1-2016         Image: Source allowy modules in NY3 amountants 19:0 1-2016         Image: Source allowy modules in NY3 amountant 19:0 1-2016         Image: Source allowy modules in NY3 amountant 19:0 1-2016         Image: Source allowy modules in NY3 amountant 19:0 1-2016         Image: Source allowy modules	Standard	n/a		- 1	0	5	-	5 -	1		
EEE 7       Reduce in power information interaction interactinteraction interaction in	EEM	n/a - IECC only, already included in NYS amendments to 90.1-2016		34	0	\$	-	s -			
Subset       Way Mark 2007 Displayed by Displayed Displayed by Displayed D	EEM 7	Reduce fan power allowances		and the second second	1000	-	-		and the second	18,212	Costed as increased system
Edit       VixV area       Restaure       VixV area       S	Standard	VAV fans: 0.00130 bhp/cm				-		3 -			size for reduction in static
EEM Model guestroom NACk values y centro       5       5       -         EEM Model guestroom NACk values y centro       5       5       -         EEM Model guestroom NACk values y centro       5       5       -         EEM Model guestroom NACk values y centro       0       5       5       -         EEM Model guestroom NACk values y centro       0       5       5       -         EEM Model guestroom NACk values y centro       0       5       5       -         EEM Model guestroom NACk values y centro       0       5       5       -         EEM Model guestroom NACk values y centro       0       5       5       -         EEM Model guestroom NACk values y centro       0       5       5       -         EEM Model guestroom NACk values y centro       0       5       5       -         EEM Model guestroom NACk values y centro       0       5       5       -         EEM Model guestroom NACk values y centro       0       5       5       -         Standard Jung values y centro       0       5       5       -       5       -         Standard Value Values Y centro       0       5       5       -       -       -         Standard Jung Val	EEM	VAV fans: 0.00100 bhp/cfm	RSMeans D3040 134	5,108.16	cím	S	3.566	\$ 18,21	2		pressure
Sector         mail         <	EEM 8	Hotel guestroom HVAC vacancy contro				110	1.00		5	1000	
Cite N         Cite N         Cite N         Cite N         Cite N         Cite N         Second N           Cite N         An obse not apply to this building type         -         0         S         S         -           Cite N         An obse not apply to this building type         -         0         S         S         -           Cite N         An obse not apply to this building type         -         0         S         S         -           Cite N         An obse not apply to this building type         -         0         S         -         S           Cite N         An obse not apply to this building type         -         0         S         -         S         S           Cite N         An obse not apply to this building type         -         0         S         -         S <td< td=""><td>Standard</td><td>n/a - Already included in 90.1-2016</td><td></td><td></td><td>0</td><td>3</td><td>1112</td><td>3 -</td><td></td><td></td><td></td></td<>	Standard	n/a - Already included in 90.1-2016			0	3	1112	3 -			
Standard	EEMO	High-afficiency SHW		De la companya di se	Part Carlo	0	-	φ -	1912 - 120		
EEM       Ma. does not apply to his building type       Image: Source of the so	Standard	n/a - does not apply to this building type			0	\$	-	S -	1		
EEM 10 figh-efficiency communical kitcher sequence	EEM	n/a - does not apply to this building type			0	\$		5 -			
Standard Info	EEM 10	High-efficiency commercial kitchen equipmen	STHEFT STAN	and the second				COL DO	1		
Elin 14       The Vale No. Byte 10 million Assume 12m at well + 12m wells paraget + 42m of Additional Paraget Insulation Assume 12m at well + 12m wells paraget + 42m of Additional Paraget Insulation Assume 12m at well + 12m wells paraget + 42m of Additional Paraget Insulation Assume 12m at well + 12m wells paraget + 42m of Restored 12m Addition Assume 12m at well + 12m wells paraget + 42m of Restored 12m Addition Assume 12m at well + 12m wells paraget + 42m of Restored 12m Addition Assume 12m at well + 12m wells paraget + 42m of Restored 12m Addition Assume 12m at well + 12m wells paraget + 42m of Restored 12m Addition Assume 12m at well + 12m wells paraget + 42m of Restored 12m Addition Assume 12m at well + 12m wells paraget + 42m of Restored 12m Addition Assume 12m at well + 12m wells paraget + 42m of Restored 12m Addition Assume 12m at well + 12m wells paraget + 42m of Restored 12m Addition Assume 12m at well + 12m wells paraget + 42m of Restored 12m Addition Assume 12m at well + 12m wells paraget + 42m of Restored 12m Addition Assume 12m at well + 12m wells paraget + 42m of Restored 12m Addition Assume 12m at well + 12m wells paraget + 42m of Restored 12m Addition Assume 12m at well + 12m wells paraget + 42m of Restored 12m Addition Assume 12m at well + 12m wells paraget + 42m of Restored 12m Addition Assume 12m at well + 12m wells paraget + 42m of Restored 12m Addition Additi	Standard	n/a - does not apply to this building type			0	5		5 -	-		
Standard w/r       Standard w/r <td< td=""><td>FFM 11</td><td>Thermal bridging reduction</td><td>AND INCOME.</td><td>Contract of the local division of the local</td><td>0</td><td>-</td><td>ALC: NO.</td><td>4 -</td><td></td><td>1.596</td><td>13</td></td<>	FFM 11	Thermal bridging reduction	AND INCOME.	Contract of the local division of the local	0	-	ALC: NO.	4 -		1.596	13
Additional Paraget Insulation Assume 12 nat walt + 20n of paraget #42 no fl         REM ans 07 22 16.10         4,644         Area         5         0.3400         S         1.598           EEM 13         Extends 13 thing power reduction.         RSMeans 26 51 13.55         6.764         wattr 6         5         -         -           EEM 13         Extends 12 thing power reduction.         RSMeans 26 51 13.55         6.764         wattr 6         5         -         -           EEM 14         Extends extends registration of R-4.20n for entrine primeter of root.         RSMeans 26 51 13.55         6.764         wattr 6         -         5         -         -           Standard Lippton fewstor registration of R-4.20n for entrine primeter attration of RSMeans 26 51 13.55         6.764         wattr 6         -         5         -         -           Standard Indoced LiPpton fewstor registration of RSMeans 26 51 13.55         C         - <td>Standard</td> <td>Standard wall insulation</td> <td>1</td> <td></td> <td></td> <td>\$</td> <td></td> <td>s -</td> <td></td> <td></td> <td></td>	Standard	Standard wall insulation	1			\$		s -			
Database height for oud deck 8 ft of total insulation of R-4.2/m for entire perimeter of root.         Notes         No	EEM'	Additional Parapet Insulation: Assume 12in at wall + 42in of parapet height + 12in wide parapet + 42in of	RSMeans 07 22 16 10	4 694	Area	s	0.3400	\$ 1.59	6	-	
ELM 12       EXering lighting power reduction       ************************************	CCM	parapet height to roof deck. 9 ft of total insulation of R-4.2/in for entire perimeter of roof.	100000000000000000000000000000000000000	1,001	Area		0,0400	- 1,00			and the second sec
Option of the dramatic of the dramatic dram	EEM \$2 Standard	Exterior lighting power reduction	DSMeans 26 51 17 55	5.764	wolle	10		8	13		A DECEMBER OF STREET,
EEM 10       Efficient devices root program attive drives       \$	FEM	Reduced LPDs ~10% more efficient	RSMeans 26 51 13.55		waits	5		s -	+		
Standard       n/a - does not apply to this building type       -       each       \$       -         EEM       14       ERK for appatrant makap at units       -       each       \$       -         Standard       n/a - already included in 90.1-2016       -       0       \$       -       -         EEM       n/a - already included in 90.1-2016       -       0       \$       -       -         Standard       n/a - already included in 90.1-2016       -       0       \$       -       -         EEM       file       Demand-Listage recirculated SHW controls       -       0       \$       -       -         Standard       n/a - already included in 90.1-2016       -       0       \$       -	EEM 13	Efficient elevator, regenerative drives	in the second	and the second second	-	-	- T	Sector 1	A COLORED	THE REAL	Contraction of the local division of the loc
EEM       Infa - does not apply to this building type <ul> <li>eech</li> <li>eech</li> <li>-</li> <li>eech</li> <li>-</li> <li>-</li></ul>	Standard	n/a - does not apply to this building type		14 S	each	\$		\$ .	-		
Link to Zapartment maskap ar Units         Standard In/a - alterady included in 90.7-2016         EEM. In/a - alterady included in 90.7-2016         Standard In/a         Standard In/a         Standard In/a         ADDITIONAL COST ADJUSTMENTS         ADDITIONAL COST ADJUSTMENTS         Standard In/a Cost Adjust Expression         Standard In/a Cost Adjust Expresin         Standar	EEM	n/a - does not apply to this building type			each	5	-	\$ -			Contraction of the local division of the loc
Number of the setting included in 90,1-2016       Image: Setting included in 90,1-2016       Image: Setting included in 90,1-2016         EEM Infa - Applies to IECC path only       Image: Setting included in 90,1-2016       Image: Setting included in 90,1-2016         EEM Infa - Applies to IECC path only       Image: Setting included in 90,1-2016       Image: Setting included in 90,1-2016         ADDITIONAL COST ADUSTVENTS       Image: Setting included in 90,1-2016       Image: Setting included in 90,1-2016         ADDITIONAL COST ADUSTVENTS       Image: Setting included in 90,1-2016       Image: Setting included in 90,1-2016         ADA 3       Reduced capacity for hesting equipmen       Image: Setting included in 90,1-2016       Image: Setting included in 90,1-2016         Standard Info: Water boiler, gas fied, 360 MBH       REMeans D3020 130       Image: Setting included include inclu	Standard	EXY for apartment makaup air units			0	\$		5 -	and a second		Contraction of the local division of the loc
EEM 16       Demand-Lissed recirculated SHW controls <ul> <li>Canadard In/a</li> <li>Canadard In/a</li></ul>	EEM	n/a - already included in 90.1-2016			0	\$		\$ -			
Standard       n/a       -       0       \$       -       5       -         ADDITIONAL COST ADJUSTMENTS       -       0       \$       -       5       -         ADDITIONAL COST ADJUSTMENTS       -       -       0       \$       -       5       -         ADA1       Reduced capacity for beating equipmen       -       -       units       \$       -       <	EEM 15	Demand-based recirculated SHW controls		COMPLETE ST	the second	1000	Total Inte			and the second	
EEM       Init - applies to IE-CC path only       -       0       \$       -	Standard	n/a			0	\$		\$ -	-		
Additional Logis Additional Costs And Extension Carbon Control of	EEM	n/a - applies to IECC path only			0	5		5 -	-	1.1 P. ( 1.1	and the second se
Standard // MCLUDED WITH AHU IN ACA 3 EEM ACA 2 Reduced capacity for heating equipmen Standard // for water boler, gas fied, 366 MBH EEM // the water boler, gas fied, 368 MBH EEM // the water boler, gas fied, 368 MBH ACA 3 Reduced capacity for air handling equipmen Standard // AV AHU, 34305 ctm Standard // AV AHU, 3405 c	ACA 1	Reduced capacity for cooling equipmen		tert act	-	1.10	10.00	a land			
EEM         -         units         \$         177,744         \$         -           AGA 2         Reduced capacity for heating equipmen         -         units         \$         23,274         \$	Standard	INCLUDED WITH AHU IN AGA 3	1	1.41	units	\$		5 -			
ACA 2       Reduced capacity for heating equipmen       5       54         Standard /r/v water bole; gas find, 369 MBH       RSMeans D3020 130       1       0       \$ 23,368       23,368       (12,406)         EEM       Hot water bole; gas find, 369 MBH       RSMeans D3020 130       1       0       \$ 23,368       23,368       (12,406)         Standard /r/v       AVX AHU, 34026 ctm       RSMeans D3040 134       1       units       \$ 344,205	EEM			200	units	5	177,744	\$ -	-		
standard       ricowains (JSQU 130)       1       0       2       2/3/274       3       2/3/274         EEM       Hof water bolier, gas ined, 309 MBH       RSMeans D3201 130       1       0       \$       2/3/385       (12,806)         AGA 3       Reduced capacity for air handling equipmen       3       3/4/205       \$       3/4/205       \$       (12,806)         Standard       VAV AHU, 3/305 c/m       RSMeans D3/201 134       1       units       \$       3/4/205       \$       3/4/205         Standard insultation to account for PTAC openings, thermal bridging requirement       RSMeans D3/204 134       1       units       \$       3/4/205       \$       -	ACA 2	Reduced capacity for heating equipmen	DOMason Danie and	The second second			22 011	P 00.03	1	94	Contraction of the Contraction o
ACA 3 Reduced especity for air handling equipmen Standard VAY AHU, 3305 ctm ECM VAY AHU, 3305 ctm RSMeans D3040 134 Units \$ 344,205 Units \$ 344,205 \$ 344,20	EEM	Hot water boiler, gas fired, 350 MBH	RSMeans D3020 130	7	n	8	23 368	\$ 23.27	8		
Standard         VAV AHU, 3305 c/m         RSMeans D3040 134         1         units         \$ 344,205	ACAJ	Reduced capacity for air handling equipmen			· · ·	-	20,000		35	(12,808)	
EEM         VAV Arty, 32012 c/m         RSMeans D3040 134         1         units         \$ 331,399 <t< td=""><td>Standard</td><td>VAV AHU, 34305 clm</td><td>RSMeans D3040 134</td><td>1</td><td>units</td><td>\$</td><td>344,205</td><td>\$ 344,20</td><td>5</td><td></td><td></td></t<>	Standard	VAV AHU, 34305 clm	RSMeans D3040 134	1	units	\$	344,205	\$ 344,20	5		
ACA 4 there are insulation to account for PTAG openings, thermal bridging requirement  ACA 4 there are insulation to account for PTAG openings, thermal bridging requirement  Standard into a does not apply to this building type  ACA 5 Standard into account on PTAG openings, thermal bridging requirement  Standard into a does not apply to this building type  ACA 5 Standard into account on PTAG openings, thermal bridging requirement  Standard into account on PTAG openings, thermal bridging requirement  Standard into account on PTAG openings, thermal bridging requirement  Standard into account on PTAG openings, thermal bridging requirement  Standard into account on PTAG openings, thermal bridging requirement  Standard into account on PTAG openings, thermal bridging requirement  Standard into account on PTAG openings, thermal bridging requirement  Standard into account on PTAG openings, thermal bridging requirement  Standard into account on PTAG openings, thermal bridging requirement  Standard into account on PTAG openings, thermal bridging requirement  Standard into account on PTAG openings, thermal bridging requirement  Standard into account on PTAG openings, thermal bridging requirement  Standard into account on PTAG openings, thermal bridging requirement  Standard into account on PTAG openings, thermal bridging requirement  Standard into account on PTAG openings, thermal bridging requirement  Standard into account on PTAG openings, thermal bridging requirement  Standard into account on PTAG openings, thermal bridging requirement  Standard into account on PTAG openings, thermal bridging requirement  Standard into account on PTAG openings, thermal bridging requirement  Standard into account on PTAG openings, thermal bridging requirement  Standard into account on PTAG openings, thermal bridging requirement  Standard into account on PTAG openings, thermal bridging requirement  Standard into account on PTAG openings, thermal bridging requirement  Standard into account on PTAG openings, thermal bridging requirement  St	EEM	VAV AHU, 33012 ctm	RSMeans D304D 134	1	units	\$	331,399	\$ 331,39	9		
Standard     -     0     5     -     <	ACA 4	Increased insulation to account for PTAC openings, thermal bridging requirement	A DOLLAR STORE	And a state of the	0	10	122	2			and the second second
ACA 5 Electric vehicle charging attains capable parking lots for 5% of space \$17,962 Standard EEM 208/240V 40 amp outlets (zones 5A and 6A only) chargehub.com 14 outlets \$1,300 \$ 17,962 ACA 6 Solar-ready zone per Appendix 0A of 2016 ECC \$ Standard EEM 0 \$ - \$ - Standard EEM 7 0 \$ - \$ - Total \$ 111.298	EEM	n/a - does not apply to this building type			0	8		s -	-		
Standard         -         0         5         -         5           EEM         208/240V 40 amp outlets (zones 5A and 6A only)         chargehub.com         14         outlets         \$ 1,300         \$ 17,952           ACA & Sola-ready zone per Appendix CA of 2016 ECC         -         0         \$ -         \$ -         \$ -           Standard EEM         -         0         \$ -         \$ -         \$ -         -	ACAS	Electric vehicle charging station capable parking lots for 5% of space	S-0.0		-		1100		10	17,962	and the second second
EEM         2002/240V 40 amp outlets (zones 5A and 6A only)         [chargehub.com         14         outlets         \$ 1,300         \$ 17,952           ACA 6         Solar-ready zone per Appendix CA of 2018 IECC         -         0         \$ -         0 <td>Standard</td> <td></td> <td></td> <td></td> <td>0</td> <td>5</td> <td></td> <td>\$ -</td> <td></td> <td>Contraction of the local data</td> <td></td>	Standard				0	5		\$ -		Contraction of the local data	
Acch #         Solar-ready zone per Appendix CA of 2018 (ECC         0         \$         5           Standard         -         0         \$         111.298 <td>EEM</td> <td>208/240V 40 amp outlets (zones 5A and 6A only)</td> <td>chargehub.com</td> <td>14</td> <td>outlets</td> <td>\$</td> <td>1,300</td> <td>\$ 17,96</td> <td>2</td> <td></td> <td>and the second s</td>	EEM	208/240V 40 amp outlets (zones 5A and 6A only)	chargehub.com	14	outlets	\$	1,300	\$ 17,96	2		and the second s
EEM Total \$ 111.298	ACA 8	Solar-ready zone per Appendix CA of 2018 IECC	The second second	and so in the local day	0		and the second		and the second second	1 1 1 5 1 1 <b>A</b> 1 1	and the state of the
Total \$ 111.298	EEM				0	3		s .	-		
								Total	\$	111.298	

	2020 NYStretch WAREHOUSE - 4A EEM Incremental Cost Worksheet Prepared by Vidaris Inc. 19-Jun-2019									
EEM	Descriptión	Source of Item Cost	Number of EEM Units	Unit	Co	et? Unit	Total Item Cost	Total Inc	remental Cost	Notes / Comments
Standard	Standard U-9 032, R-30 roof insulation (metal building)		49.495	Area	2	and the second second	and the second second		22,663	
Clandard	4A: U-0.037; H-32.2 (+ H-2.2) Standard wall insulation (metal building)		00.007	Valida			• •			
Standard	44: U-0.060; R-15.3 Enhanced read insulation final states anticate share dark)		28,687	Area	3	•	<u>ه</u>			
EEM	4A: U-0.035; R-32.2 (+ R-2.2)	RSMeans 07 22 16 10	49,485	Area	5	0,3881	\$ 19,208			
EEM	Enhanced wall insulation (nonresidential mass wall) 4A: U-0.048, R-19.5 (+ R-4.28)	RSMeans 07 21 13.10	26,667	Area	5	0.1370	\$ 3,655			
EEM 2	Enhanced fenestration	N. State Reality of the	ALL DOG STORY	200.2	1.0	NUMBER OF	N VOTA	1200 0	100	Collins Station of the local
EEM	Enhanced windows, U-0.38	PNNL CE ANALYSIS	190	Area	5	0.53	\$ 100			
EEM 3	All leakage testing for mid-sized buildings Not Required	A "Safe No. 21 - 2	and the second	-	and the second	1000	1	13.15	17,000	
EEM	Testing required	Vidaris	act act	unite	ŝ	17,000	\$ 17,000			
Standard	Reduced LPD for Interior lighting; high afficacy lights in dwnling units Lighting per ASHRAE 90.1-2016	and a state of the	24.400	watts	5	6.75	\$		· · · · ·	No cost assumed for this
EEM	Reduced LPDs, ~20% more efficient	HBL	18,659	Walts	8		5 -	1		building type
Standard	Occupancy sensors and automatic lighting controls including agress lighting n/a - IECC only	10,20 P/ P 100	1000		5		5 .			Contraction of the second
EEM	n/a - IECC only		2		\$	-	\$ .			
Standard	extensi ngmang control	Contraction of the second second		A CALCULATION OF	\$		5 .			
EEM 7	n/a - IECC only; already included in NYS amendments to 90.1-2016 Reduce for house allowed as				S		s .			
Standard	n/a - does not apply to this building type	A REAL PROPERTY AND INCOME.		Contraction of the	\$	1,031	5 -	and a summer		
EEM &	n/a - does not apply to this building type Hotel questroom NVAC vacancy control	and the second second second second	and the owner which the		\$	4	5 -		-	The Party of Street, or other states
Standard	n/a - already included in 90.1-2018				5	•	5 -			
EEM 9	nna - aready included in 90,1-2018 High-afficiency BHW	THE REAL ADDRESS OF THE REAL PROPERTY AND ADDRESS OF THE REAL PROPERTY ADDRESS OF THE REAL P	- internal	10007	5	10	S		MODEL N	CREATING INCOME.
Standard	n/a - does not apply to this building type				5		5 -			
EEM 10	High-efficiency commercial kitchen equipment	NO DO COM	COLUMN STREET,	1		12 11 14	COLUMN T		100000	R DOLLAR AND COLORADO
Standard EEM	n/a - does not apply to this building type n/a - does not apply to this building type		10.00		5	-	5			
EEM 11	Thermal bridging reduction	OT SUPPORT OF STREET	10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		1	1.5	in the second second			
EEM	n/a - does not apply to this building type		1 ÷ 1	Area	5	-	5			
EEM 12 Standard	Exterior lighting power reduction	DCMases 26 51 12 55	4 100	in the	10000				1.61	
EEM	Reduced LPDs, -8% more efficient	RSMeans 26 51 13.55	4,700	- NAMES	5		\$	1.55		
EEM 13 Standard	Efficient elevator, regenerative drives		CONTRACTOR OF	each	•	10.020	1		AND INCOME AND INCOME.	EVER DE LA VIER
EEM	n/a - does not apply to this building type			each	\$	- 2	5 .			
Standard	n/a - already included in 90,1-2016	The second second second	The second second		\$		5 .	Section of the local division of the local d		
EEM (S	n/a - already included in 90.1-2015 Demand bia ed rectionizated SIAV controls	AND DESCRIPTION OF THE OWNER.	•		\$		S +		CALCULAR ADDRESS	and a second a second
Standard	n/a	and the second			8		5 -			and the second se
ADDITION	Inta - applies to IECC path only AL COST ADJUSTMENTS	EVCENOSULAR DE LA	· · · · ·		\$	Lyn china	5	Columburation of the local division of the l	C. C	to be a set of the set of the set
ACA 1	Reduced capacity for cooling equipment	55 p 80 9 50 17	1000	11200		7 25	a strate a series	*	Still and	
EEM	INCLUDED WITH AND IN ACK J.			units	5		5 .	1		
ACA 2	Reduced capacity for heating equipment	All and the second second		100		101.8				CONTRACTOR OF
EEM	induction in the internet of			units	5	-	5			
ACA J Standard	Reduced capacity for all handling equipment PSZ AHU, CAV, 3390 chn	RSMeans 23 74 33 10	1	onits	\$	18 894	5 15 601		(2,999)	
EEM	PSZ AHU, CAV, 2513 ctm	RSMeans 23 74 33.10	i i	units	\$	13,602	\$ 13,692			
Standard	n/a - does not apply to this building type	and the second s	Section 199	2	\$		5 .		and the second second	a second a second
EEM	n/a - does not apply to this building type				5		s .	1	and the second	
Standard	Annual of the state of the stat			0	\$		5 -		2,000	
ACA 6	208/240V 40 amp outlets (zones 5A and 6A only) Solar-ready zone per Appendix CA of 2018 IFCC	chargehub.com	2	outlets	\$	1,300	\$ 2,600	-	in the second	COLUMN TWO IS NOT
Standard	In Construction of the Annual Mathematical State of the Annual State of the		10 가기 좋기		\$		\$ -	1		
EEM			•		\$	+	5 ···		20 565	
							rotal	ð	39,000	

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CLU         Description         Description         Description         Cult Protect (CUL)         Cult Pr		2020 NYStretch WAREHOUSE - 5A EEM Incremental Cost Worksheet Prepared by Vidaris Inc, 19-Jun-2019										
EAM       Address	EEM	Description	Source of Item Cost	Number of EEM Units	Unit	Cost / Unit	Total Item Cost	Total Incremental Cost	Notes / Comments			
Normal Part All 2 (14.2)         Normal Part Part Part Part Part Part Part Part	EEM 1 Standard	Enhanced insulation for roofs and walls Standard U-0.032, R-30 roof insulation (metal building)		48,495	Area	5 -	s -	\$ 20,019				
Normal         R34 42 000, 14:13         R34 42 000, 15:13         R34 42 00, 15:13         R34 4	Standard	5A: (J-0.037; R-32.2 (* R-2.2) Standard wall insulation (metal building)		26,687	Area	s .	s .					
Column Market	CCN	54. U-0.050; R-18.6 Enhanced root insulation (insulation entirely above deck)	REMeans 07 22 16 10	49.495	Area	\$ 0.3881	5 19.208					
Bits       Number of the state	CCM	SA: U-0.035; R-32.2 (+ R-2.2) Enhanced wall insulation (nonresidential mass wall)	REWerner 07 21 13 10	26 687	Area	\$ 0.0304	¢ 811					
Shorted         Structure         PAUL CE AVAL/2011         PAUL CE AVA	EEM 2	SA U-0.048 R-19.5 (+ R-0.95) Enhanted ferentration	Howearis of 21 13,10	20,001	Aica			\$ 103	and the lot of the second			
Ling and price bandle stands political stands polit	Standard	Standard windows, U-0.38	PNNL CF ANALYSIS	190	Area	5 0.54	\$ - \$ 103					
State       Video       I       Units       Video       Vid	EEM 3	Air leakage testing for mid-stred buildings	I THE GE MINE LONG	1				\$ 6,400				
EEA / Brained LPR for home highing link of access galaxis decising units         ECA // Image access acccess access access access access access access access a	Standard EEM	Not Required Testing required	Vidaris	1	units	\$ 5,400	5 6,400					
EARL       Pressure of an information lighting operation including uppers lighting uppers lightinghting uppers lightinghting uppers lighting u	EEM 4 Standard	Reduced LPD for interior lighting; high efficacy lights in dwelling units Lighting per ASHRAE 90.1-2016	Superior Di Suc 198	24,400	watts	5 6.75	3 -		No cost assumed for this			
Bits All         Polytacide and another grand pointer instance grand pointer insta	EEM	Reduced LPDs, -20% more efficient	HBL	18,699		S -	5 -		building type			
EEM         Max - IECC only         Max - IECC only         S <t< td=""><td>Standard</td><td>Occupancy sensors and automatic lighting controls including egress lighting n/a - IECC only</td><td></td><td></td><td></td><td>\$ -</td><td>s -</td><td></td><td></td></t<>	Standard	Occupancy sensors and automatic lighting controls including egress lighting n/a - IECC only				\$ -	s -					
Standard         No.         Standard	EEM 6	n/a - IECC only	the second second	in the second	Concession in the local division in the loca	5 -	5 -	S	Automatica and a state			
The Mark Deck Dark Deck Deck Deck Deck Deck Deck Deck Dec	Standard	n/a		· · · · · ·	_	\$ -	5 -					
Sincher         CV Mill:         0.0000 Bigstim         S<	EEM 7	Reduce fair, power allowances	State of the local division of the	1	and in case of	December 19	Concerning and	1	ALC: UNKNOWN OF			
CV Music 0.0008 biplicity         CV Music 0.0008 biplicity         S <th< td=""><td>Standard</td><td>CV fans: 0.00094 bhp/cfm</td><td></td><td></td><td></td><td>\$ 1,031</td><td>s -</td><td></td><td></td></th<>	Standard	CV fans: 0.00094 bhp/cfm				\$ 1,031	s -					
EM #       Hade justeticem PMAC preancy control       Image: Second PMAC preancy control       Image: Second PMAC preancy control       Image: Second PMAC preancy control         EEM Noticement PMAC preancy control       Image: Second PMAC preancy control       Image: Second PMAC preancy control       Image: Second PMAC preancy control         EEM Noticement PMAC preancy control on pre- ter and ear not exply to this building type       Image: Second PMAC preancy control on the pre- second PMAC preancy control on the pre- ter and pre- disc not exply to this building type       Image: Second PMAC pre- ter and pre- pre- ter and pre- ter and p	EEM	CV fans: 0.00088 bhp/c/m				\$ 4	s +					
Side of the standard model of the 1-2018       Image: Standard of the 1-2018       Image: Standard of the 1-2018         Standard VX - dises out apply to the building type       Image: Standard VX - dises out apply to the building type       Image: Standard VX - dises out apply to the building type         EEM 10 - dises out apply to the building type       Image: Standard VX - dises out apply to the building type       Image: Standard VX - dises out apply to the building type         EEM 10 - dises out apply to the building type       Image: Standard VX - dises out apply to the building type       Image: Standard VX - dises out apply to the building type         EEM 11 - EXtraCol Standard VX - dises out apply to the building type       Image: Standard VX - dises out apply to the building type       Image: Standard VX - dises out apply to the building type         EEM 12 - EXtraCol Standard VX - dises out apply to the building type       Image: Standard VX - dises out apply to the building type       Image: Standard VX - dises out apply to the building type         EEM 12 - EXtraCol Standard VX - dises out apply to the building type       Image: Standard VX - dises out apply to the building type       Image: Standard VX - dises out apply to the building type         EEM 12 - EXtraCol Standard VX - dises out apply to the building type       Image: Standard VX - dises out apply to the building type       Image: Standard VX - dises out apply to the building type         EEM 13 - EXtraCol Standard VX - dises out apply to the building type       Image: Standard VX - dises out apply to the building type       Image: Standar	EEMO	Hotel guestroom HVAC vacancy control			1000			<ul> <li>Contract (1995)</li> </ul>				
EBM & High-efficiency BHW <ul> <li></li></ul>	EEM	n/a - aiready included in 90.1-2016 n/a - aiready included in 90.1-2015				\$ -	5 .					
EEM 0       Int - dear and apply to mix building type         EEM 10       High- dear construction         Standard not - does not apply to mix building type         EEM 11       High- dear construction         Standard not - does not apply to mix building type         EEM 11       High- dear construction         Standard Lipht part of the standard type of the standard type         EEM 11       High- dear construction         Standard Lipht part of the standard type of the sta	EEM 9 Standard	High-efficiency SHW	and the second sec	-	1.	s -	3 .	A CONTRACTOR				
Data Div       Part Provide Status       Image Provid	EEM	n/a - does not apply to this building type			101000	5 -	S -		and the second state			
EEM 1       Mat - dees not apply to this building type         Standard Inder - dees not apply to this building type <ul> <li></li></ul>	Standard	n/a - does not apply to this building type			_	8 -	s -					
Standard in die des and apply in the building type EEM in die des nat apply in the building type EEM in die des na	EEM 11	n/a - does not apply to this building type Thermal bridging reduction	A DEALER AND A DEALER AND A	A DECEMBER OF	CC 10-1	Statistics in	State of the local division of the local div	1				
Class 32       Technic Table Tab	Standard	n/a - does not apply to this building type			_	5 .	5 -					
Standard Liphing per ASHRAE 50.1-2016 (FX 2000 LPDs, 5% Umber 401 Control L	EEM 12	Exterior lighting power reduction	International Second Second	NO DOM NO	1000	80 SIN 11	Nacione da	Contraction of the second				
EEM 14       Efficient derivator, regenerative drives       3       -         Standard Ark - does not apply to this building type       -       each       3       -         EEM 14       EFK for spurtment instance at a part to this building type       -       0       5       -         Standard Ark - energy included in 90 1-2016       -       0       5       -       -         Standard Ark - energy included in 90 1-2016       -       0       5       -       -         Standard Ark - energy included in 90 1-2016       -       0       5       -       -         EEM At a stready include in 90 1-2016       -       0       5       - <td< td=""><td>Standard EEM</td><td>Lighting per ASHRAE 90.1-2016 Reduced LPDs, ~8% more efficient</td><td>RSMeans 26 51 13 55 RSMeans 26 51 13 55</td><td>5,101</td><td>watts</td><td>\$ - \$ -</td><td>5 -</td><td>1</td><td></td></td<>	Standard EEM	Lighting per ASHRAE 90.1-2016 Reduced LPDs, ~8% more efficient	RSMeans 26 51 13 55 RSMeans 26 51 13 55	5,101	watts	\$ - \$ -	5 -	1				
Control of the does not apply to his building type       -	EEM 13	Efficient elevator, regenerative drives	TO ALL DATE OF THE OWNER	UNIERO180	earb		15 -	3				
ELM 41       ELM for spartment makeup air units         Standard Inva - aiready included in 90.1-2016       0       5       5         EEM Inva - aiready included in 90.1-2016       0       5       5         EEM Inva - aiready included in 90.1-2016       0       5       5         EEM Inva - aiready included in 90.1-2016       0       5       5         EEM Inva - aiready included in 90.1-2016       0       5       5         Standard Inva       0       5       5       5         ACA 1       Reduced capacity for cooling equipment       0       5       5         Standard Inva       -       0       5       5       -         ACA 1       Reduced capacity for cooling equipment       -       0       5       -         Standard InvCLUDED WITH AHU IN ACA 3       -       -       -       0       5       -         Standard Inva CLUDED WITH AHU IN ACA 3       -       -       -       0       5       -       -         Standard Inva CLUDED WITH AHU IN ACA 3       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -	EEM	n/a - does not apply to this building type			each	\$ -	š -	-				
EEM     Inta-atrady included in 901-2016     -     0     \$     -	EEM 14 Standard	ERV for apartment makeup air units n/a - almady included in 90.1-2016			0	5 -	5 -					
Standard Male       0       \$       <	EEM IS	n/a - already included in 90.1-2018 Demandshared regionidated SHW controls		-	0		5 -	1				
EEM       Intra - applies to IECC path only         ACA 1       Reduced capacity for cooling equipment         Standard INCLUDED WITH AHUIN ACA 3         EEM         ACA 2       Reduced capacity for heating equipment         Standard INCLUDED WITH AHUIN ACA 3         EEM         ACA 3       Reduced capacity for heating equipment         Standard INCLUDED WITH AHUIN ACA 3         EEM         ACA 3       Reduced capacity for a landing equipment         Standard INCLUDED WITH AHUIN ACA 3         EEM         CEM         ACA 3       Reduced capacity for a landing equipment         Standard INCLUDED WITH AHUIN ACA 3         EEM         PSZ AHU, CAV, 2394 cfm         ACA 1       Increased insulation to scould by TAG openings, thermal bildging requirements         Standard INCLUDED WITH AHUIN ACA 3         EEM       PSZ AHU, CAV, 2394 cfm         ACA 1       Increased insulation to scould by the fill bildging requirements         Standard INCLUDED WITH AHUIN ACA 3       1         EEM       PSZ AHU, CAV, 2394 cfm         ACA 3       Increased insulation to scould by the fill bildging requirements         Standard INC to be so deply to this building type         EEM       O       S       S	Standard	n/a			0	S -	5 -					
ACA 1       Reduced capacity for scaling equipment         Standard INCLUDED WITH ANU IN ACA 3       -         EEM       -       units       \$ -         ACA 2       Reduced capacity for heating equipment       -         Standard INCLUDED WITH ANU IN ACA 3       -       -         Standard INCLUDED WITH ANU IN ACA 3       -       -         Standard INCLUDED WITH ANU IN ACA 3       -       -         VACA 2       Reduced capacity for heating equipment       -         Standard INCLUDED WITH ANU IN ACA 3       -       -         VACA 3       Reduced capacity for at heading equipment       -         Standard INSCLUDED WITH ANU IN ACA 3       -       -         VACA 3       Reduced capacity for at heading equipment       -         Standard INSCLUDED WITH ANU IN ACA 3       -       -         VACA 3       Reduced capacity for at heading equipment       -         Standard INSCLUDED WITH AND IN CA 3       -       -         Standard INSCLUDED WITH AND IN CAN 233 / 0       -       -         ACA 4       Increased Invuision to second to PTAC openings, thermal bidging requirements       -         Standard INV to this building type       -       0       5       -         EEM       Increased Invuision to se	ADDITION	Infa - applies to IECC path only IAL COST ADJUSTMENTS		a statist	0	and the second second	1 States	and the second second	NUCL OF A DECK			
EEM     -     units     \$ 177,744     \$ -       AGA 2     Acdition     MICLUDED WITH AMU IW ACA 3     \$     \$       EEM     Féduced capacity for heating equipment     -     units     \$ 177,744     \$ -       ACA 3     Féduced capacity for heating equipment     -     units     \$ 177,744     \$ -       EEM     Féduced capacity for air handling equipment     -     units     \$ -     \$ -       Standard     INCLUDED WITH AMU IW ACA 3     -     \$ -     \$ -       EEM     F52 AHU, CAV, 255 cfm     \$ -     \$ -     \$ -       EEM /r 52 AHU, CAV, 259 cfm     R5Means 23 74 33.10     1     units     \$ 14,442     \$ 14,442       Standard /r>     F52 AHU, CAV, 259 cfm     R5Means 23 74 33.10     1     units     \$ 14,442     \$ 14,442       Standard rive     -     0     \$ -     \$ -     \$ -       Standard rive     -     0     \$ -     \$	ACA 1	Reduced capacity for cooling equipment	And a second second		units	s -	5 -	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Non-Core of this purchase			
ACA 3       reduced capacity for name and sequences         Standard IV/CUDED With ALU W ACA 3       -         EEM       -         Variation of the sequence of the se	EEM				units	\$ 177,744	5 -					
EEM     -     -     -     -     -     1       Standard     PSZ ANU, CAV, 2755 cm     RSMeans 23 74 33 10     1     units     \$     14,442 <t< td=""><td>Standard</td><td>Reduced capacity for healing equipment INCLUDED WITH AHU IN ACA 3</td><td>No. of Concession, Name</td><td></td><td>units</td><td>5 -</td><td>5 .</td><td>1</td><td></td></t<>	Standard	Reduced capacity for healing equipment INCLUDED WITH AHU IN ACA 3	No. of Concession, Name		units	5 -	5 .	1				
Standard         PS2 ANU, CAV, 2755 cfm         PS2 ANU, CAV, 2755 cfm         PS2 ANU, CAV, 239 cfm         PS2 ANU, CAV, 239 cfm         14,442         \$ 14,442	EEM ACA 3	Reduced capacity for air handling equipment	and the second se	and in	units	5	15 +	\$ (1.274)	Constant and			
ACA A Increased invulation to secount for PTAC openings, thermal bildging requirements. Standard In/a - does not apply to this building type EEM In- does not apply to this building type EEM 208/240V 40 amp outlets (zones 5A and 6A only) ACA 3 Electric vehicle charging station capable patking fors for 5% of spaces Chargehub.com Chargehub	Standard	PSZ AHU, CAV, 2765 clm	RSMeans 23 74 33 10 RSMeans 23 74 33 10	1	unita	\$ 14,442	5 14,442					
Standard:     -     0     3     -     3     -       EEM     n/x - does not apply to this building type     -     0     3     -     -       ACA 3     Electric vehicle charging station capable patking fots for 5% of spaces     -     0     5     -       Standard:     -     0     5     -     5     -       ACA 3     Electric vehicle charging station capable patking fots for 5% of spaces     -     0     5     -       ACA 5     Electric vehicle Charging station capable patking fots for 5% of spaces     -     0     5     -       ACA 8     Colar-feady zone per Appendic CA of 2018 (ECC)     -     0     5     -     -       Standard     -     0     5     -     5     -     -       EEM     -     0     5     -     5     -	ACA 4	Increased Insulation to account for PTAC openings, thermal bridging requirements	(10 miles 20 74 00,10	1000000000	- Contraction	10,101	10,101	1 Sec. 19 10 Sec. 19 10				
ACCA Electric vehicle charging station capable parking iots for 5% of spaces Standard EEM 208/240V 40 amp outlets (zones SA and 6A only) Chargehub.com 3 outlets 5 1,300 5 4,338 ACCA 6 604ar-feady zone per Appendix CA of 2015 (ECC) Chargehub.com 3 outlets - 5	EEM	n/a - does not apply to this building type In/a - does not apply to this building type			0	3 -	5	1000				
EEM         208/240V 40 amp outlets (zones SA and 8A only)         chargehub.com         3         outlets         \$         4.338         \$           ACA 8         60/ar-ready zone par Appendix CA of 2016 (ECC)         0         \$         5         5           Standard         0         \$         \$         5         5         5           EEM         0         \$         \$         5         7         5	ACA 5	Electric vehicle charging station capable patking lots for 5% of spaces	TANK STATISTICS		0	5 -	5	\$ 4,338	and and a state of the state of the			
ACA 8         Bodar-ready zone per Appendix CA of 2016 (ECG)         S           Standard         0         \$         \$           EEM         0         \$         \$	EEM	208/240V 40 amp outlets (zones SA and 6A only)	chargehub.com	3	outets	\$ 1,300	\$ 4,338	1				
EEM . 0 \$ - 5	AGA 6 Standard	Bolar-ready zone per Appendix CA of 2016 IECC	and the second designed in the second designed and the		0	5 .	5 -	1				
	EEM				0	\$ +	5 Total	C 20 586				

	2020 NYStretch WAREHOUSE - 6A EEM Incremental Cost Worksheet Prepared by Vidaris Inc. 19-Jun-2019									
EEM	Description	Source of Item Cost	Number of EEM Units	Unit	Cost/ Unit	Total Item Cost	Total Incremental Cost	Notes / Comments		
ECM T	Standard U-0.032, R-30 roof insulation (metal building)		10.105	11-11	SPECIAL STREET	103	\$ 30,495			
Standard	6A. U-0.031; R-33.4 (+ R-3.4)		49,495	Area	a	5 -				
Standard	6A: U-0.050; R-18.6		26,687	Area	s -	5 (•)				
EEM	Enhanced roof insulation (insulation entirely above deck)	RSMeans 07 22 16,10	49,495	Area	5 0,5996	\$ 29,685				
FEM	Enhanced wall insulation (nonresidential mass wall)	DEM week 07 21 12 10	70.007	Area	£ 0.0304					
FFM 3	6A: U-0.048; R-19.5 (+ R-0.95)	Howeans of 21 (3,10	20,007	Area	3 0.0304	a 811		Current and the second second		
Standard	Standard windows, U-0.36		190	Area	5 -	5 -	103	and a second second second		
EEM N	Enhanced windows, U-0.34	PNNL CE ANALYSIS	190	Area	\$ 0.55	\$ 105	a state	and the second sec		
Standard	Not Required		1	units	5 -	5 -	\$ 6,400			
EEM	Testing required	Vidaris	Ť.	units	\$ 6,400	5 6,400				
Standard	Lighting per ASHRAE 90.1-2016		24,400	watta	\$ 6.75	5		No cost assumed for this		
EEM	Reduced LPDs, -20% more efficient	HBL	18,689	1	5	5 -		builling type		
Standard	Occupancy sensors and automatic lighting controls including egress lighting n/a - IECC only	Contraction of the lot		ALC: NO PERSONNEL	1.5	15 .		100 H 0 11 11 11		
EEM	n/a - IECC only				5 -	5 .				
Standard	tixtener lighting control	No. of Concession, Name			18	5		Contraction of the second		
EEM	n/a - IECC only, already included in NYS amendments to 90,1-2016				3	5				
EEM 7	Reduce fan powst allowances. CV fans: 0 00094 bho/c/m		Concerns of the local division of the		States and States			THE STREET		
Standard	VAV tans: 0.00130 bhp/ctm				\$ 1,031	\$				
EEM	VAV fans: 0.00086 bhp/cfm		the second second		5 4	s -				
EEN 8	Hotel guestroom HVAC vacancy control	a state of the state of the	1		West and		The second second	KARTSIG TINS		
EEM	n/a - already included in 90.1-2016 n/a - already included in 90.1-2016				5 -	5 -				
EEM 9	High-efficiency SHW	All of the second s	don too?	(Children)	and the second second	AS NO MERCINE	A CONTRACTOR	Test of the second second		
EEM	n/a - does not apply to this building type n/a - does not apply to this building type		•		5 .	5 -				
EEM 10	High-efficiency commercial kitchen equipment	The second s	A COLUMN TWO IS NOT		ALCONTRACTOR D	1	State of the second	11125011O.R		
Standard	n/a - does not apply to this building type				s -	\$ -	·····			
EEM 11	Thermal bridging reduction	THE SECTION AND ADDRESS OF STREET, STR	ALL DOCTORNEY	COLOR P		A REAL PROPERTY AND	310 LA	SUBSERVICE CONTRACTOR		
Standard	n/a - does not apply to this building type n/a - does not sonly to this building type		1222 11 211	_	5 .	5 .				
EEM 12	Exterior lighting power reduction	- FAMILIAN PROVIDE	Service and March	14	Statute of the	Constraines	And I wanted at 1	and the second second		
Standard	Lighting per ASHRAE 90.1-2016	RSMeans 26 51 13 55	5,101	watta	5	5				
EEM 13	Efficient elevator, regenerative drives	RSW8818 20 51 13 55	hanness and		CONTRACTOR OF STREET,	3		And in case of the local diversion of		
Standard	n/a - does not apply to this building type			each	8 -	\$ -				
EEM 14	ERV for apertment makeup air units	And the state of the second	la constante	each.	A CONTRACTOR OF	3	3	Martin Martin		
Standard	n/a - already included in 90 1-2016		· · ·	0	8 -	\$ .				
EEM 16	Demand-based recirculated SHW controls	Manhood States of Long States of Long States	here and here here	U	a second second	3	\$2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	100000000000000000000000000000000000000		
Standard	n/a pla - stoles to IECC path only			0	s -	5 -				
ADDITION	AL COST ADJUSTMENTS	A DECK STORE STORES	and the second second	0	Contraction of the		PETRONAL PROPERTY.	ALLO MUNICALIN		
ACA 1	Reduced capacity for cooling equipment	and and a second second	you the state of	100	1000	And Address of the Party of the	1	Design of the second		
EEM	INCLUDED WITH AND IN ACK 3		110000	units .	\$ 177,744	s				
ACA 2	Reduced capacity for heating equipment	STATISTICS AND ADDRESS OF THE OWNER	The HLY STORE	20mm	the constraint		Network of the second second	50-51 E IT		
EEM	AND DED THIN AND IN MON 3			units	1	\$ .				
ACA 3	Reduced capacity for air handling equipment	DEM 25 24 25 14			A		\$ (2,024)	Print I Kill I H		
EEM	PSZ AHU, CAV, 2010 clm	RSMeans 23 74 33 10 RSMeans 23 74 33 10	1	units	a 14,691 12,667	\$ 12,867				
ACA 4	Increased Insulation to account for PTAC openings, thermal bridging requirements		ALL FROM	MONTO D		ALCONT OCT				
EEM	n/a - does not apply to this building type			0	5 .	3				
ACAS	Electric vehicle charging station capable parking lots for 5% of spaces	the second second second	State of the second second		Ka za za za za	ALC: NO DE LA COMPANY	\$ 4,338	11/2 1		
EEM	208/240V 40 amp outlets (zones SA and 6A only)	chargehub com	3	0 atequo	5 1.300	5 4338				
ACAS	Solar-ready zone per Appendix CA of 2018 IECC	No. of Concession, Name	STAD IN	dautid	1000	100	4	the state of the s		
EEM				0	1	5 .				
						Total	\$ 39.315	-		

	2020 MYStricth 10 STORY HIGH-RISE APARTMENT - 4A EEM Incremental Cost Worksheet Prepared by Vidaris Inc, 19-Jun-2019										
EEM	Description	Source of Item Cost	Number of EEM Units	Unit	Cost / Unit	Total Item Gost	Total Incremental Cost	Notes / Comments			
EEM 1	Enhanced Insulation for roots and walls	St. 11. 1914	i inter				3 3,091				
Standard	Standard U-0.032, R-30 root insulation (insulation entirely above deck) Standard wall insulation (residential steel-frame wall)		8,435	Area							
Standard	4A: U-0.064; R-13.4	1	20,112	Alba		-					
EEM	AA U-0.030, R-32.2 (+ R-2.2)	RSMnans 07 22 16 10	8,435	Area	\$ 0,3881	\$ 3,274					
EEM	Enhanced wall insulation (residential steel-frame wall) 4A 150 051 R-14 2 /+ R-0 771	RSMeans 07 21 13,10	29,112	Area	\$ 0.0246	\$ 717					
EEM 2	Enhanced fenestration	A Property and a second	10.000		State of the state	Warner and	\$ 5,679				
Standard EEM	Standard windows, U-0.39 Enhanced windows, U-0.37	PNNL CE ANALYSIS	12,383	Area	\$ 0.54	6 679					
EEM 3	Air leakage teating for mid-sized buildings	Contraction of the second second		0	THE REAL PROPERTY OF			A CONTRACTOR OF A CONTRACTOR OFTA CONTRACTOR O			
EEM	n/a - does not apply to this building type n/a - does not apply to this building type		-	0	\$	\$ -					
EEM 4	Reduced LPD for Interior lighting; high efficacy lights in dwelling units	And in the local division of the	60 160	watte	18	1 1 1 1 1					
EEM	Reduced LPDs, ~20% more efficient	HBL	57,804	watts	\$ .	s •		No cost assumed for this building type			
EEM S	Occupancy sensors and automatic lighting controls including egress lighting	A DESCRIPTION OF THE OWNER	West Street Street		and the second se	States of the local division of the	S	And the second s			
EEM	n/a - IECC only		1	ő	5	\$					
EEM 6	Exterior lighting control		A CONTRACTOR OF	0		5		A REAL PROPERTY AND A REAL			
EEM	n/a - IECC only, already included in NYS amendments to 90.1-2016		1	ō	5	\$ -					
EEM 7	Reduce fan power allowances		Concercion of the local distance	1.000	5 .	5 .	1	Cartin Residant Science (Children			
EEM	n/a - does not apply to this building type				\$ .	\$ -					
EEM 8	Hotel guestroom HVAC vacancy control	A COLORED	1	100,000,000	5 .	s .					
EEM	n/a - already included in 90.1-2016		•		\$ +	5 -	-				
EEM 9 Standard	High-efficiency SHW Not water boder with 80% (hermal efficiency	Contraction of the local division of the	and the second second		5 .	5 -					
EEM	Hot water boiler with 94% thermal efficiency		•		\$ .	5 -					
EEM 10 Standard	High-efficiency commercial kitchen equipment n/a - does not apply to this building type				S ·	5 -					
EEM	n/a - does not apply to this building type			-	s -	\$ 2	1 1 370				
Standard	Thermal Endging reduction Standard wall insulation	Automatic Instantion			S -	\$ -	•				
EEM	Additional Parapet Insulation: Assume 12in at wall + 42in of parapet height + 12in wide parapet + 42in of	RSMeans 07 22 16.10	3,735	Area	\$ 0.3400	\$ 1,270					
EEM 12	parapet height to root deck. S it of total insulation of K-4, zhin for entire perimeter of root. Exterior lighting power reduction	- 10- 191	Charles in the	Section 33	Sector Sector		101 - 101 - 101	A DESCRIPTION OF A DESC			
Standard	n/a - not modeled for this building type	RSMeans 26 51 13 55 RSMeans 26 51 13 55	1 2 1		1 :	s . s .					
EEM 13	Efficient elevator, regenerative drives	100000000000000000000000000000000000000	0 E 16 1	- 12	Stranger and	A	\$ 10,000				
Standard	Standard elevator motors, 30hp Elevator motors with resensative drives, 30 hp.	Previous projects		each	\$ 10,000	5 10.000					
EEM 14	ERV for apartment makeup air unita	Carl and the state of the	S BARRIE		The state of the s	No. of Contract	\$ 5 0 H H H H				
Standard	n/a - already included in 90.1-2016 n/a - already included in 90.1-2016			0	3 .	5 .					
EEM 18	Demand-based rectroulated SHW controls		1000			17	\$				
EEM	n/a n/a - applies to IECC path only			0	1	s -					
ADDITION	AL COST ADJUSTMENTS	Section and section						DE RECLEMAN DE RECEPT			
Standard	PTAC, 105 tons	RSMeans D3050 255	1	units	\$ 179,837	\$ 179,837					
EEM	PTAC, 104 tons	RSMeans D3050 255	1	units	5 177,287	\$ 177,287	e (450	A CONTRACTOR OF THE OWNER			
Standard	Hot water boller, gas fired, 1076 MBH	RSMeans D3020 130		units	\$ 43,188	\$ 43,188					
EEM	Hot water boller, gas fired, 1059 MBH Reduced exception for all handling additionant	RSMeans D3020 130	1	0	\$ 42,719	5 42,719		Street States of the survey of			
Standard	(INCLUCED WIPACKAGED UNITS IN ACA 1)		- 1	units	5	5 -					
EEM ACA 4	Increased insulation to account for PTAC openings, thermal bridging requirements	100 1 10 10 10 10 10 10 10 10 10 10 10 1		units	5	5	\$ 8,255				
Standard	Opaque wall with U-0.061	DON		0	\$	5 -					
ACA 6	Opaque wall with 0-0.045, R-22.2 (+R-5.85) Electric vehicle charging station capable parking lots for 5% of spaces	Kalleans 07 21 13.10	28,086	U	· 0,16/1	· 3,255	\$ 2,600	THE PART OF ANY SOL INC.			
Standard		discount of a sum	1	O	\$ 1.504	5 -					
ACAG	200/240V 40 amp outlets (zones 5A and 6A only) Solar-matly zone per Appendix CA of 2018 IECC	cnarganub.com	A CONTRACTOR	coners	.300	4 2,000	4 11 11 11	the set of the set			
Standard		-		0	\$	5 .					
- Line	1					Total	\$ 26,775				

CPU         Description         Description         Description         Probability         P		10 STC EE	2020 NYStretch ORY HIGH-RISE APAR M Incremental Cost W Prepared by Vidaris I 19-Jun-2019	TMENT - 5A orksheet nc.					
CBA Markane Insulant Instruct Markane Markam       Add 1       Add 2       Ad	EEM	Description	Source of Item Cost	Number of EEM Units	Unit	Cost / Unit	Total Item Cost	Total Incremental Cost	Notes / Comments
Description         Description <thdescription< th=""> <thdescription< th=""></thdescription<></thdescription<>	EEM 1 Standard	Enhanced insulation for roats and walls Standard LL0.022, B-30 and insulation (insulation anticals above dask)	24 C 27 C 2 A 47 C	8 456 1		AMERICAN AND IN COLORS		\$ 4,252	and the second second
Data with and with a set of a set	Standard	Standard wall insulation (residential steel-frame wall)		0,430	Area				
EAU all Labels BLA LABELS LABELS LABELS LABELS BLA LABELS BLA LABELS BLA LABELS	Granderu	5A U-0.055 R-16.0		29,112	AVED	•	• •		
City Construction function functin function function function function function function function	EEM	5A: U-0.030, R-32.2 (+ R-2.2)	RSMeans 07 22 16,10	8,435	Area	\$ 0.3881	\$ 3,274		
Build of a set o	EEM	Enhanced will insulation (residential steel-frame wall)	R5Means 07 21 13 10	29,112	Area	8 0.0336	\$ 978		
Standard	EEH 2	Enhanced fenestration	The state of the s	al	Cold State	A DESCRIPTION OF	Contraction of the	\$ 9,755	NOTION AND INCOME.
Bit Market Ma	Standard	Standard windows, U-0.39		12,363	Area	\$	5 -		
Standar         Nonsent and point in the latting type:         Image: sent and point in the latting type: in the latting type in tha latting type in tha latting type in the latting ty	EEM 3	Enhanced windows, U-0.36 All festage testing for mid-sized buildings	PNNL CE ANALYSIS	12,383	Area	\$ 0.79	\$ 9,755	· · · · · · · · · · · · · · · · · · ·	A DESCRIPTION OF THE OWNER.
EUL       M does not aday? In this building type       M does not aday? In this building agrees adapting the boothing units.       N does not aday? In this building agrees adapting addition adapting addition additio	Standard	rvla - does not apply to this building type			0	15 -	5 +		
Statuse         Lighting per difference of the base of the	EEM A	n/a - does not apply to this building type Reduced 1 CP for Interfect Babiling, black attracts the tax that is doubted	The statement of the statement of the	· · · ·	0	5 ·	5 -		the state of the s
Edstand UPb, args/standarding lighting controls, instaining agreess lighting lighting lighting lighting lighting lighting lighti	Standard	Lighting per ASHRAE 90 1-2016		60,150	watts	5 .	5 -		No cost assumed for this
BADel Subjectory as an automatic by any sources in statistical agrees lighting	EEM	Reduced LPDs, -20% more efficient	HBL	57,804	watts	\$ -	5 -		building type
EAM         Into I: IECC only         Into II	Standard	Occupancy sensors and automatic lighting controls including egrass lighting n/a - /ECC only		a Course and	0	5	5 .	10 - 00     1      1	
Case         Cas         Case         Case	EEM	n/a - IECC only		-	Ő	\$ -	5 -		
EEU Model (E. 2007)       Main (E. 2007)       S	Siandard	Exterior lighting control		COLUMN TO DESCRIPTION	0		and the second second	<b>x</b>	Merrie Constants
ELEPT.       Relate fin jower days in the building year       i       <	EEM	n/a - IECC only, already included in NYS amendments to 90.1-2016		1	0	5 .	\$ .		
Bit M     Max-scenario starty of prints public for the building type       Starty M     Max-scenario starty of prints public for the building type       Starty M     Max-scenario starty of prints public for the building type       Starty M     Max-scenario starty of prints public for the building type       Max-scenario starty of the building type     Image: Starty of the scenario starty of the building type       Max-scenario starty of the building type     Image: Starty of the scenario starty of the building type       Max-scenario starty of the building type     Image: Starty of the scenario starty of the building type       Max-scenario starty of the building type     Image: Starty of the scenario starty of the building type       Max-scenario starty of the building type     Image: Starty of the scenario starty of the building type       Max-scenario starty of the building type     Image: Starty of the scenario starty of the building type       Max-scenario starty of the building type     Image: Starty of the scenario starty of the building type       Max-scenario starty of the building type     Image: Starty of the scenario starty of the building type       Starty of the type starty of the building type     Image: Starty of the scenario starty of the scen	EEM 7	Reduce fan power ellowances		No in the last	A Real A	and the second second		Franklin (a)	
EEM A     Hold guestmoon MVAC vacancy solution     i	EEM	n/a - does not apply to this building type				\$ .	3 .		
Status       max       status	EUM 8	Hotel guestroom HVAC vacancy control	the state of the	in the second	1000	the second second		\$	A 101 - 100
EBA A     right efficiency status     right efficiency status     right efficiency status       FEM A     right efficiency status     right efficiency status     right efficiency status       FEM A     right efficiency status     right efficiency status     right efficiency status       FEM A     right efficiency status     right efficiency status     right efficiency status       FEM A     right efficiency status     right efficiency status     right efficiency status       Status     right efficiency status     right efficiency status     right efficiency status       Status     right efficiency status     right efficiency status     right efficiency status       Status     right efficiency status     right efficiency status     right efficiency status       Status     right efficiency status     right efficiency status     right efficiency status       Status     right righ	EEM	n/a - already included in 90.1-2016 n/a - already included in 90.1-2016				5	3		
Sincedum of mail of a not apply to him building type file dualing	EEM 9	High-emclency SHW	NO OF TAXABLE PARTY.	A second with the	1444	and a second second	1964	3	CONTRACTOR OF STREET
Eth N 10       High-Afficiency Connected Windows you       3       -	Standard	n/a - does not apply to this building type				\$	\$		
Standard of Ad-desis not apply to this building type Term Ad-desis n	EEM 10	High-efficiency commercial kitchen equipment	A DESCRIPTION OF THE OWNER.	And the state of the	0.1	Contract of the local division of the	a second second	5	COLUMN DATE OF THE OWNER
EEM PAR-dock not apply to this building type PAR-dock not apply PAR-dock not apply to this building type PAR-dock not a	Standard	n/a - does not apply to this building type				5 -	5 -		
Standard var unaution EEM Adden Paraget Insulation Assure 12m at well + 42m of paraget height + 12m wide paraget + 42m of paraget beight port acts 9 if of four insulation of R-4.2m for entire paraget + 42m of paraget beight port acts 9 if of four insulation of R-4.2m for entire paraget + 42m of Paraget beight port acts 9 if of four insulation of R-4.2m for entire paraget + 42m of Paraget beight port acts 9 if of four insulation of R-4.2m for entire paraget + 42m of Paraget beight port acts 9 if of four insulation of R-4.2m for entire paraget + 42m of Paraget beight port acts 9 if of four insulation of R-4.2m for entire paraget + 42m of Paraget beight port acts 9 if of four insulation of R-4.2m for entire paraget + 42m of Paraget beight port acts 9 if of four insulation of R-4.2m for entire paraget + 42m of Paraget beight port acts 9 if of four insulation of R-4.2m for entire paraget + 42m of Paraget beight port acts 9 if of four insulation of R-4.2m for entire paraget + 42m of Paraget beight port acts 9 if 0.4m for entire paraget + 42m of Paraget beight port acts 9 if 0.4m for entire paraget + 42m of Paraget beight port acts 9 if 0.4m for entire paraget beight port Paraget beight port acts 9 if 0.4m for entire paraget beight port Paraget beight port acts 9 if 0.4m for entire paraget beight port Paraget beight port acts 9 if 0.4m for entire paraget beight port Paraget beight port acts 9 if 0.4m for entire paraget beight port Paraget beight port acts 9 if 0.4m for entire paraget beight port Paraget beight port acts 9 if 0.4m for entire paraget beight port Paraget beight port acts 9 if 0.4m for entire paraget beight port Paraget beight port acts 9 if 0.4m for entire paraget beight port Paraget beight port acts 9 if 0.4m for entire paraget beight port Paraget beight port acts 9 if 0.4m for entire paraget beight port Paraget beight port acts 9 if 0.4m for entire paraget beight port Paraget beight port acts 9 if 0.4m for entire paraget beight port Paraget beight port acts 9 if 0.4m for enti	EEM 11	hra - does hot apply to this building type Thermal bridging reduction	and the second second		Concession in the	13 -	5 -	E (220	Contractor of the local division of the loca
EMM         Additional Paraget Insultion, Assume 12m at wall + 42m wide paraget + 42m of Extended Ployth are of decise 10 of total mutuation of R4.2 Unit for entire perimeter of root.         PSM eans 07 22 16.10         3.755         Area         \$         0.3400         \$         1.270           EEM 12 EXtended Ployth area EXtended Ployth area (account of the transbuilding type) (ab : not modeled for this building type) (ab : not modeled for this bu	Standard	Standard wall insulation				8 - 1	5 -		
Eff N 32 Extender (A), not modeled for the building type EEM 33 Extender (A), not modeled for the building type EEM 33 Extender elevator, regulation elevator, regulation elevator, generative divers, 30 p EEM 34 Extender elevator, regulation elevator, regulation elevator, generative divers, 30 p EEM 35 Extender elevator, regulation elevator, regulation elevator, generative divers, 30 p EEM 35 Extender elevator, regulation elevator, regulation elevator, generative divers, 30 p EEM 35 Extender elevator, regulation elevator, regulation elevator, generative divers, 30 p EEM 35 Extender elevator, regulation elevator, regulation elevator, generative divers, 30 p EEM 35 Extender elevator, regulation elevator, regulation elevator, generative divers, 30 p EEM 35 Extender elevator, regulation elevator, regulation elevator, elev	EEM	Additional Parapet Insulation: Assume 12in at wall + 42in of parapet height + 12in wide parapet + 42in of parapet bright to real deriv. 9 th of fold insulation of I2.4 2in for earlier parameter of real.	R5Means 07 22 16.10	3,735	Area	\$ 0.3400	\$ 1,270		
Standard wie - oof modeled for this building type EEM wie - oof modeled for this building type EEM Missional Standard	EEM 12	Exterior lighting power reduction	MONTHERE MALL	they were said	2000	a second s	the second	1	Standing Property and
Edit NJ       The indicates for this purposed for this purpose	Standard	n/a - not modeled for this building type	RSMeans 26 51 13 55	-		\$	5 -		
Standard eventser motors, 300p       - aach	EEM 13	Efficient elevator, reconcrative drives	RSMeans 26 51 13 55	Je sind	Contraction of the local division of the loc	And some in succession	3 -	10.000	Contract of the local division of the local
EEM H       EEVator motors with regarantable drives, 30 hp       Previous projects       1       each       \$       10,000	Standard	Standard elevator motora, 30hp	in the second second		each	5 -	\$		
Standard We already included in 90.1-2016 EEM f D demand data feed in 10.1-2018 EEM f D demand data feed in 10.1-2018 Standard r/a a spepts to IECC path only ADDITIONAL COST ADJUSTIVENTS ADDITIONAL COST ADJUSTIVENTS ADDITIONAL COST ADJUSTIVENTS ADDITIONAL COST ADJUSTIVENTS ADDITIONAL COST ADJUSTIVENTS Standard PTAC, 105 tons EEM PTAC	EEM 14	Elevator motors with regenerative drives, 30 hp FRV for anartment matering all units	Previous projects	1	each	\$ 10,000	\$ 10,000	Contraction of the local division of the	and the second se
EEM       n/a - alxeady included in 90.1-2016         EEM f3       Demaid-based recirculated BHW controls         Standard r/a       0       \$       \$         Standard r/a       0       \$       \$         ADDITIONAL COST ADJUSTNENTS       0       \$       \$         ADDITIONAL COST ADJUSTNENTS       0       \$       \$         ADALT       Reduced capacity for scooling equipment       0       \$       \$         Standard       PTAC, 103.2 tons       180,632       \$       180,632       \$       180,632       \$       180,632       \$       180,632       \$       (4,679)         Standard PTAC, 106 tons       PTAC, 103.2 tons       Reduced capacity for neating equipment       \$       175,054       \$       (771)         Standard IV/Auster boler, gas fined, 1073 MBH       PTAC, 106 tons       \$       43,089       \$       43,089       \$	Standard	r/a - already included in 90 1-2016		1	0	1	\$ -		and the second se
Sampan       Anionative restriction are public barry controls         EEM       na* apples to IECC path only         ADDITIONAL Color ADJUSTIENTS       0         ACA 1       Reduced cappolity for conting equipment         Standard PLAC, 106 tons       PTAC, 103, 2 tons         PTAC, 103, 2 tons       ASMeans D3050 255       1         Units       \$       180,632       \$         Standard PLAC, 106 tons       RSMeans D3050 255       1       units       \$       180,632       \$       (4,679)         Standard PLAC, 103, 2 tons       RSMeans D3050 255       1       units       \$       180,632       \$       (4,679)         Standard PLAC, 103, 2 tons       RSMeans D3020 150       1       units       \$       43,069       (773)         Standard PLAC, 103, 2 tons       RSMeans D3020 130       1       units       \$       43,069       (773)         Standard Motuser back (SGR DMITS M ACA 1)       PSMeans D3020 130       1       units       \$       43,069       (773)         Standard (MCUCCE WPACKAGED UNITS M ACA 1)       PSMeans D3020 130       1       units       \$       5       -         Standard (Opeque wall with U-0.02       PSMeans D3020 130       1       units       \$       5 <td< td=""><td>EEM</td><td>n/a - akeady included in 90.1-2016</td><td></td><td></td><td>0</td><td>5 -</td><td>s -</td><td></td><td></td></td<>	EEM	n/a - akeady included in 90.1-2016			0	5 -	s -		
EEM       max apples to IECC path only.       0       \$       \$	Standard	Na	1		0	15 -	5 -	And and the local date	
AGA 1 Reduced capacity for factoring equipment Standard PTAC, 105 tons PTAC, 105	EEM	n/a - applies to IECC path only			0	\$ -	\$ .		
Standard       PTAC, 105 tons       PR6Mears D0392 255       1       units       \$       180.632       \$       180.632         EEM       PTAC, 103 tons       RSMears D0392 255       1       units       \$       175,054       \$       (771)         Standard       Hot water boling, as fined, 1023 MBH       RSMears D0202 130       1       units       \$       43,068       \$       43,068       \$       (771)         Standard       Hot water boling, ast fined, 1023 MBH       RSMears D0202 130       1       0       \$       42,318       \$       42,318       \$       (771)         ACA 3       Reduced capacity for air handling equipment       RSMears D0202 130       1       0       \$       4,2318       \$       42,318       \$       42,318       \$       \$       -	ACA 1	Reduced capacity for cooling equipment			and the second	and and a second		L (4.679)	a says in a design of the local distance
EEM       PTAC, 10.3, 2 tons       PTAC, 10.3, 2 tons       PTAC, 10.3, 2 tons       (773)         Standard       Hot water bolier, gas lined, 10/2 MBH       PSMeans D3020 130       1       units       \$ 43,069       (773)         Standard       Hot water bolier, gas lined, 10/2 MBH       PSMeans D3020 130       1       units       \$ 43,069       (773)         Standard       Mich water bolier, gas lined, 10/2 MBH       PSMeans D3020 130       1       units       \$ 42,318       (773)         ACA 3       Reduced capacity for ark handling equipment	Standard	PTAC. 106 tons	RSMeans D3050 255	1	units	\$ 180,632	\$ 180,632		
Notice as find, 1072 MBH         RSMeans D3020 130         1         Units         \$ 43,089         \$ 43,089         \$ (77)           EEM         Hot water boler, gas find, 1072 MBH         RSMeans D3020 130         1         0         \$ 42,318         \$ 43,089         \$ (77)           Standard (INCLUCEC capacity for air handling requirement         RSMeans D3020 130         1         0         \$ 42,318	EEM	PTAC, 103.2 tons Baddined exceptly for heating equipment	RSMeana D3050 255	1	units	\$ 175,954	\$ 175,954	*	the second s
EEM     Hot water bolier, gas fired, 1045 MBH     RSMeans D3020 130     1     0     \$ 42,318     42,318       Standard (INCLUCED WPACKAGED UNITS IN ACA 1)     -     umits     \$ -     5     -       EEM     -     umits     \$ -     \$ -     5     -       AGA 4     Inclused capacity for alt handling equipment     -     umits     \$ -     5     -       AGA 4     Inclused to accolute for PTAC openings, themal bridging requirements     -     -     -     -     -       Standard     Opaque wal with U-0.052     -     5     -     5     -     -       RCA 4     Incleased insulation to accolute for PTAC openings, themal bridging requirements     -     0     \$ -     5     -       RCA 5     Electric vehicle charging station capable parking lots for 5% of spaces     -     -     0     \$ -     5     -       Standard     -     -     0     \$ -     5     -     -     -       208/240V 40 amp outlets (zones 5A and 6A only)     -     -     0     \$ -     5     -       Standard     -     0     \$ -     \$ -     -     -     -       Standard     -     0     \$ -     \$ -     -     -     -       <	Standard	Hot water boller, gas fired, 1073 MBH	RSMeans D3020 130	1	units	\$ 43,089	\$ 43,089	* (m)	
Non-Section Company for an international equiption of an international equiption of an international equiption of an international equiption of a coolinit for PTAC openings, thermal bridging requirements.     -     units     \$     -     5       EEM     Charge wall with U-0.052     -     0     \$     -     5     7,938       Standard     Opque wall with U-0.058, r2s.1 (sR-8.03)     RSMeams 07 21 13.10     20,086     0     \$     0.2826     \$     7,938       CACA     Electrific vehicle charging station capable parking lots for 5% of spaces     -     0     \$     -     \$     2,600       Standard     208/240V 40 amp outlets (zones SA and 6A only)     -     0     \$     \$     2,600       Standard     -     0     \$     -     \$     \$     -       Standard     -     0     \$     -     \$     -	EEM	Hot water boiler, gas fired, 1045 MBH	RSMeans D3020 130	1	0	\$ 42,318	\$ 42,318		
EEM     Condend     Increased insulation for account for PTAC openings, thermal bridging requirements       Standard     Opeque wall with U/0.052     0     \$     -     5     7,538       Standard     Opeque wall with U/0.058, r2.61 (sr.8.8.3)     RCM     28,058     0     \$     0.2826     \$     7,538       NCA &     Electric Vehild's charging station capable parking lots for 5% of spaces     Chargehub.com     2     0     \$     2,600       Standard     Opeque wall with U/0.058, r2.61 (sr.8.8.3)     Chargehub.com     2     0     \$     2,600       Standard     Opeque wall with U/0.058, r2.61 (sr.8.6.3)     Chargehub.com     2     0     \$     2,600       Standard     Opeque wall with U/0.058, r2.61 (sr.8.6.3)     Chargehub.com     2     0     \$     2,600       Standard     Opeque wall with U/0.058, r2.61 (sr.8.6.3)     Chargehub.com     2     0     \$     2,600       Standard     Opeque wall with U/0.058, r2.61 (sr.8.6.3)     Chargehub.com     2     0     \$     2,600       Standard     Opeque wall with U/0.058, r2.61 (sr.8.6.3)     S     1,300     \$     2,600       Standard     Opeque wall with U/0.058, r2.61 (sr.8.6.3)     S     1,300     \$     2,600       Standard     Opeque wall with U/0.058, r2.61 (sr.8.	Standard	(INCLUCED WIPACKAGED UNITS IN ACA 1)			units	15 .	5 .	11 11 11 11 11 11 11 11 11 11 11 11 11	and the second se
Nucl A         Increases maxation to inconcount for PTAC openings, marmal bridging requirements         0         5         7,938           Standard         Opaque wall with U-0.052         0         \$         0.2826         \$         7,938           EEM         Opaque wall with U-0.052         0         \$         0.2826         \$         7,938           IEMAS         Electric vehicle charging station capable parking lots for 5% of spaces         0         \$         0         \$         2,600           Standard         208/240V 40 amp outlets (zones 5A and 6A only)         chargehub.com         2         0         \$         2,600           EEM         208/240V 40 amp outlets (zones 5A and 6A only)         chargehub.com         2         0         \$         \$         \$           Standard         0         \$         -         0         \$         \$         \$           EEM         0         \$         0         \$         \$         \$         \$           CA4         Boltsmark         0         \$         \$         \$         \$         \$           EEM         0         \$         \$         \$         \$         \$         \$	EEM				units	\$ -	5 .	and the second	
EEM         Opaque wall with U/2 0.08, R-26.1 (+R-5.3)         RSMeams 07 21 13.10         28,086         0         \$         0.2826         \$         7,038         \$         2,600           Standard         Elscrifts Vehicle charging station capable parking lots for 5% of spaces         chargehub.com         2         0         \$         2,600         \$         2,600         \$         2,600         \$         \$         2,600         \$	Standard	Opaque wall with U-0.052	the state of the s	Contraction of the	0	15 1	5	7,938	ADVENT OF A CONTRACTOR
ACA & Electric Vehicle charging station capable parking lots for 5% of spaces	EEM	Opaque wall with U-0.036, R-28.1 (+R-6.83)	RSMeans 07 21 13.10	28,086	0	\$ 0.2826	\$ 7,938	and the second second	
EEM 208/240V 40 amp outlets (zones 5A and 6A only) chargehub.com 2 outlets \$ 1,300 \$ 2,600 ACA A Bolar-ready zone per Appendix GA of 2018 (ECC Standard EEM Total \$ 30.364	ACA 5	Electric vehicle charging station capable parking lots for 5% of spaces	AND STREET, ST	ALL DESCRIPTION OF	0	1	and the second	3,000	THE STATE AND A STATE OF
ACA 6 Rolar-ready zonis per Appendix GA of 2018 (ECC 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	EEM	208/240V 40 amp outlets (zones 5A and 6A only)	chargehub.com	2	outlets	\$ 1,300	\$ 2,600		
Total \$ 30.364	ACAG	Solar-ready zons per Appendix GA of 2918 IECC	and some Provide second and an and	ALC: NOT				\$	THE RELATION
Total \$ 30.364	EEM			1	0	\$	\$		
							Total	\$ 30.364	

Description         Description <thdescription< th=""> <thdescription< th=""></thdescription<></thdescription<>		2020 NYStretch 10 STORY HIGH-RISE APARTMENT - 6A EEM Incremental Cost Worksheet Prepared by Vidaris Inc, 19-Jun-2018									
Link       Answer       Link       Asset       Link       Link <thlink< th="">       Link       <thlink< th="">       Link       Link</thlink<></thlink<>	EEM	Description	Source of Item Cost	Number of EEM Units	Unit	Co	st/Unit	Total Item Cost	Total Incremental Cost	Notes / Comments	
Subarry (1992), 199 minute (1992), 199 minute (1992) (1990 1990) 44 (2003 N - 77 minute (1992)) 44 (2003 N - 77 minute (1992)) 45 (2003 N - 77 minute (1992	EEM 1	Enhanced insulation for roots and walts	5.15 L.S. (Sec.)					0.0159	\$ 0,503		
Description         Control of the set of the	Standard	Standard U-0.032, R-30 roof insulation (insulation entirely above deck) Standard wall insulation (residential steel-frame wall)		3,435	Area						
Edit Mit Und Grow Shall () PLAM, my main multiply       PRAME and 07 21 10.0       PLAME       PLA	Standard	6A: U-0.049, R-17.5		28,112				·			
Description         Endbases of 21 1s 10         2011         Nor.         9         0.000         5         0.000           Strated         Strated </td <td>EEM</td> <td>GA U-0.029; R-33.4 (+ R-3.4)</td> <td>RSMeans 07 22 16,10</td> <td>8,435</td> <td>Area</td> <td>5</td> <td>0,5098</td> <td>\$ 5,059</td> <td></td> <td></td>	EEM	GA U-0.029; R-33.4 (+ R-3.4)	RSMeans 07 22 16,10	8,435	Area	5	0,5098	\$ 5,059			
Bit Barrier Row 2000       Province Row 2000 <th< td=""><td>EEM</td><td>Enhanced wall insulation (residential steef-frame wall)</td><td>RSMeans 07 21 13 10</td><td>29,112</td><td>Area</td><td>5</td><td>0.0496</td><td>\$ 1,444</td><td></td><td></td></th<>	EEM	Enhanced wall insulation (residential steef-frame wall)	RSMeans 07 21 13 10	29,112	Area	5	0.0496	\$ 1,444			
Binder Green with the set of a set	EEM 2	Enhanced fenestration	No March Street of Street of Street			W. y	1000	Carlo March	\$ 10,005	Lord, Marrie Markel 18	
Bit Hashes and building strained inclusion state and states and stat	Standard	Standard windows, U-0.38 Enhanced windows, U-0.35	PNNL CE ANALYSIS	12,383	Area	5	0.61	\$ 10.005			
Status         Internet apply on the solution type         Internet apply on the solution type         Internet apply on the solution type           Status         <	EEM 3	All leakage testing for mid-sized buildings	all and the second	To all and the second	The second	All and a second	1 Y	And a state of the second		ALL DESCRIPTION OF THE OWNER OWNER OF THE OWNER OWNE OWNER OWNE	
EEAA metasize LPC is found registing informational production lawing update in density general space of the section law information law informating law information law information law informa	Standard EEM	n/a - does not apply to this building type n/a - does not apply to this building type			0	3	- 1	\$ .			
Display       Prob	EEM 4	Reduced LPD for interior lighting; high efficecy lights in dwelling units	A STREET, STRE	10 100			0.76	and the second second		the work assumed for this	
Effect         Obsequency services make multiplicating controls floading agrees lighting         Image: service multiplication agrees lighting         Image: service mul	EEM	Reduced LPDs. ~20% more efficient	HBL	57,804	watts	5	6.70	\$ .		building type	
Status         Nor. II COC and Mathematical Status <td>EEM &amp;</td> <td>Occupancy sensors and automatic lighting controls including egress lighting</td> <td>and the second s</td> <td>State of the local division in the local div</td> <td></td> <td></td> <td>COLUMN TWO</td> <td>And Distant</td> <td></td> <td>A state of the</td>	EEM &	Occupancy sensors and automatic lighting controls including egress lighting	and the second s	State of the local division in the local div			COLUMN TWO	And Distant		A state of the	
Bit Market Prive         District Prive         Distrest Prive         District Prive         Distr	Standard	n/a - IECC enly n/a - IECC enly		1.1.1	0	5		5 -			
Status       mod.       C.	EEM 6	Exterior lighting control	aller a portable data	A STREET	-		100				
EE 07 /r       Relaxes for a your of apply of the building type	EEM	n/a n/a - IECC only; already included in NYS amendments to 90.1-2016			0	ŝ	÷.	5			
Define       More - Book (not legge) while bound (pro- tices)       Image: Second (Second Carbon (Second Carbon))         Standard (Second Carbon)       Second (Second Carbon)       Second (Second Carbon)       Second (Second Carbon)         Standard (Second Carbon)       Second (Second Carbon)       Second (Second Carbon)       Second (Second Carbon)       Second (Second Carbon)         Standard (Second Carbon)       Action (Second Carbon)       Second (Second Carbon)       Second (Second Carbon)       Second (Second Carbon)       Second (Second Carbon)         Standard (Second Carbon)       Action (Second Carbon)       Second (Second Carbon)       Second (Second Carbon)       Second (Second Carbon)       Second (Second Carbon)         Standard (Second Carbon)       Action (Second Carbon)       Second (Second Carbon)       Second (Second Carbon)       Second (Second Carbon)         Standard (Second Carbon)       Action (Second Carbon)       Second (Second Carbon)       Second (Second Carbon)       Second (Second Carbon)         Standard (Second Carbon)       Action (Second Carbon)       REMemon (7 22 16.10)       Second (Second Carbon)       Second (Second Carbon)         Standard (Second Carbon)       Action (Second Carbon)       REMemon (7 22 16.10)       Second (Second Carbon)       Second (Second Carbon)         Standard (Second Carbon)       Action (Second Carbon)       REMeteran (Second Carbon)       Second (	EEM 7	Reduce fan power allowances	Alter and a state of the	Contraction of the	3 DUCED	Contraction of	19231113			and the second s	
If If A. Model guest model (MAC Variancy control)       5       5       5         If A. And an out apply of his building type       5       5       5       5         If A. And an out apply of his building type       5       5       5       5         If A. And an out apply of his building type       5       5       5       5         If A. And an out apply of his building type       5       5       5       5         If A. And an out apply of his building type       5       5       5       5         If A. And	EEM	n/a - does not apply to this building type				15		5 -			
Mile altrady included in the 1.0010       Image: Second apply included in the 1.0010         Standard View Amage: Second apply included in the 1.0010       Image: Second apply included includes type         Standard View Amage: Second apply includes includes the second apply includes type       Image: Second apply includes includes type         Standard View Amage: Second apply includes type       Image: Second apply includes type         Standard View Amage: Second apply includes type       Image: Second apply includes type         Standard View Amage: Second apply includes type       Image: Second apply includes type         Standard View Amage: Second apply includes type       Image: Second apply includes type         Standard View Amage: Second apply includes type       Image: Second apply includes type         Standard View Amage: Second apply includes type       Image: Second apply includes type         Standard View Amage: Second apply includes type       Image: Second apply includes type         Standard View Amage: Second apply includes type       Image: Second apply includes type         Standard View Amage: Second apply includes type       Image: Second apply includes type         Standard View Amage: Second apply includes type       Image: Second apply includes type         Standard View Amage: Second apply includes type       Image: Second apply includes type         Standard View Amage: Second apply includes type       Image: Second apply includes type	HEM &	Hotel guestroom HVAC vacancy control	Colorest Property of	CONSULTANT.	STOC 1		Contraction of the		A CONTRACTOR OF	Charles and the state	
EX A Max-difference (BMV) EX A Max-differenc	EEM	n/a - already included in 90.1-2016				\$		5 -			
BEN M     Max - choice not apply to this building type     is	EEM 9 Standard	High-efficiency BHW	State Art State		Conception in the	15		5	AS SUINE AND	And a second	
EEM 10 minute devices and apply to mix building type in the studient statute studient by the mix building type in the studient by the studi	EEM	In/a - does not apply to this building type				\$		s .			
EEM V       Adv-descend apply to this building type:       -       \$       -	EEM 10 Sienderd	High-efficiency commercial kitchen equipment	States and the states	1		5	•	5 .		Contraction of the local division of the loc	
ERM 11 Terma Indiagn reduction Additional Proceed Insulation Assume Train at wall + 20x of paraget height + 12xx wide paraget + 42xx of Additional Proceed Insulation Assume Train at wall + 20x of paraget height + 12xx wide paraget + 42xx of RedMeans 07 22 18.10 3,735 Area	EEM	n/a - does not apply to this building type				5		\$ -			
EEE       Additional Paraget Insulation: Assume 12m at walk + 42m of paraget height + 12m wede paraget + 42m of entire perimeter of road.       RisMeans 26 51 13.25       - <t< td=""><td>EEM 11 Standard</td><td>Thermal bridging reduction Standard wall insulation</td><td></td><td></td><td></td><td>5</td><td></td><td>s .</td><td>a 1740A</td><td>all de la company</td></t<>	EEM 11 Standard	Thermal bridging reduction Standard wall insulation				5		s .	a 1740A	all de la company	
paraget negrit neor deck II et faul includent af x4-2xh for enue permeter af road. Bar 12 Exercise resulting over resolution in the fault permeter af road. Bar 14 Section of phyling power resolution in the fault permeter af road. Bar 14 Section of phyling power resolution in the fault permeter af road. Bar 14 Section of phyling power resolution in the fault permeter af road. Bar 14 Section of phyling power resolution in the fault permeter af road. Bar 14 Section of phyling power resolution in the fault permeter af road. Bar 14 Section of phyling power resolution in the fault permeter af road. Bar 14 Section of phyling power resolution in the fault permeter af road. Bar 14 Section of phyling power resolution in the fault permeter af road. Bar 14 Section of phyling power resolution in the fault permeter af road. Bar 14 Section of phyling power resolution in the fault permeter af road. Bar 14 Section of phyling power resolution in the fault permeter af road. Bar 14 Section of phyling power resolution in the fault permeter af road. Bar 14 Section of phyling power resolution in the fault permeter af road. Bar 14 Section of phyling power resolution in the fault permitted af HV controls. Bar 14 Section of phyling power resolution in the fault permitted af HV controls. Bar 14 Section of phyling power resolution in the fault permitted af HV controls. Bar 14 Section permitted af HV con	EEM	Additional Parapet Insulation: Assume 12in at wall + 42in of parapet height + 12in wide parapet + 42in of	RSMeans 07 22 16.10	3,735	Area	5	0.3400	\$ 1,270			
Standard intervention for the building type (PSMeans 28 51 13.55	EEM 12	parapet height to roof deck, 9 ft of total insulation of R-4 2hn for entire permitter of root. Exterior lighting power reduction	State of the second second	A DESCRIPTION OF	the second second	1000	ANTIPATION	ALC: NOT THE OWNER	<ul> <li>20</li> <li>200</li> </ul>	and the second second	
ELM       Main and manual standard devises and units       Main and main standard devises and units       10	Standard	n/a - not modeled for this building type	RSMeens 26 51 13.55			5		5 -			
Standard eventor motions, 30 hp	EEM 13	In/a - not modeled for this building type Efficient elevator, regenerative drives	RSMeans 20 51 13.55	CALCULATION ST	W DIET	1.3	Co-per like	(+) (X-1)	\$ 10,000	Design of the latest	
Edit of Error in the second for the global with tregletation of the second for t	Standard	Standard elevator motors, 30hp	Demissis projects	· · · · · · · · · · · · · · · · · · ·	each	- 15	10 000	\$ 10.000			
Standard       ///.e. etcedy included in 90.7.5016       -       0       \$       -<	EEM 14	ERV for apartment makeup air units	in runnau projecta	den on one	-	- NORM			1	and the second states of the s	
EEM 15       Demand-based recirculated 3HW controls         Standard Ave       0       \$       \$         Standard Ave       0       \$       \$         ADDITIONAL COST ADJUBTINENTS       0       \$       \$         ADDITIONAL COST ADJUBTINENTS       1       0       \$       \$         ADDITIONAL COST ADJUBTINENTS       1       0       \$       \$       1         Standard P/AC, 108 tons       RSMeans 03050 255       1       units       \$       183,620       \$       (8,00)         Standard P/AC, 108 tons       RSMeans 03020 255       1       units       \$       183,620       \$       (8,00)         Standard P/AC, 108 tons       RSMeans 03020 130       1       0       \$       44,195       \$       (1,000)         Standard P/AC, 108 tons       RSMeans 03020 130       1       0       \$       43,189       \$       (1,000)         Standard P/AC, 108 tons       RSMeans 03020 130       1       0       \$       43,189       \$       (1,000)         Standard P/AC, 108 tons       RSMeans 07 21 13,10       0       \$       43,189       \$       1         EEM       Nachar Bayes and P/AC A and BA only)       charready 2001 page wildiwith U-0.04       <	Standard	rva - atready included in 90 1-2016 n/a - atready included in 90 1-2016	-	1	0	5	1	\$ .			
Standard Ma       -       0       3       -       3       -         ADDITIONAL COST ADJUSTMENTS       ADDITIONAL COST ADJUSTMENTS       5       -       0       5       -       5       -         ADDITIONAL COST ADJUSTMENTS       Standard       PZAC, 108 tons       8       183,620       5       183,620 </td <td>EEM 15</td> <td>Demand-based rectroutated SHW controls</td> <td>the state of the</td> <td>the second second</td> <td>10 m</td> <td>No.</td> <td></td> <td>10000</td> <td>A DECK DECK</td> <td>2 VI - 1 - 1</td>	EEM 15	Demand-based rectroutated SHW controls	the state of the	the second second	10 m	No.		10000	A DECK DECK	2 VI - 1 - 1	
ADDITIONAL COST ADJUSTMENTS AG& 1 rediced capability for sacking equipment EEM PTAC, 108 tons EEM to water boler, gas fired, 1172 MBH EEM to water boler, gas fired, 1172 MBH EEM to water boler, gas fired, 1172 MBH EEM to water boler, gas fired, 1172 MBH ACA 2 Reduced capability for lating equipment ACA 3 Reduced capability for lating equipment ACA 3 Reduced capability for lating equipment ACA 4 Reduced capability for lating equipment ACA 5 Reduced capability for lating equipment ACA 6 Reduced capability for lating equipment ACA 1 Reduced capability for lating equipment EEM to water boler, gas fired, 1172 MBH ACA 1 Reduced capability for lating equipment ACA 1 Reduced capability for lating equipment EEM to units \$ - \$ - \$ - \$ - \$ - \$ - \$ - \$ - \$ - \$	Standard	n/a - applies to IECC path only	1	1	0	3	-	5			
ACA 1         Rediced capacity for canning equipment         RSMeans 03050 285         1         units         \$ 183,620         \$ 183,620           EEM         PTAC, 104 tons         RSMeans 03050 285         1         units         \$ 183,620	ADDITION	AL COST ADJUSTMENTS									
EEM       PTAC, 104 tons       RRMeans 03050 255       1       units       \$       177,311       \$       177,311       \$       (170,010)         Standard       Molecuest capability for lating equipment       RSMeans 0,0202 130       1       units       \$       177,311       \$       (1000)         Standard       Molecuest capability for lating equipment       RSMeans 0,0202 130       1       units       \$       44,195       \$       (1000)         ACA 3       Reduced capability for lating equipment       RSMeans 0,0202 130       1       units       \$       44,195       \$       (1000)         Standard       (INCLUDED WINTS IN ACA 1)       units       \$       43,188       \$       43,188       \$       43,188       \$       43,188       \$       44,195       \$	AGA 1 Standard	PTAC, 108 tons	RSMeans D3050 255	T	units	5	183,620	\$ 183,620	. (0,3V4)		
ACA a         Recluses capability for insulting equipments         RSMeans D3020 130         1         units         \$ 44,105         \$ 44,105         \$ 44,105           Standard         Kolk water boler, gas fred, 1172 MBH         RSMeans D3020 130         1         0         \$ 44,105         \$ 44,105         \$	EEM	PTAC, 104 tons	RSMeans D3050 255	1	units	5	177,311	\$ 177,311	E (1.000)	WAR STREET, DOLLARS, D.	
EEM         Hot water boler, gas fred, 1075 MBH         RSMeans D3020 130         1         0         \$         43,189         \$         43,189         \$           Standard         (MCLUDED WIPACKAGED UNITS IN ACA 1)         -         units         \$         <	Standard	Hol water boiler, gas fired, 1112 MBH	RSMeans D3020 130	1	units	5	44,195	\$ 44,195	e		
Standard     um8s     S     S       EEM     ACA 1     Increased insulation to account for PTAC openings, themal bridging requirements       Standard     Opaque wall with U-0.04     \$     \$       EEM     Opaque wall with U-0.027, R-3.55 (1+13.9)     RSMeans 07 21 13.10     26.060     0     \$     \$     12,444       EEM     Opaque wall with U-0.027, R-3.55 (1+13.9)     RSMeans 07 21 13.10     26.060     0     \$     \$     2,400       Standard     Eextric vehicle charging station capable parking lots for 5% of spaces     Chargehub.com     -     2     0     \$     2,400       Standard     Standard     Chargehub.com     -     2     0     \$     2,800       EEM     208/240/ 40 amp outble (zones 5A and 6A only)     chargehub.com     -     2     0     \$     5       Standard     Standard     -     0     \$     -     \$     5     -       Standard     Standard     -     -     0     \$     5     -     -	EEM	Hot water boller, gas find, 1076 MBH Reduced canacity for air bandling equipment	RSMeans D3020 130	11	0	5	43,189	5 43,189		1/ 51	
EEM     ACA 4     Instressed insulation to account for PTAC openings, thermal bridging requirements       Sindard     Opaque will U-0.04       EEM     Opaque will U-0.077, R-56,57 (+R-13.9)       ACA 5     EEM       Standard     28,0865       200/24/0V 40 amp outlets (zones 5A and 6A only)       EEM     Opaque will U-0.04       200/24/0V 40 amp outlets (zones 5A and 6A only)       ACA 5     Sofarready zone per Advise (CG       Standard       EEM       200/24/0V 40 amp outlets (zones 5A and 6A only)       Chargehub.com       Chargeh	Standard	(INCLUDED WIPACKAGED UNITS IN ACA 1)			untifs	5		5 -			
Standard EEM       Opaque wall will U-0.04 Opaque wall will U-0.071, R-3.657 (+R-13.9) Standard EEM       RSMaans 07 21 13.10       28,006       0       \$       -       1       2,4431       \$       2,4431         Standard EEM       Dectric Vahile Charping 11400n capable parting lots for 5% of spaces       Chargehub.com       -       2       0       \$       -       2,600         Standard EEM       Delay Forth per Appendix CA of 2018 EECC       C       5       -       -       0       \$       -       -       0       \$       -       -       -       0       \$       -       -       -       0       \$       -       -       -       0       \$       -       -       0       \$       -       -       0       \$       -       -       0       \$       -       -       0       \$       -       -       0       \$       -       -       0       \$       -       -       0       \$       -       -       0       \$       -       -       0       \$       -       -       0       \$       -       -       0       \$       -       -       0       \$       -       -       0       \$       -       -	EEM ACA 4	Increased insulation to account for PTAC openings, thermal bridging requirements	A CONTRACTOR OF A	and the second	units	5	ALC: NO	3 .	\$ 12,444	A THE REAL PROPERTY.	
IEEM       [VISMeans IV/2] 13.10       20,000       0       13       0.4431       12,444         Standard       Image: standard standar	Standard	Opaque wall with U-0.044	DON 07.04 (0.10		0	15	- Fuer	\$			
Standard     Chargehub.com     0     \$      0       200/240V 40 amp outlets (zones 5A and 6A only)     chargehub.com      0     \$        ACA 6     3 ofar-ready zone per Appendix CA of 2016 IECC      0     \$        Standard      0     \$      \$	ACA 5	Departure wall with U-0.027, R-36.57 (+R-13.9) Electric vehicle charging station capable parking lots for 5% of spaces	KSMeans 1/ 21 13.10	20,085	U	1.0	0.4431	12,444	\$ 2,600	and the second s	
LEEM     [200724U 4] amp outgets (zones an and on only]     [Chargenuo.com     21     outgets     1 august     2 august     2 august       Standard       0     \$      \$       EEM      0     \$     \$     \$	Standard		al minuteria mana		Ū	15	1 200	\$ 2,000			
Standard EEM	ACA 6	200//40V 40 amp outlets (zones 5A and 6A only) Solar-ready zone per Appendia CA of 2018 IECC	icnargenub.com	21	outtabs	13	1,300	a 2,600		CAN LEAST DE	
Total \$ 35.508	Standard	a construction of the second se			0	5		\$			
	1.5.1P			A	-			Total	\$ 35.508		

	2020 NYStretch 20 STORY HIGH-RISE APARTMENT - 4A EEM Incremental Cost Worksheet Prepared by Vidaris Inc. 19-Jun-2019										
EEM	Description	Source of Item Cost	Number of EEM Units	Unit	Cost / Unit	Total Item Cost	Total Incremental Cost	Notes / Comments			
EEM 1 Standard	Enhanced insulation for roofs and walls Standard U.0.032, B.10 roof insulation (insulation entrols about dark)	CALLED BALLE		Area	Contraction of the		\$ 4,397				
Standard	Standard wall insulation (residential steel-trame wall)		45 603	Area		5					
E Par	4A: U-0.064; R-13.4 Enhanced roof insulation (insulation entirely above deck)	COLUMN AND AND AND AND AND AND AND AND AND AN		and the second s							
ECM	4A: U-0.030; R-32.2 (+ R-2.2)	RSMeans 07 22 16,10	8,435	Area	\$ 0,3881	\$ 3,274					
EEM	4A: U-0.051; R-14.2 (+ R-0.77)	RSMeans 07 21 13.10	45,603	Area	\$ 0.0246	5 1,124					
EEM 2 Standard	Enhanced fenestration Standard windows, U-0.39	A DECEMBER OF A	37 187	Ama	COLOR ONLY		\$ 20,165	COLUMN TRANSPORT			
EEM	Enhanced windows, U-0.37	PNNI. CE ANALYSIS	37,387	Area	\$ 0.54	\$ 20,165					
EEM3 Standard	Air leakage testing for mid-sized buildings		Constant of the local division of the local	0		an a share		101-11(E. R. B)			
EEM	r/a - does not apply to this building type		1.1	Ö	5	5 .	in the second				
Standard	Reduced LPD for Interior Righting; high afficacy lights in dwelling units Lighting per ASHRAE 90 1-2018	AND ADDRESS OF A DECK	13.812	watts	\$ 6.75	5 91229	\$ 15,780				
EEM	Reduced LPDs, -20% more efficient	HBL	11,473	watts	5 -	\$ 109,015.58		Cost for retail area only			
Standard	Occupancy sensors and automatic lighting controls including egress lighting			0	5	ş .					
EEM	n/a - IECC only			0	\$ -	s -					
Standard	Extendrugnung contros			0	5 . 1	5 -	CONTRACTOR OFFICE	and the second s			
EEM	n/a - IECC only, stready included in NYS amendments to 90.1-2016	100 million (100)		0	5 -	5 .					
Standard	n/a - does not apply to this building type				5 -	\$ -					
EEM	n/a - does not apply to this building type Hotel exections BVAC vacance control				5 -	5 -	the second	and the problem			
Standard	n/a - elready included in 90.1-2016				s -	5 -					
EEM D	n/a - already included in BC 1-2016 High-afficiency BHW	Contractor in the local division of the		-	5 -	\$.	Contraction in the local division in the local division of the loc	NAME OF TAXABLE PARTY.			
Standard	Natural gas water heaters, 1200 MBH, 90% thermal efficiency (as (3) 400MBH units)		3	each	\$ .	\$ -		a second de la companya de la			
EEM 10	Natural gas water heaters, 1200 MBH, 94% thermal efficiency(as (3) 400MBH units) High-efficiency commercial kitchen equipment	Contraction of the local division of the	3	each	\$ .	\$	CONTRACTOR OF	100 M - 54 L 45 DOL 5.00			
Standard	n/a - does not apply to this building type				5 .	5					
EEM 11	nra - does not apply to this building type Thermal bridging reduction	A CONTRACTOR OF THE OWNER	Contraction in the	1.00	5 *	5 (A)	\$ 1,270	Contraction and the second sec			
Standard	Standard well insulation Additional Research (switching: Accurred 17in of well + 47in of persons) height + 17in wide persons) + 47in of	2200 2200			\$ .	\$ *					
EEM	parapet height to roof deck. 9 It of total insulation of R-4.2/n for entire perimeter of roof.	RSMeans 07 22 16.10	3,735	Area	\$ 0.3400	\$ 1,270					
EEM 17	Exterior lighting power reduction	Of Maure 36 61 13 66	100 C	Par line	100 CI 8 C	1					
EEM	n/a - not modeled for this building type	RSMpans 26 51 13.55			\$ .	\$ .					
EEM 13 Standard	Efficient elevator, regenerative drives Standard elevator motors, 30ho	1 - 1 - 1 - 1 - 2 - 1	and the second	each	18		\$ 20,000	100 F 100 F 100 F			
EEM	Elevator motors with regenerative drives, 30 hp	Previous projects	2	each	\$ 10,000	\$ 20,000					
Standard	ercy for apartment makeup air units n/a - aiready included in 90.1-2016			0	15 - 1	s .					
EEM	n/a - already included in 90.1-2016			0	\$ .	\$					
Standard	n/a			0	5 -	s					
EEM	n/a - applies to IECC path only			0	\$ .	s .		and the second second			
ACA 1	Reduced aspacity for cooling equipment						\$ (5,640)	Sign Fr. Manadalia			
Standard Standard	WSHP, 174 tons Closed circuit cooling lower, 140 tons	RSMeans D3050 240 RSMeans 23 65 133 10	1	unds	\$ 492,590 \$ 109,740	\$ 492,590 \$ 1/0,740					
EEM	WSHP, 172 tons	RSMeans D3050 240		units	\$ 487,823	\$ 487,823					
ACA 2	Closed circuit cooling tower, 138.2 tons Reduced capacity for heating equipment	RSMeans 23 65 133.10	CRAME COLOR	units	\$ 108,676	\$ 108,676	A REAL PROPERTY AND A				
Standard	(INCLUDED WIPACKAGED UNITS IN ACA 1)	1		units	5 -	5 .					
ACA 3	Reduced capacity for air handling equipment	d'an and the same	and the second second	unds	Barline Line	State of the local division of the local div	1	The second second			
Standard	(INCLUCED W/PACKAGED UNITS IN ACA 1)		2	unite	\$ .	s -					
ACA 4	Increased insulation to account for PTAC openings, thermal bridging requirements	1	le state all	Units	Ale and the second	1000	Salaria and	al sector and the sector of th			
Standard EEM	n/a - does not apply to this building type n/a - does not apply to this building type			0	\$ .	s .					
ACAS	Electric vehicle charging station capable parking lots for 5% of spaces	Teller Teller	lange - state da		the state	Distance School	\$ 2,600				
Standard EEM	208/240V 40 amp outlets (zones 5A and 6A only)	chargebub com		0 outlets	\$ 1300	\$ 2600					
ACAD	Solar-ready zone per Appendix CA of 2018 IECC	TO AN AND MADE TO A	EL CONTRA		1.000			COLUMN TRANSPORT			
EEM				0	5 .	5 -					
						Total	\$ 58,379				

	2020 NYStretch 20 STORY HIGH-RISE APARTMENT - 5A EEM Incremental Cost Worksheet Prepared by Vidaris Inc. 19-Jun-2019									
EEM	Description	Source of Item Cost	Number of EEM Units	Unit	Cast / Unit	Total Itein Cost	Total Incremental Cost	Noles / Comments		
EEN 1	Enhanced insulation for roofs and walls	State of the second second			100		\$ 4,800			
Standard	Standard U-0.032, R-30 roof insulation (insulation entirely above deck)		8,435	Area	3 .	3 .				
Standard	5A U-0.055 R-16.0		45,603	Area	5 -	\$ -				
FEM	Enhanced roof insulation (insulation entirely above deck)	RSMeans 07 22 16 10	8.435	Area	\$ 0.3881	\$ 3,274				
E 5/47	5A U-0.030, R-32.2 (+ R-2.2)		5,466	7464	• • • • • •	0,211				
EEM	55 LL0.052 R-17.1 (#R-1.05)	RSMmann 07 21 13,10	45,603	Area	\$ 0.0336	\$ 1,532				
EEM 2	Enhanced fenestration	Mary Print Party		and the second	AND POST	1	\$ 29,452	and the second sec		
Standard	Standard windows, U-0.39	2007 200 2007 2007	37,387	Area	5 -	3				
EEM	Enhanced windows, U-0.36	PNNL CE ANALYSIS	37,387	Area	\$ 0.79	\$ 29,452	and the second s	in the last of the local division of the loc		
Sinndard	n/s - does not apply to this building type	and the other Designation of the other Designa		0	5 .	5 .	A REAL PROPERTY AND ADDRESS OF			
EEM	n/a - does not apply to this building type			0	5 -	5 -				
EEM A	Reduced LPD for Interior lighting; high efficacy lights in dwelling units	NAME OF TAXABLE PARTY.					\$ 15,705	The second s		
Standard	Lighting per ASHRAE 90 1-2016	LIDI	13,812	watts	5 8.75	\$ 100.016		Cost for retail area only		
FFMA	Occupancy sensors and automatic lighting controls including enross lighting	TIBE CONTRACTOR OF THE OWNER	11,41.5		and the second division of the second divisio	4 199,010	COLUMN STREET, ST	Charles & Summer A. Market and S.		
Standard	n/a - /ECC only			0	5 -	5 .				
EEM	n/a - IECC only			0	3 -	5 .		and the second sec		
EEM 6	Exterior lighting control	and the second se	and the second second	0			CONTRACTOR DOWNLOW			
EEM	n/a - IECC only: already included in NYS amendments to 98,1-2018			0	\$ .	5 -				
EEM 7	Reduce fan power allowances	States of the second	A DECEMPTOR NO.	1000	CONTRACT OF		A CALLER AND A CALL	A DATE OF THE OWNER		
Standard	n/a - does not apply to this building type		17		5 -	\$ .				
EEM	n/a - does not apply to this building type	VALUE OF LAND	Contraction of the local division of the loc	1000	3	3	CONTRACTOR DE LA CONTRACTÓR	a descent of the second se		
Standard	n/a - already included in 90.1-2016	Contraction of the local distribution of the			5 -	5 .				
EEM	n/a - already included in 90.1-2016		14		S -	\$ ÷				
EEM 9	High-efficiency SHW	A DESCRIPTION OF THE OWNER OF THE		aach			Contraction of the state	A REAL PROPERTY AND ADDRESS OF		
EEM	n/a - does not apply to this building type		3	each	1	5 -				
EEM 10	High-efficiency commercial kitchen equipment	State of the second second	and the second second	Sec.	AND DON'T A	10	And the owner of the			
Standard	n/a - does not apply to this building type		+		8 •	s -				
EEM de	n/a - does not apply to this building type	and the second second second	the second		and the second second	3	1 1270	No. of Concession, Name		
Standard	Standard wall insulation				5 -	\$ -				
EEN	Additional Parapet Insulation. Assume 12in at wall + 42in of parapet height + 12in wide parapet + 42in of parapet height to roof deck. 9 h of total insulation of R-4.2/in for entire perimeter of roof.	RSMeans 07 22 16 10	3,735	Area	\$ 0.3400	\$ 1,270				
Standard	extender lighting power reduction	RSMeans 26 51 13.55		and the second second	5 .	5 .		and the second second second second		
EEM	n/a - not modeled for this building type	RSMeans 26 51 13.55	14 U		5	\$ -				
EEM 13	Efficient elevator, regenerative drives	Internation and the second	and the second se	7. 11.	and a second second	Arr. 100 100 200	\$ 20,000			
Standard	Standard elevator motors, 30hp	Dravinia projecta		each	\$ 10.000	\$ 20,000				
EEM 14	ERV for apartment makeup air units		-	and the second second			Statistican Statistics			
Standard	n/a - already included in 90.1-2016		14. I	0	5 .	\$ -				
EEM	n/a - already included in 90,1-2016	and the second se		0	\$ -	3 -		CONTRACTOR OF THE OWNER.		
Standard	n/a		No. A. Land	D	s -	5 -				
EEM	n/a - applies to IECC path only			0	\$ +	s -				
ADDITION	AL COST ADJUSTMENTS									
Standard	WSHP, 172 Ions	RSMeans D3050 240	1	units	\$ 486,559	\$ 486,559	19/5041			
Standard	Closed circuit cooling lower, 138 tons	RSMeans 23 65 133.10	1	units	\$ 108,392	\$ 108,392				
EEM	WSHP, 169.8 tons	RSMeans D3050 240	1	units	\$ 481,756	\$ 481,759				
EEM	Closed circuit cooling fower, 138 5 tons	RSMeans 23 65 133.10		Units	\$ 107,311	5 107.311	ALC: NOT THE REAL PROPERTY OF	And in case of the local division of the loc		
Standard	UNCLUDED WIPACKAGED UNITS IN ACA 1)		-	units	5 -	5 -	100 million (100 million)			
EEM			8 - S	units	5 -	5 -	No. of Concession, Name	and the second se		
ACA 3	Reduced capacity for air handling equipment	A PERSONAL PROPERTY AND	1	unite	15	5 .	and the second second	and the second second		
EEM	functioners and and an and a			units	5	5 -				
ACA4	Increased insulation to account for PTAC openings, thermal bridging regultaments	And the second			Section and the second	1.2	All Inches 16	And I Have been a state of the		
Standard	n/a - does not apply to this building type			0	5 -	5				
ACAS	Electric vehicle charoling station capable parking lots for 5% of spaces	THE OWNER WARRANT OF THE OWNER WARRANT	and the state of the		the second second		\$ 2,600			
Standard	A REAL PROPERTY AND A REAL PROPERTY OF THE REAT	1	No. Contraction	0	s -	s -				
EEM	208/240V 40 amp outlets (zones 5A and 6A only)	chargehub.com	2	outlets	\$ 1,300	\$ 2,600	and the second second second second	A REAL PROPERTY AND A REAL PROPERTY AND A		
Standard	Botar-ready zone per Appendix CA of 2018 IECC	CONTRACTOR OF THE	pale of the	0	5	5 -				
EEM			1	0	s .	s -				
						Total	\$ 68,030			

	2020 NYStretch 20 STORY HIGH-RISE APARTMENT - 6A EEM Incremental Cost Worksheet Prepared by Vidaris Inc. 19-Jun-2019										
EEM	Description	Source of Item Cost	Number of EEM Units	Unit	Cost / Unit	Total Item Cost	Total Incremental Cost	Notes / Comments			
EEM 1	Enhanced insulation for roots and walls	A COLUMN TO A COLUMN	0.415		Mar and Street of		\$ 7,321	Contraction in the second			
Chandand	Standard wall insulation (residential steel-frame wall)		0,430	Nea	•	•					
Standard	6A: U-0.049; R-17.5		45,803	Area	5	\$: \#C					
EEM	Enhanced roof insulation (insulation entirely above deck)	R5Means 07 22 16,10	0,435	Area	\$ 0,5998	\$ 5,059					
FEM	Enhanced wall insulation (residential steel-trame wall)	0011 07 24 12 10	45 600	A							
CON CONTRACTOR	SA U-0.044, R-19.1 (+ R-1.55)	Homeans 07 21 13,10	40,003	Area	\$ 0.0490	\$ 2,202					
Standard	Standard windows, U-0.38	State of the local division of the local div	37.387	Area	15	5	\$ 30,209	The second se			
EEM	Enhanced windows, U-0.35	PNNL CE ANALYSIS	37,387	Area	\$ 0.81	\$ 30,209					
EEM 3	Air leakage testing for mid-sized buildings	A DESCRIPTION OF THE OWNER	an and a second	COLORINA COLORI	the second	N W ST		155 (2-3#c 17c) (21)			
EEM	n/a - does not apply to this building type			0	\$ .	5 -					
EEM 4	Reduced LPD for Interior lighting; high efficacy lights in dwelling units	TOP I WITH BOARD	States and		Harris Cal		\$ 15,788				
Standard	Lighting per ASHRAE 90.1-2016		13,812	watte	\$ 6.75	\$ 93,229		Cost for retail area only			
EEM	Reduced LPDs, ~20% more efficient	HBL	11,473	watts	\$ -	\$ 109,016		Coat for retail area only			
EEM 5	Occupancy sensors and automatic lighting controls including egress lighting	N. 24		- Containing	Charles and	and the second second					
EEM	n/a - IECC only		- 2	0	3	5					
EEM 6	Exterior lighting control	VIN 1 STREET	All carries of the	10310170	and the second	Contra and	<ol> <li>Training (1)</li> </ol>	in a state			
Standard	n/a n/a - FCC only already included in NVS amendments to 90 1,2016			0	\$ ···	\$					
EEM7	Reduce fan power allowances	A STATISTICS IN	and the second		And the second	CONTRACTOR OF	10 m	THE REPORT OF LAND			
Standard	n/a - does not apply to this building type		100.00		5 -	5 -					
EEM 8	Intel question HVAC variance control	Contraction of the local division of the loc	la provide and	and succession	5	\$		the second s			
Standard	n/a - already included in 90.1-2016				5 -	5 -					
EEM	n/a - already included in 90.1-2016		1. The second second		\$ -	5 -					
Standard	n/a - does not apply to this building type	a second statement of the	3	each	15	S	A DOUGHT IN NOT THE OWNER.	AND DESCRIPTION OF THE OWNER OF T			
EEM	n/a - does not apply to this building type		3	each	5 -	\$ - I					
EEM 10	High-efficiency commercial kitchen equipment	Nº	and the second s	State of the local division of the local div	ALC: NO.		the second second second				
EEM	nfa - does not apply to this building type				5 .	ŝ :					
EEM 11	Thermal bridging reduction		S	1000	tin and	a car	\$ 1,270	is on a fair the contract			
Standard	Standard wall insulation Additional Paranet Insulation Assume 12m at wall + 42in of paranet height + 12in wide paranet + 42in of		÷.		\$ -	\$					
EEM	parapet height to roof deck. 9 ft of total insulation of R-4 2/m for entire perimeter of roof.	RSMeans 07 22 16.10	3,735	Area	\$ 0.3400	\$ 1,270					
EEM 12	Exterior lighting power reduction	There	and the second second		PRIME	Martin Coll	a contraction of the	to a second second			
EEM	n/a - not modeled for this building type	RSMeans 26 51 13.55 RSMeans 26 51 13.55			5	5					
EEM 13	Efficient elevator, regenerative drives	Contract Contract of the	The second second	المرج ومثلا	A starting of the start	1	\$ 20,000	- 10 m - 10 m			
Standard	Standard elevator motors, 30hp	Developing and light		each	5	5					
EEM 14	ERV for apartment makeup air units	Previous projects	-	each	a 10,000	S 20.000	State State State State	or Contract Strength			
Standard	n/a - already included in 90.1-2016			0	5 -	\$ -					
EEM 15	n/a - already included in 90.1-2016 Demand-based recirculated SHW controls	and the second second	the state of the s	0	5 -	\$	and the second second	And Person in case of the local diversion of			
Standard				0	5 -	5 .					
EEM	n/a - applies to IECC path only	-	1 I	0	5	5 .					
ACA 1	Reduced capacity for cooling equipment					1. 4 3 . 3	\$ (9.658)	and the state			
Standard	WSHP, 166 tons	RSMeans D3050 240	T	units	\$ 471,779	\$ 471,779	Contractory of the second seco				
EFM	Closed circuit cooling tower, 134 tons WSHP, 163 5 tons	RSMeans 23 65 133.10 RSMeans D3050 240	1	units	5 105,065	5 105,068					
EEM	Closed circuit cooling tower, 131.3 tons	RSMeans 23 65 133,10	1	units	\$ 103,292	\$ 103,292					
ACA 2	Reduced capacity for heating equipment		Service of		HER PRINT	Constant of the local data	1	a long the second s			
EEM	(INCLODED WIPACKAGED ONITS IN ACA 1)		1	units	5 -	5 .					
ACA3	Reduced capacity for air handling equipment	The surface of	CR 2011	Contraction of the	AND REAL PROPERTY.	the states	NV STREET	TANK NOT ST			
Standard	(INCLUCED WIPACKAGED UNITS IN ACA 1)			units	\$ -	5 -					
ACA 4	Increased insulation to account for PTAC openings, thermal bridging regularments	The local days	lie in h	units	4	-	Contract in the local division of the	and the state of the state			
Standard	n/e - does not apply to this building type		1000 C 1000	0	5 -	\$ -		the second se			
ACAA	n/a - does not apply to this building type Electric vehicle shareing station camble participation for the statement	1		0	5 -	5 -		and the second s			
Standard	and a second standard and second se		1	D	5 - 1	5 - 1	2,000				
EEM	206/240V 40 amp oullets (zones 5A and 6A only)	chargehub.com	2	outlets	\$ 1,300	\$ 2,600					
Standard	solar-ready sone per Appendix CA of 2018 IECC		100	0	5	\$	1	and the product of the product of the			
EEM				0	\$	\$					
						Total	\$ 67,531				

NYSERDA, a public benefit corporation, offers objective information and analysis, innovative programs, technical expertise, and support to help New Yorkers increase energy efficiency, save money, use renewable energy, and reduce reliance on fossil fuels. NYSERDA professionals work to protect the environment and create clean-energy jobs. NYSERDA has been developing partnerships to advance innovative energy solutions in New York State since 1975.

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New York State Energy Research and Development Authority

17 Columbia Circle Albany, NY 12203-6399 toll free: 866-NYSERDA local: 518-862-1090 fax: 518-862-1091

info@nyserda.ny.gov nyserda.ny.gov



State of New York Andrew M. Cuomo, Governor

New York State Energy Research and Development Authority Richard L. Kauffman, Chair I Alicia Barton, President and CEO

# NYStretch Energy Code — 2020

An Overlay of the 2018 International Energy Conservation Code and ASHRAE Standard 90.1-2016

Version 1.0 | July 2019



# PREFACE

The NYStretch Energy Code 2020 project was undertaken by NYSERDA to develop a pivotal tool for New York jurisdictions to support the State's energy and climate goals by accelerating the savings obtained through their local building energy codes. Authorities having jurisdiction have the legal ability to voluntarily adopt NYStretch-Energy.

The NYStretch Code was developed as a statewide model code to save more energy than New York's minimum code and to be readily adopted as a more stringent local standard to the ECCCNYS. It was developed with the following goals:

- Technically sound
- Thoroughly reviewed by stakeholders
- Written in code enforceable language
- Fully consistent with the 2018 IECC, ASHRAE 90.1-2016, and uniform codes

For communities that adopt it, the NYStretch Code will provide greater savings over the ECCCNYS for both residential and commercial buildings.

#### **Marginal Markings**

Solid vertical lines in the margins of Parts 1, 2, and 3 indicate a technical change from the requirements of 2018 IECC and ASHRAE 90.1-2016. Black, right-facing arrows in the left-hand margin indicate a deletion from the requirements.

#### **Unaffected Provisions**

The chapters, sections, tables, and other provisions in the 2018 IECC and ASHRAE 90.1-2016 not amended by NYStretch Code shall continue in full force and effect. Nothing in the NYStretch Code shall be construed as deleting all or part of any unaffected provision.

#### Severability

If any portion of the NYStretch Energy Code 2020, the 2018 IECC or ASHRAE 90.1-2016 is held by a court of a competent jurisdiction to be illegal or void, such holding shall not affect the validity of any other portion of the NYStretch Code, the 2018 IECC or ASHRAE 90.1-2016

#### Implied license / Use of NYStretch

While a jurisdiction may adopt one or both of the Commercial and Residential provisions, it is NYSERDA's desire, but not a rule, that the NYStretch be adopted as written. Changes to or deletions of the provisions contained herein may affect energy savings, cost savings, and enforceability. Jurisdictions are encouraged to contact NYSERDA <u>codes@nyserda.ny.gov</u> before considering any changes to the NYStretch.

# DISCLAIMER

Version 1 of NYStretch Energy Code-2020 (NYStretch) is an overlay of the 2018 International Energy Conservation Code (2018 IECC) and ASHRAE Standard 90.1-2016 (ASHRAE). It does not reflect changes the New York State Fire Prevention and Code Council may adopt for the 2020 New York State Energy Conservation Construction Code (2020 NYS ECCC). Visit https://www.dos.ny.gov/DCEA/CodeUpdate.html for updates on the 2020 NYS ECCC.

Furthermore this version of NYStretch does not contain changes to it that New York City may adopt for the 2020 Energy Conservation Code of New York City (2020 ECC NYC). Visit <u>https://www1.nyc.gov/site/buildings/codes/energy-conservation-code.page</u> for updates on the 2020 ECC NYC.

It is NYSERDA's intent to release a version of NYStretch that will overlay the 2020 NYS ECCC upon release of that code by New York State Department of State.

#### **Stringency of NYStretch**

NYSERDA recognizes that there are differentials between the requirements of the IECC and ASHRAE paths in NYStretch. It is NYSERDA's intent to create two separate inclusive code books, one for the IECC paths and another for the ASHRAE paths and find and correct the differentials between those code provisions such that they are consistent with the intent and stringency of NYStretch. Until that time, where there is a differential between the paths, the more stringent of the requirements will prevail.

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# Table of Contents

PREFA	CEi
DISCLA	ii
ACKNO	WLEDGEMENTSiv
1 Am	endments to 2018 International Energy Conservation Construction Code
Comme	
1,1	Amendments to Section C401.2
1.2	Amendments to Section C402.1
1.3	Replace Section C402.1.3
1.4	Amendments to Table C402.1.4
1.5	Addition of New Section C402.1.4.2
1.6	Amendments to Section C402.2
1.7	Addition of New Section C402.2.8
1.8	Amendments to Section C402.4
1.9	Amendments to Table C402.4
1.10	Amendments to Section C402.54
1.11	Addition of New Section C402.5.9
1.12	Amendments to Section C403.7.4
1.13	Amendments to Section C403.8.1
1.14	Amendments to Table C403.8.1(1)
1,15	Amendments to Section C405.2.1
1.16	Addition of New Section C405.2.1.4
1.17	Amendments to Section C405.2.3
1.18	Amendments to Section C405.2.3.2
1.19	Amendments to Section C405.2.6
1.20	Addition of New Section C405.2.6.5
1.21	Amendments to Table C405.3.2(1)
1.22	Amendments to Table C405.3.2(2)
1.23	Amendments to Table C405.4.2(2)
1.24	Addition of New Section C405.8.1.1
1.25	Addition of New Section C405.9
1.26	Addition of New Section C405.10
1.27	Addition of New Section C405.11
1.28	Addition of Section C405.12
1.29	Addition of Section C405.13
1.30	Replacement of Section C406.1
1.31	Amendment to Section C406.1.1
1.32	Replacement and Renaming of Section C406.5
1.33	Replacement and Renaming of Section C406.6
1.34	Replacement and Renaming of Section C406.7

	1.35	Replacement of Section C407	23
	1.36	Amendments to Section C408.2	23
	1.37	Amendments to Section C408.2.2	24
	1,38	Addition of New Section C408.4	24
	1,39	Addition of New Section C502.2.3.1	25
	1,40	Addition of New Section C502.2.4.1	25
	1.41	Addition of New Section C502.3	25
	1.42	Addition of New Section C503.3.4	25
	1.43	Addition of New Section C503.4.2	25
	1.44	Addition of New Section C503.5.1	26
	1.45	Addition of New Appendix CB	27
	1.46	Addition of New Appendix CC	29
2	Ame	endments to ASHRAE 90.1-2016	.32
	2.1	Addition to Section 3.2	32
	2.2	Amendments to Section 4.2.1.1	32
	2.3	Replacement of Table 4.2.1.1	34
	2.4	Addition of Table 4.2.1.2	34
	2.5	Addition of Table 4.2.1.3	34
	2.6	Addition of New Section 5.2.3	35
	2.7	Addition of New Section 5.4.1.1	36
	2.8	Amendments to Section 5.4.3.1.3.	36
	2.9	Amendments to Section 5.5.3	36
	2.10	Amendments to Section 5.6.1.1	37
	2.11	Amendments to Section 6.5.3.1.1.	.37
	2.12	Amendments to Table 6.5.3.1-1	,38
	2.13	Amendments to Section 6.5.6.1	.38
	2.14	Addition of New Section 10.4.3.5	.39
	2.15	Addition of New Section 10.4.6	.40
	2.16	Addition of New Section 10.4.7	.42
	<b>2</b> .17	Addition of New Section 10.4.8	.42
	2.18	Amendments to Section 11.2	.42
	2.19	Amendments to Section 11.4.3.2	.43
	2.20	Amendments to Table 11.5.1	.44
	2.21	Amendments to Section G1.2.1	51
	2.22	Amendments to Section G1.2.2	. 52
	2.23	Addition of New Section G1.2.2.1	. 52
	2.24	Addition of New Section G1.2.2.2.	, 52
	2.25	Amendments to Section G2.4.1	, 52
	2.26	Amendments to Section G2.4.2	, 53
	2.27	Amendments to Table G3.1	53

3 Ar	nendments to 2018 International Energy Conservation Construction Code	
Reside	ential Provisions	56
3.1	Amendments to Section 401.2	56
3.2	Amendments to Table R402.1.2	56
3.3	Amendments to Table R402.1.4	
3.4	Amendments to Section R402.2.2.	
3.5	Amendments to Section R402.4.1.1	57
3.6	Amendments to Section R403.3	58
3.7	Addition of New Section R403.3.8	58
3.8	Amendments to Section R403.5	58
3.9	Amendments to Section R403.5.4.	58
3.10	Addition of New Section R403.5.5	
3.11	Addition of New Section R403.6.2	60
3.12	Addition of New Section R403.6.3	60
3.13	Amendments to Section R404.1	61
<b>3</b> .1 <b>4</b>	Addition of New Section R404.2	61
3.15	Amendments to Table R406.4	61
3.16	Addition of New Section R408	62
3.17	Amendments to "ACCA" in Chapter 6	63
3.18	Addition of a new entry for "IAPMO" to Chapter 6	63
3.19	Addition of a new entry for "PHI" to Chapter 6	64
3.20	Addition of a New Entry for "PHIUS" to Chapter 6	64

# PART 1

- 1 Amendments to 2018 International Energy Conservation Construction Code Commercial Provisions
- 1.1 Amendments to Section C401.2 Application

C401.2 Application. Commercial buildings shall comply with one of the following compliance paths:

- 1. ASHRAE Compliance Path (prescriptive): The requirements of ASHRAE 90.1-2016 (as amended) Section 4.2.1.1(a). The building shall also comply with the following:
  - a. The *building thermal envelope* opaque assembly requirements of Section C402.1.4.
     EXCEPTION: *Semi-heated spaces* in compliance with ASHRAE 90.1-2016 (as amended) are not required to comply with Section C402.1.4.
  - b. The *fenestration* requirements of Section C402.4.
     EXCEPTION: Semi-heated spaces in compliance with ASHRAE 90.1-2016 (as amended) are not required to comply with Section C402.4.3.
  - c. The interior and exterior lighting power allowance requirements of Section C405.3.2 and Section C405.4.2, respectively.
  - d. The requirements of Section C406 and tenant spaces shall comply with the requirements of Section C406.1.1.
  - e. The requirements of Section C408 (note: in lieu of Section C408.4, the requirements of 5.9.2 prevail) and, if mandated by local ordinance, Appendix CC.
- ASHRAE Compliance Path (Section 11): The requirements of ASHRAE 90.1-2016 (as amended) Section 4.2.1.1(b). The building shall also comply with Section C408 (note: in lieu of Section C408.4, the requirements of 5.9.2 prevail) and, if mandated by local ordinance, Appendix CC.
- 3. ASHRAE Compliance Path (Appendix G): The requirements of ASHRAE 90.1-2016 (as amended) 4.2.2.1(c). The building shall also comply with Section C408 (note: in lieu of Section C408.4, the requirements of 5.9.2 prevail) and, if mandated by local ordinance, Appendix CC.
- 4. Prescriptive Compliance Path: The requirements of Sections C402 through C406 and C408, and, if mandated by local ordinance, Appendix CC.
- 1.2 Amendments to Section C402.1 General (Prescriptive)

**C402.1 General (Prescriptive).** Building thermal envelope assemblies for buildings that are intended to comply with the code on a prescriptive basis in accordance with the compliance path described in Item 4 of Section C401.2, shall comply with the following:

- 1. The opaque portions of the building thermal envelope shall comply with the specific insulation requirements of Section C402.2 and the thermal requirements of the *U-, C- and F-factor*-based method of Section C402.1.4, or the component performance alternative of section C402.1.5.
- 2. Roof solar reflectance and thermal emittance shall comply with Section C402.3.
- 3. Fenestration in building envelope assemblies shall comply with Section C402.4.
- 4. Air leakage of building envelope assemblies shall comply with Section C402.5.

Alternatively, where buildings have a *vertical fenestration* area or skylight area exceeding that allowed in Section C402.4, the building and building thermal envelope shall comply with Section C401.2, Item 1 or Section C401.2, Item 2 or Section C401.2, Item 3.

Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall comply with Section C403.10.1 or C403.10.2.

1.3 Replace Section C402.1.3 Insulation Component R-Value-Based Method

#### C402.1.3 (Reserved for jurisdictions choosing to allow the provisions of Appendix CB)

1.4 Amendments to Table C402.1.4 Opaque Thermal Envelope Assembly Maximum Requirements: U-Factor Method

		4		5	6					
CEINIATE ZONE	All other	Group R	All other	Group R	All other	Group R				
Roofs										
Insulation Entirely above roof deck	U-0.030	U-0.030	U-0.030	U-0.030	U-0.029	U-0.029				
Metal buildings	U-0.035	U-0.035	U-0.035	U-0.035	U-0.028	U-0.026				
Attic and other	U-0.020	U-0.020	U-0.020	U-0.020	U-0.019	U-0.019				
Walls, above grade										
Mass <sup>e</sup>	U-0.099	U-0.086	U-0.086	U-0.076	U-0.076	U-0.067				
Metal building	U-0.048	U-0.048	U-0.048	U-0.048	U-0.048	U-0.048				
Metal framed	U-0.061	U-0.061	U-0.052	U-0.052	U-0.047	U-0.044				
Wood framed and other <sup>c</sup>	U-0.061	U-0.061	U-0.048	U-0.048	U-0.048	U-0.046				
	Walls	, below grade	5							
Below-grade wall <sup>c</sup>	C-0.119	C-0.092	C-0.119	C-0.092	C-0.092	C-0.063				
	· · · · · · · · · · · · · · · · · · ·	Floors								
Mass <sup>d</sup>	U-0.057	U-0.051	U-0.057	U-0.051	U-0.051	U-0.051				
Joist/framing	U-0.033	U-0.033	U-0.033	U-0.033	U-0.027 <sup>f</sup>	U-0.027 <sup>f</sup>				
	Slab-o	n-grade floor	'S							
Unheated slabs	F-0.52	F-0.52	F-0.52	F-0.51	F-0.51	F-0.434				
Heated slabs	F-0.63	F-0.63	F-0.63	F-0.63	F-0.63	F-0.63				
	Ор	aque doors								
Swinging	U-0.50	U-0.50	U-0.37	U-0.37	U-0.37	U-0.37				
Garage door <14% glazing	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31				

#### Table C402.1.4

#### Opaque Thermal Envelope Assembly Maximum Requirements, U-Factor Method<sup>a,b</sup>

NYStretch Energy Code 2020

Part 1 - Amendments to 2018 IECC Commercial Provisions

For SI: 1 inch = 25.4 mm, 1 pound per square foot =  $4.88 \text{ kg/m}^2$ , 1 pound per cubic foot =  $16 \text{ kg/m}^3$ , ci = Continuous insulation, NR = No Requirement, LS = Liner System.

- a. Where assembly U-factors, C-factors, and F-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
- b. Where U-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The R-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
- c. Where heated slabs are below grade, below-grade walls shall comply with the U-factor requirements for above-grade mass walls.
- d. "Mass floors" shall be in accordance with Section C402.2.3.
- e. "Mass walls" shall be in accordance with Section C402.2.2.

## 1.5 Addition of New Section C402.1.4.2 Thermal Resistance of Mechanical Equipment Penetrations (Mandatory)

**C402.1.4.2 Thermal resistance of mechanical equipment penetrations (Mandatory).** When the total area of penetrations from mechanical equipment listed in Table C403.2.3(3) exceeds 1 percent of the opaque above-grade wall area, the mechanical equipment penetration area shall be calculated as a separate wall assembly with a default U-factor of 0.5.

**Exception:** Where mechanical equipment has been tested in accordance with testing standards approved by the authority having jurisdiction, the mechanical equipment penetration area may be calculated as a separate wall assembly with the U-factor as determined by such test.

1.6 Amendments to Section C402.2 Specific Building Thermal Envelope Insulation Requirements (Prescriptive)

**C402.2 Specific building thermal envelope insulation requirements (Prescriptive).** Insulation in building thermal envelope opaque assemblies shall comply with Sections C402.2.1 through C402.2.8 and Table C402.1.4.

1.7 Addition of New Section C402.2.8 Continuous Insulation (Mandatory)

**C402.2.8 Continuous insulation (Mandatory).** In new construction, structural elements of balconies and parapets that penetrate the *building thermal envelope*, shall comply with one of the following:

- 1. Structural elements penetrating the *building thermal envelope* shall be insulated with *continuous insulation* having a minimum thermal resistance of R-3.
- 2. Structural elements of penetrations of the *building thermal envelope* shall incorporate a minimum R-3 thermal break where the structural element penetrates the *building thermal envelope*.

1.8 Amendments to Section C402.4 Fenestration (Prescriptive)

**C402.4 Fenestration (Prescriptive).** Fenestration shall comply with Sections C402.4.1 through C402.4.5 and Table C402.4. Daylight responsive controls shall comply with this section and Section C405.2.3.

1.9 Amendments to Table C402.4

Building Envelope Fenestration Maximum U-Factor and SHGC Requirements

CLIMATE ZONE	4	5	6
	Vertical Fe	nestration	
	U-Fa	ctor	
Fixed fenestration	0.36	0.36	0.34
Operable fenestration	0.43	0.43	0.41
	All other vertic	al fenestration	
All fenestration	0.30	0.27	0.27
Entrance doors	0.77	0.77	0.77
	SH	GC	·
PF < 0.2	0.36	0.38	0.40
0.2 ≤ PF < 0.5	0.43	0.46	0.48
PF ≥ 0.5	0.58	0.61	0.64
	Skyli	ghts	
U-Factor	0.48	0.48	0.48
SHGC	0.38	0.38	0.38

Table C402.4
Building Envelope Fenestration Maximum LI-Factor and SHGC Requirement

## 1.10 Amendments to Section C402.5

Air Leakage--Thermal Envelope (Mandatory)

**C402.5 Air leakage--thermal envelope (Mandatory).** The *thermal envelope* of buildings shall comply with Section C402.5.9 or shall comply with Sections C402.5.1 through C402.5.8 and C408.4. New buildings not less than 25,000 square feet and not greater than 50,000 square feet, and less than or equal to 75 feet in height, shall show compliance through testing in accordance with Section C402.5.9.

## 1.11 Addition of New Section C402.5.9. Air Barrier Testing

**C402.5.9 Air Barrier Testing.** The *building thermal envelope* shall be tested in accordance with ASTM E779 at a pressure differential of 0.3 inch water gauge (75 Pa) or an equivalent method approved by the code official and shall be deemed to comply with the provisions of this section when the tested air leakage rate of the building thermal envelope is not greater than 0.40 cfm/ft<sup>2</sup> (2.0 L/s \* m<sup>2</sup>). Where the NYStretch Energy Code 2020

Part 1 - Amendments to 2018 IECC Commercial Provisions

compliance is based on such testing, the building shall also comply with Sections C402.5.5, C402.5.6, and C402.5.7. A report that includes the tested surface area, floor area, air by volume, stories above grade, and leakage rates shall be submitted to the code official and the building owner.

### 1.12 Amendments to Section C403.7.4 Energy Recovery Ventilation Systems (Mandatory)

**C403.7.4 Energy recovery ventilation systems (Mandatory).** Where the supply airflow rate of a fan system exceeds the values specified in Tables C403.7.4(1) and C403.7.4(2), the system shall include an energy recovery ventilation system. The energy recovery ventilation system shall be configured to provide a change in the enthalpy of the outdoor air supply of not less than 50 percent of the difference between the outdoor air and return air enthalpies, at design conditions. Where an air economizer is required, the energy recovery ventilation system shall include a bypass or controls that permit operation of the economizer as required by Section C403.5.

**Exception:** An energy recovery ventilation system shall not be required in any of the following conditions:

- 1. Where energy recovery systems are prohibited by the International Mechanical Code.
- 2. Laboratory fume hood systems that include not fewer than one of the following features:
  - 2.1 Variable-air-volume hood exhaust and room supply systems configured to reduce exhaust and makeup air volume to 50 percent or less of design values.
  - 2.2 Direct makeup (auxiliary) air supply equal to or greater than 75 percent of the exhaust rate, heated not warmer than 2°F (1.1°C) above room setpoint, cooled to not cooler than 3°F (1.7°C) below room setpoint, with no humidification added, and no simultaneous heating and cooling used for dehumidification control.
- 3. Systems serving spaces that are heated to less than 60°F (15.5°C) and that are not cooled.
- 4. Where more than 60 percent of the outdoor heating energy is provided from site-recovered or site-solar energy.
- 5. Heating energy recovery in Climate Zones 1 and 2.
- 6. Cooling energy recovery in Climate Zones 3C, 4C, 5B, 5C, 6B, 7, and 8.
- 7. Systems requiring dehumidification that employ energy recovery in series with the cooling coil.
- 8. Where the largest source of air exhausted at a single location at the building exterior is less than 75 percent of the design ventilation outdoor air flow rate. Multiple exhaust fans or outlets located within a 30-foot radius from the *outdoor air* supply unit shall be considered a single exhaust location.
- 9. Systems expected to operate less than 20 hours per week at the *outdoor air* percentage covered by Table C403.7.4(1).
- 10. Systems exhausting toxic, flammable, paint or corrosive fumes, or dust.
- 11. Commercial kitchen hoods used for collecting and removing grease vapors and smoke.

## 1.13 Amendments to Section C403.8.1 Allowable Fan Horsepower

**C403.8.1 Allowable fan horsepower (Mandatory).** Each HVAC system having a total fan system motor nameplate horsepower exceeding 5 hp (3.7 kW) at fan system design conditions shall not exceed the allowable *fan system motor nameplate hp* (Option 1) or *fan system bhp* (Option 2) shown in Table C403.8.1(1). This includes supply fans, exhaust fans, return/relief fans, and fan-powered terminal units associated with systems providing heating or cooling capability. Single-zone variable air volume systems shall comply with the constant volume fan power limitation.

#### Exceptions:

- 1. Hospital, vivarium and laboratory systems that utilize flow control devices on exhaust or return to maintain space pressure relationships necessary for occupant health and safety or environmental control shall be permitted to use variable volume fan power limitation.
- 2. Individual exhaust fans with motor nameplate horsepower of 1 hp (0.746 kW) or less are exempt from the allowable fan horsepower requirement.
- 3. Fans supplying air to active chilled beams.

## 1.14 Amendments to Table C403.8.1(1) Fan Power Limitation

#### Table C403.8.1(1) Fan Power Limitation

	Limit	Constant volume	Variable volume				
Option 1: Fan system motor	Allowable nameplate motor hp	hp ≤ CFM₅*0.0009	hp <u>&lt;</u> CFM₅* 0.0011				
nameplate hp							
Option 2: Fan system bhp	Allowable fan system bhp	bhp ≤ CFM₅ X 0.00088 + A	bhp ≤ CFM₅ X 0.0010 + A				
For SI: 1 bhp = 735.5 W, 1 hp = 745.5 W, 1 cfm = 0.4719 L/S							
Where:							
CFM <sub>s</sub> = The maximum design supply airflow rate to conditioned spaces served by the system in cubic feet per minute.							
hp = The maximum combined motor nameplate horsepower.							
bhp = The maximum combined fan brake horsepower.							
A = Sum of [PD X CFM <sub>D</sub> /4131]							
Where:							
PD = Each applicable pressure drop adjustment from Table C403.8.1 (2) in. w.c.							

CFM<sub>D</sub> = The design airflow through each applicable device from Table C403.8.1(2) in cubic feet per minute.

### 1.15 Amendments to Section C405.2.1 Occupant Sensor Controls

# **C405.2.1 Occupant sensor controls.** Occupant *sensor controls* shall be installed to control lights in the following space types:

- 1. Classrooms/lecture/training rooms.
- 2. Conference/meeting/multipurpose rooms.

NYStretch Energy Code 2020 Part 1 – Amendments to 2018 IECC Commercial Provisions

- 3. Copy/print rooms.
- 4. Corridor/transition areas.
- 5. Dining areas.
- 6. Lounges/breakrooms.
- 7. Enclosed offices.
- 8. Open plan office areas.
- 9. Restrooms.
- 10. Storage rooms.
- 11. Locker rooms.
- 12. Other spaces 300 square feet (28 m<sup>2</sup>) or less that are enclosed by floor-to-ceiling height partitions.
- 13. Warehouse storage areas.
- 1.16 Addition of New Section C405.2.1.4 Occupant Sensor Control Function for Egress Illumination

**C405.2.1.4 Occupant sensor control function for egress illumination.** In new buildings, luminaires serving the exit access and providing means of egress illumination required by Section 1008.1 of the *International Building Code*, including luminaires that function as both normal and emergency means of egress illumination shall be controlled by a combination of listed emergency relay and occupancy sensors, or signal from another building control system that automatically reduces the lighting power by 50 percent when unoccupied for longer than 15 minutes.

#### **Exceptions**:

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- 1. Means of egress illumination serving the exit access that does not exceed 0.02 watts per square foot of building area is exempt from this requirement.
- 2. Emergency lighting designated to meet Section 1008.3 of the International Building Code.
- 1.17 Amendments to Section C405.2.3 Daylight Responsive Controls

**C405.2.3 Daylight responsive controls.** *Daylight-responsive controls* complying with Section C405.2.3.1 shall be provided to control the electric lights within *daylight zones* in the following spaces:

- 1. Spaces with a total of more than 100 watts of general lighting within sidelit zones complying with Section C405.2.3.2. General lighting does not include lighting that is required to have specific application control in accordance with Section C405.2.4.
- 2. Spaces with a total of more than 100 watts of general lighting within toplit zones complying with Section C405.2.3.3.

Exceptions: Daylight responsive controls are not required for the following:

1. Spaces in health care facilities where patient care is directly provided.
- 2. Lighting that is required to have specific application control in accordance with Section C405.2.4.
- 3. Sidelit zones on the first floor above grade in Group A-2 and Group M occupancies.
- New buildings where the total connected lighting power calculated in accordance with Section C405.3.1 is not greater than the adjusted interior lighting power allowance (LPA<sub>adj</sub>) calculated in accordance with Equation 4-9:

$$LPA_{adj} = [LPA_{norm} \times (1.0 - 0.4 \times UDZFA / TBFA)]$$
 (Equation 4-9)

Where:

LPA<sub>adj</sub> = Adjusted building interior lighting power allowance in watts.

- LPA<sub>norm</sub> = Normal building lighting power allowance in watts calculated in accordance with Section C405.3.2 and reduced in accordance with Section C406.3 where Option 2 of Section C406.1 is used to comply with the requirements of Section C406.
- UDZFA = Uncontrolled daylight zone floor area is the sum of all sidelit and toplit zones, calculated in accordance with Sections C405.2.3.2 and C405.2.3.3, that do not have daylight responsive controls.
- TBFA = Total building floor area is the sum of all floor areas included in the lighting power allowance calculation in Section C405.3.2.
- 1.18 Amendments to Section C405.2.3.2 Sidelit Zone

**C405.2.3.2 Sidelit zone**. The sidelit zone is the floor area adjacent to vertical *fenestration* that complies with all of the following:

- Where the fenestration is located in a wall, the sidelit zone shall extend laterally to the nearest full-height wall, or up to 1.0 times the height from the floor to the top of the fenestration, and longitudinally from the edge of the fenestration to the nearest full-height wall, or up to 2 feet (610 mm), whichever is less, as indicated in Figure C405.2.3.2.
- 2. The area of the fenestration is not less than 24 square feet (2.23 m<sup>2</sup>).
- 3. The distance from the fenestration to any building or geological formation that would block *access* to daylight is no greater than one-half of the height from the bottom of the fenestration to the top of the building or geologic formation.
- 4. The visible transmittance of the fenestration is not less than 0.20.

1.19 Amendments to Section C405.2.6 Exterior Lighting Controls

**C405.2.6 Exterior lighting controls.** Exterior lighting systems shall be provided with controls that comply with Sections C405.2.6.1 through C405.2.6.5. Decorative lighting systems shall comply with Sections C405.2.6.1, C405.2.6.2, and C405.2.6.4.

### Exceptions:

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- 1. Lighting for covered vehicle entrances and exits from buildings and parking structures where required for eye adaptation.
- 2. Lighting controlled from within dwelling units.

C405.2.6.1 (Daylight shutoff) is unchanged.

### C405.2.6.2 (Decorative lighting shutoff) is unchanged.

**C405.2.6.3 Lighting setback.** Lighting not controlled in accordance with Section C405.2.6.2 shall be controlled so that the total wattage of such lighting is automatically reduced by not less than 50 percent by selectively switching off or dimming luminaires at one of the following times:

- 1. From not later than midnight to not earlier than 6 a.m.
- 2. From not later than one hour after business closing to not earlier than one hour before business opening.
- 3. During any time where activity has not been detected for 15 minutes or more.

### C405.2.6.4 (Exterior time-switch control function) is unchanged.

# 1.20 Addition of New Section C405.2.6.5 Outdoor parking area lighting control

**C405.2.6.5 Outdoor parking area lighting control.** Outdoor parking area luminaires mounted 24' or less above the ground shall be controlled to automatically reduce the power of each luminaire by a minimum of 50 percent when no activity has been detected for at least 15 minutes. No more than 1500 W of lighting power shall be controlled together.

Exception: Outdoor parking areas with less than 1,000 watts of lighting.

# 1.21 Amendments to Table C405.3.2(1)

Interior Lighting Power Allowances: Building Area Method

BUILDING AREA TYPE	LPD (w/ft <sup>2</sup> )
Automotive facility	0.64
Convention center	0.70
Courthouse	0.74
Dining: bar lounge/leisure	0.69
Dining: cafeteria/fast food	0.66
Dining: family	0.61
Dormitory <sup>a, b</sup>	0.52
Exercise center	0.65
Fire station <sup>a</sup>	0.50
Gymnasium	0.67
Health care clinic	0.68
Hospital <sup>a</sup>	0.86
Hotel/motel <sup>a, b</sup>	0.70
Library	0.78
Manufacturing facility	0.60
Motion picture theater	0.62
Multifamily <sup>c</sup>	0.49
Museum	0.68
Office	0.69
Parking garage	0.12
Penitentiary	0.67
Performing arts theater	0.85
Police station	0.68
Post office	0.62
Religious building	0.72
Retail	0.91
School/university	0.67
Sports arena	0.76
Town hall	0.72
Transportation	0.51

# TABLE C405.3.2(1) Interior Lighting Power Allowances: Building Area Method

### TABLE C405.3.2(1)

# Interior Lighting Power Allowances: Building Area Method (continued)

BUILDING AREA TYPE	LPD (w/ft²)
Warehouse 0.41	
Workshop 0.83	
<ul> <li>a. Where sleeping units are excluded from I Section R405.1, neither the area of the sleeping units is counted.</li> <li>b. Where dwelling units are excluded from I R405.1, neither the area of the dwelling u dwelling units is counted.</li> <li>c. Dwelling units are excluded. Neither the a lighting in the dwelling units is counted.</li> </ul>	ighting power calculations by application of eeping units nor the wattage of lighting in the ighting power calculations by application of units nor the wattage of lighting in the area of the dwelling units nor the wattage of

# 1.22 Amendments to Table C405.3.2(2)

Interior Lighting Power Allowances: Space-By-Space Method

#### **COMMON SPACE TYPES** <sup>a</sup> LPD (w/ft<sup>2</sup>) Atrium Less than 40 feet in height 0.023 per foot in total height Greater than 40 feet in height 0.40 + 0.02 per foot in total height Audience seating area In an auditorium 0.63 In a convention center 0.65 In a gymnasium 0.43 In a motion picture theater 0.64 In a penitentiary 0.28 In a performing arts theater 1.34 In a religious building 0.98 In a sports arena 0.42 Otherwise 0.40 Banking activity area 0.79 Breakroom (See Lounge/Breakroom) Classroom/lecture hall/training room In a penitentiary 1.06 Otherwise 0.74 Computer room 1.16 Conference/meeting/multipurpose room 0.93 Confinement cells 0.52 Copy/print room 0.50 Corridor In a facility for the visually impaired (and 0.81 not used primarily by the staff) b In a hospital 0.81 In a manufacturing facility 0.28 In a primary or secondary school (and 0.74 not used primarily by the staff) Otherwise 0.58 Courtroom 1.06

# Table C405.3.2(2) Interior Lighting Power Allowances: Space-by-Space Method

NYStretch Energy Code 2020 Part 1 – Amendments to 2018 IECC Commercial Provisions

COMMON SPACE TYPES <sup>a</sup>	LPD (w/ft <sup>2</sup> )		
Dining area			
In bar/lounge or leisure dining	0.62		
In cafeteria or fast food dining	0.53		
In a facility for the visually impaired (and not used primarily by the staff) <sup>b</sup>	1.48		
In family dining	0.54		
In a penitentiary	0.72		
Otherwise	0.53		
Electrical/mechanical room	0.39		
Emergency vehicle garage	0.41		
Food preparation area	0.92		
Guestroom <sup>c, d</sup>	0.75		
Laboratory			
In or as a classroom	1.04		
Otherwise	1.32		
Laundry/washing area	0.43		
Loading dock, interior	0.51		
Lobby			
For an elevator	0.52		
In a facility for the visually impaired (and not used primarily by the staff) <sup>b</sup>	2.03		
In a hotel	0.68		
In a motion picture theater	0.38		
In a performing arts theater	0.82		
Otherwise	0.9		
Locker room	0.45		
Lounge/breakroom			
In a healthcare facility	0.53		
Otherwise	0.44		
Office			
Enclosed	0.85		
Open plan	0.78		
Parking area, interior <sup>i</sup>	0.11		
Pharmacy area	1.23		
Restroom			
In a facility for the visually impaired (and not used primarily by the staff) <sup>b</sup>	0.81		

NYStretch Energy Code 2020

Part 1 – Amendments to 2018 IECC Commercial Provisions

COMMON SPACE TYPES <sup>a</sup>	LPD (w/ft²)		
Otherwise	0.75		
Sales area	1.06		
Seating area, general	0.38		
Stairway (See space containing stairway)			
Stairwell	0.50		
Storage room	0.43		
Vehicular maintenance area	0.53		
Workshop	1.09		

BUILDING TYPE SPECIFIC SPACE TYPES <sup>a</sup>	LPD (w/ft²)			
Automotive (See Vehicular Maintenance Area above)				
Convention Center—exhibit space 0.69				
Dormitory—living quarters <sup>c, d</sup>	0.46			
Facility for the visually impaired <sup>b</sup>				
In a chapel (and not used primarily by the staff)	0.89			
In a recreation room (and not used primarily by the staff)	1.53			
Fire Station—sleeping quarters <sup>c</sup>	0.19			
Gymnasium/fitness center				
In an exercise area	0.50			
In a playing area	0.75			
Healthcare facility				
In an exam/treatment room	1.16			
In an imaging room	0.98			
In a medical supply room	0.54			
In a nursery	0.94			
In a nurse's station	0.75			
In an operating room	1.87			
In a patient room <sup>c</sup>	0.45			
In a physical therapy room	0.84			
In a recovery room	0.89			
Library				
In a reading area	0.77			
In the stacks	1.20			

NYStretch Energy Code 2020

Part 1 – Amendments to 2018 IECC Commercial Provisions

BUILDING TYPE SPECIFIC SPACE TYPES <sup>a</sup>	LPD (w/ft²)			
Manufacturing facility				
In a detailed manufacturing area	0.86			
In an equipment room	0.61			
In an extra-high-bay area (greater than 50' floor-to-ceiling height)	0.73			
In a high-bay area (25-50' floor-to-ceiling height)	0.58			
In a low-bay area (less than 25' floor-to- ceiling height)	0.61			
Museum				
In a general exhibition area	0.61			
In a restoration room	0.77			
Performing arts theater—dressing room	0.35			
Post Office—Sorting Area	0.66			
Religious buildings				
In a fellowship hall	0.54			
In a worship/pulpit/choir area	0.98			
Retail facilities				
In a dressing/fitting room	0.49			
In a mall concourse	0.79			
Sports arena—playing area				
For a Class   facility <sup>e</sup> 2.26				
For a Class II facility <sup>f</sup> 1.45				
For a Class III facility <sup>g,j</sup>	1.08			
For a Class IV facility <sup>h,j</sup>	0.72			
Transportation facility	I			
In a baggage/carousel area	0.40			
In an airport concourse	0.31			
At a terminal ticket counter	0.48			
Warehouse—storage area	1			
For medium to bulky, palletized items	0.27			
For smaller, hand-carried items	0.65			
<ul> <li>a. In cases where both a common space type and a building area specific space are listed, the building area specific space type shall apply.</li> <li>b. A 'Facility for the Visually Impaired' is a facility that is licensed or will be licensed by local or state authorities for senior long-term care, adult daycare, senior support or people with special visual needs.</li> <li>a. Where share in a public set or will be licensed.</li> </ul>				
application of Section R405.1, neither the area of the sleeping units nor the				

wattage of lighting in the sleeping units is counted.

BL	JILDING TYPE SPECIFIC SPACE TYPES <sup>a</sup>	LPD (w/ft²)	
d.	Where dwelling units are excluded from li application of Section R405.1, neither the wattage of lighting in the dwelling units is	ghting power calculations by area of the dwelling units nor the counted.	
e.	. Class I facilities consist of Professional facilities; and Semi-professional, Collegiate, or Club facilities with seating for 5,000 or more spectators.		
f.	Class II facilities consist of Collegiate and Semi-professional facilities with seating for fewer than 5,000 spectators; Club facilities with seating for between 2,000 and 5,000 spectators; and Amateur League and High School facilities with seating for more than 2,000 spectators.		
g.	Class III facilities consist of Club, Amateur with seating for 2,000 or fewer spectators	League, and High School facilities	
h.	Class IV facilities consist of Elementary Sch Amateur League and High School facilities	ool and Recreational facilities, and without provisions for spectators.	
i.	The wattage of lighting in daylight transition parking is excluded.	on zones and ramps without	
j.	Pool surfaces are excluded. Neither the su pool nor the wattage of the lighting servin	rface area of the swimming or spa g them shall be counted.	

# 1.23 Amendments to Table C405.4.2(2)

Lighting power allowances for building exteriors

	Zone 1	Zone 2	Zone 3	Zone 4	
Base Site Allowance	350 W	400 W	500 W	900 W	
	Unco	vered Parking Areas			
Parking areas and drives	0.03 W/ft <sup>2</sup>	0.04 W/ft <sup>2</sup>	0.05 W/ft <sup>2</sup>	0.05 W/ft <sup>2</sup>	
	B	uilding Grounds			
Walkways and ramps     0.5 W/linear foot     0.5 W/linear foot     0.6 W/linear foot     0.7 W/linear					
Walkways and ramps 10 feet wide or greater, plaza areas special feature areas	0.10 W/ft <sup>2</sup>	0.10 W/ft <sup>2</sup>	0.11 W/ft²	0.14 W/ft <sup>2</sup>	
Dining areas	0.65 W/ft <sup>2</sup>	0.65 W/ft <sup>2</sup>	0.75 W/ft <sup>2</sup>	0.95 W/ft <sup>2</sup>	
Stairways 0.6 W/ft <sup>2</sup>		0.7 W/ft <sup>2</sup> 0.7 W/ft <sup>2</sup>		0.7 W/ft <sup>2</sup>	
Pedestrian tunnels 0.12 W/ft <sup>2</sup>		0.12 W/ft <sup>2</sup>	0.14 W/ft <sup>2</sup>	0.21 W/ft <sup>2</sup>	
Landscaping	0.03 W/ft <sup>2</sup>	0.04 W/ft <sup>2</sup>	0.04 W/ft <sup>2</sup>	0.04 W/ft <sup>2</sup>	
	Buildir	ng Entrances and Exit	S		
Pedestrian and vehicular12.6 W/linear foot12.6 Ventrances and exitsof opening widthof op		12.6 W/linear foot of opening width	20 W/linear foot of opening width	20 W/linear foot of opening width	
Entry canopies	0.20 W/ft <sup>2</sup>	0.25 W/ft <sup>2</sup>	0.4 W/ft <sup>2</sup>	0.4 W/ft <sup>2</sup>	
Loading docks	0.35 W/ft <sup>2</sup>	0.35 W/ft <sup>2</sup>	0.35 W/ft <sup>2</sup> 0.35 W/ft <sup>2</sup>		
		Sales Canopies			
Free-standing and 0.40 W/ft <sup>2</sup>		0.40 W/ft <sup>2</sup>	0.6 W/ft <sup>2</sup>	0.7 W/ft <sup>2</sup>	
Outdoor Sales					
Open areas (including 0.20 W/ft <sup>2</sup>		0.20 W/ft <sup>2</sup>	0.35 W/ft <sup>2</sup>	0.50 W/ft <sup>2</sup>	
Street frontage for vehicle sales lots in addition to "open area" allowance		7 W/linear foot	7 W/linear foot	21 W/linear foot	

# Table C405.4.2(2) Lighting Power Allowances for Building Exteriors

For SI: 1 foot = 304.8 mm, 1 watt per square foot = 1 W/0.0929 m<sup>2</sup>. W = watts 1.24 Addition of New Section C405.8.1.1 Power conversion system

**C405.8.1.1 Power conversion system.** New traction elevators with a rise of 75 feet or more in new buildings shall have a power conversion system that complies with Sections 405.8.1.1.1 through 405.8.1.1.3.

**C405.8.1.1.1 Motor**. Induction motors with a Class IE2 efficiency ratings, as defined by IEC EN 60034-30, or alternative technologies, such as permanent magnet synchronous motors that have equal or better efficiency, shall be used.

**C405.8.1.1.2 Transmission.** Transmissions shall not reduce the efficiency of the combined motor/transmission below that shown for the Class IE2 motor for elevators with capacities below 4,000 lbs. Gearless machines shall be assumed to have a 100 percent transmission efficiency.

**C405.8.1.1.3 Drive.** Potential energy released during motion shall be recovered with a regenerative drive that supplies electrical energy to the building electrical system.

1.25 Addition of New Section C405.9 Commercial Kitchen Equipment

**C405.9 Commercial Kitchen Equipment.** Commercial kitchen equipment shall comply with the minimum efficiency requirements of Tables C405.9(1) through table C405.9(5).

	Heavy-Load Cooking Energy Efficiency	Idle Energy Rate	Test Procedure
Standard Open Deep-	≥ 50%	≤ 9,000 Btu/hr	
Fat Gas Fryers			ACTNA Chandrad 51201 17
Standard Open Deep-	≥ 83%	≤ 800 watts	ASTIVI Standard F1361-17
Fat Electric Fryers			
Large Vat Open Deep-	≥ 50%	≤ 12,000 Btu/hr	
Fat Gas Fryers			ACTNA Chan david 52144 17
Large Vat Open Deep-	≥ 80%	≤ 1,100 watts	ASTIVI Stanoard F2144-17
Fat Electric Fryers			

### Table C405.9(1) Minimum Efficiency Requirements: Commercial Fryers

Product Interior Volume (Cubic Feet)         Maximum Idle Energy Consump Rate (Watts)		Test Procedure
0 < V < 13	≤ 21.5 V	
13 ≤ V < 28	≤ 2.0 V + 254.0	ASTM Standard F2140-11
28 ≤ V	≤ 3.8 V + 203.5	

 Table C405.9(2)

 Minimum Efficiency Requirements: Commercial Hot Food Holding Cabinets

### Table C405.9(3) Minimum Efficiency Requirements: Commercial Steam Cookers

Fuel Type	Pan Capacity	Cooking Energy Efficiency <sup>a</sup>	Idle Rate	Test Procedure
	3-pan	50%	400 watts	
Electric Steam	4-pan	50%	530 watts	
Electric Steam	5-pan	50%	670 watts	
	6-pan and larger	50%	800 watts	ASTM Standard
	3-pan	38%	6,250 Btu/h	F1484-18
Con Channel	4-pan	38%	8,350 Btu/h	
Gas Steam	5-pan	38%	10,400 Btu/h	
	6-pan and larger	38%	12,500 Btu/h	

a. Cooking Energy Efficiency is based on heavy load (potato) cooking capacity

Machine Type	High Temp Efficiency Requirements Low Temp Efficience			ency Requirements	Test
	Idle Energy	Water	Idle Energy	Water	Procedure
	Rate <sup>a</sup>	<b>Consumption<sup>b</sup></b>	Rate <sup>a</sup>	Consumption <sup>b</sup>	
Under Counter	≤ 0.50 kW	≤ 0.86 GPR	≤ 0.50 kW	≤ 1.19 GPR	
Stationary Single	≤ 0.70 kW	≤ 0.89 GPR	≤ 0.60 kW	≤ 1.18 GPR	
Tank Door	-				
Pot, Pan, and	≤ 1.20 kW	≤ 0.58 GPSF	≤ 1.00 kW	≤ 0.58 GPSF	ASTM
Utensil					Standard
Single Tank	≤ 1.50 kW	≤ 0.70 GPR	≤ 1.50 kW	≤ 0.79 GPR	F1696-18
Conveyor					
Multiple Tank	≤ 2.25 kW	≤ 0.54 GPR	≤ 2.00 kW	≤ 0.54 GPR	ASTM
Conveyor					Standard
Single Tank	Reported	GPH ≤ 2.975x +	Reported	GPH ≤ 2.975x +	F1920-15
Flight Type		55.00		55.00	
Multiple Tank	Reported	GPH ≤ 4.96x +	Reported	GPH ≤ 4.96x +	
Flight Type		17.00		17.00	

# Table C405.9(4) Minimum Efficiency Requirements: Commercial Dishwashers

a. Idle results shall be measured with the door closed and represent the total idle energy consumed by the machine including all tank heater(s) and controls. Booster heater (internal or external) energy consumption should not be part of this measurement unless it cannot be separately monitored per US EPA Energy Star Commercial Dishwasher Specification Version 2.0.

b. GPR = gallons per rack; GPSF = gallons per square foot of rack; GPH = gallons per hour; x = sf of conveyor belt (i.e., W\*L)/min (maximum conveyor speed).

NYStretch Energy Code 2020 Part 1 – Amendments to 2018 IECC Commercial Provisions

Fuel Type	Classification	Idle Rate	Cooking-Energy Efficiency, %	Test Procedure
Gas	Full-Size	≤ 12,000 Btu/h	≥ 46	
Electric	Half-Size	≤ 1.0 Btu/h	> 71	ASTM F1496 - 13
LIECTIC	Full-Size	≤ 1.60 Btu/h	7271	
	Combi	nation Ovens		
Gar	Steam Mode	≤ 200P³+6,511 Btu/h	≥ 41	
Gas	Convection Mode	≤ 150P°+5,425 Btu/h	≥ 56	
Floatric	Steam Mode	≤ 0.133P <sup>a</sup> +0.6400 kW	≥ 55	ASTIVI F2801 - 17
Electric	Convection Mode	≤ 0.080Pª+0.4989 kW	≥ 76	
Gas	Single	≤ 25,000 Btu/h	≥ 48	ASTN4 52002 19
	Double	≤ 30,000 Btu/h	≥ 52	ASTIVI F2093 - 18

Table C405.9(5) Minimum Efficiency Requirements: Commercial Ovens

a. P = Pan Capacity: The number of steam table pans the combination oven is able to accommodate as per the ASTM F – 1495 – 05 standard specification.

# 1.26 Addition of New Section C405.10 Electric Vehicle Charging Station Capable

**C405.10 Electric vehicle charging station capable.** New parking garages and new parking lots powered by the energy services for a building, and with 10 or greater parking spaces, shall provide either:

- 1. Panel capacity and conduit for the future installation of minimum 208/240V 40-amp outlets for 5 percent of the total parking spaces and not less than two parking spaces; or
- 2. Minimum 208/240V 40-amp outlets for 5 percent of the total parking spaces and not less than two parking spaces.
- 1.27 Addition of New Section C405.11 Solar-Ready Zone

C405.11 Solar-ready zone (Mandatory). New buildings shall comply with the provisions of Appendix CA.

# 1.28 Addition of Section C405.12 Whole Building Energy Monitoring

**C405.12 Whole building energy monitoring.** Measurement devices shall be installed in new buildings to individually monitor energy use of each of the following types of energy supplied by a utility, energy provider, or plant that is not within the building:

- 1. Natural gas
- 2. Fuel oil
- 3. Propane
- 4. Steam
- 5. Chilled Water
- 6. Hot Water

### **Exceptions:**

- 1. Buildings less than 25,000 square feet (2,325 m<sup>2</sup>).
- 2. Group R buildings with less than 10,000 square feet of common area (930 m<sup>2</sup>).
- 3. Fuel use for on-site emergency equipment.

# 1.29 Addition of Section C405.13 Whole Building Electrical Monitoring

**C405.13 Whole building electrical monitoring.** Each new building shall have a measurement device capable of recording electrical energy use every 60 minutes and the capability to report use on an hourly, daily, monthly, and annual basis. The measurement device shall be capable of retaining the recorded data for 36 months.

### Exceptions:

- 1. Buildings less than 25,000 square feet (2,325 m<sup>2</sup>).
- 2. Group R buildings with less than 10,000 square feet of common area (930 m<sup>2</sup>).
- 3. Fuel use for on-site emergency equipment.

# 1.30 Replacement of Section C406.1 Requirements

C406.1 Requirements. Buildings shall comply with at least one of the following Sections.

- 1. More efficient HVAC equipment in accordance with Section C406.2.
- 2. Reduced lighting power in accordance with Section C406.3.
- 3. Enhanced digital lighting controls in accordance with Section C406.4.
- 4. Dedicated outdoor air systems with energy recovery ventilation in accordance with Section C406.5.
- 5. Enhanced envelope performance in accordance with Section C406.6.
- 6. Reduced air infiltration in accordance with Section C406.7.

NYStretch Energy Code 2020 Part 1 – Amendments to 2018 IECC Commercial Provisions 1.31 Amendment to Section C406.1.1 Tenant Spaces

**C406.1.1. Tenant spaces.** Tenant spaces shall comply with Section C406.2, C406.3, C406.4 or C406.7. Alternatively, tenant spaces shall be in compliance with Section C406.5 or C406.6 where the entire building is in compliance.

Exception: Previously occupied tenant spaces that comply with this code using Section C501.

# 1.32 Replacement and Renaming of Section C406.5 On-Site Renewable Energy

**C406.5 Dedicated outdoor air system**. Buildings containing equipment or systems regulated by Section C403.3.4, C403.4.3, C403.4.4, C403.4.5, C403.6, C403.8.4, C403.8.5, C403.8.5.1, C403.9.1, C403.9.2, C403.9.3 or C403.9.4 shall be equipped with an independent ventilation system designed to provide not less than the minimum 100-percent outdoor air to each individual occupied space, as specified by the International Mechanical Code. The ventilation system shall be equipped with an energy recovery system meeting the requirements of Section C403.7.4, without exception (Note: C406.5 cannot be selected where ERV is prohibited by the *International Mechanical Code* or otherwise prohibited.) The HVAC system shall include supply-air temperature controls that automatically reset the supply-air temperature in response to representative building loads, or to outdoor air temperatures. The controls shall reset the supply-air temperature not less than 25 percent of the difference between the design supply-air temperature.

### 1.33 Replacement and Renaming of Section C406.6 Dedicated Outdoor Air System

**C406.6 Enhanced envelope performance.** The thermal performance of the envelope shall demonstrate a 15 percent improvement compared to the requirements of Section C402.1.5.

1.34 Replacement and Renaming of Section C406.7 Reduced Energy Use in Service Water Heating

**C406.7 Reduced air infiltration.** Air infiltration shall be verified by whole building pressurization testing conducted in accordance with Section C402.5.9. The measured air leakage rate of the building envelope shall not exceed 0.25 cfm/ft<sup>2</sup> (2.0 L/s x m<sup>2</sup>) under a pressure differential of 0.3 in. water (75 Pa), with the calculated surface area being the sum of the above and below grade building envelope. A report that includes the tested surface area, floor area, air by volume, stories above grade, and leakage rates shall be submitted to the code official and the building owner.

**Exception:** For buildings with more than 250,000 square feet (25 000 m<sup>2</sup>) of conditioned floor area, air leakage testing need not be conducted on the whole building where testing is conducted on representative above-grade sections of the building. Tested areas shall total not less than 25 percent of the conditioned floor area and shall be tested in accordance with this section.

# 1.35 Replacement of Section C407 Total Building Performance

# Section C407 Total Building Performance

**C407.1 Scope.** This section establishes criteria for compliance using total building performance. Buildings following the total building performance path must comply with ASHRAE 90.1-2016 (as amended), demonstrating compliance under Section 11 or Appendix G of such standard.

# 1.36 Amendments to Section C408.2 Mechanical Systems and Service Water-Heating Systems Commissioning and Completion Requirements

C408.2 Mechanical, renewable energy, and service water heating systems commissioning and completion requirements. This section is required when one of the following conditions is met:

- 1. The *building* is not less than 25,000 square feet (2,325 m<sup>2</sup>).
- 2. The total mechanical equipment capacity being installed is greater than 480,000 Btu/h (140.7 kW) cooling capacity.
- 3. The combined *service water-heating* and space-heating capacity is greater than 600,000 Btu/h (175.8 kW).

Prior to passing the final mechanical and plumbing inspections, the *registered design professional or approved agency* shall provide evidence of systems *commissioning* and completion in accordance with the provisions of this section.

*Construction document* notes shall clearly indicate provisions for *commissioning* and completion requirements in accordance with this section and are permitted to refer to specifications for further requirements. Copies of all documentation shall be given to the owner or owner's authorized agent and made available to the *code official* upon request in accordance with Sections C408.2.4 and C408.2.5.

Mechanical systems, renewable energy, and *service water heating* systems shall include, at a minimum, the following systems (mechanical and/or passive) and associated controls:

- 1. Heating, cooling, air handling and distribution, ventilation, and exhaust systems, and their related air quality monitoring systems.
- 2. Air, water, and other energy recovery systems.
- 3. Manual or automatic controls, whether local or remote, on energy using systems including but not limited to temperature controls, setback sequences, and occupancy-based control, including energy management functions of the building management system.
- 4. Plumbing, including insulation of piping and associated valves, domestic and process water pumping, and mixing systems.
- 5. Mechanical heating systems and service water heating systems.
- 6. Refrigeration systems.

NYStretch Energy Code 2020 Part 1 – Amendments to 2018 IECC Commercial Provisions

- 7. Renewable energy and energy storage systems where installed generating capacity is not less than 25kW.
- 8. Other systems, equipment and components that are used for heating, cooling or ventilation, and affect energy use.

#### C408.2.1 Commissioning Plan is unchanged.

1.37 Amendments to Section C408.2.2 Systems Adjusting and Balancing

**C408.2.2 Systems adjusting and balancing.** HVAC systems shall be balanced in accordance with ANSI/ASHRAE 111, "Testing, Adjusting, and Balancing of Building HVAC Systems" or other approved engineering standards.

C408.2.2.1 Air systems balancing is unchanged.

C408.2.2.2 Hydronic systems balancing is unchanged.

1.38 Addition of New Section C408.4 Air Barrier Commissioning

**C408.4 Air barrier commissioning.** Prior to passing final inspection, the registered design professional or approved agent shall provide evidence of air barrier commissioning and substantial completion in accordance with the provisions of sections C408.4.1 through C408.4.3.

**C408.4.1 Documentation.** Construction documents shall include documentation of the continuous air barrier components included in the design and a field inspection checklist that includes all requirements necessary for maintaining air barrier continuity and durability in accordance with Section C402.5.1.

**C408.4.2 Field inspections.** Reports from field inspections during project construction showing compliance with continuous air barrier requirements including proper material handling and storage, use of approved materials and material substitutes, proper material and surface preparation, and air barrier continuity shall be provided to the owner and, upon request, to the code official. Air barrier continuity shall be determined by testing or inspecting each type of unique air barrier joint or seam in the building envelope for continuity and defects.

**C408.4.3 Report.** A final commissioning report indicating compliance with the continuous air barrier requirements shall be provided to the building owner and, upon request, to the code official.

1.39 Addition of New Section C502.2.3.1 Commissioning

**C502.2.3.1 Commissioning.** New heating, cooling, and duct system components that are part of the addition and the controls that serve them shall comply with Sections C408.2.2, C408.2.3 and C408.2.5.

**Exception:** Mechanical systems in additions where the total mechanical equipment capacity of the building is less than 480,000 Btu/h (140.7 kW) cooling capacity and 600,000 Btu/h (175.8 kW) combined service water heating and space heating capacity.

1.40 Addition of New Section C502.2.4.1 Commissioning

**C502.2.4.1 Commissioning.** New service hot water system components that are part of the addition and the controls that serve them shall comply with Sections C408.2.2, C408.2.3, and C408.2.5.

**Exception:** Service hot water systems in additions where the combined service water heating and space heating capacity of the building is less than 600,000 Btu/h (175.8 kW).

1.41 Addition of New Section C502.3 Air Barriers

**C502.3 Air barriers.** The thermal envelope of additions shall comply with Sections C402.5.1 through C402.5.8.

1.42 Addition of New Section C503.3.4 Air Barriers

**C503.3.4 Air barriers.** The thermal envelope of alterations shall comply with Sections C402.5.1 through C402.5.8.

1.43 Addition of New Section C503.4.2 Commissioning

**C503.4.2 Commissioning.** New heating, cooling and duct system components that are part of the alteration and the controls that serve them shall comply with Sections C408.2.2, C408.2.3, and C408.2.5.

**Exceptions:** Mechanical systems in alterations where the total mechanical equipment capacity of the building is less than 480,000 Btu/h (140.7 kW) cooling capacity and 600,000 Btu/h (175.8 kW) combined service water heating and space heating capacity.

1.44 Addition of New Section C503.5.1 Commissioning

**C503.5.1 Commissioning.** New service hot water system components that are part of the alteration and the controls that serve them shall comply with Sections C408.2.2, C408.2.3, and C408.2.5.

**Exception:** Service hot water systems in alterations where the combined service water heating and space heating capacity of the building is less than 600,000 Btu/h (175.8 kW).

# 1.45 Addition of New Appendix CB Rated R-value of Insulation—Commercial

# **Appendix CB**

# Rated *R*-Value of Insulation – Commercial

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

### Section CB101 Scope

**CB101.1 General.** These provisions shall be applicable for new construction where an Insulation R-value based method is required.

### Section CB102 Insulation Component *R*-Value-Based Method

**CB102.1 General.** The opaque portions of the building thermal envelope shall comply with the specific insulation requirements of Section C402.2 and the thermal requirements of the R-value-based method of Section CB102.2.

**CB102.2 Insulation component** *R***-value-based method.** *Building thermal envelope* opaque assemblies shall comply with the requirements of Sections C402.2 and C402.4 based on the *climate zone* specified in Chapter 3. For opaque portions of the *building thermal envelope* intended to comply on an insulation component *R*-value basis, the *R*-values for insulation shall be not less than that specified in Table CB102.2. Commercial buildings or portions of commercial buildings enclosing *Group R* occupancies shall use the R values from the "*Group R*" column of Table CB102.2. Commercial buildings or portions of the real case of the real buildings or portions of the real buildings or portions of the cB102.2. Commercial buildings or portions of the cB102.2. Commercial buildings or portions of the cB102.2. Commercial buildings or portions of the real case of the real buildings or portions of the cB102.2. Commercial buildings or portions of the real case of the real

### Table CB102.2

#### Opaque Thermal Envelope Insulation Component Minimum Requirements, R-Value Method<sup>a, h</sup>

CLIMATE ZONE	4 EXCEPT MARINE		5 AND MARINE 4		6	
CLINIATE ZONE	All other	Group R	All other	Group R	All other	Group R
		R	oofs			
Insulation Entirely above roof deck	R-33ci	R-33ci	R-33ci	R-33ci	R-33ci	R-33ci
Metal buildings <sup>b</sup>	R-19 +	R-19 +	R-19 +	R-19 +	R-30 +	R-30 +
	R-11 LS	R-11 LS	R-11 LS	R-11 LS	R-11 LS	R-11 LS
Attic and other	R-53	R-53	R-53	R-53	R-53	R-53
	Walls, above grade					
Mass <sup>f</sup>	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci
Metal building	R-13 +	R-13+	R-13+	R-13+	R-13+	R-13+
	R-13ci	R-19.5ci	R-19.5ci	R-19.5ci	R-19.5ci	R-19.5ci

NYStretch Energy Code 2020

I

Part 1 – Amendments to 2018 IECC Commercial Provisions

Metal framed	R-13 +	R-13 +	R-13 +	R-13 +	R-13+	R-13+
	R-8.5ci	R-8.5ci	R-11ci	R-11ci	R13.5ci	R14.5ci
Wood framed and other	R-13 +	R-13 +	R-13 +	R-13 +	R-13 +	R-13 +
	R-4.5ci	R-4.5ci	R-9ci	R-9ci	R-9ci	R-9.5ci
	or R-19 +	or R-19 +	or R-19 +	or R-19 +	or R-19 +	or R-19 +
	R-1.5ci	R-1.5ci	R-5ci	R-5ci	R-5ci	R-6ci
		Walls, b	elow grade	•	·····	
Below-grade wall <sup>c</sup>	R-7.5ci	R-10ci	R-7.5ci	R-10ci	R-10ci	R-15ci
		Fl	oors			•
Mass <sup>d</sup>	R-15ci	R-16.7ci	R-15ci	R-16.7ci	R-16.7ci	R-16.7ci
Joist/framing	R-30	R-30 <sup>e</sup>	R-30 <sup>e</sup>	R-30 <sup>e</sup>	R-38	R-38
		Slab-on-g	grade floors	4.		
Unheated slabs	R-15 for	R-15 for	R-15 for	R-15 for	R-15 for 24"	R-15 for
	24" below	24" below	24" below	24" below	below	24" below
Heated slabs <sup>g</sup>	R-20 for	R-20 for	R-20 for	R-20 for	R-20 for 48"	R-20 for
	48" below	48" below	48" below	48" below	below + R-5	48" below
	+ R-5 full	+ R-5 full	+ R-5 full	+ R-5 full	full slab	+ R-5 full
	slab	slab	slab	slab		slab
Opaque doors						
Non-Swinging	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm, 1 pound per square foot =  $4.88 \text{ kg/m}^2$ , 1 pound per cubic foot =  $16 \text{ kg/m}^3$ .

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.

- b. Where using R-value compliance method, a thermal spacer block shall be provided, otherwise use the U-factor compliance method in Table C402.1.4.
- c. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
- d. "Mass floors" shall be in accordance with Section C402.2.3.
- e. Steel floor joist systems shall be insulated to R-38.
- f. "Mass walls" shall be in accordance with Section C402.2.2.
- g. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.
- h. Not applicable to garage doors. See Table C402.1.4.

# 1.46 Addition of New Appendix CC Additional Power Distribution System Packages—Commercial

# Appendix CC Additional power distribution system packages – Commercial

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

### Section CC101 Scope

**CC101.1 General.** These provisions shall be applicable for new construction where additional power distribution system packages are required.

### Section CC102 Additional Power Distribution System Packages

### CC102.1 General (Mandatory). New buildings shall comply with at least one of the following:

- 1. Additional *on-site renewable energy* in accordance with Section CC102.2.
- 2. Electrical energy monitoring in accordance with Section CC102.3.
- 3. Interoperable automated demand-response (AutoDR) infrastructure in accordance with Section CC102.4.
- 4. Electric vehicle charging stations in accordance with Section CC102.5.
- 5. Automatic receptacle controls in accordance with CC102.6.

**CC102.2 On-site renewable energy.** The total minimum rating of *on-site renewable energy* systems shall be one of the following:

- 1. Not less than 1.71 Btu/hr/ft<sup>2</sup> (5.4 w/m<sup>2</sup>) or 0.50 w/ft<sup>2</sup> of conditioned floor area.
- 2. Not less than 3 percent of energy use within the building for mechanical, service hot water heating, and lighting regulated in Chapter 4 [CE].

**CC102.3 Electrical energy monitoring.** Buildings shall comply with Sections CC102.3.1 through CC102.3.4. Buildings shall be equipped to measure, monitor, record, and report electricity consumption data for each end-use category listed in Table CC102.3.1. For buildings with tenants, the end-uses in Table CC102.3.1 shall be separately monitored for the total building load and (excluding shared systems) for each individual tenant.

# Exception:

- 1. Up to 10 percent of the load for each of the end uses shall be allowed to be from other electrical loads.
- 2. Individual tenant spaces that have their own utility services and meters and have less than 5,000 square feet (465 m<sup>2</sup>) of conditioned floor area.

**CC102.3.1 End-use metering categories**. Meters or other approved measurement devices shall be provided to collect energy use data for each end-use category specified in Table CC102.3.1. These meters shall have the capability to collect energy consumption data for the whole building or for each separately metered portion of the building. Where multiple meters are used to measure any end-use category, the data acquisition system shall total all the energy used by that category. Not more than 5 percent of the measured load for each end-use category specified in Table CC102.3.1 shall be from a load not within that category.

LOAD CATEGORY	
HVAC systems	
Interior lighting	
Exterior lighting	
Receptacle circuits	
Total electrical energy	

TABI	LE CC102.3.1	
ENERGY	USE CATEGORIE	S

**CC102.3.2 Meters.** Meters and other measurement devices required by this Section shall be configured to automatically communicate energy consumption data to the data acquisition system required by Section CC102.3.3. Source meters shall be any digital-type meter. Lighting, HVAC, and other building systems that can monitor their energy consumption shall not require meters. Current sensors are an alternative to meters, provided they have a tested accuracy of +/-2 percent. Required metering systems and equipment shall be able to provide not less than hourly data that is fully integrated into the data acquisition system and produce a graphical energy report in accordance with Sections CC102.3.3 and CC102.3.4.

**CC102.3.3 Data acquisition systems.** A data acquisition system shall have the capability to store data from the required meters and other sensing devices for not less than 36 months. The data acquisition system shall be able to store real-time energy consumption data and provide hourly, daily, monthly, and yearly logged data for each end-use category required by Table CC102.3.1.

**CC102.3.4 Graphical energy report.** A permanent reporting mechanism shall be provided in the building that can be accessed by building operation and management personnel. The reporting mechanism shall be able to graphically provide the energy consumption data for each end-use category required by Table CC102.3.1 for not less than every hour, day, month and year for the previous 36 months.

**CC102.4 Interoperable automated demand-response (AutoDR) infrastructure.** The building controls shall be designed with automated demand-response (Auto-DR) infrastructure capable of receiving demand-response requests from the utility, electrical system operator, or third-party DR program provider, and of automatically implementing load adjustments to the HVAC and lighting-systems.

Buildings shall comply with the following:

- 1. HVAC systems shall be programmed to allow automatic centralized demand reduction in response to a signal from a centralized contact or software point.
- 2. HVAC equipment with variable speed control shall be programmed to allow automatic adjustment of the maximum speed of the equipment.
- 3. Lighting systems with central control shall be programmed to allow automatic reduction of total connected lighting power.

**CC102.5 Electric vehicle charging stations.** Not less than two electric vehicle charging stations at minimum 208/240V 40 amp shall be provided on the *building site*.

**CC102.6 Automatic receptacle controls.** The following receptacles shall be automatically controlled in accordance with Section CC102.6.1:

- 1. At least 50 percent of all 125 V, 15- and 20-amp receptacles in all private offices, conference rooms, rooms used primarily for printing and/or copying functions, break rooms, classrooms, and individual workstations.
- 2. At least 25 percent of branch circuit feeders installed for modular furniture not shown on the construction documents.

All controlled receptacles shall be permanently marked to visually differentiate them from uncontrolled receptacles and are to be uniformly distributed throughout the space. Plug-in devices shall not be used to comply with Section CC102.6.1.

### **Exceptions:**

- 1. Receptacles specifically designated for equipment intended for continuous operation (24 hours/day, 365 days/year).
- 2. Spaces where an automatic shutoff would endanger occupant safety or security.

**CC102.6.1 Automatic receptacle control function.** Automatic receptacle controls shall comply with one of the following:

- Automatically turn receptacles off at specific programmed times, and the occupant shall be able to manually override the control device for up to two hours. An independent program schedule shall be provided for controlled areas of not more than 5000 square feet and not more than one floor.
- 2. Be an occupant sensor to automatically turn receptacles off within 20 minutes of all occupants leaving a space.
- 3. Be an automated signal from another control or alarm system to automatically turn receptacles off within 20 minutes of all occupants leaving a space.

# PART 2

# 2 Amendments to ASHRAE 90.1-2016

# 2.1 Addition to Section 3.2 Definitions

**Baseline building source energy:** the annual *source energy* use in units of BTU for a *building* design intended for use as a baseline for rating above-standard design or when using the *performance rating method* as an alternative path for minimum standard compliance in accordance with Section 4.2.1.1.

**On-site electricity generation systems:** systems located at the *building* site that generate electricity, including but not limited to generators, combined heat and power systems, fuel cells, and *on-site renewable energy* systems.

Proposed building source energy: the annual source energy use in units of BTU for a proposed design.

Site Energy: The amount of fuel that is consumed on-site to operate a building.

*Source Energy*: the total amount of primary fuel that is required to operate a building incorporating transmission, delivery, and production losses. Source Energy is calculated by multiplying site energy of each fuel type by the conversion factors in Table 4.2.1.2.

2.2 Amendments to Section 4.2.1.1 New Buildings

### 4.2.1.1 New Buildings

New buildings shall comply with either the provisions of

- a. Section 5, "Building Envelope"; Section 6, "Heating, Ventilating, and Air Conditioning"; Section 7, "Service Water Heating"; Section 8, "Power"; Section 9, "Lighting"; and Section 10, "Other Equipment," or
- b. Section 11, "Energy Cost Budget Method,", or
- c. Appendix G, "Performance Rating Method", using one of the following methods:
  - 1. Performance Cost Index Method. When using Appendix G, the Performance Cost Index (PCI) shall be less than or equal to the Performance Cost Index Target (PCIt) when calculated in accordance with the following:

PCIt = [BBUEC + (BPF<sub>cost</sub> x BBREC)]/BBP

Where

PCI = Performance Cost Index calculated in accordance with Section G1.2.

BBUEC = Baseline Building Unregulated Energy Cost, the portion of the annual energy

cost of a Baseline building design that is due to unregulated energy use.

- BBREC = Baseline *Building* Regulated *Energy* Cost, the portion of the annual *energy* cost of a *Baseline building design* that is due to *regulated energy use*.
- BPF<sub>cost</sub> = Building Performance Factor from Table 4.2.1.1. For building area types not listed in Table 4.2.1.1 use "All others." Where a building has multiple building area types, the required BPF<sub>cost</sub> shall be equal to the area-weighted average of the building area types.
- BBP = Baseline Building Performance.

Regulated *energy* cost shall be calculated by multiplying the total *energy* cost by the ratio of *regulated energy* use to total *energy* use for each *fuel* type. Unregulated *energy* cost shall be calculated by subtracting regulated *energy* cost from total *energy* cost.

 Performance Source Energy Index Method. When using Appendix G, the Performance Source Energy Index (PSEI) shall be less than or equal to the Performance Source Energy Index Target (PSEIt) when calculated in accordance with the following:

Where

- PSEI = Performance Source Energy Index calculated in accordance with Section G1.2
- BBUSE = Baseline building unregulated source energy use in units of BTU, the portion of the annual site energy of a baseline building design that is due to unregulated energy use multiplied by the site to source conversion ratios in Table 4.2.1.2 for each fuel type.
- BBRSE = Baseline building regulated source energy use in units of BTU, the portion of the annual site energy of a baseline building design that is due to regulated energy use multiplied by the site to source conversion ratios in Table 4.2.1.2 for each fuel type.
- BPF<sub>source</sub> = Building Performance Factor from Table 4.2.1.3. For building area types not listed in Table 4.2.1.3 use "All others." Where a building has multiple building area types, the required BPF<sub>source</sub> shall be equal to the area-weighted average of the building area types.
- BBSE = Baseline building source energy.

# 2.3 Replacement of Table 4.2.1.1

Building Performance Factor

### Table 4.2.1.1 Building Performance Factor (Cost) (BPFcost)

Building Area Type	4A	5A	6A	
Office	.54	.54	».55	
Retail	.45	.42	.44	
School	.45	.46	.46	
Hotel/motel	.62	.56	.56	
Multifamily	.67	.67	.64	
Healthcare/hospital	.54	.54	.51	
Restaurant	.56	.55	.55	
Warehouse	.42	.42	.46	
All others	.53	.52	.52	

# 2.4 Addition of Table 4.2.1.2

Site to Source Energy Conversion Ratios

### Table 4.2.1.2 Site to Source Energy Conversion Ratios

Energy Type	New York Ratio
Electricity (Grid Purchase)	2.55
Electricity (On-site Renewable Energy Installation)	1.00
Natural Gas	1.05
Fuel Oil	1.01
Propane & Liquid Propane	1.01
Steam	1.20
Hot Water	1.20
Chilled Water, Coal, Wood, Other	1.00

# 2.5 Addition of Table 4.2.1.3

Building Performance Factor (Source) (BPF<sub>source</sub>)

Table 4.2.1.3 Building Performance Factor (BPF<sub>source</sub>)

Building Area Type	4A	5A	6A
Office	.55	.55	.56
Retail	.45	.42	.43
School	.45	.45	.45
Hotel/motel	.62	.56	.54
Multifamily	.68	.68	.65
Healthcare/hospital	,56	.56	.54
Restaurant	<sub>2</sub> .63	.64	.63
Warehouse	.44	.46	.49
All others	.55	.54	.54

2.6 Addition of New Section 5.2.3

Additional Requirements to Comply with Section 11 and Appendix G

### 5.2.3 Additional Requirements to Comply with Section 11 and Appendix G

The building envelope in new buildings 50,000 square feet and greater shall comply with either:

- 1. Section 5.5, "Prescriptive Building Envelope Option," or
- 2. An envelope performance factor shall be calculated in accordance with 90.1 Appendix C, and buildings shall comply with one of the following:
  - i. For multifamily, hotel/motel and dormitory building area types, the margin by which the *proposed envelope performance factor* exceeds the *base envelope performance factor* shall not be greater than 15 percent. For compliance with this requirement, the *base envelope performance factor* shall be calculated using metal framing operable windows. In *buildings* with window area accounting for 40 percent or more of the *gross wall* area, the SHGC of the *vertical fenestration* on east and west oriented façade may be reduced by the following multiplier to account for the permanent site shading from existing buildings or infrastructure.

M <sub>West</sub> = 0.18 + 0.33/WWR M <sub>East</sub> = 0.35 + 0.26/WWR Where: M <sub>West</sub> = SHGC multiplier for the West façade M <sub>East</sub> = SHGC multiplier for the East façade WWR = the ratio of the proposed *vertical fenestration* area to the *gross wall* area in consistent units.

The multiplier may be applied to the rated SHGC of the *vertical fenestration* which has at least 50 percent of the area located directly opposite of the shading surfaces and no higher from the street level than the difference between the shading surface height and the shading surface distance from the façade. *Orientation* must be determined following Section 5.5.4.5, Fenestration Orientation.

- For all other *building* area types, the margin by which the proposed *envelope performance* factor exceeds the base envelope performance factor shall be not greater than 7 percent.
   For compliance with this requirement, the base envelope performance factor shall be calculated using metal framing fixed windows.
- iii. For mixed-use *buildings* the margin shall be calculated as the *gross wall area*-weighted average of i and ii.

# 2.7 Addition of New Section 5.4.1.1 Continuous Insulation

### 5.4.1.1 Continuous Insulation

In new construction, structural elements of balconies and parapets that penetrate the *building envelope*, shall comply with one of the following:

- 1. Structural elements penetrating the *building* thermal *envelope* shall be insulated with *continuous insulation* having a minimum thermal resistance of R-3.
- 2. Structural elements of penetrations of the *building* thermal *envelope* shall incorporate a minimum R-3 thermal break where the structural element penetrates the *building* thermal *envelope*.
- 2.8 Amendments to Section 5.4.3.1.3 Testing, Acceptable Materials, and Assemblies

### 5.4.3.1.3 Testing, Acceptable Materials, and Assemblies

The *building* shall comply with whole-*building* pressurization testing in accordance with Section 5.4.3.1.3(a) or with the *continuous air barrier* requirements in Section 5.4.3.1.3(b) or 5.4.3.1.3(c). New *buildings* not less than 25,000 square feet and not greater than 50,000 square feet, and less than or equal to 75 feet in height, must show compliance through testing in accordance with Section 5.4.3.1.3(a).

### The remainder of 5.4.3.1.3 is unchanged.

2.9 Amendments to Section 5.5.3 Opague Areas

### 5.5.3 Opaque Areas.

For all *opaque* surfaces except *doors*, compliance shall be demonstrated by one of the following two methods:

- a. Minimum rated *R-value* of insulation for the *thermal resistance* of the added insulation in framing cavities and *continuous insulation* only. Specifications listed in Normative Appendix A for each *class of construction* shall be used to determine compliance.
- b. Maximum *U*-factor, *C*-factor, or *F*-factor for the entire assembly. The values for typical *construction* assemblies listed in Normative Appendix A shall be used to determine compliance.

### **Exceptions to 5.5.3**

1. For assemblies significantly different than those in Appendix A, calculations shall be performed in accordance with the procedures required in Appendix A.

- 2. For multiple assemblies within a single *class of construction* for a single *space-conditioning category*, compliance shall be shown for either (a) the most restrictive requirement or (b) an area-weighted average *U-factor*, *C-factor*, *or F-factor*.
- 3. When the total area of penetrations from mechanical equipment listed in Table 6.8.1-4 exceeds 1 percent of the *opaque above-grade wall* area, the mechanical equipment penetration area shall be calculated as a separate wall assembly with a default *U-factor* of 0.5, and compliance shall be shown with method b. Where mechanical equipment has been tested in accordance with testing standards, approved by the *authority having jurisdiction*, the mechanical equipment penetration area may be calculated as a separate wall assembly with the *U-factor* as determined by such test.

# 2.10 Amendments to Section 5.6.1.1 Subsection to 5.6 Building Envelope Trade-Off Option

### 5.6.1.1

All components of the *building envelope* shown on architectural drawings or installed in *existing buildings* shall be modeled in the *proposed design*. The *simulation program* model *fenestration* and *opaque building* envelope types and area shall be consistent with the *construction documents*. Any *building envelope* assembly that covers less than 5 percent of the total area of that assembly type (e.g., *exterior walls*) need not be separately described, provided it is similar to an assembly being modeled. If not separately described, the area of a *building envelope* assembly shall be added to the area of an assembly of that same type with the same *orientation* and thermal properties. When the total area of penetrations from mechanical equipment listed in Table 6.8.1-4 exceeds 1 percent of the *opaque above-grade wall* area, the mechanical equipment penetration area shall be calculated as a separate wall assembly with a default *U-factor* of 0.5.

### Exception to 5.6.1.1

Where mechanical equipment has been tested in accordance with testing standards approved by the *authority having jurisdiction*, the mechanical equipment penetration area may be calculated as a separate wall assembly with the *U-factor* as determined by such test.

# 2.11 Amendments to Section 6.5.3.1.1 Allowable Fan Horsepower

### 6.5.3.1.1 Allowable Fan Horsepower.

Each *HVAC system* having a total *fan system motor nameplate horsepower* exceeding 5 hp at *fan system design conditions* shall not exceed the allowable *fan system motor nameplate horsepower* (Option 1) or fan *system* bhp (Option 2) as shown in Table 6.5.3.1-1. This includes supply fans, return/relief fans, exhaust fans, and fan-powered *terminal* units associated with *systems* providing heating or cooling capability that operate at *fan system design conditions*. Single-zone *VAV systems* shall comply with the constant-volume fan power limitation.

### Exceptions to 6.5.3.1.1

- 1. Hospital, vivarium, and laboratory *systems* that use flow *control devices* on exhaust and/or return to maintain *space* pressure relationships necessary for occupant health and safety or environmental *control* may use variable-volume fan power limitation.
- 2. Individual exhaust fans with motor nameplate horsepower of 1 hp or less.
- 3. Fans supplying air to active chilled beams.

# 2.12 Amendments to Table 6.5.3.1-1 Fan Power Limitation

### Table 6.5.3.1-1 Fan Power Limitation

	Limit	Constant volume	Variable volume		
Option 1: Fan system					
motor nameplate hp	Allowable nameplate motor hp	hp ≤ CFMs*0.0009	hp ≤ CFMs* 0.0011		
Option 2: Fan system bhp	Allowable fan system bhp	bhp ≤ CFMs X 0.00088 + A	bhp ≤ CFMs X 0.0010 + A		
For SI: 1 bhp = 735.5 W, 1 hp = 745.5 W, 1 cfm = 0.4719 L/S Where: CFM <sub>s</sub> = The maximum design supply airflow rate to conditioned spaces served by the system in cubic feet per minute. hp = The maximum combined motor nameplate horsepower. Bhp = The maximum combined fan brake horsepower. A = Sum of IPD X CFM <sub>2</sub> (4131)					
Where: PD = Each applicable pressure drop adjustment from Table 6.5.3.1-2 in in. of water					
$CFM_{0}$ = The design airflow through each applicable device from Table 6.5.3.1-2 in cubic feet per minute					

# 2.13 Amendments to Section 6.5.6.1 Exhaust Air Energy Recovery

### 6.5.6.1 Exhaust Air Energy Recovery.

Each fan *system* shall have an *energy* recovery *system* when the design supply fan airflow rate exceeds the value listed in Tables 6.5.6.1-1 and 6.5.6.1-2, based on the climate zone and percentage of *outdoor air* at design airflow conditions. Table 6.5.6.1-1 shall be used for all *ventilation systems* that operate less than 8,000 hours per year, and Table 6.5.6.1-2 shall be used for all ventilation systems that operate 8,000 or more hours per year.

*Energy* recovery *systems* required by this section shall result in an *enthalpy recovery ratio* of at least 50 percent. A 50 percent *enthalpy recovery ratio* shall mean a change in the enthalpy of the *outdoor air* supply equal to 50 percent of the difference between the *outdoor air* and entering exhaust air enthalpies at *design conditions*. Provision shall be made to bypass or *control* the *energy* recovery *system* to permit *air economizer* operation as required by Section 6.5.1.1.

### Exceptions

- 1. Laboratory systems meeting Section 6.5.7.3.
- 2. Systems serving spaces that are not cooled and that are heated to less than 60°F.

- 3. Where more than 60 percent of the *outdoor air* heating *energy* is provided from *site*recovered energy or site-solar energy.
- 4. Heating *energy* recovery in Climate Zones 0, 1, and 2.
- 5. Cooling *energy* recovery in Climate Zones 3C, 4C, 5B, 5C, 6B, 7, and 8.
- 6. Where the largest source of air exhausted at a single location at the building exterior is less than 75 percent of the design ventilation outdoor air flow rate, multiple exhaust fans or outlets located within a 30-foot radius from the outdoor air supply unit shall be considered a single exhaust location.
- 7. *Systems* requiring dehumidification that employ *energy* recovery in series with the cooling coil.
- 8. *Systems* expected to operate less than 20 hours per week at the *outdoor air* percentage covered by Table 6.5.6.1-1.
- 2.14 Addition of New Section 10.4.3.5 Power Conversion System

### 10.4.3.5 Power Conversion System

New traction elevators with a rise of 75 feet or more in new buildings shall have a power conversion system that complies with Sections 10.4.3.5.1 through 10.4.3.5.3.

#### 10.4.3.5.1 Motor

Induction motors with a Class IE2 efficiency ratings, as defined by IEC EN 60034-30, or alternative technologies, such as permanent magnet synchronous motors that have equal or better efficiency, shall be used.

### 10.4.3.5.2 Transmission

Transmissions shall not reduce the efficiency of the combined motor/transmission for the Class IE2 motor for elevators with capacities below 4,000 lbs. Gearless machines shall be assumed to have a 100 percent transmission efficiency.

#### 10.4.3.5.3 Drive

Potential energy released during motion shall be recovered with a regenerative drive that supplies electrical energy to the building electrical system.

# 2.15 Addition of New Section 10.4.6

**Commercial Kitchen Equipment** 

### **10.4.6 Commercial Kitchen Equipment**

Commercial kitchen equipment shall comply with the minimum efficiency requirements of Tables 10.4.6-1 through Table 10.4.6-5.

### Table 10.4.6-1: Minimum Efficiency Requirements: Commercial Fryers

	Heavy-Load Cooking Energy Efficiency	Idle Energy Rate	Test Procedure
Standard Open Deep-Fat Gas Fryers	≥50%	≤ 9,000 Btu/hr	ACTNA Chandend F12C1 17
Large Vat Open Deep-Fat Gas Fryers	≥ 50%	≤ 12,000 Btu/hr	ASTIVI Standard F1361-17
Standard Open Deep-Fat Electric Fryers	≥ 83%	≤ 800 watts	
Large Vat Open Deep-Fat Electric Fryers	≥ 80%	≤ 1,100 watts	ASTIVI Standard F2144-17

### Table 10.4.6-2: Minimum Efficiency Requirements: Commercial Hot Food Holding Cabinets

Product Interior Volume (Cubic Feet)	Maximum Idle Energy Consumption Rate (Watts)	Test Procedure
0 < V < 13	≤ 21.5 V	
13 ≤ V < 28	≤ 2.0 V + 254.0	ASTM Standard F2140-11
28 ≤ V	≤ 3.8 V + 203.5	

### Table 10.4.6-3: Minimum Efficiency Requirements: Commercial Steam Cookers

Fuel Type	Pan Capacity	Cooking Energy Efficiency <sup>a</sup>	Idle Rate	Test Procedure
	3-pan	50%	400 watts	
	4-pan	50%	530 watts	
	5-pan	50%	670 watts	
	6-pan and larger	50%	800 watts	ASTM Standard
Gas Steam	3-pan	38%	6,250 Btu/h	F1484-18
	4-pan	38%	8,350 Btu/h	
	5-pan	38%	10,400 Btu/h	
	6-pan and larger	38%	12,500 Btu/h	

a. Cooking Energy Efficiency is based on heavy load (potato) cooking capacity

	High Temp Efficiency		Low Temp Efficiency		Tost Procedure
Machine Type	Requirements		Requirements		
	Idle Energy	Water	Idle Energy	Water	restrictedure
	Rate <sup>a</sup>	Consumption <sup>b</sup>	Rate <sup>a</sup>	Consumption <sup>b</sup>	
Under Counter	≤ 0.50 kW	≤ 0.86 GPR	≤ 0.50 kW	≤ 1.19 GPR	
Stationary Single	≤ 0.70 kW	≤ 0.89 GPR	≤ 0.60 kW	≤ 1.18 GPR	
Tank Door					
Pot, Pan, and	≤ 1.20 kW	≤ 0.58 GPSF	≤ 1.00 kW	≤ 0.58 GPSF	
Utensil					ASTM Standard
Single Tank	≤ 1.50 kW	≤ 0.70 GPR	≤ 1.50 kW	≤ 0.79 GPR	F1696-18
Conveyor					
Multiple Tank	≤ 2.25 kW	≤ 0.54 GPR	≤ 2.00 kW	≤ 0.54 GPR	ASTM Standard
Conveyor					F1920-15
Single Tank	Reported	GPH ≤ 2.975x +	Reported	GPH ≤ 2.975x +	
Flight Type		55.00		55.00	
Multiple Tank	Reported	GPH ≤ 4.96x +	Reported	GPH ≤ 4.96x +	
Flight Type		17.00		17.00	

Table 10.4.6-4: Minimum Efficiency Requirements: Commercial Dishwashers

 a. Idle results shall be measured with the door closed and represent the total idle energy consumed by the machine including all tank heater(s) and controls. Booster heater (internal or external) energy consumption should not be part of this measurement unless it cannot be separately monitored per US EPA Energy Star Commercial Dishwasher Specification Version 2.0

b. GPR = gallons per rack; GPSF = gallons per square foot of rack; GPH = gallons per hour; x = sf of conveyor belt (i.e., W\*L)/min (maximum conveyor speed).

Fuel Type	Classification	Idle Rate	Cooking-Energy Efficiency, %	Test Procedure			
	Convection Ovens						
Gas	Full-Size	≤ 12,000 Btu/h	≥ 46				
Flootrio	Half-Size	≤ 1.0 Btu/h	> 71	ASTM F1496 - 13			
Electric	Full-Size	≤ 1.60 Btu/h	271				
	Combination Ovens						
6	Steam Mode	≤ 200P <sup>a</sup> +6,511 Btu/h	≥ 41				
Gas	Convection Mode	≤ 150Pª +5,425 Btu/h	≥ 56	ASTM F2861 - 17			
Ele stale	Steam Mode	≤ 0.133P <sup>a</sup> +0.6400 kW	≥ 55				
Electric	Convection Mode	≤ 0.080P <sup>a</sup> +0.4989 kW	≥ 76				
	Rack Ovens						
6	Single	≤ 25,000 Btu/h	≥ 48	ACTN4 F2002 19			
Gas	Double	≤ 30,000 Btu/h	≥ 52	ASTIVI F2093 - 18			

Table 10.4.6-5: Minimum Efficiency Requirements: Commercial Ovens

a. P = Pan Capacity: The number of steam table pans the combination oven is able to accommodate as per the ASTM F – 1495 – 05 standard specification.

# 2.16 Addition of New Section 10.4.7 Electric Vehicle Charging Station Capable

### 10.4.7 Electric vehicle charging station capable.

New parking garages and new parking lots powered by the energy services for a building, and with 10 or more parking spaces, shall provide either:

- 1. Panel capacity and conduit for the future installation of minimum 208/240V 40-amp outlets for 5 percent of the total parking spaces and not less than two parking spaces; or
- 2. Minimum 208/240V 40-amp outlets for 5 percent of the total parking spaces and not less than two parking spaces.
- 2.17 Addition of New Section 10.4.8 Solar-Ready Zone

### 10.4.8 Solar-ready zone (Mandatory)

Comply with the provisions of Appendix CA of 2018 IECC (as amended).

2.18 Amendments to Section 11.2 Compliance

### 11.2 Compliance.

Compliance with Section 11 will be achieved if

- a. All requirements of Sections 5.4, 6.4, 7.4, 8.4, 9.4, and 10.4, and Section C408 and Appendix CC (if mandated by local ordinance) of the 2018 IECC (as amended) are met;
- b. The *design energy cost*, as calculated in Section 11.5, does not exceed the building *energy use budget*, as calculated by the *simulation program* described in Section 11.4, and
- c. The *energy efficiency* level of components specified in the *building* design meet or exceed the *efficiency* levels used to calculate the design energy cost; and
- d. In new buildings 50,000 square feet and greater, an envelope performance factor shall be calculated in accordance with 90.1 Appendix C, and buildings shall comply with one of the following:
  - i. For multifamily, hotel/motel and dormitory building area types, the margin by which the *proposed envelope performance factor* exceeds the *base envelope performance factor* shall not be greater than 15 percent. For compliance with this requirement, the *base envelope performance factor* shall be calculated using metal framing operable windows. In buildings with window area accounting for 40 percent or more of the wall area, the SHGC of the *vertical fenestration* on east and west oriented façade may be reduced by the following multiplier to account for the permanent site shading from existing buildings or infrastructure.

M <sub>West</sub> = 0.18 + 0.33/WWR M <sub>East</sub> = 0.35 + 0.26/WWR Where: M <sub>West</sub> = SHGC multiplier for the West facade M <sub>East</sub> = SHGC multiplier for the East facade WWR = the ratio of the proposed *vertical fenestration* area to the *gross wall area* in consistent units.

The multiplier may be applied to the rated SHGC of the *vertical fenestration* which has at least 50 percent of the area located directly opposite of the shading surfaces and no higher from the street level than the difference between the shading surface height and the shading surface distance from the façade. Orientation must be determined following Section 5.5.4.5.

- ii. For all other buildings area types, the margin by which the proposed *envelope performance factor* exceeds the *base envelope performance factor* shall be not greater than 7 percent. For compliance with this requirement, the *base envelope performance factor* shall be calculated using metal framing fixed windows.
- iii. For mixed-use buildings, the margin shall be calculated as the *gross wall area*-weighted average of options *a* and *b*.

# 2.19 Amendments to Section 11.4.3.2 Annual Energy Costs

### 11.4.3.2 Annual Energy Costs.

The design energy cost and energy cost budget shall be determined using rates for purchased energy (such as electricity, gas, oil, propane, steam, and chilled water) that are approved by the adopting authority. Where on-site renewable energy or site-recovered energy is used, the budget building design shall be based on the energy source used as the backup energy source, or electricity if no backup energy source has been specified. Where the proposed design includes electricity generated from sources other than on-site renewable energy, the baseline design shall include the same generation system.
#### 2.20 Amendments to Table 11.5.1

Modeling Requirements for Calculating Design Energy Cost and Energy Cost Budget

Pro	posed Design (Column A)	Budget Building Design (Column B)
Des	ign Energy Cost (DEC)	Energy Cost Budget (ECB)
1. D	esign Model	
a. b. c.	The simulation model of the proposed design shall be consistent with the design documents, including proper accounting of fenestration and opaque envelope types and area; interior lighting power and controls; HVAC system types, sizes, and controls; and service water-heating systems and controls. All conditioned spaces in the proposed design shall be simulated as being both heated and cooled, even if no cooling or heating system is being installed. Temperature and humidity control set points and schedules, as well as temperature control throttling range, shall be the same for proposed design and baseline building design. When the Energy Cost Budget Method is applied to buildings in which energy-related features have not yet been designed (e.g., a lighting system), those yet-to-be- designed features shall be described in the proposed design so that they minimally comply with applicable mandatory and prescriptive requirements from Sections 5 through 10. Where the space classification for a building is not known, the building shall be categorized as an office building.	The budget building design shall be developed by modifying the proposed design as described in this table. Except as specifically instructed in this table, all building systems and equipment shall be modeled identically in the budget building design and proposed design.
2. A	dditions and Alterations	
It is a mod all of a.	acceptable to demonstrate compliance using building els that exclude parts of the <i>existing building</i> , provided the following conditions are met: Work to be performed under the current permit application in excluded parts of the <i>building</i> shall meet the requirements of Sections 5 through 10.	Same as <i>proposed design</i> .
b.	Excluded parts of the <i>building</i> are served by <i>HVAC systems</i> that are entirely separate from those serving parts of the <i>building</i> that are included in the <i>building</i> model.	
C.	Design <i>space</i> temperature and <i>HVAC system</i> operating <i>set points</i> and schedules on either side of the boundary between included and excluded parts of the <i>building</i> are identical.	
d.	If a declining block or similar utility rate is being used in the analysis and the excluded and included parts of the <i>building</i> are on the same utility meter, the rate shall reflect the utility block or rate for the <i>building</i> plus the addition	

Table 11.5.1 Modeling Requirements	or Calculating Design Energy	y Cost and Energy Cost (Continued)
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Proposed Design (Column A)	Budget Building Design (Column B)			
Design Energy Cost (DEC)	Energy Cost Budget (ECB)			
3. Space Use Classification	The same and the second second second second second			
The <i>building</i> area type or <i>space</i> type classifications shall be chosen in accordance with Section 9.5.1 or 9.6.1. The user or designer shall specify the <i>space</i> use classifications using either the <i>building</i> area type or <i>space</i> type categories but shall not combine the two types of categories within a single permit application. More than one <i>building</i> area type category may be used for a <i>building</i> if it is a mixed-use facility.	Same as <i>proposed design</i> .			
4. Schedules				
The schedule types listed in Section 11.4.1.1(b) shall be required input. The schedules shall be typical of the <i>proposed design</i> as determined by the designer and approved by the <i>authority having jurisdiction</i> . Required schedules shall be identical for the <i>proposed design</i> and <i>budget building design</i> .	Same as proposed design.			

hoposea besign (column A)	budget bunding besign (column b)				
Design Energy Cost (DEC)	Energy Cost Budget (ECB)				
5. Building Envelope					
<ul> <li>All components of the <i>building envelope</i> in the <i>proposed design</i> shall be modeled as shown on architectural drawings or as installed for <i>existing building envelopes</i>.</li> <li>Exceptions: The following <i>building</i> elements are permitted to differ from architectural drawings.</li> <li>Any <i>building envelope</i> assembly that covers less than 5 percent of the total area of that assembly type (e.g., exterior walls) need not be separately described. If not separately described, the area of a <i>building envelope</i> assembly must be added to the area of the adjacent assembly of that same type. When the total area of penetrations from mechanical equipment listed in Table 6.8.1-4 exceeds 1 percent of the <i>opaque</i> above-grade wall area, the mechanical equipment penetration area shall be calculated as a separate wall assembly with a default Uffactor of 0.5. Where mechanical equipment has been tested in accordance with testing standards approved by the <i>authority having jurisdiction</i>, the mechanical equipment penetration area may be calculated as a separate wall assembly with the U-factor as determined by such test.</li> <li>Exterior surfaces whose azimuth <i>orientation</i> and tilt differ by no more than 45 degrees and are otherwise the same may be described as either a single surface or by using multipliers.</li> <li>The exterior <i>roof</i> surface shall be modeled using the aged solar <i>reflectance</i> and thermal <i>emittance</i> determined in accordance with Section 5.5.3.1.1(a). Where aged test data are unavailable, the <i>roof</i> surface shall be modeled with a solar <i>reflectance</i> of 0.30 and a thermal <i>emittance</i> of 0.90.</li> <li>Manually operated <i>fenestration</i> shading devices, such as fins, overhangs, and lightshelves, shall be modeled.</li> </ul>	<ul> <li>The budget building design shall have identical conditioned floor area and identical exterior dimensions and orientations as the proposed design, except as follows:</li> <li>a. Opaque assemblies, such as roof, floors, doors, and walls, shall be modeled as having the same heat capacity as the proposed design but with the minimum U-factor required in Table C402.1.4 for new buildings or additions and Section C503.3 for alterations. Opaque assemblies in semiheated spaces shall be modeled as having the same heat capacity as the proposed design but with the minimum U-factor required in Section 5.5.</li> <li>b. The exterior roof surfaces shall be modeled with a solar reflectance and thermal emittance as required in Section 5.5.3.1.1(a). All other roofs, including roofs exempted from the requirements in Section 5.5.3.1.1, shall be modeled the same as the proposed design.</li> <li>c. No shading projections are to be modeled; fenestration shall be assumed to be flush with the wall or roof. If the fenestration area for new buildings or additions exceeds the maximum allowed by Section 5.5.4.2, the area shall be reduced proportionally along each exposure until the limit set in Section 5.5.4.5 then the energy cost budget shall be generated by simulating the budget building design with its actual orientation and again after rotaing the entire budget building design 90, 180, and 270 degrees and then averaging the results. Fenestration U-factor shall be equal to the criteria from C402.4 for the appropriate climate, and the SHGC shall be equal to the criteria from C402.4 for the appropriate climate. For portions of those tables where there are no SHGC requirements, the SHGC shall be equal to that determined in accordance with Section C3.6(c). The VT shall be equal to that determined in accordance with Section C3.6(c). The VT shall be equal to the adtect of building envelope assumptions for the existing building in the budget building design shall reflect the limitations on area, U-factor, and SHGC as described in Sectio</li></ul>				

Proposed Design (Column A)	Budget Building Design (Column B)
Design Energy Cost (DEC)	Energy Cost Budget (ECB)
6. Lighting	
<ul> <li>Lighting power in the proposed design shall be determined as follows:</li> <li>a. Where a complete <i>lighting system</i> exists, the actual lighting power for each <i>thermal</i> block shall be used in the model.</li> <li>b. Where a <i>lighting system</i> has been designed, lighting power shall be determined in accordance with Sections 9.1.3 and 9.1.4.</li> <li>c. Where no lighting exists or is specified, lighting power shall be determined in accordance with the <i>Building</i> Area Method for the appropriate <i>building area type</i>.</li> <li>d. <i>Lighting system</i> power shall include all <i>lighting system</i> components shown or provided for on plans (including <i>lamps</i>, <i>ballasts</i>, task <i>fixtures</i>, and furniture-mounted <i>fixtures</i>).</li> <li>e. The lighting schedules in the <i>proposed design</i> shall reflect the mandatory <i>automatic</i> lighting control requirements in Section 9.4.1 (e.g., programmable <i>controls</i> or occupancy sensors)</li> <li>Exception: Automatic daylighting controls required by Section 9.4.1 shall be modeled directly in the proposed design or through schedule adjustments determined by a daylighting analysis approved by the building official.</li> <li>f. Automatic lighting <i>controls</i> included in the <i>proposed design</i> but not required by Section 9.4.1 may be modeled directly in the <i>building</i> simulation or be modeled in the building simulation through schedule adjustments determined by a separate analysis approved by the <i>authority having jurisdiction</i>. As an alternative to modeling such lighting controls, the <i>proposed design</i> lighting power may be reduced for each <i>luminaire</i> under <i>control</i> by dividing the rated lighting power of the <i>luminaire</i> by the factor (1 + ΣCF), where ΣCF indicates the sum of all applicable <i>control</i> factors (CF) per Section 9.6.3 and Table 9.6.3.</li> </ul>	<ul> <li>a. Lighting power in the <i>budget building design</i> shall be determined using the same categorization procedure (<i>Building</i> Area Method or Space-by-Space Method) and categories as the <i>proposed design</i> with lighting power set equal to the maximum allowed for the corresponding method and category in Tables C405.3.2(1) and C405.3.2(2). Additional interior lighting power for nonmandatory <i>controls</i> allowed under Section 9.6.3 shall not be included in the <i>budget building design</i>.</li> <li>b. Power for <i>fixtures</i> not included in the lighting power calculation shall be modeled identically in the <i>proposed design</i> and <i>budget building design</i>.</li> <li>c. Mandatory <i>automatic</i> lighting <i>controls</i> required by Section 9.4.1 shall be modeled the same as the <i>proposed design</i>.</li> </ul>
7. Thermal Blocks – HVAC Zones Designed	Same as proposed design
Where HVAC zones are defined on HVAC design drawings, each HVAC zone shall be modeled as a separate thermal block.	same as proposed design.
<ul> <li>Exceptions: Different HVAC zones may be combined to create a single thermal block or identical thermal blocks to which multipliers are applied, provided all of the following conditions are met:</li> <li>1. The space-use classification is the same throughout the thermal block.</li> </ul>	
<ol> <li>All HVAC zones in the thermal block that are adjacent to glazed exterior walls and glazed semiexterior walls face the same orientation or their orientations are within 45 degrees of each other.</li> <li>All of the zones are senied by the same HVAC system or by the</li> </ol>	
same kind of HVAC system.	

Proposed Design (Column A)	Budget Building Design (Column B)				
Design Energy Cost (DEC)	Energy Cost Budget (ECB)				
8. Thermal Blocks – HVAC Zones Not Designed					
<ul> <li>Where the <i>HVAC zones</i> and <i>systems</i> have not yet been designed, <i>thermal blocks</i> shall be defined based on similar internal load densities, occupancy, lighting, thermal and space temperature schedules, and in combination with the following:</li> <li>a. Separate <i>thermal blocks</i> shall be assumed for interior and perimeter <i>spaces</i>. Interior <i>spaces</i> shall be those located more than 15 ft from an <i>exterior wall</i> or <i>semiexterior</i> wall. Perimeter <i>spaces</i> shall be those located closer than 15 ft from an <i>exterior wall</i> or <i>semiexterior wall</i>. A separate thermal zone does not need to be modeled for areas adjacent to <i>semiexterior walls</i> that separate <i>semiheated space</i> from <i>conditioned space</i>.</li> <li>b. Separate <i>thermal blocks</i> shall be assumed for <i>spaces</i> adjacent to glazed <i>exterior walls</i> or glazed <i>semiexterior walls</i>; a separate zone shall be provided for each <i>orientation</i>, except that orientations that differ by no more than 45 degrees may be considered to be the same <i>orientation</i>. Each zone shall include all <i>floor</i> area that is 15 ft or less from a glazed perimeter <i>walls</i> having more than one <i>orientation</i> shall be divided proportionately between zones.</li> <li>c. Separate <i>thermal blocks</i> shall be assumed for <i>spaces</i> having <i>floors</i> that are in contact with the ground or exposed to ambient conditions from zones that do not share these features.</li> <li><b>9</b>. <i>Thermal Blocks</i> – Multifamily <i>Residential Buildings</i></li> </ul>	Same as proposed design.				
9. mermu blocks - Multhaming Residential Buildings					
<i>Residential spaces</i> shall be modeled using one <i>thermal block</i> per <i>space</i> except that those facing the same orientations may be combined into one <i>thermal block</i> . Corner units and units with <i>roof</i> or <i>floor</i> loads shall only be combined with units sharing these features.	Same as proposed design.				

Proposed Design (Column A)		Budget Building Design (Column B)				
D	esign Energy Cost (DEC)	Energy Cost Budget (ECB)				
10	D. HVAC Systems					
Th su de a.	the HVAC system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed esign shall be determined as follows: Where a complete HVAC system exists, the model shall reflect the actual system type using actual component capacities and efficiencies.	The <i>HVAC system</i> type and related performance parameters for the <i>budget building design</i> shall be determined from Figure 11.5.2, the <i>system</i> descriptions in Table 11.5.2-1 and accompanying notes, and in accord with rules specified in Section 11.5.2(a) through 11.5.2(k).				
b.	Where an <i>HVAC system</i> has been designed, the HVAC model shall be consistent with design documents. Mechanical <i>equipment</i> efficiencies shall be adjusted from actual <i>design conditions</i> to the standard rating conditions specified in Section 6.4.1 if required by the simulation model. Where <i>efficiency</i> ratings include supply fan energy, the <i>efficiency</i> rating shall be adjusted to remove the supply fan <i>energy</i> from the <i>efficiency</i> rating in the <i>budget building design</i> . The equations in Section 11.5.2 shall not be used in the <i>proposed</i> <i>design</i> . The <i>proposed design HVAC system</i> shall be modeled using <i>manufacturers'</i> full- and part- load data for the <i>HVAC system</i> without fan power.					
c.	Where no heating system exists, or no heating system has been specified, the heating system shall be modeled as fossil fuel. The system characteristics shall be identical to the system modeled in the budget building design.					
d.	Where no cooling system exists, or no cooling system has been specified, the cooling system shall be modeled as an air-cooled single-zone system, one unit per thermal block. The system characteristics shall be identical to the system modeled in the budget building design.					

Proposed Design (Column A)	Budget Building Design (Column B)			
Design Energy Cost (DEC)	Energy Cost Budget (ECB)			
11. Service Water-Heating Systems				
<ul> <li>The service water-heating system type and all related performance parameters, such as equipment capacities and efficiencies, in the proposed design shall be determined as follows:</li> <li>a. Where a complete service water-heating system exists, the model shall reflect the actual system type using actual component capacities and efficiencies.</li> <li>b. Where a service water-heating system has been designed, the service water-heating model shall be consistent with design documents.</li> <li>c. Where no service water-heating system exists or is specified, no service water heating shall be modeled.</li> </ul>	<ul> <li>The service water-heating system type in the budget building design shall be identical to the proposed design. The service water-heating system performance of the budget building design shall meet the requirements of Section C404.2, and where applicable the requirements of C404.2.1 and C404.2.2, without exception.</li> <li>Exceptions: <ol> <li>If the service water heating system type is not listed in Table C404.2, it shall be identical to the proposed design.</li> <li>Where Section 7.5.1 or 7.5.2 applies, the boiler shall be split into a separate space-heating boiler and hot-water heater.</li> <li>For 24-hour facilities that meet the prescriptive criteria for use of condenser heat recovery systems described in Section 6.5.6.2, a system meeting the requirements of that section shall be included in the baseline building design, regardless of the exceptions to Section 6.5.6.2. If a condenser heat recovery system meeting the requirement described in Section 6.5.6.2 cannot be modeled, the requirement for including such a system in the actual building shall be met as a prescriptive requirement in accordance with Section 6.5.6.2 and no heat recovery system shall be included in the</li> </ol> </li> </ul>			
12. Miscellaneous Loads				
Receptacle, motor, and <i>process loads</i> shall be modeled and estimated based on the <i>building area type</i> or <i>space</i> type category and shall be assumed to be identical in the <i>proposed</i> and <i>budget building designs</i> . These loads shall be included in simulations of the <i>building</i> and shall be included when calculating the <i>energy cost budget</i> and <i>design energy cost</i> . All end-use load components within and associated with the <i>building</i> shall be modeled, unless specifically excluded by Sections 13 and 14 of Table 11.5.1, including exhaust fans, parking garage <i>ventilation</i> fans, exterior <i>building</i> lighting, swimming <i>pool</i> heaters and pumps, elevators and escalators, refrigeration <i>equipment</i> , and cooking <i>equipment</i> .	Receptacle, motor, and <i>process loads</i> shall be modeled and estimated based on the <i>building area type</i> or <i>space</i> type category and shall be assumed to be identical in the <i>proposed design</i> and <i>budget building design</i> . These loads shall be included in simulations of the <i>building</i> and shall be included when calculating the <i>energy cost</i> <i>budget</i> and <i>design energy cost</i> . All end-use load components within and associated with the <i>building</i> shall be modeled, unless specifically excluded by Sections 13 and 14 of Table 11.5.1, including exhaust fans, parking garage <i>ventilation</i> fans, exterior <i>building</i> lighting, swimming <i>pool</i> heaters and pumps, elevators and escalators, refrigeration <i>equipment</i> , and cooking <i>equipment</i> .			

Proposed Design (Column A)	Budget Building Design (Column B)			
Design Energy Cost (DEC)	Energy Cost Budget (ECB)			
13. Modeling Exceptions				
All elements of the <i>proposed design building envelope</i> , HVAC, <i>service water heating</i> , lighting, and electrical <i>systems</i> shall be modeled in the <i>proposed design</i> in accordance with the requirements of Sections 1 through 12 of Table 11.5.1.	None			
may be excluded from the simulation model provided that	- Alexandre and the start of the second			
<ol> <li>component <i>energy</i> use does not affect the <i>energy</i> use of systems and components that are being considered for trade- off and</li> </ol>				
<ol> <li>the applicable prescriptive requirements of Sections 5.5, 6.5, 7.5, and either 9.5 or 9.6 applying to the excluded components are met.</li> </ol>				
14. Modeling Limitations to the Simulation Program				
If the <i>simulation program</i> cannot model a component or <i>system</i> included in the <i>proposed design</i> , one of the following methods shall be used with the approval of the <i>authority having jurisdiction</i> :	Same as proposed design.			
a. Ignore the component if the <i>energy</i> impact on the trade-offs being considered is not significant.				
b. Model the component substituting a thermodynamically similar component model.				
c. Model the <i>HVAC system</i> components or <i>systems</i> using the <i>budget building design's HVAC system</i> in accordance with Section 10 of Table 11.5.1. Whichever method is selected, the component shall be modeled identically for both the <i>proposed design</i> and <i>budget building design</i> .				

#### 2.21 Amendments to Section G1.2.1 Mandatory Provisions

#### G1.2.1 Mandatory Provisions.

This *performance rating method* requires conformance with the following provisions:

- All requirements of Sections 5.4, 6.4, 7.4, 8.4, 9.4, 10.4, and Sections C408 and Appendix CC (if mandated by local ordinance) of the 2018 IECC (as amended) shall be met. These sections contain the mandatory provisions of the standard and are prerequisites for this rating method.
- 2. The interior lighting power shall not exceed the *interior lighting power allowance* determined using either Tables G3.7 or G3.8 and the methodology described in Sections 9.5.1 and 9.6.1.

#### 2.22 Amendments to Section G1.2.2 Performance Rating Calculation

#### G1.2.2 Performance Rating Calculation.

The performance of the *proposed design* is calculated by either the provisions of G1.2.2.1 Performance Cost Index or G1.2.2.2 Performance Source Energy Index.

2.23 Addition of New Section G1.2.2.1 Performance Cost Index

#### G1.2.2.1 Performance Cost Index.

The performance of the proposed design is calculated in accordance with provisions of this appendix using the following formula:

Performance Cost Index =

Proposed building performance / Baseline building performance

Both the *proposed building performance* and the *baseline building performance* shall include all end-use load components within and associated with the building when calculating the Performance Cost Index.

2.24 Addition of New Section G1.2.2.2 Performance Source Energy Index

#### G1.2.2.2 Performance Source Energy Index.

The performance of the proposed design is calculated in accordance with provisions of this appendix using the following formula:

Performance Source Energy Index = Proposed building source energy / Baseline building source energy

Both the *proposed building source energy* and the *baseline building source energy* shall include all end-use load components within and associated with the building when calculating the Performance Source Energy Index.

2.25 Amendments to Section G2.4.1 On-site Renewable Energy and Site-Recovered Energy

#### G2.4.1 On-site Renewable Energy and Site-Recovered Energy.

Site-recovered energy shall not be considered purchased energy and shall be subtracted from the proposed design energy consumption prior to calculating the proposed building performance. Onsite renewable energy generated by systems included on the building permit used by the building shall be subtracted from the proposed design energy consumption prior to calculating the proposed building performance or proposed building source energy. The reduction in proposed building performance or proposed building source energy associated with on-site renewable energy systems shall not exceed 5 percent of the calculated baseline building performance or baseline building source energy, respectively.

#### 2.26 Amendments to Section G2.4.2 Annual Energy Costs

#### G2.4.2 Annual Energy Costs.

The design energy cost and baseline energy cost shall be determined using either actual rates for purchased energy or State average energy prices published by DOE's Energy Information Administration (EIA) for commercial building customers, but rates from different sources may not be mixed in the same project. Where on-site renewable energy or site-recovered energy is used, the baseline building design shall be based on the energy source used as the backup energy source, or the baseline system energy source in that category if no backup energy source has been specified. Where the proposed design includes electricity generated from sources other than onsite renewable energy, the baseline design shall include the same generation system.

#### 2.27 Amendments to Table G3.1

Modeling Requirements for Calculating Proposed and Baseline Building Performance (No. 5 Building Envelope)

No.         Proposed Building Performance           Building Envelope         All components of the building envelope in the proposed	Baseline Building Performance
Building Envelope     All components of the building envelope in the proposed	Atal and Antication States (1997)
All components of the <i>building envelope</i> in the <i>proposed</i>	
<ul> <li>design shall be modeled as shown on architectural drawings or as built for existing building envelopes.</li> <li>Exceptions: The following building elements are permitted to differ from architectural drawings: <ol> <li>All uninsulated assemblies (e.g., projecting balconies, perimeter edges of intermediate floor stabs, concrete floor beams over parking garages, roof parapet) shall be separately modeled using either of the following techniques: <ol> <li>Separate model of each of these assemblies within the energy simulation model.</li> <li>Separate calculation of the U-factor for each of these assemblies are then averaged with larger adjacent surfaces using an area-weighted average method. This average U-factor is modeled within the energy simulation model.</li> </ol> </li> </ol></li></ul>	<ul> <li>Equivalent dimensions shall be assumed for each building envelope component type as in the proposed design; i.e., the total gross area of walls shall be the same in the proposed design and baseline building design. The same shall be true for the areas of roofs, floors, and doors, and the exposed perimeters of concretes slabs on grade shall also be the same in the proposed design and baseline building design. The following additional requirements shall apply to the modeling of the baseline building design.</li> <li>a. Orientation. The baseline building performance shall be generated by simulating the building with its actual orientation and again after rotating the entire building 90, 180, and 270 degrees, then averaging the results. The building shall be modeled so that it does not shade itself.</li> <li>Exceptions: <ol> <li>If it can be demonstrated to the satisfaction of the rating authority that the building orientations.</li> <li>Buildings where the vertical fenestration area</li> </ol> </li> </ul>

#### Table G3.1 Modeling Requirements for Calculating Proposed and Baseline Building Performance

provided that it is similar to an assembly being modeled. If not separately described, the area of a building envelope assembly shall be added to the area of an assembly of that same type with the same orientation and thermal properties. When the total area of penetrations from mechanical equipment listed in Table 6.8.1-4 exceeds 1% of the opaque above-grade wall area, the mechanical equipment penetration area shall be calculated as a separate wall assembly with a default U-factor of 0.5. Where mechanical equipment has been tested in accordance with testing standards approved by the *authority* having jurisdiction, the mechanical equipment penetration area may be calculated as a separate wall assembly with the U-factor as determined by such test.

- 2. Exterior surfaces whose azimuth orientation and tilt differ by less than 45 degrees and are otherwise the same may be described as either a single surface or by using multipliers.
- 3. The exterior *roof* surface shall be modeled using the aged solar reflectance and thermal emittance determined in accordance with Section 5.5.3.1.1(a). Where aged test data are unavailable, the roof surface may be modeled with a reflectance of 0.30 and a thermal emittance of 0.90.
- 4. Manual fenestration shading devices, such as blinds or shades, shall be modeled or not modeled the same as in the *baseline building design*. Automatically controlled fenestration shades or blinds shall be modeled. Permanent shading devices, such as fins, overhangs, and light shelves shall be modeled.
- 5. Automatically controlled *dynamic glazing* may be modeled. Manually controlled dynamic glazing shall use the average of the minimum and maximum SHGC and VT.
- b. Infiltration shall be modeled using the same methodology, air leakage rate, and adjustments for weather and building operation in both the proposed design and the baseline building design. These adjustments shall be made for each simulation time step and must account for but not be limited to weather conditions and HVAC system operation, including strategies that are intended to positively pressurize the building. The air leakage rate of the building envelope (I75Pa) at a fixed building pressure differential of 0.3 in. of water shall be 0.4 cfm/ft<sup>2</sup>. The air leakage rate of the building envelope shall be converted to appropriate units for the simulation program using one of the methods in Section G3.1.1.4.

Exceptions: When whole-building air leakage testing, in accordance with ASTM E779, is specified during design and completed after construction, the proposed design air

percent.

- b. Opaque Assemblies. Opaque assemblies used for new buildings, existing buildings, or additions shall conform with assemblies detailed in Appendix A and shall match the appropriate assembly maximum Ufactors in Tables G3.4-1 through G3.4-8:
  - Roofs--Insulation entirely above deck (A2.2).
  - Above-grade walls--Steel-framed (A3.3). .
  - Below-grade walls--Concrete block (A4).
  - Floors--Steel-joist (A5.3).
  - Slab-on-grade floors shall match the F-factor for unheated slabs from the same tables (A6).
  - Opaque door types shall be of the same type of constructions as the proposed design and conform to the U-factor requirements from the same tables (A7).
- Vertical Fenestration Areas. For building area types с. included in Table <u>G3.1.1-1</u>, vertical fenestration areas for new buildings and additions shall equal that in Table G3.1.1-1 based on the area of gross abovegrade walls that separate conditioned spaces and semiheated spaces from the exterior. Where a building has multiple building area types, each type shall use the values in the table. The vertical fenestration shall be distributed on each face of the *building* in the same proportion as in the *proposed* design. For building areas not shown in Table G3.1.1-1, vertical fenestration area for new buildings and additions shall equal that in the proposed design or 40% of gross above-grade wall area, whichever is smaller, and shall be distributed on each face of the building in the same proportions in the proposed design. The fenestration area for an existing building shall equal the existing *fenestration area* prior to the proposed work and shall be distributed on each face of the building in the same proportions as the existing building. For portions of those tables where there are no SHGC requirements, the SHGC shall be equal to that determined in accordance with Section C3.6(c).
- d. Vertical Fenestration Assemblies. Fenestration for new buildings, existing buildings, and additions shall comply with the following:
  - Fenestration U-factors shall match the • appropriate requirements in Tables G3.4-1 through G3.4-8 for the applicable glazing percentage for Uall.
  - Fenestration SHGCs shall match the appropriate requirements in Tables G3.4-1 through G3.4-8 using the value for SHGCall for the applicable

leakage rate of the building envelope shall be as measured.	vertical glazing percentage.
	<ul> <li>All vertical fenestration shall be assumed to be flush with the exterior wall, and no shading projections shall be modeled.</li> </ul>
	<ul> <li>Manual window shading devices such as blinds or shades are not required to be modeled.</li> </ul>
	e. Skylights and Glazed Smoke Vents. Skylight area shall be equal to that in the proposed design or #%, whichever is smaller. If the skylight area of the proposed design is greater than 3%, baseline skylight area shall be decreased by an identical percentage in all roof components in which skylights are located to reach 3%. Skylight orientation and tilt shall be the same as in the proposed design. Skylight U-factor and SHGC properties shall match the appropriate requirements in Tables <u>G3.4-1</u> through <u>G3.4-8</u> using the value and the applicable skylight percentage.
	f. <b>Roof Solar Reflectance and Thermal Emittance.</b> The exterior <i>roof</i> surfaces shall be modeled using a solar <i>reflectance</i> of 0.30 and a thermal <i>emittance</i> of 0.90.
	g. <b>Roof Albedo.</b> All <i>roof</i> surfaces shall be modeled with a reflectivity of 0.30.

# PART 3

### 3 Amendments to 2018 International Energy Conservation Construction Code Residential Provisions

#### 3.1 Amendments to Section 401.2

R401.2 Compliance. Projects shall comply with one of the following:

- 1. The provisions of Sections R401 through R404.
- 2. The provisions of Sections R401 through R404 and the provisions of Section R408 (passive house).
- 3. The provisions of Section R406 (ERI).
- 4. For *Group* R-2, *Group* R-3 and *Group* R-4 *buildings*, the provisions of Section R405 (simulated performance) and the provisions of Sections R401 through R404 labeled "Mandatory." The building energy cost shall be equal to or less than 80 percent of the standard reference design building.

#### 3.2 Amendments to Table R402.1.2

Insulation and fenestration requirements by component

Climate Zone	Fenestration U-factor <sup>h</sup>	Skylight U-factor <sup>h</sup>	Glazed fenestration SHGC <sup>h</sup>	Ceiling R-Value	Wood Frame Wall <sup>b,c</sup> R-Value	Mass Wall <sup>d</sup> R-Value	Floor R- Value	Basement Wall <sup>e</sup> R-Value	Slab <sup>f</sup> R-Value and Depth	Crawl Space Wall <sup>e</sup> R-Value
4	0.27	0.50	0.4	49	21 int. or 20+5 or 13+10	15/20	30 <sup>g</sup>	15/19	10,4 ft	15/19
5	0.27	0.50	NR	49	21 int. or 20+5 or 13+10	15/20	30 <sup>g</sup>	15/19	10,4 ft	15/19
6	0.27	0.50	NR	49	20+5 or 13+10	15/20	30 <sup>g</sup>	15/19	10,4 ft	15/19

#### Table R402.1.2 Insulation and Fenestration Requirements by Component<sup>a</sup>

NR = Not Required

For SI: 1 foot = 304.8 mm.

a. R-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed R-value of the insulation shall be not less than the R-value specified in the table.

b. Int. (intermediate framings) denotes standard framing 16 inches on center. Headers shall be insulated with a minimum of R-10 insulation.

c. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+10" means R-13 cavity insulation plus R-10 continuous insulation.

d. Mass walls shall be in accordance with Section R402.2.5. The second R-value applies when more than half the insulation is on the interior of the mass wall.

e. 15/19 means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall.
 f. R-10 continuous insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation R-value for

slabs as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an R-value of R-19.

h. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

#### NYStretch Energy Code 2020

Part 3 – Amendments to 2018 Energy Conservation Construction Code Residential Provisions

## 3.3 Amendments to Table R402.1.4 Equivalent U-factors

Climate Zone	Fenestration U-factor	Skylight U-factor	Ceiling U- factor	Frame Wall U-factor	Mass Wall U-factor <sup>b</sup>	Floor U- factor	Basement Wall U- factor	Crawl Space Wall U- factor
4	0.27	0.50	0.026	0.045	0.056	0.033	0.050	0.042
5	0.27	0.50	0.026	0.045	0.056	0.033	0.050	0.042
6	0.27	0.50	0.026	0.045	0.056	0.033	0.050	0.042

#### Table R402.1.4 Equivalent U-factors<sup>a</sup>

. Nonfenestration U-factors shall be obtained from measurement, calculation or an approved source.

Mass wall shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall U-factor shall not exceed 0.056.

3.4 Amendments to Section R402.2.2 Ceilings without attic spaces

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**R402.2.2 Ceiling without attic spaces.** Where Section R402.1.2 requires insulation R-values greater than R-38 in the ceiling and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation R-value for such roof/ceiling assemblies shall be R-38. Insulation shall extend over the top of the wall plate to the outer edge of such plate and shall not be compressed. This reduction of insulation from the requirements of Section R402.1.2 shall be limited to 500 square feet (46 m<sup>2</sup>) or 20 percent of the total insulated ceiling area, whichever is less. This reduction shall not apply to the U-factor alternative approach in Section R402.1.4 and the Total UA alternative in Section R402.1.5.

3.5 Amendments to Section R402.4.1.1 Installation

**R402.4.1.1 Installation.** The components of the *building thermal envelope* as indicated in Table R402.4.1.1 shall be installed in accordance with the manufacturer's instruction and the criteria indicated in Table R402.4.1.1 as applicable to the method of construction. An approved agency shall inspect all components and verify compliance. The inspection shall include an open wall visual inspection of all components included in Table R402.4.1.1 and shall be installed so that the insulation material uniformly fills each cavity side-to-side and top-to-bottom, without substantial gaps or voids around obstructions, and is split, installed, or fitted tightly around wiring and other penetrations in the cavity. No more than 2 percent of the total insulated area shall be compressed below the thickness required to attain the labeled R-value or contain gaps or voids in the insulation.

3.6 Amendments to Section R403.3 Ducts

**R403.3 Ducts.** All ducts and air handlers shall be installed in accordance with Section R403.3.1 through R403.3.8, where applicable. The duct system in new buildings and additions shall be located in a conditioned space in accordance with Sections R403.3.7 (1) and R403.3.7 (2).

3.7 Addition of New Section R403.3.8 Duct system sizing (Mandatory)

**R403.3.8 Duct system sizing (Mandatory).** Ducts shall be sized in accordance with ACCA Manual D based on calculations made in accordance with Sections R403.7 and R403.8.

3.8 Amendments to Section R403.5 Service hot water systems

**R403.5 Service hot water systems**. Energy conservation measures for service hot water systems shall be in accordance with Sections R403.5.1 through R403.5.5

3.9 Amendments to Section R403.5.4 Drain water heat recovery units

**R403.5.4 Drain water heat recovery units.** Drain water heat recovery units shall have a minimum efficiency of 40 percent if installed for equal flow or a minimum efficiency of 52 percent if installed for unequal flow. Vertical drain water heat recovery units shall comply with CSA B55.2 and be tested and labeled in accordance with CSA B55.1 or IAPMO 346. Sloped drain water heat recovery units shall comply with IAPMO PS 92 and be tested and labeled in accordance with IAPMO PS 92 and be tested and labeled in accordance with IAPMO 346. Potable water-side pressure loss of drain water heat recovery units shall be less than 3 psi for individual units connected to one or two showers. Potable water-side pressure loss of drain water heat recovery units shall be less than 2 psi for individual units connected to three or more showers.

3.10 Addition of New Section R403.5.5 Supply of heated water

**R403.5.5 Supply of heated water.** In new *buildings*, heated water supply piping shall be in accordance with one of the following:

**R403.5.5.1 Maximum allowable pipe length method.** The maximum allowable pipe length from the nearest source of heated water to the termination of the fixture supply pipe shall be in accordance with the maximum pipe length in Table R403.5.5.1. Where the length contains more than one size of pipe, the largest size shall be used for determining the maximum allowable length of the piping in Table R403.5.5.1.

**R403.5.5.2 Maximum allowable pipe volume method.** The water volume in the piping shall be calculated in accordance with Section R403.5.5.2.1. The maximum volume of hot or tempered water in the piping to public lavatory faucets shall be 2 ounces. For fixtures other than public lavatory faucets, the maximum volume shall be 64 ounces for hot or tempered water from a water heater or boiler; and 24 ounces for hot or tempered water from a circulation loop pipe or an electrically heat-traced pipe. The water volume in the piping shall be calculated in accordance with Section R403.5.5.2.1.

**R403.5.5.2.1 Water volume determination.** The volume shall be the sum of the internal volumes of pipe, fittings, valves, meters and manifolds between the source of hot water and the termination of the fixture supply pipe. The volume shall be determined from the "Volume" column of Table R403.5.5.1. The volume contained within fixture shutoff valves, flexible water supply connectors to a fixture fitting, or within a fixture fitting shall not be included in the water volume determination. Where hot or tempered water is supplied by a circulation loop pipe or a heat-traced pipe, the volume shall include the portion of the fitting on the branch pipe that supplies water to the fixture.

		M	aximum Pipe or Tube Leng	th
Nominal Pipe or Tube Size (inch)	VOLUME (Liquid Ounces Per Foot Length)	System without a circulation loop or heat-traced line (feet)	System with a circulation loop or heat-traced line (feet)	Lavatory faucets – public (metering and nonmetering (feet)
1/4ª	0.33	50	16	6
5/16ª	0.5	50	16	4
3/8ª	0.75	50	16	3
1/2	1.5	43	16	2
5/8	2	32	12	1
3/4	3	21	8	0.5
7/8	4	16	6	0.5
1	5	13	5	0.5
1 1/4	8	8	3	0.5
1 1/2	11	6	2	0.5
2 or larger	18	4	1	0.5

Table R403.5.5.1 Pipe Volume and Maximum Piping Lengths

**R403.5.5.3 Drain water heat recovery units**. New buildings shall include a drain water heat recovery unit that captures heat from at least one shower, and such drain water heat recovery unit must have a minimum efficiency of 40 percent if installed for equal flow or a minimum efficiency of 52 percent if installed for unequal flow. Vertical drain water heat recovery units shall comply with CSA B55.2 and be tested and labeled in accordance with CSA B55.1 or IAPMO 346. Sloped drain water heat recovery units shall comply with IAPMO 346. Potable water-side pressure loss of drain water heat recovery units shall be less than 3 psi for individual units connected to one or two showers.

Potable water-side pressure loss of drain water heat recovery units shall be less than 2 psi for individual units connected to three or more showers.

**R403.5.5.4 Recirculation Systems.** Projects shall include a recirculation system with no more than 0.5-gallon (1.9 liter) storage. The storage limit shall be measured from the point where the branch feeding the fixture branches off the recirculation loop to the fixture. Recirculation systems must be based on an occupant-controlled switch or an occupancy sensor, installed in each bathroom, which is located beyond a 0.5-gallon stored-volume range from the water heater.

#### 3.11 Addition of New Section R403.6.2 Balanced and HRV/ERV systems (Mandatory)

**R403.6.2 Balanced and HRV/ERV systems (Mandatory)**. In new buildings, every dwelling unit shall be served by a heat recovery ventilator (HRV) or energy recovery ventilator (ERV) installed per manufacturer's instructions. The HRV/ERV must be sized adequately for the specific application, which will include the building's conditioned area, and number of occupants.

**Exception**: In Climate Zone 4, a balanced *ventilation* system designed and installed according to the requirements of Section M1507.3 of the 2015 International Residential Code (IRC) that uses the return side of the building's heating and/or cooling system air handler to supply outdoor air, shall be permitted to comply with this section. When the outdoor air supply is ducted to the heating and/or cooling system air handler, the mixed air temperature shall not be less than that permitted by the heating equipment manufacturer's installation instructions. Heating and/or cooling system air handlers used to distribute outdoor air shall be field-verified to not exceed an efficacy of 45 W/CFM if using furnaces for heating and 58 W/CFM if using other forms of heating. In the balanced system design, an equivalent exhaust air flow rate shall be provided simultaneously by one or more exhaust fans, located remotely from the source of supply air. The balanced system's exhaust and supply fans shall be interlocked for operation, sized to provide equivalent air flow at a rate greater than or equal to that determined by IRC Table M1507.3.3(1) and shall have their fan capacities adjusted for intermittent run time per Table M1507.3.3(2). Continuous operation of the balanced *ventilation* system shall not be permitted.

3.12 Addition of New Section R403.6.3 Verification

**R403.6.3 Verification**. Installed performance of the mechanical *ventilation* system shall be tested and verified by an *approved agency* and measured using a flow hood, flow grid, or other airflow measuring device in accordance with Air Conditioning Contractors of America (ACCA) HVAC Quality Installation Verification Protocols – ANSI/ACCA 9QIvp-2016.

3.13 Amendments to Section R404.1 Lighting equipment (Mandatory)

**R404.1 Lighting equipment (Mandatory).** Not less than 90 percent of the permanently installed lighting fixtures shall use lamps with an efficacy of at least 65 lumens per watt or have a total luminaire efficacy of at least 45 lumens per watt.

**R404.1.1 Lighting equipment (Mandatory).** Fuel gas lighting systems shall not have continuously burning pilot lights.

3.14 Addition of New Section R404.2 Electrical power packages (Mandatory)

R404.2 Electrical power packages (Mandatory). New buildings shall comply with the following:

- 1. Solar-ready zone. Detached one and two-family dwellings and townhouses where the conditioned space is greater than 1,400 square feet shall comply with the requirements of Appendix RA.
- Electrical Vehicle Service Equipment Capable. Detached one or two-family dwellings and townhouses with parking area provided on the *building site* shall provide a 208/240V 40-amp outlet for each dwelling unit or panel capacity and conduit for the future installation of such an outlet. Outlet or conduit termination shall be adjacent to the parking area. For residential occupancies where there is a common parking area, provide either:
  - a. Panel capacity and conduit for the future installation of 208/240V 40-amp outlets for 5 percent of the total parking spaces, but not less than one outlet, or
  - b. 208/240V 40-amp outlets for 5 percent of the total parking spaces, but not less than one outlet.

#### 3.15 Amendments to Table R406.4 Maximum Energy Rating Index

	Climate Zone	Energy Rating Index <sup>a</sup>					
	4	50					
	5	50					
	6	50					
a.	Where <i>on-site renewable energy</i> is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or R402.1.4 of the 2015 <i>International Energy Conservation Code</i> .						

#### Table R406.4 Maximum Energy Rating Index

#### 3.16 Addition of New Section R408 Passive House

### Section R408 Passive House

**R408.1 General.** *Buildings* shall comply with either Section R408.1.1 or R408.1.2 and shall comply with Section R408.2.

**R408.1.1. Passive House Institute US (PHIUS) Approved Software. PHIUS+.** Passive Building Standard - North America, where Specific Space Heat Demand and (sensible only) Cooling Demand, as modeled and field-verified by a Certified Passive House Consultant, is less than or equal to 9kBTU/ft2/year. The *dwelling unit* shall also be tested with a blower door and found to exhibit no more than 0.05 CFM50/ft<sup>2</sup> or 0.08 CFM75/ft<sup>2</sup> of air leakage.

**R408.1.2 Passive House Institute (PHI) Approved Software.** Passive House Institute: Low Energy Building Standard, where Specific Space Heating and (sensible only) Cooling Demand is less than or equal to 9.5 kBTU/ft<sup>2</sup>/year, as modeled and field-verified by a Certified Passive House Consultant. The *dwelling unit* shall also be tested with a blower door and found to exhibit an *infiltration* rate of no more than 1.0 air changes per hour under a pressure of 50 Pascals.

#### **R408.2 Documentation**

- 1. If using the PHIUS software:
  - a. Prior to the issuance of a building permit, the following items must be provided to the *code official*:
    - i. A list of compliance features; and
    - ii. A statement that the estimated Specific Space Heat Demand is "based on plans."
  - b. Prior to the issuance of a certificate of occupancy, the following item must be provided to the *code official*:
    - A copy of the final report submitted on a form that is approved to document compliance with PHIUS+ standards. Said report must indicate that the finished building achieves a Certified Passive House Consultant verified Specific Space Heat Demand of less than or equal to 9 kBTU/ft2/year.

62

- 2. If using the PHI software:
  - a. Prior to the issuance of a building permit, the following items must be provided to the *code official*:
    - i. A list of compliance features; and
    - ii. A statement that the estimated Specific Space Heating and Cooling Demand is "based on plans."
  - b. Prior to the issuance of a certificate of occupancy, the following item must be provided to the *code official*:
    - i. A copy of the final report submitted on a form that is approved to document compliance with PHI standards. Said report must indicate that the finished building achieves a Certified Passive House Consultant verified Specific Space Heating or Cooling Demand is less than or equal to 9.5 kBTU/ft<sup>2</sup>/year.
- 3.17 Amendments to "ACCA" in Chapter 6 Referenced Standards

Manual D—16: Residential Duct Systems R403.3.8

Manual J—16: Residential Load Calculation Eighth Edition R403.7

Manual S—14: Residential Equipment Selection R403.7

- 3.18 Addition of a new entry for "IAPMO" to Chapter 6 Referenced Standards
- IAPMO International Association of Plumbing and Mechanical Officials 4755 E. Philadelphia St. Ontario, CA 91761
- IAPMO IGC 346:2017 Test Method for Measuring the Performance of Drain Water Heat Recovery Units R403.5.4.3
- IAPMO PS 92-2013: Heat Exchangers and Indirect Water Heaters R403.5.4.3

- 3.19 Addition of a new entry for "PHI" to Chapter 6 Referenced Standards
- PHI Passive House Institute Rheistrasse 44/46 64283 Darmstadt, Germany

PHI 2016: Low Energy Building Standard, Version 9f R408.1

3.20 Addition of a New Entry for "PHIUS" to Chapter 6 Referenced Standards

PHIUS Passive House Institute US 116 West Illinois Street, Suite 5E Chicago, IL 60654, USA

PHIUS+ 2015: Passive Building Standard – North America R408.1



State of New York Andrew M. Cuomo, Governor

New York State Energy Research and Development Authority Richard L. Kauffman, Chair I Alicia Barton, President and CEO NYStretch Energy Code-2020

## Comparison to 2020 Energy Conservation Construction Code of NYS







The following is a summary of the differences between the 2020 NYStretch Energy Code (NYStretch), the 2020 NYS Energy Code (ECCCNYS-2020), and ASHRAE 90.1 2016. It is not intended to be a replacement for the actual language in the NYStretch Code or the NYS Energy Code. One should always refer to the NYS Energy Code when determining compliance as amended by the 2020 NYStretch Code language.

#### I. Differences between NYStretch and ECCCNYS-2020: Residential Buildings

#### Compliance Path Options – ONE of FOUR can be used:

- **1. Prescriptive and REScheck**<sup>™</sup> R401 through R404 (Specific Prescriptive R-value or U-factor) and mandatory requirements; regardless of compliance path, REScheck<sup>™</sup> software most often used: or
- 2. Passive House R401 through R404 and Passive House compliance, or
- 3. ERI Path (R406), or
- **4. Simulated Performance Path** (R405) and mandatory provisions of R401 through R404. Building energy < 80% of the standard reference design

Climate Zone 4	Fen U-Factor	SkyLt U-Factor	SHGC	Ceiling R-Val	Wood Wall R-Value	Mass Wall R-Value	Floor R-Val	Bsmt Wall R-value	Slab R-Value/ Depth	Crawl Sp Wall R-Value
Stretch Code	0.27	0.50	.04	49	21 or 20+5 or 13+10	15/20	30ª	15/19	10, 4 ft.	15/19
Energy Code	0.32	0.55	0.4	49	20 or 13+5	8/13	19	10/13	10, 2 ft.	10/13

#### Table R402.1.2 – Envelope (U-factor Table R402.1.4 changed accordingly. Prescriptive, e.g., can be traded.)

Climate Zone 5	Fen U-Factor	SkyLt U-Factor	SHGC	Ceiling R-Val	Wood Wall R-Value	Mass Wall R-Value	Floor R-Val	Bsmt Wall R-value	Slab R-Value/ Depth	Crawl Sp Wall R-Value
Stretch Code	0.27	0.50	NR	49	21 or 20+5 or 13+10	15/20	30ª	15/19	10, 4 ft.	15/19
Energy Code	0.30	0.55	NR	49	20 or 13+5	13/17	30ª	15/19	10, 2 ft.	15/19

Climate Zone 6	Fen U-Factor	SkyLt U-Factor	SHGC	Ceiling R-Val	Wood Wall R-Value	Mass Wall R-Value	Floor R-Val	Bsmt Wall R-value	Slab R-Value/ Depth	Crawl Sp Wall R-Value
Stretch Code	0.27	0.50	NR	49	21 or 20+5 or 13+10	15/20	30ª	15/19	10, 4 ft.	15/19
Energy Code	0.30	0.55	NR	49	20+5 or 13+10	15/20	30ª	15/19	10, 4 ft.	15/19
Option 2	.28	0.55	NR	60	23 cav.	19/21	30ª	15/19	10, 4 ft.	15/19

Alternatively, insulation sufficient to fill the framing cavity and providing not less than an R-value of P-19,

#### Provisions in NYStretch that are not in NYS Energy Code

- R402.2.2 Ceilings without attic spaces (cathedralized). In the NYStretch Code, minimum insulation R-value is R-38 uncompressed out over exterior walls rather than R-30. As in the NYS Energy Code, this reduction in R-value is limited to 500 sf or 20% of insulated roof area, whichever is less.
- Table R402.4.11 Insulation installation NYStretch Code requires open wall visual inspection to ensure the quality of the insulation installation. This requirement asks for more attention to openings around tub/showers, registers, and Recessed Lighting.
- R403.3 Ducts Ducts in new buildings must be located in conditioned space. Buried ducts can be considered in conditioned space as in the NYS Energy Code, and must be installed/buried as prescribed by the NYS Energy Code. In both NYStretch and the NYS Energy Code, duct leakage testing must be performed where ducts are buried in attic insulation. The threshold is less than or equal to 1.5 cfm per 100 sf conditioned floor area for leakage to outdoors.
- R403.3.8 Duct sizing NYStretch Code specifically requires that ducts must be sized in accordance with ACCA Manual D (mandatory).
- R403.5.4 Drain water heat recovery units Drain water heat recovery units must have a minimum efficiency of 40% if installed for equal flow or a minimum efficiency of 52% if installed for unequal flow. Requirements are given for vertical and sloped drain water heat recovery units.
- R403.5.5 Supply of hot water NYStretch Code requires one of the following: 1) maximum allowable pipe length between water heater and fixture; 2) maximum allowable pipe volume between water heater and fixture;
   3) drain-water heat recovery; or 4) recirculation system.
- R403.6.2 Balanced whole house mechanical ventilation NYStretch Code requires HRV or ERV in Climate Zones 5 and 6 in every dwelling unit (mandatory). In Climate Zone 4, a central fan integrated system with simultaneous supply and exhaust is an option.
- R403.6.3 Verification of ventilation NYStretch Code requires verification of ventilation air flow by approved agency, tested to ACCA HVAC Quality Installation Verification Protocols.
- R404.1 Lighting NYStretch Code requires 90% high-efficacy lighting, with lamps at a minimum of 65 lumens per watt and luminaires at minimum of 45 lumens/watt (mandatory).
- R404.2 Electrical power packages. (Mandatory for newly constructed buildings.) NYStretch Code requires:
  - A solar-ready zone for newly constructed detached one- and two-family homes and townhomes that have more than 1400 sf of conditioned floor area according to Appendix RA of the NYS Energy Code. The solar-ready zone applies to buildings with at least 600 sf roof area between 110 degrees and 270 degrees of true north. Exceptions are given for buildings shaded more than 70% of daylight hours annually and for those where an on-site renewable energy system is permanently installed. Reserved electric panel space, roof-load calculation and electrical pathway from roof to panel is required.
  - Electric vehicle charging capability for one- and two-family detached homes and townhomes. 208V outlet for each dwelling unit or panel space and conduit for future installation of outlet. For common parking areas, the code requires 1) panel capacity and conduit for future installation of 208/240V outlets for 5% of spaces' but with a minimum of at least one space or 2) 208/240V outlets for 5% of parking spaces with a minimum of at least one space.
- R404.2 ERI path NYStretch requires an ERI of 50 PLUS the NYS Energy Code (as amended) mandatory requirements and R403.5.3; NYS Energy Code requires ERI of 62 Climate Zone 4, 61 for Zones 5 and 6.
- R408 Passive House An optional compliance path in NYStretch; allows use of either PHIUS or PHI approved software along with ECCCNYS-2020 prescriptive AND mandatory requirements. Dwelling unit MUST score a maximum of 9.5 kbtuh/ft2/yr and be blower-door tested to meet air leakage or infiltration rates defined by the passive house entities and NYStretch.

#### II. Differences between NYStretch and ECCCNYS-2020: Commercial Buildings

#### **Compliance Path Options:**

 ASHRAE 90.1 2016 Prescriptive Path – (Sections 5 through 10, as amended by NYStretch) plus section C408 (commissioning) of the NYS Energy Code (as amended by NYStretch) and Appendix CC if mandated by local ordinance (Additional power distribution system packages), or

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- ASHRAE 90.1 2016 Energy Cost Budget Method (Section 11, as amended by NYStretch) plus Section C408 (commissioning) of the NYS Energy Code (as amended by NYStretch), and Appendix CC if mandated by local ordinance (additional power distribution system packages), or
- **3.** ASHRAE 90.1 2016 Appendix G, Performance Rating Method (as amended by NYStretch) Section C408 (commissioning) of the NYS Energy Code (as amended by NYStretch), and Appendix CC if mandated by local ordinance (additional power distribution system packages), or
- **4. 2020 Energy Conservation Construction Code (NYS Energy Code), Prescriptive Path** (Sections C402 through C406 and C408, as amended by NYStretch) and Appendix CC if mandated by local ordinance (additional power distribution system packages).

#### **Prescriptive Path**

TABLE C402.1.4 – Comparison ECCCNYS-2020/NYStretch, U-factor Method ALSO used for ASHRAE 90.1 Prescriptive Path

4 5 6 **Climate Zone** All Other Group R All Other Group R All Other Group R Roofs U-0.032/ U-0.032/ U-0.032/ U-0.032/ U-0.032/ U-0.032/ Insulation Entirely U-0.030 U-0.030 U-0.030 U-0.030 U-0.029 U-0.029 above Roof Deck U-0.031/ U-0.031/ U-0.035 U-0.035 U-0.035 U-0.035 Metal Buildings U-0.028 U-0.026 U-0.027/ U-0,027/ U-0.027/ U-0.021/ U-0.021/ U-0.021/ Attic and Other U-0.019 U-0.020 U-0.020 U-0.019 U-0.020 U-0.020 Walls, Above Grade U-0.071/ U-0.104/ U-0.090/ U-0.90/ U-0.080/ U-0.080/ Masse U-0.099 U-0.086 U-0.086 U-0.076 U-0.076 U-0.067 U-0.052/ U-0.052/ U-0.052/ U-0.052/ U-0.052/ U-0.052/ **Metal Buildings** U-0.048 U-0.048 U-0.048 U-0.048 U-0.048 U-0.048 U-0.064/ U-0.064/ U-0.064/ U-0.064/ U-0.064/ U-0.064/ Metal Framed U-0.061 U-0.061 U-0.052 U-0.052 U-0.047 U-0.044 U-0.064/ U-0.064/ U-0.064/ U-0.064/ U-0.051/ U-0.051/ Wood Framed U-0,048 U-0.048 U-0.046 and Other<sup>c</sup> U-0.061 U-0.061 U-0.048 Walls, Below Grade C-0.119/ C-0.119 C-0.119/ C-0.119 C-0.119/ C-0.119/ **Below-Grade Wall**<sup>c</sup> C-0.092 C-0.063 C-0.092 C-0.092

OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR METHOD<sup>®, b</sup>

#### NYStretch Energy Code-2020

### Comparison to 2020 Energy Conservation Construction Code of NYS



### 

Climate Zone		4		5	6		
Climate zone	All Other	Group R	All Other	Group R	All Other	Group R	
			Floors				
Mass <sup>d</sup>	U-0.076/ U-0.057	U-0.074/ U-0.051	U-0.074/ U-0.057	U-0.064/ U-0.051	U-0.064/ U-0.051	U-0.064/ U-0.051	
Joist/Framing	U-0.033	U-0.033	U-0.033 U-0.033		U-0.033/ U-0.027	U-0.033/ U-0,027	
	Service State	Slat	o-on-Grade Floors				
Unheated Slabs	F-0.54/ F-0.52	F <b>-0.5</b> 4/ F-0.52	F-0.54/ F-0.52	F-0.54/ F-0.51	F-0.54/ F-0.51	F-0.54/ F-0.434	
Heated Slabs	F-0.86 0.64/ F-0.63	F-0.86 0.64/ F-0.63	F-0.79 0.64/ F-0.63	F-0.79 0.64/ F-0.63	F-0.79 0.55/ F-0.63	F-0.69 0.55/ F-0.63	
			Opaque Doors				
Swinging Door	U-0.061/ U-0.050	U-0.061/ U-0.050	U-0.037	U-0.037	U-0.037	U-0.037	
Garage Door < 14% Glazing	U-0.031	U-0.031	U-0.031	U-0.031	U-0.031	U-0.031	

For SI: 1 inch = 25,4 mm, 1 pound per square foot = 4,88 kg/m2, 1 pound per cubic foot = 16 kg/ 3 ci = Continuous insulation, NR = No Requirement, LS = Liner System,

• Where assembly U-factors, C-factors, and F-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A,

<sup>b</sup> Where U-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The R-value of continuous insulation can be added to or subtracted from the original tested design.

Where heated slabs are below grade, below-grade walls shall comply with the U-factor requirements for above-grade mass walls,

<sup>d</sup> Mass floors' shall be in accordance with Section C402.2.3.

\* "Mass walls" shall be in accordance with Section C402.2.2.

**TABLE C402.1.3** – Comparison ECCCNYS-2020 versus NYStretch Table CB 102.2 (Also used for ASHRAE 90.1-2016; MUST be adopted specifically by the jurisdiction)

#### OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD<sup>a, h</sup>

	4 Excep	t Marine		5	6		
Climate Zone	All Other	Group R	All Other	Group R	All Other	Group R	
			Roofs				
Insulation Entirely above Roof Deck	<b>R-30ci/</b> R-33ci	R-30ci/ R-33ci	<b>R-30ci</b> / R-33ci	<mark>R-30c</mark> i/ R-33ci	R- <b>30ci</b> / R-33ci	R-30ci/ R-33ci	
Metal Buildings <sup>b</sup>	R-9.5 + R-11 LS	R-9.5 + R-11 LS	R-9.5 + R-11 LS	R-9.5 + R-11 LS	R-9.5 + R-11 LS/ R-30 + R-11 LS	R-9.5 + R-11 LS/ R-30 + R-11 LS	
Attic and Other	<b>R-38</b> / R-53	<b>R-38</b> / R-53	R- <b>38</b> / R-53	<b>R-49</b> / R-53	<b>R-49</b> / R-53	R-49/ R-53	
		Wa	IIs, Above Grade				
Mass <sup>e</sup>	R-9.5ci/ R-11.4ci	R-11,4ci/ R-13,3ci	R-11.4ci/ R-13.3ci	R-13.3ci/ R-15.2ci	<b>R-13.3ci</b> / R-15,2ci	R-12.5ci	
Metal Buildings	R-13 + R-13ci	R-13 + R-13ci/ R-13 + R-19.5ci	R-13 + R-13ci/ R-13 + R-19.5ci	R-13 + R-13ci/ R-13 + R-19.5ci	R-13 + R-13ci/ R-13 + R-19_5ci	R-13 + R-13ci/ R-13 + R-19.5ci	
Metal Framed	R-13 + R-7.5ci/ R-13 + R-8 5ci	R-13 + R-7.5ci/ R-13 + R-8.5ci	R-13 + R-7.5ci/ R-13 + R-11ci	R-13 + R-7.5ci/ R-13 + R-11ci	R-13 + R-7.5ci/ R-13 + R-13,5ci	R-13 + R-7.5ci/ R-13 + R-14 5ci	
Wood Framed and Other	R-13 + R-3,8ci or R-20/ R-13 + R-4,5ci or R-19 + R-1,5ci	R-13 + R-3.8ci or R-20/ R-13 + R-4.5ci or R-19 + R-1.5ci	R-13 + R-3.8ci or R-20/ R-13 + R-9ci or R-19 + R-5ci	R-13 + R-7.5ci or R-20 + R-3.8ci/ R-13 + R-9ci or R-19 + R-5ci	R-13 + R-7.5ci or R-20 + R-3.8ci/ R-13 + R-9ci or R-19 + R-5ci	R-13 + R-7.5ci or R-20 + R-3.8ci/ R-13 + R-9.5ci or R-19 + R-6ci	
		Wa	ills, Below Grade				
Below-Grade Wall <sup>c</sup>	R-7.5ci	R-7.5ci/ R-10ci	R-7.5ci	R-7.5ci/ R-10ci	R-7.5ci/ R-10ci	R-7.5ci/ R-15ci	
We want the second			Floors				
Mass <sup>d</sup>	R-10c/ R-15ci	R-10.4c/ R-16.7ci	<mark>R-10c/</mark> R-15ci	R-12.5c/ R-16,7ci	R-12.5c/ R-16.7ci	R-12.5c/ R-16.7ci	
Joist/Framing <sup>e</sup>	R-30	R-30	R-30	R-30	<b>R-30</b> / R-38	<b>R-30</b> / R-38	



Climata Zana		4		5	6					
Climate Zone	All Other	Group R	All Other	Group R	All Other	Group R				
	Slab-on-Grade Floors									
Unheated Slabs	R-10 for 12" below/ R-15 for 24" below	R-10 for 24" below/ R-15 for 24" below	R-15 for 24" below							
Heated Slabs <sup>®</sup>	R-15 for 24" below + R-5 full slab/ R-20 for 48" below + R-5 full slab	R-15 for 24" below + R-5 full slab/ R-20 for 48" below + R-5 full slab	R-15 for 36" below + R-5 full slab/ R-20 for 48" below + R-5 full slab	R-15 for 36" below + R-5 full slab/ R-20 for 48" below + R-5 full slab	R-15 for 36" below + R-5 full slab/ R-20 for 48" below + R-5 full slab	R-15 for 36" below + R-5 full slab				
			Opaque Doors							
Non-Swinging	R-4.75	R-4.75	R-4,75	R-4.75	R-4.75	R-4.75				

For SI, 1 inch = 25,4 mm, 1 pound per square foot = 4,88 kg/m2, 1 pound per cubic foot = 16 kg/m3, ci = Continuous insulation, NR = No Requirement, LS = Liner System

<sup>o</sup> Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A,

- <sup>9</sup> Where using R-value compliance method, a thermal spacer block shall be provided, otherwise use the U-factor compliance method in Table C402.14.
- <sup>c</sup> Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

"Mass walls" shall be in accordance with Section C402.2.2.

<sup>9</sup> The first value is for perimeter insulation and the second value is for slub insulation. Perimeter insulation is not required to extend below the bottom of the slab. <sup>h</sup> Not applicable to garage doors. See Table C40214.

#### Provisions in NYStretch that are not in NYS Energy Code

- C402.1.4.2 Thermal Resistance of Mechanical Equipment Penetrations (mandatory) When the area of mechanical equipment penetrations exceeds 1% of the opaque above-grade wall area, this shall be considered a separate wall assembly with a default U-factor of 0.5.
- C402.2.8 Continuous Insulation (mandatory) Balconies or parapets that penetrate building thermal envelope must be 1) insulated with continuous insulation having R-value of at least R-3 or 2) incorporate a minimum R-3 thermal break where building envelope is penetrated.
- C402.5 Air Leakage (mandatory) and C402.5.9 Air Barrier Testing
  - New buildings between 25,000 sf and 50,000 sf and < 75ft high shall be tested by blower door and have</li> leakage rates < 0.40 cfm/sf @ 75 pascals. These buildings must also comply with NYS Energy Code requirements pertaining to air intakes, exhausts, stairways, and shafts; loading dock weather-seals; and vestibules (C402.5.5, C402.5.6, and C402.5.7).
  - Other new buildings may demonstrate compliance according to the above provisions or by complying with the prescriptive requirements in Sections C402.5.1 through 402.5.8 and C408.4 (see below for description).
- C403.7.4 Energy Recovery Ventilation (mandatory) (previously C403.2.7) Energy recovery ventilation is mandatory when ventilation air flows exceed certain amounts. The NYS Energy Code and NYStretch requirements are the same. NYStretch modified one exception to identify conditions with multiple exhaust fans or outlets.
- C403.8.1 Allowable Fan HP (mandatory) (previously C403.2.12.1) Small differences regarding fan-power limitation between NYS Energy Code and NYStretch, plus additional exceptions in NYStretch.

### NYStretch Energy Code–2020

### Comparison to 2020 Energy Conservation Construction Code of NYS



- 1. Adds corridors and dining areas to locations where occupancy sensors are required (C405.2.1).
- 2. Adds occupancy sensor controls to dim lighting at building exits when unoccupied (C405.2.1.4).
- 3. Requires daylight responsive controls in spaces with more than 100 watts (versus 150 watts) of general lighting (C405.2.3).
- 4. Exterior lighting unless controlled from within a dwelling unit, exterior lighting must be reduced by at least 50% during certain times of day (C405.2.6).
- 5. Parking lot lighting reduced by at least 50% when no activity detected for at least 15 minutes (C405.2.6.5).
- 6. Interior lighting allowances for both building area method and space-by-space method there are more stringent by about 10–20% (Tables C405.3.2([1 and 2]).
- 7. Exterior lighting allowances for some areas that are slightly more stringent (Table C405.4.2[2]).

**C405.8.1.1 Power Conversion System for Elevators (prescriptive)** – Elevators with rise of more than 75ft are required to have power conversion system. Motor shall have Class IE2 efficiency rating or alternative that has equal or better efficiency. Potential energy released during motion shall be recovered and supplied to building electrical system.

**C405.9 Commercial Kitchen Equipment (prescriptive)** – Efficiency requirements for fryers, hot food holding cabinets, steam cookers, dishwashers, ovens.

**C405.10 Electric Vehicle Charging Capability (prescriptive)** – Parking garages and lots with more than 10 spaces must provide panel capacity and conduit for 208/240V outlets for at least 5% of parking spaces with a minimum of two or provide the outlets for 5% of spaces with a minimum of two spaces.

**C405.11 Solar-Ready Zone (mandatory)** – Requires compliance with Appendix CA. Provide designated roof space for future PV or solar thermal system on buildings that are five stories or less and oriented between 110 and 270 degrees of true north. There are some exceptions such as an on-site renewable energy system, a building shaded more than 70% of daylight hours, or a licensed design professional who certifies requirements for extensive rooftop equipment, vegetation, skylights, or other obstruction. Requirements include a plan in design for and electrical conduit to roof from electrical panel, along with panel space for the PV interface and roof-load calculations.

**C405.12 Whole Building Energy and C405.13 Whole Building Electrical Monitoring (prescriptive)** – Monitoring energy use for all energy sources in new buildings except for buildings <25,000 sf; Group R buildings with <10,000 sf of common area; and fuel use for on-site emergency equipment.

#### C406.1 Additional Energy Efficiency Packages

📕 On-site Renewable Energy option is now part of Appendix CC "Additional power distribution system packages."

#### C407 Total Building Performance Method of Compliance

Must comply with ASHRAE 90.1 2016 Compliance Path – Section 11 or Appendix G

#### C408.2 Commissioning this section is required when one of following conditions is met:

- 1. Building greater than 25,000 sf
- 2. Mechanical system capacity > 480,000 Btu/h
- 3. Combined water and space heating > 600,000 Btu/h

Includes more specific requirements/details for commissioning mechanical, renewable energy, and water heating systems. HVAC systems must be balanced in accordance with ANSI/ASHRAE 111, "Testing, Adjusting, and Balancing of Building HVAC Systems."

**C408.4 Air Barrier Commissioning** – Registered design professional or approved agent shall provide documentation of air barrier components and field inspection reports.

#### C502 and C503 Existing Buildings/Additions

Commissioning required for new HVAC, water heating systems, and air barriers in additions.

#### Appendices

- Optional adoption by local jurisdiction or township
  - Appendix CB: Prescriptive R-value tables
  - Appendix CC: Additional Power Distribution System Packages

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# Energy Savings and Cost-Effectiveness Analysis of the 2020 NYStretch Energy Code Residential Provisions

Final Report | Report Number 19-37 | July 2019



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### Energy Savings and Cost-Effectiveness Analysis of the 2020 NYStretch Energy Code Residential Provisions

Prepared for:

#### New York State Energy Research and Development Authority

Albany, NY

Marilyn Dare Senior Project Manager

Prepared by:

#### **Resource Refocus LLC**

Berkeley, CA

Vrushali Mendon Senior Technical Consultant

> Margaret Pigman Technical Consultant

Dr. Carrie Brown Senior Technical Consultant

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### Abstract

This report summarizes the energy savings and cost-effectiveness analysis of the residential provisions of the 2020 NYStretch Energy Code of New York State. This is compared to the residential provisions of the 2016 New York City Energy Conservation Code (NYCECC) in New York City, and the residential provisions of the 2020 ECCC NYS in the rest of the state. The report includes the methodology used in the analysis, assumptions, and results at the applicable climate design zones for New York State. An additional analysis evaluating the energy savings and cost-effectiveness of the additional energy efficiency credits path (R407) is also conducted. The results associated with the analysis are summarized in the Appendix.

### Keywords

Energy code, stretch energy code, cost effectiveness, NYSERDA

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### **Table of Contents**

No	tice			i	
Pre	ferre	ed Cit	ation	i	
Ab	strac	:t	I	ii	
Ke	ywor	'ds	I	ï	
Ac	know	vledg	mentsi	ii	
Lis	t of 1	Table	S	v	
Ac	rony	ms a	nd Abbreviations	1	
Su	mma	ı <b>гу</b>		1	
1	Intr	roduc	tion	1	
2	Qu	alitati	ive Assessment	2	
3	Qu	antita	ntive Analysis	7	
3	.1	Over	view of the Analysis	7	
-	3.1. Re:	1 sident	Determining the Baseline Annual Energy Use and Energy Cost for ial Prototypes	7	
	3.1. Cor	2 nstruct	Determining the Annual Energy Use, Annual Energy Cost, and Incremental ion Cost for Residential Prototypes using NYStretch	8	
	3.1.	3	Cost Effectiveness of Residential Provisions of NYStretch	8	
3	.2	Suite	e of Energy Models and Aggregation Scheme	9	
3	.3	Ener	gy Analysis1	0	
	3.3.	1	Simulation Tool1	0	
	3.3.	2	Weather Locations	0	
	3.3.	3	Site, Source, and Energy Cost Calculations	0	
	3.3.	4	Baseline Models for New York State1	1	
	3.3.	5	Implementation of the 2020 NYStretch Requirements1	1	
3	.4	Incre	emental Cost Calculations1	6	
	3.4.	.1	Location Multipliers	6	
	3.4.	2	Incremental Cost for Each Measure1	7	
	3.4.	.3	Total Incremental Costs by Prototype and Climate Design Zone	4	
3	5.5	Cost	-Effectiveness Analysis2	5	
	3.5.	.1	Fuel Prices	5	
	3.5.	2	Economic Parameters	5	
4	Re	sults.		9	
2	.1	Ener	rgy Savings at the Climate Design Zone and State Level	9	
	4.1.1	Site Energy Savings			
----	--------------	--	------	--	--
	4.1.2	Source Energy Savings			
4	I.2 Ene	ergy Cost Savings at the Climate Design Zone and State Level			
4	I.3 Cos	t-Effectiveness			
	4.3.1	Simple Payback			
	4.3.2	10-Year Present Value of Energy Cost Savings			
	4.3.3	30-year Life Cycle Cost (LCC) Savings			
5	Discuss	sion	41		
6	Conclus	sion	42		
7	7 References				
Ар	pendix A	. Cost-Effectiveness Analysis of Section R407	A-1		
Ар	pendix B	. Energy Savings for All Models	B-1		
En	dnotes		EN-1		

## **List of Tables**

Table 1. A Preliminary Qualitative Comparison	2
Table 2. A Preliminary Qualitative Comparison	6
Table 3. Matrix of Construction Weights Used in the Analysis	9
Table 4. Split of Construction Weights between CDZ 4A-NYC and CDZ 4A-balance	10
Table 5. Federal Minimum Equipment Efficiencies	11
Table 6. Savings from Moving Ducts to Conditioned Space	13
Table 7. Lighting Energy Use	16
Table 8. Location Cost Multipliers Used in the Analysis	17
Table 9. Incremental Cost Estimates for Exterior Wall Insulation: R-21 int vs. R-20	
Table 10. Incremental Cost Estimates for Floor Insulation: R-30 vs. R-19	18
Table 11. Incremental Cost Estimates for Slab Insulation: 4' vs. 2' R-10 XPS	19
Table 12 Incremental Cost Estimates for Passment Wall Insulations B 10 vo. B 10 Coulty	20
Table 12. Incremental Cost Estimates for Dasement Wait Insulation, R-19 VS. R-10 Cavity	
Table 13. Incremental Cost Estimates for Ventilation: HRV/ERV System vs. Exhaust	20
Table 12. Incremental Cost Estimates for Ventilation: HRV/ERV System vs. Exhaust         Ventilation	20
Table 12. Incremental Cost Estimates for Ventilation: HRV/ERV System vs. Exhaust         Ventilation         Table 14. Incremental Cost Estimates for Ventilation: CFIS System vs. Exhaust Ventilation	21
<ul> <li>Table 12. Incremental Cost Estimates for Basement Wall Insulation. R-19 Vs. R-10 Cavity</li> <li>Table 13. Incremental Cost Estimates for Ventilation: HRV/ERV System vs. Exhaust</li> <li>Ventilation</li> <li>Table 14. Incremental Cost Estimates for Ventilation: CFIS System vs. Exhaust Ventilation</li> <li>Table 15. Total Incremental Costs of the Prescriptive and Mandatory Provisions of</li> </ul>	21 21
<ul> <li>Table 12. Incremental Cost Estimates for Basement Wall Insulation. R-19 Vs. R-10 Cavity</li> <li>Table 13. Incremental Cost Estimates for Ventilation: HRV/ERV System vs. Exhaust Ventilation</li> <li>Table 14. Incremental Cost Estimates for Ventilation: CFIS System vs. Exhaust Ventilation</li> <li>Table 15. Total Incremental Costs of the Prescriptive and Mandatory Provisions of the 2020 NYStretch Code Compared to the 2016 NYCECC in CDZ 4A-NYC</li> </ul>	21 22
<ul> <li>Table 12. Incremental Cost Estimates for Basement Wall Insulation. R-19 Vs. R-10 Cavity</li> <li>Table 13. Incremental Cost Estimates for Ventilation: HRV/ERV System vs. Exhaust Ventilation</li> <li>Table 14. Incremental Cost Estimates for Ventilation: CFIS System vs. Exhaust Ventilation</li> <li>Table 15. Total Incremental Costs of the Prescriptive and Mandatory Provisions of the 2020 NYStretch Code Compared to the 2016 NYCECC in CDZ 4A-NYC and 2020 ECCC NYS Elsewhere</li> </ul>	20 21 22
<ul> <li>Table 12. Incremental Cost Estimates for Basement Wall Insulation. R-19 VS. R-10 Cavity</li> <li>Table 13. Incremental Cost Estimates for Ventilation: HRV/ERV System vs. Exhaust Ventilation</li> <li>Table 14. Incremental Cost Estimates for Ventilation: CFIS System vs. Exhaust Ventilation</li> <li>Table 15. Total Incremental Costs of the Prescriptive and Mandatory Provisions of the 2020 NYStretch Code Compared to the 2016 NYCECC in CDZ 4A-NYC and 2020 ECCC NYS Elsewhere</li></ul>	21 22 24 25
<ul> <li>Table 12. Incremental Cost Estimates for Basement Wall Insulation. R-19 Vs. R-10 Cavity</li> <li>Table 13. Incremental Cost Estimates for Ventilation: HRV/ERV System vs. Exhaust Ventilation</li> <li>Table 14. Incremental Cost Estimates for Ventilation: CFIS System vs. Exhaust Ventilation</li> <li>Table 15. Total Incremental Costs of the Prescriptive and Mandatory Provisions of the 2020 NYStretch Code Compared to the 2016 NYCECC in CDZ 4A-NYC and 2020 ECCC NYS Elsewhere</li> <li>Table 16. Fuel Prices</li></ul>	21 22 22 24 25 27
<ul> <li>Table 12. Incremental Cost Estimates for Basement Wall Insulation. R-19 Vs. R-10 Cavity</li> <li>Table 13. Incremental Cost Estimates for Ventilation: HRV/ERV System vs. Exhaust Ventilation</li> <li>Table 14. Incremental Cost Estimates for Ventilation: CFIS System vs. Exhaust Ventilation</li> <li>Table 15. Total Incremental Costs of the Prescriptive and Mandatory Provisions of the 2020 NYStretch Code Compared to the 2016 NYCECC in CDZ 4A-NYC and 2020 ECCC NYS Elsewhere</li></ul>	21 22 22 24 25 27 28
<ul> <li>Table 12. Incremental Cost Estimates for Basement Wall Insulation. R-19 Vs. R-10 Cavity</li> <li>Table 13. Incremental Cost Estimates for Ventilation: HRV/ERV System vs. Exhaust Ventilation</li> <li>Table 14. Incremental Cost Estimates for Ventilation: CFIS System vs. Exhaust Ventilation</li> <li>Table 15. Total Incremental Costs of the Prescriptive and Mandatory Provisions of the 2020 NYStretch Code Compared to the 2016 NYCECC in CDZ 4A-NYC and 2020 ECCC NYS Elsewhere</li></ul>	21 22 24 24 25 27 28

Table 20. Regulated Site Energy Savings for the Prescriptive and Mandatory Provisions	
of the 2020 NYStretch Code for Multifamily Buildings	30
Table 21. Weighted Average Regulated Site Energy Savings for the Prescriptive and	
Mandatory Provisions of the 2020 NYStretch Code	31
Table 22. Site to Source Energy Conversion Ratios	32
Table 23. Source Energy Savings for the Prescriptive and Mandatory Provisions	
of the 2020 NYStretch Code for Single-family Buildings	
Table 24. Source Energy Savings for the Prescriptive and Mandatory Provisions	
of the 2020 NYStretch Code for Multifamily Buildings	
Table 25. Weighted Average Source Energy Savings for the Prescriptive and Mandatory	
Provisions of the 2020 NYStretch Code	
Table 26. Annual Energy Cost Savings of the Prescriptive and Mandatory Provisions of the	
2020 NYStretch Code for Single-family Buildings	34
Table 27. Annual Energy Cost Savings of the Prescriptive and Mandatory Provisions	
of the 2020 NYStretch Code for Multifamily Buildings	
Table 28. Weighted Average Annual Energy Cost Savings of the Prescriptive and	
Mandatory Provisions of the 2020 NYStretch Code	
Table 29. Weighted Average Simple Payback	37
Table 30. Weighted Average Net Present Value (NPV) of Energy Cost Savings	
over 10 Years	38
Table 31. Weighted Average 30-Year LCC Savings	38
Table 32. Weighted Results for the Prescriptive and Mandatory Provisions of the 2020	
NYStretch Code at the State Level	39
Table 33. Fuel Prices used in the Analysis, With and Without the Cost of Carbon	40
Table 34. Weighted Average 30-Year LCC Savings When the Avoided Cost of Carbon	
is Included	40

# Acronyms and Abbreviations

CDZ	climate design zone
CPI	consumer price index
DHW	domestic hot water
DOE	US Department of Energy
DWHR	drain water heat recovery
ECCC NYS	2020 Energy Conservation Construction Code of New York State
EF	energy factor
EIA	Energy Information Association
ERV	energy recovery ventilator
EUL	effective useful life
EV	electric vehicle

ft	feet
HRV	heat recovery ventilator
HVAC	heating, ventilation, and air conditioning
IECC	International Energy Conservation Code
kWh	kilowatt hours
LCC	life cycle cost
lf	linear foot
lm	lumen
LPD	lighting power density
MF	multifamily
m/s	meters per second
MW	megawatts
NAHB	National Association of Home Builders
NPV	net present value
NREL	National Renewable Energy Laboratory
NREM	National Residential Efficiency Measures Database
NYC	New York City
NY	New York
NYCECC	New York City Energy Conservation Code
NYDOS	New York Department of State
NYS	New York State
NYSERDA	New York State Energy Research and Development Authority
PNNL	Pacific Northwest National Laboratory
RGGI	Regional Greenhouse Gas Initiative
SF	single family
SRE	sensible recovery efficiency
UEF	uniform energy factor
W	watts

## Summary

This analysis was conducted at the request of the New York State Energy Research and Development Authority (NYSERDA) to assist with the adoption of the 2020 NYStretch Energy Code. The analysis evaluates the energy savings and cost-effectiveness potential of the residential prescriptive and mandatory provisions of the 2020 NYStretch code when compared to the residential provisions of the 2020 Energy Conservation Construction Code of New York State (ECCC NYS) and the 2016 New York City Energy Conservation Construction Code (NYCECC).

The analysis closely follows the methodology set forth by the U.S. Department of Energy (U.S. DOE) for conducting cost-effectiveness analyses of residential code changes (Taylor et al. 2015) and the procedure used for the previous energy and cost-effectiveness evaluation of the 2020 ECCC NYS (NYSERDA 19-32, 2019). The analysis also leverages the residential prototype building models developed by Resource Refocus LLC for the evaluation of the 2020 ECCC NYS, which were in turn developed from the set of DOE residential prototype building models developed by the Pacific Northwest National Laboratory (PNNL) for the 2015 IECC code development analysis. This approach maintains a consistency between the current analysis and past work conducted by NYSERDA, U.S. DOE, and PNNL for New York State (NYSERDA 2019 and Mendon et al. 2016).

The analysis included a qualitative assessment to evaluate the anticipated energy impact of code changes proposed by the 2020 NYStretch code, including a determination of which impacts could be quantified through an energy analysis. An energy analysis was then conducted by creating customized energy models tailored to the code requirements for New York State. The energy savings from the energy analysis were then combined with the incremental construction costs associated with the changes to determine the simple payback, the 10-year net present value (NPV) of energy cost savings and the 30-year Life Cycle Cost (LCC) savings.

Overall, the prescriptive and mandatory provisions of the 2020 NYStretch code are expected to yield positive energy savings and cost-effective benefits to homeowners compared to the baseline 2020 ECCC NYS and the 2016 NYCECC. Table S-1 summarizes the statewide site energy, source energy, and energy cost savings, and Table S-2 summarizes the disaggregated energy and cost savings for each

climate design zone (CDZ). Table S-3 summarizes the disaggregated incremental construction costs and simple payback by building type in each CDZ. Finally, Table S-4 summarizes the average energy cost savings, incremental construction costs and cost-effectiveness results for the prescriptive and mandatory provisions of NYStretch, weighted over the single- and multifamily building construction weights for New York State.

Table 3-1. Statewide Average Annual Energy and Cost Saving	Table S-1. Statewide	Average Annual	<b>Energy and Cost</b>	Savings
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	Total Regulated Site Energy (kBtu/dwelling unit)	Total Regulated Source Energy (kBtu/dwelling unit)	Total Energy Costs (\$/dwelling unit)
Baseline*	59926,4	91545.1	1514.9
2020 NYStretch	45161.4	71769.2	1216.7
Savings	24.6%	21.6%	19.7%
* The baseline code is the 2	16 NVCECC in CD7 44-NVC	and 2020 ECCC NVS in all o	ther CDZs

The baseline code is the 2016 NYCECC in CDZ 4A-NYC and 2020 ECCC NYS in all other CDZs

Table S-2. Average	Annual Energy and	d Cost Savings b	v Climate Des	ian Zone
			· · · · · · · · · · · · · · · · · · ·	.goo

Climate Design Zone	Total Regulated Site Energy Savings	Total Regulated Source Energy Savings	Total Energy Costs Savings
4A-NYC	21,1%	19.9%	19.0%
4A-balance	21,5%	19.8%	18.8%
5A	25.3%	21.9%	19.6%
6A	26.2%	23.1%	20.9%

Table 3	S-3.	Average	Annual	Simple	Payback	by E	Building	Typ	e and	Climate	Desig	n Zone

	S	ingle-family			Multifamily	
Climate Design Zone	Total Annual Energy Cost Savings (\$/dwelling unit)	Total Incremental Costs (\$/dwelling unit)	Simple Payback (Years)	Total Annual Energy Cost Savings (\$/dwelling unit)	Total Incremental Costs (\$/dwelling unit)	Simple Payback (Years)
4A-NYC	\$301	\$1,910	6.3	\$176	\$1,625	9.2
4A-balance	\$301	\$2,463	8.2	\$167	\$1,488	8.9
5A	\$351	\$2,202	6.3	\$172	\$1,751	10.2
6A	\$372	\$1,506	4.1	NA	NA	NA
NY State	\$348	\$2,057	5.9	\$171	\$1,591	9.3

#### Table S-4. Weighted Results

	New York State Average
Annual Energy Cost Savings (\$/dwelling unit)	\$278
Incremental Costs (\$/dwelling unit)	\$1,795
Simple Payback (Years)	6.4
10-Year NPV of Cost Savings Including Replacement Costs and Residual Values (\$/dwelling unit)	\$2,854
30-Yr LCC Savings (\$/dwelling unit)	\$1,741

For the Prescriptive and Mandatory Provisions of the 2020 NYStretch Code at the State Level

While the present analysis focuses on the prescriptive and mandatory provisions of NYStretch, the code offers other compliance paths. The multiple compliance paths in NYStretch are expected to yield equal or higher savings. The performance paths offer flexibility to the builder in meeting the code, resulting in a wide variability in the performance of homes complying with the simulated paths or the passive house path. It should also be noted that this analysis assumes no fuel switching between the baseline and the NYStretch cases. Additionally, while NYStretch contains many elements that encourage better building design, this analysis used conservative savings and incremental cost estimates for many of the measures. In this respect, the estimated energy savings reported from the analysis are likely to be conservative compared to actual energy savings that can be achieved by the 2020 NYStretch code.

## 1 Introduction

The New York State Energy Research and Development Authority (NYSERDA) developed the 2020 NYStretch Energy Code with guidance from an advisory group composed of public and private stakeholders. It is a voluntary, locally adoptable stretch energy code designed as an overlay to the 2020 Energy Conservation Construction Code of New York State (ECCC NYS) and is expected to be far more efficient than the residential provisions of the 2018 International Energy Conservation Code (IECC) and the commercial provisions of ASHRAE Standard. 90.1-2016.

In order to assist communities in adopting the stretch code, NYSERDA requested an analysis of the energy savings and cost-effectiveness of the 2020 NYStretch code compared to the State baseline codes, the 2016 New York State Energy Conservation and Construction Code (NYSECC) and the 2020 ECCC NYS. This analysis was conducted in each of the three climate design zones (CDZ) in New York State: 4A, 5A, and 6A and results are provided in this technical report, along with a narrative summarizing the findings and their implications for New York State's code development process.

The analysis builds on previous analysis conducted by the team for NYSERDA, including the costeffectiveness analysis of the 2020 ECCC NYS compared to the previous 2016 NYSECC as well as technical reports and analyses published by the U.S. Department of Energy (U.S. DOE) and the Pacific Northwest National Laboratory (PNNL). Additionally, the methodology also draws from other technical resources as needed. Relevant to the residential scope of the analysis, NYSERDA made available the proposed Draft NYStretch Energy Code, January 2019<sup>1</sup> and results of an energy analysis conducted by the New Buildings Institute (NBI) and Earth Advantage during the stretch code development process. The firm Earth Advantage provided a presentation describing the potential savings for the residential provisions of the 2020 NYStretch code based on their modeling results using REMRate.

## 2 Qualitative Assessment

This section contains qualitative comparison tables for the prescriptive and mandatory provisions of the proposed 2020 NYStretch Energy Code (NYStretch) compared to the 2020 Energy Conservation Construction Code of New York State (ECCC NYS) in climate design zones (CDZ) 4A, 5A, and 6A, Because CDZ 4A covers New York City, which follows the more stringent 2016 New York City Energy Conservation Code (NYCECC), an additional evaluation of the 2020 NYStretch compared to the 2016 NYCECC is also conducted for New York City.

The qualitative assessment includes an evaluation of the expected energy impact of each provision and whether the change will be captured through energy modeling during the quantitative analysis. The assessment is limited to prescriptive and mandatory provisions of the residential provisions of the code as they apply to new construction only. It does not include editorial, clarification, and administrative type of changes, which are not expected to have a direct impact on energy. Table 1 summarizes the changes between the baseline 2020 ECCC NYS and the proposed 2020 NYStretch code, along with the results of the qualitative assessment.

#### Table 1. A Preliminary Qualitative Comparison

Code Section	Component	CDZ	2020 ECCC NYS		2020 NYStretch	Energy Impact Captured through Energy Modeling (Yes/No)	
		4A	0.	32	0.27		
	Fenestration	5A	0	.3	0.27		
		6A	0.3 <sup>a</sup>	0.28 ª	0.27		
	_	4A	0.4		0.4	Yes	
	Fenestration SHGC	5A	NR		NR		
		6A	NR ª	NR ª	NR		
D 400 4	Ceiling R value	4A	49		49	changes to the prescriptive envelope are	
R402.1		5A	49		49		
		6A	49 <sup>a</sup>	60 ª	49	expected to yield positive	
	Wood-framed R-value	4A	20 or 13+5		21 int or 20+5 or 13+10	CDZs.	
		5A	20 or 13+5		21 int or 20+5 or 13+10		
		6A	20+5 or 13+10 ª	23 cavity <sup>a</sup>	20+5 or 13+10		

The Differences with the Largest Energy Impact between the 2020 NYStretch Code and the 2020 ECCC NYS (Prescriptive + Mandatory Provisions)

#### Table 1 continued

Code Section	Component	CDZ	2020 ECCC NYS		2020 NYStretch	Energy Impact Captured through Energy Modeling (Yes/No)
		4A	1	9	30	
	Floor R-value	5A	3	0	30	1
		6A	30 ª	30 ª	30	]
		4A	10 c	or 13	15 or 19	]
	Basement wall	5A	15 c	or 19	15 or 19	-
P402.1	i t fuido	6A	15 or 19ª	15 or 19ª	15 or 19	-
K4UZ, I		4A	10,	2 ft	10, 4 ft	
	Slab R-value	5A	10,	2 ft	10, 4 ft	
	und depui	6A	10, 4 ft ª	10, 4 ft <sup>a</sup>	10, 4ft	
		4A	15 c	or 19	15 or 19	
	Crawlspace	5A	15 c	or 19	15 or 19	
		6A	15 or 19*	15 or 19*	15 or 19	
R402.4.1.1	Insulation Installation	ali	Grade Not Specified		No more than 2% of total insulated area shall have compressed insulation or gaps/voids (Grade I insulation required)	Assumptions for the baseline configuration would need significant installation quality data. In absence of such data, the impact of this change cannot be evaluated through energy modeling. This change is expected to improve insulation installation, resulting in better U-factors for the overall assemblies. Thus, the practical impact of this change is expected to be positive energy savings.
R403.3	Duct Location	all	Not controlled		Duct System is required to be within conditioned space.	Yes The savings from this change will not be modeled explicitly, but will be applied to the heating, cooling and fan energy during post-processing. This change is expected to save conduction and leakage losses from ducts and result in positive energy savings.

#### Table 1 continued

Code Section	Component	CDZ	2020 ECCC NYS	2020 NYStretch	Energy Impact Captured through Energy Modeling (Yes/No)
R403.3.8	Duct Sizing	all		Ducts are required to be sized in accordance with ACCA Manual D.	No Modeling this change would require developing a full duct network in <i>EnergyPlus</i> as well as adequate information about current trends in duct sizing in the field. Both issues would result in several configurations of the duct layout making the exercise cost prohibitive. This change is expected to save losses from incorrectly sized ducts and result in positive energy
R403.5.5	Supply of heated water	all	None	The new section adds four options for increasing the efficiency of hot water supply. These include limiting the maximum allowable pipe length or volume, installing drain water heat recovery units or recirculation systems.	Yes The savings from this change will not be modeled explicitly but will be applied to the hot water energy during post- processing. This change is expected to reduce losses from domestic hot water (DHW) pipes and is expected to result in positive energy savings.
R403.6.2	Balanced and HRV/ERV systems	all	None	The new section requires an energy or heat recovery ventilator (ERV or HRV) in each dwelling unit in CDZ 5A and 6A. In CDZ 4A, it allows a balanced ventilation system to comply with the requirement.	Yes The impact from this code change will be modeled assuming an ERV/HRV system in CDZ 5A and 6A and balanced ventilation in CDZ 4A and CDZ 4A- balance. This change is expected to reduce heating energy but also comes with an increase in fan energy. The overall impact may thus be neutral.

#### Table 1 continued

Code Section	Component	CDZ	2020 ECCC NYS	2020 NYStretch	Energy Impact Captured through Energy Modeling (Yes/No)
R403.6.3	Verification of ventilation systems	all	None	The new section requires that the performance of ventilation systems be tested and verified by an approved agency.	No This is a verification requirement and thus cannot be modeled. This change is expected to ensure proper functioning of the ventilation system. The energy impact from this provision is expected to be neutral.
R404.1	Lighting Equipment	all	60 lm/W for lamps over 40 W; 50 lm/W for lamps between 15 W and 40 W; 40 lm/W for lamps 15 W or less.	This change increases the minimum required efficacy of lamps to be 65 Im/W and the total luminaire efficacy to be 45 Im/W.	Yes The savings from this change will be modeled by reducing the lighting power density (LPD) in the models per the revised efficacy limits. This change is expected to reduce losses from inefficient lighting and is expected to result in positive energy savings.
R404.2	Electrical power packages	all	None	This new section adds requirements for a solar ready zone and electrical vehicle (EV) service equipment	No This code change requires the buildings to be solar ready and have EV infrastructure but does not explicitly mandate any specific equipment. This change is expected to yield savings by encouraging design considerations for solar energy and EV infrastructure.

The 2020 ECCC NYS includes two prescriptive envelope options for CZ 6A.

Table 2 summarizes the additional differences between the baseline 2016 NYCECC and the 2020 NYStretch code, along with the results of the qualitative assessment.

#### Table 2. A Preliminary Qualitative Comparison

The Additional Differences between the 2020 NYStretch Code and the 2016 NYCECC (Prescriptive + Mandatory Provisions)

Component	2016 NYCECC	2020 NYStretch	Energy Impact Captured through Energy Modeling (Yes/No)
Fenestration U-factor	0.32	0.27	Yes
			The impact is expected to yield positive energy savings in CDZ 4A.
Fenestration SHGC	0.4	0.4	No
Ceiling R value	49	49	NO
Wood-framed R-value	20+5	21 int or 20+5 or 13+10	The exterior walls will be modeled as R-20+5 in both
Floor R-value	30	30	the baseline and the
Basement wall R-value	15/19	15/19	requirements are the same
Slab R-value and depth	10,4	10, 4 ft	between the baseline and
Crawlspace wall R-value	15/19	15/19	the 2020 in ristretch code.
Lighting Equipment	75% of permanently installed lamps are required to be high efficacy	90% of permanently installed lamps have to be high efficacy with a minimum required efficacy of lamps to be 65 Im/W and the total luminaire efficacy to be 45 Im/W.	Yes The savings from this change will be modeled by reducing the lighting power density (LPD) in the models per the revised efficacy limits. This change is expected to reduce losses from inefficient lighting and result in positive energy savings.

In summary, the overall energy impact of the 2020 NYStretch code is expected to be positive (energy savings) over the baseline codes.

## 3 Quantitative Analysis

This section describes the overall quantitative analysis used to assess the stringency and cost-effectiveness of the residential provisions of the proposed 2020 NYStretch Energy Code compared to the 2016 New York City Energy Conservation Code (2016 NYCECC) in New York City and the 2020 Energy Conservation Construction Code of New York State (2020 ECCC NYS) in the rest of the State. The analysis methodology builds on US Department of Energy's (DOE) methodology for determining the cost-effectiveness of residential code changes (Taylor et al. 2015), similar work conducted by the Pacific Northwest National Laboratory (PNNL) in previous code cycles (Mendon et al. 2016) and the previous analysis of the 2020 ECCC NYS conducted by Resource Refocus LLC for NYSERDA (NYSERDA 2019). Additionally, the analysis leverages the DOE residential prototype building models developed by PNNL for the 2015 International Energy Conservation Code (IECC) code development process and modified by Resource Refocus LLC for support to the New York Department of State (DOS) for the 2020 ECCC NYS Rulemaking process (NYSERDA 2019).

## 3.1 Overview of the Analysis

The 2020 NYStretch is designed to overlay the 2020 ECCC NYS. Thus, the stretch code continues to offer multiple paths for compliance, including a prescriptive option, a Passive House option, and two simulated performance path alternatives. Regardless of the compliance path chosen, additional mandatory requirements need to be met. The multiple compliance paths offer flexibility to the builder in meeting the code, resulting in a wide variability in the performance of homes complying with the simulated performance paths or the passive house path. The prescriptive path on the other hand offer less variability in terms of design and is typically more widely used in residential buildings compared to performance paths. Thus, the present analysis is based on the prescriptive and mandatory provisions of the 2020 NYStretch code. An overview of the analysis along with the methodology involved in the process is described in the following sections.

## 3.1.1 Determining the Baseline Annual Energy Use and Energy Cost for Residential Prototypes

This task involved the following steps:

1. The energy models developed by Resource Refocus LLC for the previous 2020 ECCC NYS cost-effectiveness analysis were leveraged for this step. The models were modified to reflect the revised federal minimum efficiencies for oil and gas furnaces, heat pumps, and oil boilers.

- The baseline models for CDZ 4A were further split into two sets: one representing the requirements of the 2016 NYCECC and the other set representing the requirements of the 2020 ECCC NYS. This was done to accurately compute the energy savings and cost-effectiveness of the 2020 NYStretch in New York City because the 2016 NYCECC has different envelope requirements compared to the 2020 ECCC NYS.
- 3. The two sets of models were used to simulate energy use for the baseline case for single-family and low-rise multifamily units. The set representing the requirements of the 2016 NYCECC was simulated in CDZ 4A, which was selected as the representative climate location for New York City and the other set representing the requirements of the 2020 ECCC NYS was simulated in the balance of CDZ 4A and CDZs 5A and 6A.
- 4. The annual energy use for the code-regulated end-uses of heating, cooling, fans, lighting, and domestic hot water (DHW) were extracted and converted to energy costs.
- 5. The annual energy use and energy cost were aggregated to the CDZ and State level using the weights provided by NYSERDA.

### 3.1.2 Determining the Annual Energy Use, Annual Energy Cost, and Incremental Construction Cost for Residential Prototypes using NYStretch

This task involved the following steps:

- 1. A detailed evaluation of the residential provisions of the 2020 NYStretch code was conducted as it applies to the three CDZs in the State (4A, 5A, and 6A).
- 2. A set of NYStretch models was developed to minimally meet the residential prescriptive and mandatory provisions of the 2020 NYStretch Code.
- 3. The whole building incremental construction costs were calculated for the NYStretch set compared to the respective baseline. These costs were further adjusted for location and inflation.
- 4. The annual energy use for the code-regulated end uses of heating, cooling, fans, lighting, and DHW was extracted and converted to annual energy costs.
- 5. The annual energy use and energy cost were aggregated to the CDZ and State level using the weights provided by NYSERDA.

### 3.1.3 Cost Effectiveness of Residential Provisions of NYStretch

This task involved the following steps:

- 1. The energy use estimates were used to calculate energy cost savings for each prototype.
- 2. The energy savings were matched with corresponding incremental construction costs for each case.
- 3. A simple payback, 10-year present value calculation of energy cost savings, and a 30-year life cycle cost (LCC) savings were calculated.
- 4. The cost-effectiveness metrics were aggregated to the CDZ and State level using the associated construction weights.

## 3.2 Suite of Energy Models and Aggregation Scheme

The analysis leverages the models developed by Resource Refocus during the previous 2020 ECCC NYS cost-effectiveness analysis conducted for NYSERDA (NYSERDA 2019). These models, in turn developed from a set of 32 DOE/PNNL 2015 IECC residential prototype models, represent a majority of the new residential building construction stock. The set includes a detached single-family building model (total conditioned floor area of 2,400 ft<sup>2</sup>, two stories and 8.5' ceilings) and a low-rise multifamily building model (a three-story apartment building with six dwelling units per floor, in rows of three separated by a central breezeway; conditioned floor area of 1,200 ft<sup>2</sup> per unit and 8.5' ceilings), each configured with four common heating systems (gas-fired furnace, electric resistance furnace, heat pumps, and oil-fired furnaces) and four foundation types (slab-on-grade, heated and unheated basements, and crawlspaces) (Mendon et al. 2014 and Taylor et al. 2015).

These models are supplemented with a set of associated construction weights for the State, provided by NYSERDA and are summarized in Table 3. NYSERDA recommended a smaller subset of models to optimize the analysis effort and accuracy of results, resulting in a total representative construction weight of 93%. Thus, the weights were normalized to total 100% at the CDZ and State level during the analysis.

	CDZ 4A		CI	DZ 5A	Z 5A CDZ		
	SF	MF	SF	MF	SF	MF	TOTALS
Slab-on-Grade, Heat Pump	0.64%	1.69%	2.01%	0.56%	0.86%	0,0%	5.76%
Slab-on-Grade, Oil Furnace	0.0%	0.0%	0.38%	0.0%	0.0%	0.0%	0.38%
Slab-on-Grade, Gas Furnace	1.80%	2.12%	5.68%	0.70%	2,44%	0.0%	12.74%
Heated Basement, Heat Pump	0.81%	2.14%	2.55%	0.71%	1,10%	0,0%	7,31%
Heated Basement, Oil Furnace	0.0%	0.33%	0.48%	0.0%	0.0%	0.0%	0.81%
Heated Basement, Gas Furnace	2.29%	2.69%	7,21%	0,89%	3.09%	0,0%	16.18%
Unheated Basement, Heat Pump	1.30%	3.45%	4.11%	1,15%	1,76%	0.0%	11.77%
Unheated Basement, Oil Furnace	0.0%	0.53%	0.77%	0.0%	0.33%	0.0%	1.64%
Unheated Basement, Gas Furnace	3,69%	4,33%	11.61%	1,44%	4.98%	0.0%	26.05%
Crawlspace, Heat Pump	0.0%	0.99%	1.18%	0.33%	0.51%	0.0%	3.01%
Crawlspace, Gas Furnace	1.06%	1.24%	3.34%	0.41%	1.43%	0.0%	7.50%
			Percenta	ige of total NY	S Construct	ion weights	93.14%

Table 3. Matrix of Construction Weights Used in the Analysis

The weights for CDZ 4A were further divided between New York City and the balance of CDZ 4A using an average of county-level housing starts from 2014 to 2018 based on data provided by NYSERDA from the Dodge Data and Analytics database. Average housing starts for the counties of Bronx, King, New York, Queens, and Richmond were grouped into "CDZ-4A-NYC" and the counties of Nassau, Suffolk, and Westchester were grouped into "CDZ 4A-balance" as summarized in Table 4.

Table 4. Split of Construction Weights between CDZ 4A-NYC and CDZ 4A-balance

Prototype	CDZ 4A-NYC	CDZ 4A-balance	Total
Single-family	19.6%	80,4%	100.0%
Multifamily	38.0%	62.0%	100.0%

## 3.3 Energy Analysis

#### 3.3.1 Simulation Tool

The analysis was conducted in version 8.0 of EnergyPlus. While more recent versions of the engine are currently available, the analysis was conducted using the same version of EnergyPlus as the previous cost-effectiveness analysis conducted for the 2020 ECCC NYS to minimize the time required for model upgrades and potential troubleshooting. Additionally, version upgrades often involve changes in estimated energy use and maintaining the same version of EnergyPlus allows for a direct comparison with earlier work conducted by PNNL for New York State (Mendon et al. 2016).

#### 3.3.2 Weather Locations

The analysis was conducted using weather data for New York City (CDZ 4A), Buffalo (CDZ 5A) and Watertown (CDZ 6A). The baseline set of models representing the 2020 ECCC NYS was simulated in all three climate design zones with the exception of a portion of CDZ 4A representing New York City, in which a baseline set representing the 2016 NYCECC was simulated. Correspondingly, the NYStretch models were simulated in all three climate design zones.

#### 3.3.3 Site, Source, and Energy Cost Calculations

Site energy use from the annual simulation was extracted for the major code regulated end-uses, including heating, cooling, ventilation, fans, lighting, and DHW and converted to energy costs using the average fuel costs for electricity, natural gas, and fuel oil for the State, which was published by the Energy Information Association (EIA). Site energy was also converted to source energy using site-source conversion factors for electricity, natural gas, and fuel oil.

#### 3.3.4 Baseline Models for New York State

Energy models representing the baseline 2020 ECCC NYS developed for the previous 2020 ECCNYS cost-effectiveness analysis were leveraged for this analysis. First, the models were modified to use the revised federal minimum equipment efficiencies as shown in Table 5. The baseline set for CDZ 4A was then further split into a set representing the minimum requirements of the 2016 NYCECC.

Parameter	Updated Federal Minimum Efficiency2
Gas furnace	80%
Oil furnace	83%
Oil boiler	84%
Heat pump	SEER 14

**Table 5. Federal Minimum Equipment Efficiencies** 

#### 3.3.4.1 Adjustment for Duct Sealing

The 2020 ECCC NYS models were developed from the 2015 IECC PNNL/DOE models provided by NYSERDA. The PNNL/DOE models do not account for losses associated with an air distribution system, and the savings associated with duct sealing provisions were added to the energy use by PNNL with an involved post-processing setup (Mendon et al. 2013). Consistent with the previous 2020 ECCC NYS cost-effectiveness analysis, this analysis used a conservative estimate of 10% heating and cooling savings across the board from duct sealing provisions for the baseline and NYStretch cases.

#### 3.3.5 Implementation of the 2020 NYStretch Requirements

The 2020 NYStretch code requires more stringent windows, insulation, and lighting compared to the baseline codes. Additionally, it also requires several improvements to the mechanical systems, including requiring ducts to be placed within conditioned zones, efficient hot water delivery systems, and balanced ventilation systems including heat or energy recovery in the colder climate zones. Each change was qualitatively evaluated to identify the changes that would result in an energy impact and could be captured using energy modeling. This section describes the modeling methodology used for evaluating the applicable changes.

#### 3.3.5.1 Envelope Improvements

The 2020 NYStretch code requires a lower U-factor for fenestration in all three climate design zones, improved wall insulation in CDZ 4A and 5A, improved floor insulation in CDZ 4A, improved basement wall insulation in CDZ 4A and higher depth of slab insulation in CDZ 4A and 5A. All these changes were modeled by updating the material properties for the respective assembly layers in the relevant *EnergyPlus* objects. For windows, the U-factor field in the simple glazing object was updated to use a value of 0.27. For exterior walls, basement walls, and floors, the conductivity of the consolidated insulation and framing layer was adjusted to yield the required R value.

The 2020 NYStretch code allows three options for meeting the prescriptive wall insulation requirement in CDZ 4A and 5A, including R-21 intermediate framing (walls with R-10 insulated headers), R-20+5 and R-13+10. This compares with the baseline requirement of R-20 or R-13+5 in the 2020 ECCC NYS and a requirement of R-20+5 in the 2016 NYCECC. This code provision was evaluated by assuming R-21 intermediate framing walls in CDZ 4A-balance and 5A in the NYStretch cases. In CDZ 4A-NYC, because the baseline already required R-20+5, the NYStretch cases were also modeled using the R-20+5 option.

#### 3.3.5.2 Ducts in Conditioned Space

The PNNL/DOE models do not account for losses associated with an air distribution system and cannot be used to determine the energy savings from moving ducts into conditioned space without a major change to the models. Analogous to the treatment of duct sealing, a flat multiplier was applied to heating and cooling energy consumption to account for moving the ducts. A literature review revealed reported savings of 10–25%, but basic assumptions, including CDZ and original duct placement, were often unavailable. Therefore, a simplified modeling exercise was conducted in *BEopt* version 2.8 to evaluate savings in CDZs 4A, 5A, and 6A.

*BEopt* models of a 2,400 ft<sup>2</sup> two-story, single-family home with three foundation types—slab, unheated basement, and heated basement—were constructed to calculate the savings from moving ducts to conditioned space. All other house characteristics were maintained as the Building America defaults except the duct location.

Table 6 shows the savings from moving ducts with 15% leakage, insulated with R-8, to conditioned space. Broadly, the cooling savings were relatively consistent in all three CDZs – about 15% for the slab, 10% for the unheated basement, and 5% for the heated basement. For heating, CDZs 5A and 6A have similar savings, but the savings in CDZ 4A were about 10 percentage points higher—15% vs 25% for the slab, 10% vs 20% for the unheated basement, and 5% vs. 15% for the heated basement.

		Duct Location	CDZ 4A	CDZ 5A	CDZ 6A
	Slab	Attic	16%	17%	16%
Cooling	Unheated basement	Basement	11%	10%	13%
	Heated basement	Basement	7%	6%	5%
	Slab	Attic	22%	12%	12%
Heating – electricity <sup>a</sup>	Unheated basement	Basement	19%	8%	7%
clocifoldy	Heated basement	Basement	16%	5%	5%
	Slab	Attic	26%	16%	16%
Heating - gas	Unheated basement	Basement	20%	9%	9%
	Heated basement	Basement	15%	5%	4%

Table 6. Savings from Moving Ducts to Conditioned Space

<sup>a</sup> While the house has a gas furnace, there is a small amount of electricity consumption for heating, particularly fan use.

When combined with the foundation weights for CDZs 4A, 5A, and 6A, the average cooling savings were found to be between 10% and 17%, the fan energy savings between 7% and 22%, and the heating savings between 9% and 26%, depending on the CDZ. Based on these results, an average savings of 20% from the code provision were assumed in CDZ 4A-NYC and CDZ 4A-balance and 10% in CDZs 5A and 6A. These savings were applied only to prototypes with slab-on-grade, crawlspace, and unheated basements because prototypes with heated basements were conservatively assumed to have most of the ducting system located within the conditioned basement, based on Building America House Simulation Protocols (Wilson et al. 2014). For the applicable prototypes, the savings were assumed to be in addition to the 10% savings assumed from the duct sealing provisions in the baseline and implemented as a savings multiplier to the heating, cooling, and fan energy in the 2020 ECCC NYS and 2020 NYStretch cases.

#### 3.3.5.3 Drain Water Heat Recovery

The 2020 NYStretch code includes provisions for improving the efficiency of hot water supply systems. The code offers multiple options, including a compact piping layout with limits on pipe run lengths, drain water heat recovery (DWHR), or a hot water recirculation system. While all three options are designed to cut losses in the hot water delivery systems, they are associated with different costs and challenges. For example, a compact piping layout can be efficiently implemented during the design of a house. However, a DWHR or a recirculation system might be more suitable for a broader range of house configurations. Similarly, the savings that can be harnessed from any of these options vary significantly with the configuration of the house and the hot water usage profile.

The PNNL/DOE models use a simplifying assumption of treating hot water pipes as adiabatic, meaning there is no heat transfer between them and other spaces in the building. Therefore, adding DWHR to the models or shortening pipe lengths does not account for any interactive effects with space heating and cooling. Because the interactive effects are expected to be of the second order in nature, the analysis uses a savings multiplier based on a literature review. Savings percentages ranging from 25–40% were found in the literature including an estimate of 40% from Minnesota Power,<sup>3</sup> an estimate of 25 to 30% from Van Decker,<sup>4</sup> and 25% from Manitoba Hydro.<sup>5</sup> This analysis uses a conservative savings estimate of 25%. These savings are implemented by applying a multiplier of 0.75 to the hot water energy consumption in the 2020 NYStretch cases.

#### 3.3.5.4 Ventilation

The 2020 NYStretch code requires energy recovery ventilation (ERV) or a heat recovery ventilation (HRV) in CDZ 5A and 6A. In CDZ 4A, a balanced ventilation system is allowed to comply. The baseline 2020 ECCC NYS or 2016 NYCECC do not require ERV/HRVs or balanced ventilation. This code provision is evaluated by assuming balanced ventilation in CDZ 4A-NYC and CDZ 4A-balance and HRVs in CDZ 5A and 6A.

Because the 2020 NYStretch code does not include a minimum efficiency requirement for HRVs, the directory of available products from the Home Ventilation Institute (HVI) was reviewed to identify a suitable assumption. Figure 1 shows the distribution of the sensible recovery efficiency (SRE) of products available in the market today. Most of the products have SRE between 64% and 75% with some exceptionally high-efficiency units with SRE greater than 85% also available. The analysis assumes HRVs with SRE of 70% in the NYStretch cases in CDZ 5A and 6A. The HRVs are modeled using the *EnergyPlus* "ZoneVentilation:EnergyRecoveryVentilator" object, by setting latent heat recovery efficiency to zero and sensible heat recovery efficiency to 0.7. In CDZ 4A-NYC and CDZ 4A-balance, the NYStretch models are configured with the "balanced" zone ventilation option in *EnergyPlus*.

#### Figure 1. Distribution of Sensible Recovery Efficiencies of ERVs/HRVs

See endnotes for more information<sup>6</sup>



HRV/ERV Sensible Recovery Efficiency (SRE)

#### 3.3.5.5 High Efficacy Lighting

The 2020 NYStretch makes an incremental improvement to the minimum lighting efficacy requirement. Compared to the tiered requirements in the baseline 2020 ECCC NYS and the 75% high-efficacy lighting requirement in the 2016 NYCECC, the 2020 NYStretch code requires 90% of all permanently installed lighting to be high-efficacy with the minimum efficacy of lamps to be 65 lm/W and that of the total luminaire to be 45 lm/W. This code provision is expected to yield a reduction in the annual lighting energy use.

The lighting energy in the DOE/PNNL 2015 IECC models is calculated using the Building America Benchmark specifications (Wilson et al. 2014) and translated to the models as a lighting power density (LPD) or a peak lighting power input (Mendon et al. 2013). A similar approach was utilized in the previous 2020 ECCNYS cost-effectiveness analysis (NYSERDA 2019). The present analysis uses a modified approach based on the same principles by updating the energy ratio (ER) associated with the CFLs in the Building America equations to use 65 lm/W. All other parameters in the equations are left unchanged.

Table 7 shows the calculated lighting energy use for the baseline and 2020 NYStretch for the single-family prototype and each multifamily unit.

	2020 ECCC NYS		2016 N	2016 NYCECC		2020 NYStretch	
	Single- family	Multifamily	Single- family	Multifamily	Single- family	Multifamily	
Interior Hard-Wired Lighting Energy (kWh/yr)	787.1	474.0	867.6	522.4	762.3	459.0	
Interior Hard-Wired Lighting LPD (W/ft²)	0.106	0.106	0.117	0.117	0.103	0.103	
Exterior Lighting Energy (kWh/yr)	209.4	104.7	230.9	115.4	202.8	101_4	
Exterior Lighting Peak (W)	47.63	47.63	52.50	52.50	46.13	46.13	
Garage Lighting Energy (kWh/yr)	14.4	14.4	15.9	15.9	14.0	14.0	
Garage Lighting Peak (W)	7.81	7.81	8.61	8.61	7.56	7,56	

#### Table 7. Lighting Energy Use

## 3.4 Incremental Cost Calculations

The incremental costs associated with the code changes captured in the energy analysis are determined using sources such as RS Means (RS Means 2019), DOE's Building Community Cost database developed by PNNL,<sup>7</sup> the construction cost estimation study conducted by Faithful+Gould for DOE (F+G 2012), National Renewable Energy Laboratory's (NREL) National Residential Efficiency Measures (NREM) database, and technical reports published by DOE. Where required, the costs are adjusted to current dollars using the consumer price index (CPI). Finally, the costs are adjusted using location cost multipliers to come up with representative construction cost estimates for the State.

#### 3.4.1 Location Multipliers

Location multipliers are used to adjust national average costs to account for locational diversity in material and labor costs. This analysis uses location factors from the 2019 RS Means Residential Costs Data Book (RS Means 2019). The data for all available locations in New York State is grouped into CDZs 4A, 5A, and 6A using the 2018 IECC climate zone map (ICC 2017). CDZ 4A is further split into CDZ 4A-NYC and CDZ 4A-balance by separating the factors for New York City and surrounding areas from the remainder of CDZ 4A. The factors are then averaged to yield the overall factors used in this analysis, as summarized in Table 8.

#### Table 8. Location Cost Multipliers Used in the Analysis

Climate Design Zone	Average Location Factor		
4A-NYC	1.374		
4A-balance	1.234		
5A	1.059		
6A	0.998		

#### 3.4.2 Incremental Cost for Each Measure

This section describes the assumptions behind the development of incremental costs for each measure that was evaluated in the energy analysis.

#### 3.4.2.1 Fenestration

The 2020 NYStretch requires a more stringent fenestration U-factor of 0.27 in all CDZs. This compares to a baseline requirement of U-0.32 in CDZ 4A and U-0.30 in CDZ 5A and 6A. In CDZ 6A, the 2020 ECCC NYS has an additional prescriptive path with a U-0.28.

Incremental costs associated with code fenestration requirements, especially at higher efficiencies, are often difficult to map to real fenestration products because available products have rated U-factors and SHGC for various combinations of framing and glass and lack the level of granularity used by the code. ENERGY STAR® addresses this complexity by using a regression-based approach in its Cost and Savings Estimates for homes certified under ENERGY STAR Version 3 (ENERGY STAR 2016). The regression uses data from National Residential Efficiency Measures Database (NREM) developed by the National Renewable Energy Laboratory (NREL) to develop a set of regression equations. These regression equations are used to calculate the incremental costs associated with this code provision resulting in an incremental cost of \$1.04/ft<sup>2</sup> in CDZ 4A including CDZ 4A-balance, \$0.62/ft<sup>2</sup> in CDZ 5A and an average of \$0.33/ft<sup>2</sup> based on the two prescriptive baseline options in CDZ 6A. This results in an incremental cost of \$391 in CDZ 4A and CDZ 4A-balance, \$235 in CDZ 5A, \$157 in CDZ 6A for the single-family prototype, \$196 in CDZ 4A and CDZ 4A-balance, \$117 in CDZ 5A, and \$63 in CDZ 6A for each multifamily unit, after adjusting for inflation. These estimates are further multiplied by the location factors before use in the analysis.

#### 3.4.2.2 Exterior Wall Insulation

There are multiple baseline and 2020 NYStretch prescriptive options for wall insulation (Tables 1 and 2). In CDZ 4A-balance and 5A, this analysis assumes R-20 in the baseline and R-21 intermediate framing (with R-10 insulated headers) in the NYStretch case. In CDZ 4A-NYC and 6A, this analysis assumed R-20+5 in both the baseline and NYStretch cases.

The additional cost associated with R-21 int compared to R-20 walls is the cost of insulating the wall headers with R-10 insulation. The analysis assumes the headers are insulated with 2" of extruded polystyrene (XPS) at R-5/inch. Table 9 shows three estimates of incremental cost.

Source	Incremental Cost	Notes
F+G (2012)	\$1.77/ft <sup>2</sup>	\$1.62/ft <sup>2</sup> in 2012 dollars, adjusted to 2019 dollars
RS Means (2019)	\$1,88/ft <sup>2</sup>	
NREL NREM (2019)	\$1.70/ft <sup>2</sup>	
Assumption	\$1.77/ft <sup>2</sup>	

Table 9. Incremental Cost Estimates for Exterior Wall Insulation: R-21 int vs. R-20

According to the dimensions of the DOE/PNNL single-family prototype building used by Faithful + Gould in their 2012 cost estimation exercise, the total length of 2x10 headers is 258 feet (F+G 2012). This results in a total incremental cost of \$380 associated with this code provision for the single-family prototype. Detailed drawings of the multifamily prototype building are not available. Thus, the analysis assumes that the ratio of headers to exterior wall area is the same in the single- and multifamily prototypes, which translates to an incremental cost of \$136 for each multifamily unit. These estimates are further multiplied by the location factors before use in the analysis.

#### 3.4.2.3 Floor Insulation

The 2020 NYStretch code requires R-30 floor insulation in CDZ 4A compared to R-19 required by the 2020 ECCC NYS in CDZ 4A. The analysis assumes that fiberglass blanket insulation is installed between floor joists. Two estimates of incremental cost are shown in Table 10.

 Table 10. Incremental Cost Estimates for Floor Insulation: R-30 vs. R-19

Source	Incremental Cost	Notes
F+G (2012)	\$0_46/ft <sup>2</sup>	\$0.42/ft <sup>2</sup> in 2012 dollars, adjusted to 2019 dollars
RS Means (2019)	\$0.40/ft <sup>2</sup>	
Assumption	\$0.40/ft <sup>2</sup>	

Using \$0.40/ft<sup>2</sup>, the total incremental cost works out to \$480 for the single-family prototype and \$160 for each multifamily unit. Because the 2016 NYCECC already requires floor insulation of R-30 in the areas governed by the code (CDZ 4A-NYC in this analysis), this incremental cost is assumed to apply only to the balance of CDZ 4A (CDZ 4A-balance), after applying applicable location multipliers.

#### 3.4.2.4 Slab Insulation

The 2020 NYStretch code requires slab insulation to be installed up to a depth of four feet compared to the two feet required by the baseline 2020 ECCC NYS in CDZ 4A and 5A. The analysis assumes slab edge insulation to be 2" thick XPS (R-10) with 60 PSI compressive strength. Table 11 shows three estimates of the incremental cost.

Source	Incremental Cost	Notes
F+G (2012)	\$1.77/ft <sup>2</sup>	\$3.24/If for 2' deep slab edge insulation with R-10 XPS in 2012 dollars, adjusted to 2019 dollars
RS Means (2019)	\$2.42/ft <sup>2</sup>	2" thick XPS used in foundation applications
NREL NREM (2019)	\$2.00/ft <sup>2</sup>	2" thick XPS used in foundation applications
Assumption	\$2.00/ft <sup>2</sup>	

Table 11. Incremental Cost Estimates for Slab Insulation: 4' vs. 2' R-10 XPS

Using a cost of \$2.00/ft<sup>2</sup>, the total incremental cost is \$560 for the single-family prototype and \$247 for each multifamily unit. Because the 2016 NYCECC already requires four feet of R-10 slab insulation in the areas governed by the code (CDZ 4A-NYC in this analysis), this incremental cost is assumed to apply only to the balance of CDZ 4A (CDZ 4A-balance) and CDZ 5A, after applying applicable location multipliers.

#### 3.4.2.5 Basement Wall Insulation

The 2020 NYStretch code requires R-15 continuous or R-19 cavity insulation for basement walls compared to the R-10 continuous or R-13 cavity insulation required by the baseline 2020 ECCC NYS in CDZ 4A. The analysis assumes basement walls insulation to be kraft-faced fiberglass placed within the wall cavity. Table 12 shows three estimates of incremental cost including the cost of additional insulation as well as deeper framing because R-13 insulation is 3.5" thick and can be placed in a 2 x 4 cavity.

An average incremental cost of \$0.8/ft<sup>2</sup> results in a total incremental cost of \$784 for the single-family prototype and \$345 for each multifamily unit. Because the 2016 NYCECC already requires R-15/R-19 basement wall insulation in the areas governed by the code (CDZ 4A-NYC in this analysis), this incremental cost is assumed to apply only to prototypes with conditioned basements in the balance of CDZ 4A (CDZ 4A-balance), after applying applicable location multipliers.

Source	Incremental Cost	Notes
F+G (2012)	\$0.84/ft <sup>2</sup>	\$0,77/ ft <sup>2</sup> in 2012 dollars, adjusted to 2019 dollars
RS Means (2019)	\$0.97/ft <sup>2</sup>	
NREL NREM (2019)	\$0.5/ft <sup>2</sup>	
Assumption	\$0.8/ft <sup>2</sup>	

Table 12. Incremental Cost Estimates for Basement Wall Insulation: R-19 vs. R-10 Cavity

#### 3.4.2.6 Efficient Hot Water Supply

The 2020 NYStretch code has several options for encouraging the efficient delivery of hot water, including an option for a compact piping system, a recirculation system, and a DWHR system. Like other elements of the code that are focused on good design practices, the incremental cost associated with this measure varies from case to case. For example, Klein (2012) lays out several examples for developing a compact hot water delivery system, which when implemented correctly during the early design stages of a project would most likely result in first cost savings by eliminating long pipe runs that require installation and insulation. If a compact hot water delivery system is not feasible for any reason, a DWHR system or recirculation pump in some water heater configurations can help reduce heat loss through pipes or recover a portion of the waste heat.

Similar to the range in energy savings from these systems, the incremental costs also tend to vary. The U.S. Department of Energy (DOE) reports a range of \$300 to \$500 for installing DWHR systems, noting that installation is likely to be less expensive in new home construction.<sup>8</sup> The final Codes and Standards Enhancement (CASE) report developed by the California Energy Commission on DHWR reports a total cost of \$700 to \$800 for a complete installation. The study further notes that the product life for DWHR is 30 to 50 years and that no maintenance is required because the equipment has no moving parts.<sup>9</sup> Finally, the third option, recirculating pumps, are cheaper to install depending on the water heater configuration and can be controlled using a timer or a switch. The cost of installing a recirculation pump is approximately \$400.<sup>10</sup>

The present analysis assumes a DHWR because it is suitable for a wide range of home designs. Additionally, it is expected that some builders will use the compact piping layout option, thus achieving energy savings for negligible incremental costs. An average incremental cost of \$400 is assumed for this measure for both the single-family prototype as well as each multifamily unit. The cost is further adjusted by location factors.

### 3.4.2.7 Ventilation

The 2020 NYStretch code requires heat recovery ventilation (HRV) or energy recovery ventilation (ERV) in CDZ 5A and 6A. In CDZ 4A, a balanced ventilation system is deemed to comply. As discussed previously in the energy analysis, this analysis assumes a balanced ventilation system in CDZ 4A and an HRV with 70% sensible recovery efficiency (SRE) in CDZ 5A and 6A.

HRVs and ERVs are becoming more popular as the recent energy codes have driven down the air leakage thresholds, thereby introducing the need for controlled mechanical ventilation systems. While point exhaust-based systems are still commonly used to meet the IECC requirement across the country, central fan-integrated supply (CFIS) systems and ERV/HRVs are beginning to be introduced because of the better ventilation effectiveness they provide.

This analysis assumes an average incremental cost of \$300 for the single-family prototype and each multifamily unit for the CFIS unit that meets the requirement in CDZ 4A. For CDZs 5A and 6A, the analysis assumes an incremental cost of \$1,000 for the single-family prototype and each multifamily unit. These costs are further adjusted using location factors.

Tables 13 and 14 show three estimates of total cost and incremental cost compared to local exhaust-based systems for HRV/ERVs and CFIS.

Source	Total Cost	Incremental Cost	Notes
Moore (2018)	\$1,300	\$1,103	New construction HRV
Aldrich et al (2013)	\$1,500	\$1,100	Local ERV system
NREL NREM (2019)	\$1,300	\$940	HRV with 70% SRE
Assumption		\$1,000	HRV with 70% SRE

Table 13. Incremental Cost Estimates for Ventila	tion: HRV/ERV System vs. Exhaust Ventilatio
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Source	Total Cost	Incremental Cost
Moore (2018)	\$310	\$113
Aldrich et al (2013)	\$650	\$250
NREL NREM (2019)	\$850	\$490
Assumption		\$300

Table 14. Incremental Cost Estimates for Ventilation: CFIS System vs. Exhaust Ventilation

#### 3.4.2.8 Lighting

The 2020 NYStretch code raises the threshold of high-efficacy lamps to require a minimum of 65 lm/W and that of luminaires to require a minimum of 45 lm/W, while leaving the required percentage of high-efficacy hard-wired lighting unchanged at 90% as the baseline 2020 ECCC NYS. The required percentage of high-efficacy hard-wired lighting in the 2016 NYCECC, however, is 75%.<sup>11</sup>

The overall impact of the 2020 NYStretch code is to require the installation of CFLs at the higher end of the CFL efficacy spectrum or LEDs. Many of the CFLs designed to replace 40-60 W incandescent lamps that are currently labeled under the ENERGY STAR program have efficacies greater than 65 lm/W<sup>12</sup> and would, therefore, meet the NYStretch requirement. LEDs typically have higher efficacies, around 80 lm/W,<sup>13</sup> but this analysis is based on conservative estimates of energy savings and assumes the code provision is met with CFLs. Thus, the incremental cost associated with this change is assumed to be negligible because most CFLs available in the market today easily meet the ENERGY STAR designation for no incremental cost. For CDZ 4A-NYC, however, the baseline 2016 NYCECC requires only 75% of permanently installed lamps to be high efficacy. Thus, the incremental cost of meeting the 2020 NYStretch code provisions for those cases is based on purchasing more CFL bulbs at an incremental cost of \$2.93/bulb compared to incandescent lamps. In the single-family prototype, the cost of replacing seven bulbs is assumed to be \$8.79 (NYSERDA 2019).

#### 3.4.2.9 Ducts in Conditioned Space

The 2020 NYStretch code requires that all ducts be located within conditioned space, while the baseline codes do not regulate the location of ducts. Moving ducts into conditioned zones reduces losses associated with heat transfer and is proven to be a source of significant savings especially in warmer climates.

However, the typical placement of ducts varies widely depending on the house configuration, HVAC layout and even foundation type. Homes with basements tend to have a portion or all the ducts located inside basements while homes with slab-on-grade or crawlspaces tend to have most of the ducts located in the attic space which unless it is conditioned, can result in large losses.

DOE's Building America program developed several case studies and low-cost installation methods for locating ducts within the thermal boundary of a house by implementing dropped ceilings or chases in single-story homes and installing ducts between floor in multi-story ones.<sup>14</sup> They also suggest sealing an attic or crawlspace and insulating them at the perimeter to create a suitable conditioned zone for placing ducts. However, the actual cost associated with this measure depends on many factors as they apply to a given house. Building America found costs ranging from as little as \$0.39/ft<sup>2</sup> of conditioned floor area when utilizing efficient chase systems to as much as \$2.50/ft<sup>2</sup> when using spray foam insulation (Beal et al. 2011).

In the 2018 IECC, a new code provision related to buried ducts was approved (ICC 2017). This provision, which has been carried through the 2020 ECCC NYS and the 2020 NYStretch code, allows ducts buried within attic insulation to be considered "inside conditioned space" if they meet certain criteria. The criteria includes a lower leakage rate, the air handling unit (AHU) being placed inside conditioned space, and a minimum insulation level above and below the duct surface. The approach is expected to yield good energy savings while still being a lower cost solution.

Research conducted by the National Association of Home Builders (NAHB) Home Innovation Research labs compares different strategies for meeting this code requirement along with a comparison of costs.<sup>15</sup> This analysis assumes that this requirement is met by implementing buried ducts within conditioned space, including building a mechanical closet to house the AHU. The cost for this method per NAHB's research is between \$913 and \$1,107 for a 2,428 ft<sup>2</sup> single-story, slab-on-grade house configuration. It is further noted that the cost for a two-story design would be proportional to the percentage of living area on the second floor. Because the single-family prototype used in this analysis has 50% of the living area on the second floor, the incremental cost associated with this measure is assumed to be \$505 for the single-family prototype. The incremental cost for each multifamily unit is also accordingly assumed to be \$505 because the conditioned floor area is half that of the NAHB prototype. The prototypes with

23

conditioned basements are assumed to incur no additional costs because most of the ducts are already assumed to be placed in the conditioned basement as described in section 3.3.5.2. Therefore, the incremental costs are assumed to apply only to the prototypes with slab-on-grade, crawlspace and unconditioned basement.

#### 3.4.2.10 Credit Associated with Down-Sizing HVAC Equipment

The collective impact of the prescriptive and mandatory requirements of the 2020 NYStretch code reduce the design heating and cooling loads of the building and result in a reduction in the size of HVAC equipment required to service the loads for the single- and multifamily dwelling units. Because the analysis employs a whole building cost approach, the impact of equipment downsizing due to improved shell efficiency is considered in the analysis. The HVAC sizing information reported by *EnergyPlus* indicates a range in equipment capacity reduction between different prototypes and CDZs and is more notable on the cooling side. It is also expected that the actual sizes installed in the field will vary based on individual design practices. Thus, the analysis conservatively assumes a 0.5-ton reduction in HVAC equipment in CDZ 4A-balance and 5A where most of the envelope improvements apply over the baseline 2020 ECCC NYS. In CDZ 4A-NYC and 6A, the downsizing in equipment is less noticeable because the envelope requirements are mostly similar between the baseline and the 2020 NYStretch code. Thus, an equipment downsizing credit of \$330 was assumed in this analysis only for CDZ 4A-balance and 5A (ENERGY STAR 2016). This credit is subtracted from the total incremental cost after adjusting for inflation and location factors.

#### 3.4.3 Total Incremental Costs by Prototype and Climate Design Zone

The total incremental costs per dwelling unit for each prototype in each climate design zone are shown in Table 15.

	Single-family			Multifamily				
	Slab	Crawlspace	Heated Basement	Unheated Basement	Slab	Crawlspace	Heated Basement	Unheated Basement
4A-NYC	\$2,048	\$2,048	\$1,528	\$2,048	\$1,763	\$1,763	\$1,243	\$1,763
4A- balance	\$3,278	\$3,180	\$3,087	\$3,180	\$1,917	\$1,810	\$1,571	\$1,810
5A	\$2,900	\$2,307	\$1,905	\$2,307	\$2,117	\$1,856	\$1,455	\$1,856
6A	\$1,602	\$1,602	\$1,224	\$1,602	\$1,509	\$1,509	\$1,131	\$1,509

# Table 15. Total Incremental Costs of the Prescriptive and Mandatory Provisions of the 2020 NYStretch Code Compared to the 2016 NYCECC in CDZ 4A-NYC and 2020 ECCC NYS Elsewhere

### 3.5 Cost-Effectiveness Analysis

Combined with the respective energy cost savings, the incremental construction costs were used to calculate a simple payback, present value of savings over a 10-year period, and 30-year Life-Cycle Cost (LCC) savings. While the cost-effectiveness calculations are based on the parameters and equations laid out in DOE's cost-effectiveness methodology (Taylor et al. 2015), certain economic parameters have been updated using latest New York specific data where available.

#### 3.5.1 Fuel Prices

Energy use from the annual simulation is extracted for the major code regulated end-uses of heating, cooling, ventilation, fans, lighting, and domestic DHW and converted to energy costs using the average fuel costs for electricity, natural gas, and fuel oil for the State published by the Energy Information Association (EIA). The latest full year data published by EIA is for 2017 (EIA 2019a, 2019b, and 2019c). Additionally, NYSERDA provided electricity and natural gas prices specific to New York City, which were used only in CDZ 4A-NYC. The average fuel prices used in the analysis are described in Table 16.

#### **Table 16. Fuel Prices**

Fuel	CDZ 4A-NYC	All Other CDZs
Electricity	\$ 0.200/kWh	\$ 0.180/kWh
Natural gas	\$ 0.900/therm	\$ 1.167/therm
Fuel Oil	\$ 2,774/therm	\$ 2.774/therm

#### 3.5.2 Economic Parameters

The protocols and economic factors used in DOE's cost-effectiveness methodology were followed to calculate the present value and LCC savings. The present value calculation of energy cost savings requested by the State was conducted using a 10-year term, and the LCC savings calculation used a 30-year term to match the typical term used by DOE in its analysis.

#### 3.5.2.1 Mortgage Interest Rate

The mortgage interest rate has averaged around 4.5% in 2018 per latest estimates from Freddie Mac and has been trending downwards in the first half of 2019 as shown in Figure 2.<sup>16</sup>



Figure 2: Mortgage Interest Rate Trends for 2018 and 2019<sup>17</sup>

Based on the trajectory, this analysis uses an estimate of 4.0% mortgage interest rate. The discount rate is maintained the same as the mortgage interest rate per DOE's methodology.

#### 3.5.2.2 Inflation Rate

The analysis uses the latest annualized inflation rate for December 2018 of 1.9%.<sup>18</sup> The home price escalation rate is maintained the same as the inflation rate per DOE's methodology.

#### 3.5.2.3 Fuel Price Escalation Rates

The fuel price escalation rates used in the analysis are the average escalation rates for the 2018–2050 period reported by EIA in its 2019 Annual Energy Outlook for the Mid Atlantic census region.<sup>19</sup> The escalation rate for electricity is assumed to be 0.6%, that for natural gas is assumed to be 0.9% and that for fuel oil is assumed to be 1%.

#### 3.5.2.4 Down Payment Rate

The analysis assumes a 20% down payment rate to be more representative of the current scenario in the State (NYSERDA 2019).

#### 3.5.2.5 Income Tax Rate

The federal income tax rate is assumed to be 15% and the state income tax rate for the State is assumed to be 6.33% for a married filing jointly bracket of \$43,000 through \$161,550.<sup>20</sup>

#### 3.5.2.6 Property Tax Rate

The property taxes in the State vary widely by location. This analysis uses an average property tax rate of 1.65%. The economic parameters used this analysis are summarized in Table 17.

Parameter	Value		
Mortgage Interest Rate	4%		
Loan Term	30 years		
Down Payment Rate	20.0%		
Points and Loan Fees	0.5% (non-deductible)		
Discount Rate	4% (equal to Mortgage Interest Rate)		
Period of Analysis	30 years		
Property Tax Rate	1.65%		
Income Tax Rate	21.3%		
Home Price Escalation Rate	1.9%		
Inflation Rate	1.9%		
Energy Escalation Rates - Electricity	0.6%		
Energy Escalation Rates – Natural Gas	0.9%		
Energy Escalation Rates – Fuel Oil	1.0%		

#### **Table 17. Summary of Economic Parameters**

#### 3.5.2.7 Useful Measure Life, Replacements, and Residual Value

For building components that have useful lives longer than 30 years, a credit for "residual life" was applied at year 30 in the LCC calculation. For building components with a useful life less than the analysis term, the analysis assumes a like-for-like replacement consistent with the DOE methodology. Table 18 summarizes the effective useful life (EUL) of components assumed in the analysis. In order to streamline the cost-effectiveness analysis and calculations, measures with similar EULs were grouped together. For example, all measures related to opaque insulation requirements and the provision for buried ducts were grouped together into the "opaque insulation" set with an EUL of 60 years. Windows and lighting were individually evaluated with an EUL of 20 years and seven years respectively, and the provisions associated with ventilation were included in the "HVAC" set and evaluated with an EUL of 15 years.

Table 18.	Effective l	Jseful Life	of Building	Components
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Component	EUL (Years)
Opaque Insulation	60
Windows	20
Lighting	7
HVAC	15

## 4 Results

This section summarizes the results of the energy and cost-effectiveness analysis of the 2020 NYStretch Energy Code compared to the 2016 New York City Energy Conservation Code (NYCECC) in CDZ 4A-NYC and 2020 Energy Conservation Construction Code of New York State (ECCC NYS) elsewhere.

## 4.1 Energy Savings at the Climate Design Zone and State Level

The results of the energy savings analysis of the proposed 2020 NYStretch code over the respective baseline code, by end-use at the climate design zone and State level are included. These results have been aggregated over the entire set of building types, foundation types and heating systems using the construction weights matrix.

### 4.1.1 Site Energy Savings

Tables 19–21 summarize the site energy savings for code regulated end-uses by CDZ and at the State level. The results for the CDZ 6A baseline have been averaged over the two alternative options and the results for multifamily buildings in CDZ 6A are not included because the associated construction weight was zero. In summary, the results show ~24.6% site energy savings at the State level.

Climate Zone 4A-NYC								
	Heating (kBtu/dwelling unit)	Cooling (kBtu/dwelling unit)	Lighting (kBtu/dwelling unit)	Fan (kBtu/dwelling unit)	DHW (kBtu/dwelling unit)	Total Regulated Energy (kBtu/dwelling unit)		
2016 NYCECC	25990.3	6066.3	5472.2	2937.8	16426.6	56893.3		
2020 NYStretch	20244.0	4889.8	4966.9	2309.2	12318.2	44728.1		
Savings (%)	22.1%	19.4%	9.2%	21.4%	25.0%	21.4%		
		Climat	e Zone 4A-bala	ince				
Heating (kBtu/dwelling unit)Cooling (kBtu/dwelling unit)Lighting (kBtu/dwelling unit)Fan (kBtu/dwelling (kBtu/dwelling unit)DHW (kBtu/dwelling (kBtu/dwelling unit)Total Regulated Energy (kBtu/dwelling unit)								
2020 ECCC NYS	29118.5	6083.7	5093.2	3156.3	16431.5	59883.2		
2020 NYStretch	21981.5	4988.1	4966.9	2412.6	12320.5	46669.6		
Savings (%)	24.5%	18.0%	2.5%	23.6%	25.0%	22.1%		

Table 19. Regulated Site Energy Savings for the Prescriptive and Mandatory Provisions the 2020NYStretch Code for Single-Family Buildings

#### **Table19** continued

Climate Zone 5A										
	Heating (kBtu/dwelling unit)	Cooling (kBtu/dwelling unit)	Lighting (kBtu/dwelling unit)	Fan (kBtu/dwelling unit)	DHW (kBtu/dwelling unit)	Total Regulated Energy (kBtu/dwelling unit)				
2020 ECCC NYS	43133.8	3926.1	5096.0	3232.6	18050.4	73438.9				
2020 NYStretch	29343.4	3621.9	4969.6	3396.8	13527.8	54859.5				
Savings (%)	32.0%	7.7%	2.5%	-5.1%	25.1%	25.3%				
Climate Zone 6A										
	Heating (kBtu/dwelling unit)	Cooling (kBtu/dwelling unit)	Lighting (kBtu/dwelling unit)	Fan (kBtu/dwelling unit)	DHW (kBtu/dwelling unit)	Total Regulated Energy (kBtu/dwelling unit)				
2020 ECCC NYS	44539.3	3634.2	5083.3	2887.5	19014.7	75159.1				
2020 NYStretch	29811.0	3346.4	4957.2	3135.4	14251.9	55502.0				
Savings (%)	33.1%	7.9%	2.5%	-8.6%	25.0%	26.2%				

# Table 20. Regulated Site Energy Savings for the Prescriptive and Mandatory Provisions of the2020 NYStretch Code for Multifamily Buildings

Climate Zone 4A-NYC									
	Heating (kBtu/dwelling unit)	Cooling (kBtu/dwelling unit)	Lighting (kBtu/dwelling unit)	Fan (kBtu/dwelling unit)	DHW (kBtu/dwelling unit)	Total Regulated Energy (kBtu/dwelling unit)			
2016 NYCECC	7896.4	3597.9	2933.5	1492.7	12053.4	27973.9			
2020 NYStretch	6171.9	3058.3	2662.1	1233.4	9039.5	22165.2			
Savings (%)	21.8%	15.0%	9.3%	17.4%	25.0%	20.8%			
Climate Zone 4A-balance									
	Heating (kBtu/dwelling unit)	Cooling (kBtu/dwelling unit)	Lighting (kBtu/dwelling unit)	Fan (kBtu/dwelling unit)	DHW (kBtu/dwelling unit)	Total Regulated Energy (kBtu/dwelling unit)			
2020 ECCC NYS	8631.2	3592.6	2730.0	1546.6	12054.4	28554.8			
2020 NYStretch	6606.6	3055.2	2662.1	1268.1	9040.0	22632.0			
Savings (%)	23.5%	15.0%	2.5%	18.0%	25.0%	20.7%			
# Table 20 continued

Climate Zone 5A							
	Heating (kBtu/dwelling unit)	Cooling (kBtu/dwelling unit)	Lighting (kBtu/dwelling unit)	Fan (kBtu/dwelling unit)	DHW (kBtu/dwelling unit)	Total Regulated Energy (kBtu/dwelling unit)	
2020 ECCC NYS	12643.5	2438.2	2730.0	1610.1	13026.2	32447.9	
2020 NYStretch	7078.5	2540.4	2662.1	2134.9	9763.8	24179.6	
Savings (%)	44.0%	-4.2%	2.5%	-32.6%	25.0%	25.5%	

# Table 21. Weighted Average Regulated Site Energy Savings for the Prescriptive and MandatoryProvisions of the 2020 NYStretch Code

Climate Zone 4A-NYC							
	Heating (kBtu/dwelling unit)	Cooling (kBtu/dwelling unit)	Lighting (kBtu/dwelling unit)	Fan (kBtu/dwelling unit)	DHW (kBtu/dwelling unit)	Total Regulated Energy (kBtu/dwelling unit)	
2016 NYCECC	14639.4	4517.8	3879.6	2031.2	13683.2	38751.2	
2020 NYStretch	11416.1	3740.8	3521.0	1634.4	10261.4	30573.7	
Savings (%)	22.0%	17.2%	9.2%	19.5%	25.0%	21.1%	

Climate Zone 4A-balance							
	Heating (kBtu/dwelling unit)	Cooling (kBtu/dwelling unit)	Lighting (kBtu/dwelling unit)	Fan (kBtu/dwelling unit)	DHW (kBtu/dwelling unit)	Total Regulated Energy (kBtu/dwelling unit)	
2020 ECCC NYS	16266.1	4521.0	3610.7	2146.5	13685.6	40229.9	
2020 NYStretch	12336.3	3775.5	3521.0	1694.6	10262.6	31590.0	
Savings (%)	24.2%	16.5%	2.5%	21.1%	25.0%	21.5%	

Climate Zone 5A							
	Heating (kBtu/dwelling unit)	Cooling (kBtu/dwelling unit)	Lighting (kBtu/dwelling unit)	Fan (kBtu/dwelling unit)	DHW (kBtu/dwelling unit)	Total Regulated Energy (kBtu/dwelling unit)	
2020 ECCC NYS	38986.7	3723,7	4774.2	3011.9	17367.0	67863.6	
2020 NYStretch	26315.1	3474.8	4655.8	3225.1	13015.9	50686.6	
Savings (%)	32.5%	6.7%	2.5%	-7.1%	25.1%	25.3%	

Climate Zone 6A							
	Heating (kBtu/dwelling unit)	Cooling (kBtu/dwelling unit)	Lighting (kBtu/dwelling unit)	Fan (kBtu/dwelling unit)	DHW (kBtu/dwelling unit)	Total Regulated Energy (kBtu/dwelling unit)	
2020 ECCC NYS	44539.3	3634.2	5083.3	2887.5	19014.7	75159.1	
2020 NYStretch	29811.0	3346.4	4957.2	3135.4	14251.9	55502.0	
Savings (%)	33.1%	7.9%	2.5%	-8.6%	25.0%	26.2%	
		N	lew York State	•			
	Heating (kBtu/dwelling unit)	Cooling (kBtu/dwelling unit)	Lighting (kBtu/dwelling unit)	Fan (kBtu/dwelling unit)	DHW (kBtu/dwelling unit)	Total Regulated Energy (kBtu/dwelling unit)	
Baseline	32381.7	3974.2	4440.3	2700.8	16429.4	59926.4	
2020 NYStretch	22265.5	3552.5	4330.2	2698.0	12315.3	45161.4	
Savings (%)	31.2%	10.6%	2.5%	0.1%	25.0%	24.6%	

# 4.1.2 Source Energy Savings

The site energy savings calculated based on the results of the energy simulation exercise are converted into source energy savings using site-source conversion factors included in Table 4.2.1.2 of the 2020 NYStretch code. Factors for fuels relevant to this analysis are summarized in Table 22.

### Table 22. Site to Source Energy Conversion Ratios

Energy Type	New York Ratio
Electricity (Grid Purchase)	2.55
Natural Gas	1.05
Fuel Oil	1.01

Tables 23–25 summarize the source energy savings resulting from the prescriptive and mandatory provisions of the 2020 NYStretch code compared to the respective baseline code in each CDZ.

Climate Zone	Baseline Total Source Energy (kBtu/dwelling unit)	2020 NYStretch Total Source Energy (kBtu/dwelling unit)	Source Energy Savings
4A-NYC	90636.9	72065.8	20.5%
4A-balance	94033.4	74807.6	20.4%
5A	108649.2	84773.9	22.0%
6A	110706.5	85165.4	23.1%

Table 23. Source Energy Savings for the Prescriptive and Mandatory Provisions of the2020 NYStretch Code for Single-family Buildings

# Table 24. Source Energy Savings for the Prescriptive and Mandatory Provisions of the 2020 NYStretch Code for Multifamily Buildings

Climate Zone	Baseline Total Source Energy (kBtu/dwelling unit)	2020 NYStretch Total Source Energy (kBtu/dwelling unit)	Source Energy Savings
4A-NYC	50053.5	40359.2	19.4%
4A-balance	50626.1	41010.5	19.0%
5A	56132.8	44709.6	20.4%

# Table 25. Weighted Average Source Energy Savings for the Prescriptive and MandatoryProvisions of the 2020 NYStretch Code

Climate Zone	Baseline Total Source Energy (kBtu/dwelling unit)	2020 NYStretch Total Source Energy (kBtu/dwelling unit)	Source Energy Savings
4A-NYC	65177.7	52175.2	19.9%
4A-balance	66802.6	53605.6	19.8%
5A	101506.3	79324.6	21.9%
6A	110706.5	85165.4	23.1%
NY State Average	91545.1	71769.2	21,6%

# 4.2 Energy Cost Savings at the Climate Design Zone and State Level

The energy cost savings from the NYStretch code over the 2020 Energy Conservation Construction Code of New York State by fuel type at the CDZ and State level are included in Tables 26-28. The results for the CDZ 6A baseline have been averaged over the two alternative options and the results for multifamily

buildings in CDZ 6A are not included because the associated construction weight was zero. In summary, the results show  $\sim$ 19.7% energy cost savings at the State level. Results by building type and climate zone can be found in Appendix B.

	Clir	nate Zone 4A-NYC					
	Electricity Cost (\$/dwelling unit)	Natural Gas Cost (\$/dwelling unit)	Fuel Oil Cost (\$/dwelling unit)	Total Energy Cost (\$/dwelling unit)			
2016 NYCECC	1207.5	326.6	0.0	1534.1			
2020 NYStretch	980.9	251.9	0.0	1232.8			
Savings (%)	18.8%	22.9%	NA	19.6%			
	Clima	ate Zone 4A-balanc	e				
	Electricity Cost (\$/dwelling unit)	Natural Gas Cost (\$/dwelling unit)	Fuel Oil Cost (\$/dwelling unit)	Total Energy Cost (\$/dwelling unit)			
2020 ECCC NYS	1097.6	456.3	0.0	1553.9			
2020 NYStretch	909.1	343.8	0.0	1252.8			
Savings (%)	17.2%	24,7%	NA	19.4%			
	, (	limate Zone 5A		r			
	Electricity Cost (\$/dwelling unit)	Natural Gas Cost (\$/dwelling unit)	Fuel Oil Cost (\$/dwelling unit)	Total Energy Cost (\$/dwelling unit)			
2020 ECCC NYS	1115.2	576.4	81.2	1772.8			
2020 NYStretch	960.1	403.9	57.5	1421.5			
Savings (%)	13.9%	29.9%	29.1%	19.8%			
Climate Zone 6A							
	Electricity Cost (\$/dwelling unit)	Natural Gas Cost (\$/dwelling unit)	Fuel Oil Cost (\$/dwelling unit)	Total Energy Cost (\$/dwelling unit)			
2020 ECCC NYS	1122.0	612.0	40.7	1774.7			
2020 NYStretch	948.7	426.3	28.0	1403.0			
Savings (%)	15.4%	30.3%	31.3%	20.9%			

# Table 26. Annual Energy Cost Savings of the Prescriptive and Mandatory Provisions of the2020 NYStretch Code for Single-family Buildings

# Table 27. Annual Energy Cost Savings of the Prescriptive and Mandatory Provisions of the 2020NYStretch Code for Multifamily Buildings

	Clir	mate Zone 4A-NYC		
	Electricity Cost (\$/dwelling unit)	Natural Gas Cost (\$/dwelling unit)	Fuel Oil Cost (\$/dwelling unit)	Total Energy Cost (\$/dwelling unit)
2016 NYCECC	810.0	117.1	31.9	958.9
2020 NYStretch	669.1	88.8	24.7	782.5
Savings (%)	17.4%	24.2%	22.6%	18.4%
	Clima	ate Zone 4A-balanc	е	
	Electricity Cost (\$/dwelling unit)	Natural Gas Cost (\$/dwelling unit)	Fuel Oil Cost (\$/dwelling unit)	Total Energy Cost (\$/dwelling unit)
2020 ECCC NYS	728,9	158.2	33.3	920.4
2020 NYStretch	608.9	118.9	25.5	753.3
Savings (%)	16.5%	24.9%	23.4%	18.2%
		Climate Zone 5A		
	Electricity Cost (\$/dwelling unit)	Natural Gas Cost (\$/dwelling unit)	Fuel Oil Cost (\$/dwelling unit)	Total Energy Cost (\$/dwelling unit)
2020 ECCC NYS	777.2	207.0	0.0	984.2
2020 NYStretch	680.7	131.8	0.0	812.5
Savings (%)	12.4%	36.3%	NA	17.4%

# Table 28. Weighted Average Annual Energy Cost Savings of the Prescriptive and MandatoryProvisions of the 2020 NYStretch Code

Climate Zone 4A-NYC							
	Electricity Cost (\$/dwelling unit)	Natural Gas Cost (\$/dwelling unit)	Fuel Oil Cost (\$/dwelling unit)	Total Energy Cost (\$/dwelling unit)			
2016 NYCECC	958.1	195.2	20.0	1173.3			
2020 NYStretch	785.3	149.6	15.5	950.3			
Savings (%)	18.0%	23.4%	22.6%	19.0%			

### Table 28 continued

Climate Zone 4A-balance						
	Electricity Cost (\$/dwelling unit)	Natural Gas Cost (\$/dwelling unit)	Fuel Oil Cost (\$/dwelling unit)	Total Energy Cost (\$/dwelling unit)		
2020 ECCC NYS	866.3	269.3	20.9	1156.5		
2020 NYStretch	720.7	202.7	16.0	939.4		
Savings (%)	16.8%	24.7%	23.4%	18.8%		
	С	limate Zone 5A				
	Electricity Cost (\$/dwelling unit)	Natural Gas Cost (\$/dwelling unit)	Fuel Oil Cost (\$/dwelling unit)	Total Energy Cost (\$/dwelling unit)		
2020 ECCC NYS	1069.2	526.2	70.1	1665.5		
2020 NYStretch	922.1	366.9	49.7	1338.7		
Savings (%)	13.8%	30.3%	29.1%	19.6%		
	C	limate Zone 6A				
	Electricity Cost (\$/dwelling unit)	Natural Gas Cost (\$/dwelling unit)	Fuel Oil Cost (\$/dwelling unit)	Total Energy Cost (\$/dwelling unit)		
2020 ECCC NYS	1122.0	612.0	40.7	1774.7		
2020 NYStretch	948.7	426.3	28.0	1403.0		
Savings (%)	15.4%	30.3%	31.3%	20.9%		
New York State						
	Electricity Cost (\$/dwelling unit)	Natural Gas Cost (\$/dwelling unit)	Fuel Oil Cost (\$/dwelling unit)	Total Energy Cost (\$/dwelling unit)		
2020 ECCC NYS	1010.8	455.6	48.5	1514.9		
2020 NYStretch	859.6	322.6	34.6	1216.7		
Savings (%)	15.0%	29.2%	28.6%	19.7%		

# 4.3 Cost-Effectiveness

The results of the cost-effectiveness analysis in terms of simple payback, a 10-year net present value (NPV) of energy cost savings including replacement costs and residual value of efficiency measures, and a 30-yr Life Cycle Cost (LCC) savings are described below.

## 4.3.1 Simple Payback

Table 29 shows the weighted average annual energy cost savings, the associated total incremental costs, and the resulting simple payback for the 2020 NYStretch code compared to the 2016 NYCECC in CDZ 4A-NYC and 2020 ECCC NYS elsewhere, for the single- and multifamily prototypes.

Table 29. Weigh	ted Average	Simple	Payback
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	Single-family				Multifamily	
Climate Design Zone	Total Annual Energy Cost Savings (\$/dwelling unit)	Total Incremental Costs (\$/dwelling unit)	Simple Payback (Years)	Total Annual Energy Cost Savings (\$/dwelling unit)	Total Incremental Costs (\$/dwelling unit)	Simple Payback (Years)
4A-NYC	\$301	\$1,910	6.3	\$176	\$1,625	9.2
4A-balance	\$301	\$2,463	8.2	\$167	\$1,488	8.9
5A	\$351	\$2,202	6.3	\$172	\$1,751	10.2
6A	\$372	\$1,506	4.1	NA	NA	NA
NY State	\$348	\$2,057	5.9	\$171	\$1,591	9.3

# 4.3.2 10-Year Present Value of Energy Cost Savings

Table 30 shows the 10-year net present value of energy cost savings for the NYStretch code compared to the 2016 NYCECC in CDZ 4A-NYC and 2020 ECCC NYS elsewhere, for the single- and multifamily prototypes. The results include applicable replacement costs for measures with EULs less than the analysis term of 30 years and residual values for measures with EULs longer than the analysis term. The results have been aggregated over the entire set of building types, foundation types, and heating systems using the construction weights matrix. In all cases, the energy cost savings comfortably exceed the first-year incremental costs.

Single-family			Multifamily		
Climate Design Zone	Total First Year Incremental Costs (\$/dwelling unit)	10-Year NPV of Cost Savings Including Replacement Costs and Residual Values (\$/dwelling unit)	Total First Year Incremental Costs (\$/dwelling unit)	10-Year NPV of Cost Savings Including Replacement Costs and Residual Values (\$/dwelling unit)	
4A-NYC	\$1,910	\$2,866	\$1,625	\$1,784	
4A-balance	\$2,463	\$3,509	\$1,488	\$1,930	
5A	\$2,202	\$3,590	\$1,751	\$1,825	
6A	\$1,506	\$3,473	NA	NA	
NY State	\$2,057	\$3,524	\$1,591	\$1,862	

Table 30. Weighted Average Net Present Value (NPV) of Energy Cost Savings over 10 Years

# 4.3.3 30-year Life Cycle Cost (LCC) Savings

Table 31 summarizes the LCC savings of the NYStretch code over the 2020 ECCC NYS at the CDZ and State level. The results have been aggregated over the entire set of building types, foundation types and heating systems using the construction weights matrix. The residential provisions of NYStretch code are found to be cost-effective for the homeowner and yield positive savings over the life of the home in all cases, except for multifamily buildings in CDZ 5A. However, the overall State average LCC savings are positive.

Climate Design Zone	Single-family 30 Year LCC Savings (\$/dwelling unit)	Multifamily 30 Year LCC Savings (\$/dwelling unit)
4A-NYC	\$1,804	\$94
4A-balance	\$1,763	\$649
5A	\$2,235	\$(442)
6A	\$2,724	NA
NY State	\$2,275	\$226

Table 31. Weighted Average 30-Year LCC Savings

Table 32 summarizes the average energy cost savings, incremental construction costs, and costeffectiveness results for the prescriptive and mandatory provisions of NYStretch, weighted over the single- and multifamily building construction weights for the State.

	New York State Average
Annual Energy Cost Savings (\$/dwelling unit)	\$278
Incremental Costs (\$/dwelling unit)	\$1,795
Simple Payback (Years)	6.4
10-Year NPV of Cost Savings Including Replacement Costs and Residual Values (\$/dwelling unit)	\$2,854
30-Yr LCC Savings (\$/dwelling unit)	\$1,741

 Table 32. Weighted Results for the Prescriptive and Mandatory Provisions of the 2020 NYStretch

 Code at the State Level

## 4.3.3.1 Consideration of the Avoided Cost of Carbon Emissions

The analysis and results described thus far do not include the impact of carbon emissions in the calculations. However, as New York State moves towards aggressive carbon goals for buildings, accounting for the impact of carbon emissions of different fuels becomes imperative. To understand the magnitude of this impact, an exploratory exercise was conducted by blending in a "avoided cost of carbon emissions" in the fuel prices and recalculating the 30-year LCC savings. These factors for electricity, natural gas, and fuel oil were obtained from NYSERDA's Regional Greenhouse Gas Initiative (RGGI) analysis.

Consistent with the Benefit Cost Analysis Framework adopted by the NYS Public Service Commission, the analysis that developed the avoided cost of carbon emissions uses the U.S. Environmental Protection Agency's estimate of the social cost of carbon (SCC) at the 3% discount rate. For electricity, the net social cost of carbon emissions on a per-MWh basis (\$/MWh) is net of the projected RGGI compliance costs included in the New York State Independent System Operator (NYISO) CARIS2 2018 Base Case model, and is derived using the NYS Department of Public Service (DPS) estimate of the marginal emissions factor for electricity (lb. CO2/MWh) calculated using the CARIS2 2018 Base Case model; a description of the DPS methodology is provided in Attachment B of the Order Establishing the Benefit Cost Analysis Framework (issued January 21, 2016 in NYS PSC Case 14-M-0101, Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision). For natural gas and oil, the social cost of

carbon emissions on a per-MMBtu basis (\$/MMBtu) is derived using the marginal emissions factors for buildings (lb. CO2e/MMBtu) published in the Final Performance Metrics Report of the NYS Clean Energy Advisory Council – Metrics, Tracking and Performance Assessment Working Group (filed July 19, 2017 in NYS PSC Matter 16-00561).

The fuel prices used in the analysis, before and after including the cost of carbon, are summarized in Table 33 and the revised LCC savings results are included in Table 34.

Climate Zone	Without the Cost of Carbon			With the Cost of Carbon		
	Electricity (\$/kWh)	Natural Gas (\$/therm)	Fuel Oil (\$/therm)	Electricity (\$/kWh)	Natural Gas (\$/therm)	Fuel Oil (\$/therm)
4A NYC	0.200	0.900	2.774	0.223	1.248	3.258
4A except NYC	0.180	1.167	2.774	0.203	1.515	3.258
5A	0.180	1.167	2.774	0.203	1.515	3.258
6A	0.180	1.167	2.774	0.203	1.515	3.258

Table 33. Fuel Prices used in the Analysis, With and Without the Cost of Carbon

#### Table 34. Weighted Average 30-Year LCC Savings When the Avoided Cost of Carbon is Included

Climate Design Zone	Single-family 30 Year LCC Savings (\$/dwelling unit)	Multifamily 30 Year LCC Savings (\$/dwelling unit)
4A-NYC	\$2,804	\$610
4A-balance	\$2,810	\$1,162
5A	\$3,617	\$191
6A	\$5,088	NA
NY State	\$3,838	\$769

It is observed that the inclusion of carbon cost in the fuel price increases LCC savings across the board, including multifamily buildings in CDZ 5A. This indicates the added benefit of including such costs in cost-effectiveness analyses for buildings, especially as decarbonization goals replace energy savings goals and since the buildings are likely to exist as they are constructed for the next 70 to 100 years.

# 5 Discussion

The 2020 NYStretch code contains many elements that encourage better building design such as better hot water piping layouts, better duct placement etc., which can be easy to implement in new construction if planned well at the design stage. This analysis typically uses conservative savings and incremental cost estimates for many of these measures because of the range of designs and performances that can be achieved in the field. Consequently, the energy savings and cost-effectiveness results reported fall on the lower end of potential savings that can be achieved through the 2020 NYStretch code. The actual energy savings that can be achieved in the field are likely to be higher leading to better cost-effectiveness.

Additionally, this analysis assumes no fuel switching between the baseline and the 2020 NYStretch cases. The energy cost savings and correspondingly lower LCC savings for models with gas furnaces because it is an inexpensive way for water and space heating. It is plausible that newer homes, especially those built under a stretch code, would be more likely to use electric heating to leverage on-site or off-site generation resulting in better cost-effectiveness outcomes across the board. Furthermore, as demonstrated in section 4.3.3.1, when the avoided cost of carbon is included in the analysis, the LCC savings improve substantially. This effect is mainly driven by the models with gas heating. As the State works toward decarbonization goals for buildings, the consideration of carbon in conducting energy and cost-effectiveness analyses for buildings would need to be central in policy development.

# 6 Conclusion

The prescriptive and mandatory elements of the residential provisions of the 2020 NYStretch Energy Code are expected to yield positive energy savings over the baseline 2020 Energy Conservation Construction Code of New York State (2020 ECCC NYS) and the 2016 New York City Energy Conservation Construction Code (2016 NYCECC). The savings range from 21 to 26% at the CDZ level in terms of site energy savings and from 18 to 21% in terms of energy costs. The provisions are also found to be cost-effective when evaluated using a 10-year net present value of energy cost savings as well as a full 30-year LCC savings calculations from the perspective of the homeowner for single-family buildings and most multifamily buildings.

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# Appendix A. Cost-Effectiveness Analysis of Section R407

# A.1 Background

This section summarizes the results of an additional analysis of a Section R407 (Additional Energy Efficiency Credits) contained in the draft NYStretch Energy Code version dated January 2019.<sup>21</sup> Section R407 includes a table of additional efficiency credits for various envelope, equipment and generation options, with different points for a single-family versus multifamily dwelling unit. Table A-1 summarizes the additional efficiency credits table along with the available credits. When complying with this path, detached one- and two-family dwellings, semi-detached two-family dwellings and townhouses are required to obtain 2.0 credits from column A and all other residential buildings are required to obtain 3.0 credits from column B.

Category	Option	Measure	Column A	Column B
elope Options	1.1	U ≤ 0.042 Exterior Above Grade Walls	1	0.5
	1.2	U ≤0.020 Ceilings + U≤0.25 Windows	0.5	0.5
C I	1.3	15% Better UA	1.5	1
ien	1.4	U≤ 0.24 Windows	0.5	0.5
effic	1.5	2 ACH50 + High-efficiency Fans	0.5	0.5
High	1.6	2 ACH50 + High-efficiency Fans + Heat Recovery Ventilation (HRV)	1	1
7	2.1	High-efficiency Furnace or Heat Pump	1.5	1
t an	2.2	Ducted/Ductless Minisplit Heat Pump	0.5	1
ptio	2.3	High-efficiency Water Heater	0.5	1.5
nd n O	2.4	Higher-efficiency Water Heater	1	2
-efficiency Eq	2.5	Minimum 1 kW of photovoltaic power or wind power.	1.0/kW/h ousing unit	1.0/kW/ho using unit
				(max 2 credits)
High	2.6	Solar Domestic Hot Water	1.0/dwelli ng unit	1.0/dwellin g unit

Table A-1. Summary of the Options and Credits from the R407 Additional Energy Effi	ciency
Credits Table	

Thus, based on the main analysis methodology and building types under consideration, the single-family prototype would need to obtain 2.0 credits from column A and each multifamily unit would need to obtain 3.0 credits from column B. The additional analysis included the energy savings and cost-effectiveness evaluation of two least incremental cost package options that satisfied the requirements of the additional efficiency credits path.

Based on the results of this analysis and a concern that the section as written might face federal preemption, NYSERDA decided to remove the Additional Energy Efficiency Credits section from the final version of NYStretch. This appendix memorializes the approach, assumptions, and results of the cost effectiveness analysis.

# A.2 Overview of the Analysis

The scope of the additional analysis included the evaluation of two least incremental cost options that would satisfy the credit requirements set forth in section R407. Because the additional efficiency credits associated with the same measures are different for single-family versus multifamily dwelling units, this analysis optimized the least cost packages separately for the single- and multifamily prototypes. The analysis, however, did not optimize packages at the CDZ level.<sup>22</sup> The packages were evaluated as whole building packages, including the prescriptive and mandatory provisions of the 2020 NYStretch code.

The costs associated with each measure from Table A-2 were calculated and mapped against the credit points offered by each to create optimal combinations to yield the required number of 2.0 credits for the single-family prototype and 3.0 credits for the multifamily prototype. Figures A-1 and A-2 show the spread of incremental costs for various measures related to the associated credits offered for the single-family and multifamily prototypes.



Figure A-1. Incremental Costs versus Additional Efficiency Credit Offered for Each Option for a Single-Family Building

Figure A-2. Incremental Costs versus Additional Efficiency Credit Offered for Each Option for Each Multifamily Unit



For the single-family prototype, high-efficiency space conditioning equipment (option 2.1 in Table A-1) was found to be the least expensive way to obtain 1.5 points out of the required total of 2.0. On the multifamily side, higher-efficiency water heating equipment (option 2.4 in Table A-1) was found to be the least expensive way to obtain 2.0 out of the required total of 3.0 points. Thus, high-efficiency space conditioning equipment was part of both least expensive package options for single-family and higher-efficiency water heating equipment was part of both least expensive package options for multifamily.

# A.3 Single-Family Prototype Packages

As described earlier, option 2.1 from Table A-1 was the least expensive way to capture 1.5 points out of the required 2.0 points for the single-family prototype. The high-efficiency space conditioning measure requires an air source heat pump with a heating seasonal performance factor (HSPF) of 9.0, gas or oil-fired furnaces or boilers with an annual fuel utilization efficiency (AFUE) of 94% or a ground-source heat pump (GSHP) with a co-efficient of performance (COP) of 3.3. Because the cost of implementing GSHPs varies widely depending on the site and the set of models used in the analysis does not include a model with a GSHP, this analysis was conducted by assuming higher-efficiency gas and oil-fired furnaces in the single-family prototype models with heat pumps and higher-efficiency gas and oil-fired furnaces in the single-family prototype models with gas and oil-fired furnaces respectively for the 2020 NYStretch cases. The baseline models in each case are maintained at the standard federal minimum efficiencies specified in Table 5 in the body of this report.

Additional measures that would yield 0.5 points were then required to create the two least first-cost option packages to yield a total of 2.0 credits for the additional energy efficiency credits path. Based on an evaluation of all options available in the additional efficiency credits table, these least expensive options were determined to be option 1.4 (U-0.24 windows) and option 1.5 (tighter envelope option with high-efficiency fans). The elements of the least incremental cost packages assumed in this analysis for the single-family prototype are summarized in Table A-2.

Table A-2. Additional Efficiency	/ Credits Packages	Selected for the	Single-Family Prototype

No.	Package Description	Points
1	High-eff Furnace/HP + U-0.24 Windows	2.0
2	High-eff Furnace/HP + 2 ACH50 + High- efficiency Fans	2.0

It is noted that the incremental costs associated with some of the options from the additional efficiency credits table are less in some CDZs compared to the others because the baseline code requirements vary by CDZ while the additional credit options do not. For example, the option of U-0.042 walls can be met with R-20+6 walls, which when the baseline wall configuration is R-20+5, such as in CDZ 4A-NYC or CDZ 6A, would require only an additional 0.5" of insulating sheathing. This would make this measure inexpensive for capturing 1.0 point. However, because the packages were not optimized at the CDZ level, the analysis uses the same packages in all CDZs for simplicity.

## A.3.1. Energy Modeling

In order to conduct a whole building evaluation, the measures for the two least expensive packages were implemented by modifying the energy models that already include the prescriptive and mandatory provisions of the 2020 NYStretch code.

The high-efficiency gas and oil-fired furnaces were modeled by directly changing the thermal efficiency field in the *EnergyPlus* heating coil objects to 0.90. In the case of heat pumps, the required heating seasonal performance factor HSPF of 9.0 is more typically found in two-stage equipment. Additionally, while option 2.1 does not require an improved seasonal energy efficiency ratio (SEER), typical heat pumps with higher HSPFs also include better SEERs. This analysis assumes an improved SEER of 18 in addition to the HSPF of 9.0 for the high-efficiency heat pumps based on Cutler et al. (2013). The *EnergyPlus* objects associated with heat pumps require a heating and cooling coil COP. This analysis assumes COPs recommended by Cutler et al. (2013) for modeling residential heat pumps at the required SEER and HSPF levels. The efficiencies and COPs assumed in this analysis are summarized in Table A-3.

Table A-3. Heat Pump COPs Used in Analysis

	HSPF	SEER	EER	COP_cooling	COP_heating
Speed 1	9.3	18	14.5	4.25	4
Speed 2			13.3	3.90	3.5

Improved air leakage is modeled by adjusting the effective leakage area (ELA) input to the models based on the methodology for converting results of a blower door test in air changes at 50 Pa (ACH50) to ELA described in Mendon et al. (2013). Table A-4 summarizes the ELA values used in this analysis.

Table /	A-4.	Effective	Leakage	Areas	(ELAs	) Used in	Analysi	is for the	Sinal	le-family	Prototy	pe
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	ELA at 3 ACH50 (cm <sup>2</sup> )	ELA at 2 ACH50 (cm <sup>2</sup> )
Living_unit	360.92	240.62

## A.3.2. Incremental Costs

The incremental cost associated with high-efficiency space conditioning equipment is calculated over the current federal standards for equipment efficiency as summarized in Table 5. The cost includes equipment and installation as well as additional venting costs for condensing furnaces where applicable. The National Residential Efficiency Measures Database (NREM) developed by the National Renewable Energy Laboratory (NREL) reports an additional cost of \$700 for a installing a gas furnace with an AFUE of 95% compared to a standard furnace with AFUE of 80% and an incremental cost of \$800 for installing a heat pump with HSPF 9.3 compared to a standard heat pump with HSPF 7.7. Navigant (2011) reports an incremental cost of \$1,438 for 94% AFUE furnaces, replaced on burnout, compared to 80% AFUE furnaces including a labor cost of \$308. The installation costs for condensing furnaces are typically higher in retrofit applications due to a higher cost of venting so this cost is likely on the higher end of the spectrum. DOE (2016) reports an average incremental installed cost of \$630 in 2015 dollars for an AFUE 95% furnace compared to an AFUE 80% furnace, which when adjusted for inflation works out to \$680 in 2019 dollars. This analysis conservatively assumes an incremental cost of \$1,000/unit associated with this measure.

The incremental cost associated with the U-0.24 windows is calculated by applying the same regressionbased methodology described in section 3.4.2.1 to calculate the additional incremental cost associated with U-0.24 windows compared to the U-0.27 windows. The additional cost of U-0.24 windows over U-0.27 windows is thus assumed to be \$0.62/ft<sup>2</sup> (ENERGYSTAR 2016). This works out to an additional incremental cost of \$235 for the single-family prototype after adjusting for inflation.

The incremental cost associated with a tighter envelope that meets the 2 ACH50 requirement compared to the 3 ACH50 required in the baseline codes is estimated at \$0.31/ft<sup>2</sup> of conditioned floor area by NREM. Additionally, ENERGY STAR (2016) estimates a cost of \$0.11/ft<sup>2</sup> for reducing infiltration from 7 ACH50 to 6 ACH50, \$0.22/ft<sup>2</sup> for reducing infiltration from 7 ACH50 to 5 ACH50 and \$0.31/ft<sup>2</sup> for reducing infiltration from 7 ACH50 to 4 ACH50. This analysis assumes an incremental cost of \$0.31/ft<sup>2</sup> for this measure which works out to \$744 for the single-family prototype building.

The additional requirement for a high-efficiency ventilation fan can be met either with a fan with an efficiency better than 0.35 W/CFM or alternatively with furnaces with multispeed fans that are controlled to operate at the lowest speed required to provide adequate ventilation in ventilation-only mode. Thus, the incremental cost associated with this measure is assumed to be \$100/unit.

These additional costs were combined with the costs associated with the prescriptive and mandatory provisions described in Chapter 3 to yield whole building costs for use in the analysis. Table A-5 summarizes the total incremental cost for each of the two additional efficiency credits packages for

A-6

the single-family prototype, including the prescriptive and mandatory provisions of the 2020 NYStretch code. All costs are further adjusted for location factors as applicable.

CDZ	Single-family Package 1 (High-eff Furnace/HP + U-0.24 Windows)				(High-	Single-fami eff Furnace/H efficien	ly Package P + 2 ACH5 cy Fans)	Package 2 + 2 ACH50 + High- / Fans)	
	Slab	Crawlspace	Heated Basement	Unheated Basement	Slab	Crawlspace	Heated Basement	Unheated Basement	
4A-NYC	\$3,745	\$3,745	\$3,225	\$3,745	\$4,582	\$4,582	\$4,062	\$4,582	
4A- balance	\$4,090	\$3,992	\$3,899	\$3,992	\$4,842	\$4,743	\$4,651	\$4,743	
5A	\$4,086	\$3,493	\$3,092	\$3,493	\$4,731	\$4,138	\$3,737	\$4,138	
6A	\$2,835	\$2,835	\$2,457	\$2,835	\$3,442	\$3,442	\$3,064	\$3,442	

Table A-5. Total Incremental Costs for the Single-family Prototype

# A.3.3. Effective Useful Life

This analysis assumes an effective useful life (EUL) of 20 years for the high-efficiency furnaces and heat pumps based on DOE (2016). For windows, the EUL is assumed to be 20 years, as it is in the main analysis. The EUL of improved envelope tightness is assumed to be 60 years and the EUL of high-efficiency fans is assumed to be 20 years.

# A.4 Multifamily Prototype Packages

For multifamily buildings, the additional efficiency credits table includes two options, option 2.3 and option 2.4, for high-efficiency water heating equipment with varying levels of required minimum efficiencies. Option 2.4 with the higher required efficiencies of the two, natural gas or propane water heating with a minimum a uniform energy factor (UEF) of 0.97, or Heat Pump Water Heaters (HPWH) with a minimum UEF of 2.6, was found to be the least expensive method to capture 2.0 points out of the required 3.0 points. Additional measures that would yield 1.0 point were then required to create the two least first-cost option packages that would yield 3.0 credits for the additional efficiency credits path. Based on an evaluation of all options available in the additional efficiency credits table, these least expensive options were determined to be option 1.6 (tighter envelope option with heat recovery ventilation (HRV) and high-efficiency fans) and option 2.1 (high-efficiency space conditioning equipment). The elements of the least incremental cost packages assumed in this analysis for the single-family prototype are summarized in Table A-6.

The 2020 NYStretch code already requires HRVs in CDZ 5A and 6A. However, the code does not specify a required level of efficiency in the mandatory provisions. The basis for the assumption of a sensible recovery efficiency (SRE) of 0.70 used in lieu of a requirement in the prescriptive and mandatory provisions, is described in section 3.3.5.4. Thus, the additional efficiency credit associated with option 1.6 is then only the relative improvement of the SRE to 0.80 in CDZ 5A and 6A.

Table A-6 summarizes the elements of the least incremental cost packages assumed in this analysis for each multifamily unit.

Table A-6. Additional Efficiency Credits Packages Selected for the Multifamily Prototype

No.	Package Description	Points
1	High-eff Furnace/HP + Higher-eff Water Heater	3.0
2	Higher-eff Water Heater + 0.8 SRE HRVs + 2 ACH50 and High-eff Fans	3.0

## A.4.1. Energy Modeling

The high-efficiency gas and oil-fired furnaces are modeled using the same procedure as that discussed for the single-family prototype. A similar procedure is used for modeling a tighter envelope for the multifamily prototype as that described for the single-family prototype above. However, for the DOE multifamily prototype used in this analysis, the ELA is proportionally distributed between the wall, ceiling, and floor areas as discussed by Mendon et al. (2013). Thus, the reduction in ELA from option 1.6 is also applied proportionally to the wall, ceiling, and floor areas as summarized in Table A-7.

Table A-7. Effective Leakage Areas (ELAs) Used in Analysis for the Multifamily Prototype

	ELA at 3 ACH50 (cm2)	ELA at 2 ACH50 (cm2)
MF_corner-units-middle-floor	47.01	31.33
MF_middle-units-middle-floor	34,19	22.79
MF_corner-units-other	107.35	71.55
MF_middle-units-other	94.53	63.00

Option 2.4 for high-efficiency water heating requires a natural gas or propane water heater with a UEF of 0.97 or a HPWH with a UEF of 2.6. Consistent with the DOE prototype model assumptions, the multifamily prototypes with natural gas or oil heating are assumed to use natural gas-fired water heaters while the models with heat pumps for space conditioning are assumed to use electric water

heaters in this analysis. In order to model the additional efficiency credit associated with this option, the gas water heaters are assumed to switch to tankless water heaters and the electric water heaters are assumed to switch to HPWHs in the 2020 NYStretch cases.

The *EnergyPlus* model for water heaters uses a burner efficiency and a shell loss factor (UA) to model the performance of the water heater (Mendon et al. 2013). Because this analysis assumes a tankless water heater to meet the UEF requirement for the gas water heater in option 2.4, the shell losses are set to zero in the 2020 NYStretch models. The HPWHs are modeled using the *EnergyPlus* WaterHeater:HeatPump model. The efficiency of HPWH varies depending on its mode of operation. For example, when the HPWH operates in a "pure" heat pump model, the efficiency is the highest compared to when it switches between the pure and "hybrid" supplemental resistance mode. As expected, the efficiency is the lowest when the HPWH operates in resistance mode only. Thus, HPWH manufacturers report UEFs for each mode separately. This analysis assumes that the HPWH operates in pure heat pump mode and the COP is assumed to be 3.1 based on analysis conducted by NRDC.<sup>23</sup>

#### A.4.2. Incremental Costs

The total incremental costs associated with high-efficiency space conditioning equipment are conservatively assumed to be the same as those described above for the single-family prototype. The cost for a tighter envelope is assumed to be  $0.31/\text{ft}^2$  based on the reasoning discussed for the single-family prototype and works out to 372 for each multifamily unit.

The average cost of HRVs with 0.8 SRE is difficult to pin-point because of the fewer products that exist in that range, as illustrated in Figure 1. Various sources note a cost from \$850 per unit<sup>24</sup> to \$1100-\$1300 per unit.<sup>25</sup> This analysis assumes average equipment cost of \$1,200 for an HRV with a 0.8 SRE. Assuming the labor and installation remain the same between an HRV with a 0.70 SRE, the total installed cost for this option is assumed to be \$1,800.

NREM reports a range of \$1,800–\$3,500 for a gas tankless water heater compared to a storage type water heater. However, the cost is reported only for a retrofit application and the estimate includes cost of removing older equipment. In this case, the lower end of the range is more suitable for new construction. The 2015 California Codes and Standards Enhancement Initiative (CASE) report on the cost-effectiveness of gas instantaneous water heaters assumes an average incremental cost of \$725<sup>26</sup> compared to a standard storage water heater. Navigant (2018) reports a total installed cost of \$5,215 for a tankless water heater with a UEF of 0.83-0.96 and a total installed cost of \$2,013 for a standard

storage type water heater with a 40-gallon tank, resulting in an incremental cost of \$3,200 associated with this option.<sup>27</sup> A 2018 study conducted by the Energy Information Administration (EIA) reports a total installed cost of \$2,550 for a HPWH with an UEF 3.28 compared to a total installed cost of \$1,100 for a standard electric resistance storage water heater leading to an incremental cost of \$1450 for this measure.<sup>28</sup> The Northeast Energy Efficiency Partnership (NEEP) (2016) reports an incremental cost of \$1,053–\$1,144 for HPWH with EF<sub>nc</sub> higher than or equal to 2.6, compared to a baseline storage water heater.<sup>29</sup> This analysis assumes an average incremental cost of \$1,200 associated with this option for both tankless gas and HPWHs compared to standard gas and electric storage water heaters respectively. Each unit in the multifamily prototype building is assumed to have an individual water heater.

Additionally, the analysis accounted for all prescriptive and mandatory provisions of the 2020 NYStretch code. Table A-8 summarizes the total incremental cost for each of the two additional efficiency credits packages for each unit in the multifamily prototype. Like the main analysis, this analysis calculated whole package incremental construction costs for the packages compared to the baseline codes and the costs were further adjusted for location factors as applicable.

CDZ	Multifamily Package 1 (Higher-eff Water Heaters +High-eff Furnace/HP)				Multifamily Package 2 (Higher-eff Water Heaters + 2 ACH50 + 0.8 SRE HRVs)			
	Slab	Crawlspace	Heated Basement	Unheated Basement	Slab	Crawlspace	Heated Basement	Unheated Basement
4A-NYC	\$4,786	\$4,786	\$4,266	\$4,786	\$5,984	\$5,984	\$5,464	\$5,984
4A- balance	\$4,352	\$4,245	\$4,006	\$4,245	\$5,428	\$5,321	\$5,082	\$5,321
5A	\$4,393	\$4,132	\$3,731	\$4,132	\$4,575	\$4,314	\$3,913	\$4,314
6A	\$3,704	\$3,704	\$3,326	\$3,704	\$3,876	\$3,876	\$3,498	\$3,876

Table A-8. Total Incremental Costs for Each Unit in the Multifamily Prototype

### A.4.3. Effective Useful Life

This analysis assumes an EUL of 15 years for HRVs like the main analysis. An EUL of 20 years for the high-efficiency furnaces and heat pumps is assumed based on DOE (2016), the EUL of improved envelope tightness is assumed to be 60 years based on Mendon et al. (2013) and the EUL of water heaters is assumed to be 20 years (DOE 2010).

# A.5 Results

The energy savings results in terms of site and source energy savings associated with the two least expensive additional efficiency credits packages for the single-family and multifamily prototypes are summarized in Tables A-9 and A-10 respectively. The fuel prices and site-to-source conversion ratios are maintained the same as the main analysis. The additional efficiency options are observed to yield additional 10-15% savings beyond the prescriptive and mandatory provisions of the 2020 NYStretch code.

Climate Zone 4A-NYC			
	Total Regulated Site Energy (kBtu/dwelling unit)	Total Regulated Source Energy (kBtu/dwelling unit)	Total Energy Costs (\$/dwelling unit)
2016 NYCECCC	56514.2	89670.4	1511.9
2020 NYStretch Package 1	39763.7	65736.1	1151.2
2020 NYStretch Package 2	39989.9	65920.8	1151.5
Savings Package 1(%)	29.6%	26.7%	23.9%
Savings Package 2(%)	29.2%	26.5%	23.8%
Climate Zone 4A-balance			
	Total Regulated Site Energy (kBtu/dwelling unit)	Total Regulated Source Energy (kBtu/dwelling unit)	Total Energy Costs (\$/dwelling unit)
2020 ECCC NYS	59883.2	94033.4	1553.9
2020 NYStretch Package 1	41360.5	68060.0	1158.7
2020 NYStretch Package 2	38891.9	64157.7	1093.9
Savings Package 1(%)	30.9%	27.6%	25.4%
Savings Package 2(%)	35.1%	31.8%	29.6%
Climate Zone 5A			
	Total Regulated Site Energy (kBtu/dwelling unit)	Total Regulated Source Energy (kBtu/dwelling unit)	Total Energy Costs (\$/dwelling unit)
2020 ECCC NYS	73155.7	107810.3	1755.9
2020 NYStretch Package 1	49147.6	78069.8	1331.0
2020 NYStretch Package 2	45966.6	73936.1	1269.5
Savings Package 1(%)	32.8%	27.6%	24.2%
Savings Package 2(%)	37.2%	31.4%	27.7%

## Table A-9 continued

Climate Zone 6A			
	Total Regulated Site Energy (kBtu/dwelling unit)	Total Regulated Source Energy (kBtu/dwelling unit)	Total Energy Costs (\$/dwelling unit)
2020 ECCC NYS	75198.4	110746.2	1775.8
2020 NYStretch Package 1	49690.2	78364.1	1314.2
2020 NYStretch Package 2	50090.1	78796.4	1319.4
Savings Package 1(%)	33.9%	29.2%	26.0%
Savings Package 2(%)	33.4%	28.8%	25.7%
New York State			
	Total Regulated Site Energy (kBtu/dwelling unit)	Total Regulated Source Energy (kBtu/dwelling unit)	Total Energy Costs (\$/dwelling unit)
Baseline	68021.3	101901.3	1663.3
2020 NYStretch Package 1	45411.7	72759.9	1238.8
2020 NYStretch Package 2	43601.5	70374.0	1203.0
Savings Package 1(%)	33,2%	28.6%	25.5%
Savings Package 2(%)	35.9%	30.9%	27.7%

# Table A-10. Site Energy, Source Energy and Energy Cost Savings for the Multifamily Prototype

Climate Zone 4A-NYC			
	Total Regulated Site Energy (kBtu/dwelling unit)	Total Regulated Source Energy (kBtu/dwelling unit)	Total Energy Costs (\$/dwelling unit)
2016 NYCECCC	27770.4	49534.6	947.0
2020 NYStretch Package 1	16834.5	31138.4	610.0
2020 NYStretch Package 2	16846.2	31080.4	607.8
Savings Package 1(%)	39.4%	37.1%	35.6%
Savings Package 2(%)	39.3%	37.3%	35,8%
Climate Zone 4A-balance			
	Total Regulated Site Energy (kBtu/dwelling unit)	Total Regulated Source Energy (kBtu/dwelling unit)	Total Energy Costs (\$/dwelling unit)
2020 ECCC NVS	29554 6	50625.0	020.4

2020 ECCC NYS	28554.6	50625.9	920.4
2020 NYStretch Package 1	17243.8	31725.9	586.8
2020 NYStretch Package 2	15460.2	30367.5	577.0
Savings Package 1(%)	39.6%	37.3%	36.2%
Savings Package 2(%)	45.9%	40.0%	37.3%

Climate Zone 5A			
	Total Regulated Site Energy (kBtu/dwelling unit)	Total Regulated Source Energy (kBtu/dwelling unit)	Total Energy Costs (\$/dwelling unit)
2020 ECCC NYS	32447.9	56132.8	984.2
2020 NYStretch Package 1	17994.0	32993.0	597.0
2020 NYStretch Package 2	18261.7	34423.4	631.6
Savings Package 1(%)	44.5%	41.2%	39,3%
Savings Package 2(%)	43.7% 38,7%		35.8%
New York State			
	Total Regulated Site Energy (kBtu/dwelling unit)	Total Regulated Source Energy (kBtu/dwelling unit)	Total Energy Costs (\$/dwelling unit)
Baseline	29266.1	51637.4	943.4
2020 NYStretch Package 1	17306.4	31861.6	596.0
2020 NYStretch Package 2	16534.8	31550.1	599.0
Savings Package 1(%)	40.9%	38,3%	36.8%
Savings Package 2(%)	43.5%	38.9%	36.5%

Tables A-11 and A-12 summarize the savings in terms of energy costs and the simple payback for the two prototypes.

	Single- (High-eff I	family Packag Furnace/HP + I Windows)	e 1 J-0.24	Single-family Package 2 (High-eff Furnace/HP + 2 ACH50 + High- efficiency Fans)			
Climate Design Zone	Total Annual Energy Cost Savings (\$/dwelling unit)	otal Annual Total nergy Cost Incremental Savings Costs Simple \$/dwelling (\$/dwelling Payback unit) unit) (Years)		Total Annual Energy Cost Savings (\$/dwelling unit)	Total Incremental Costs (\$/dwelling unit)	Simple Payback (Years)	
4A-NYC	\$361	\$3,607	10.0	\$360	\$4,444	12.3	
4A-balance	\$395	\$3,987	10.1	\$460	\$4,739	10.3	
5A	\$425	\$3,510	8.3	\$486	\$4,155	8.5	
6A	\$462	\$2,739	5.9	\$456	\$3,346	7.3	
NY State	\$428	\$3,389	7.9	\$471	\$4,047	8.6	

	Multif (Higher-eff V F	amily Package Vater Heaters + Furnace/HP)	⊧1 ⊦High-eff	Multifamily Package 2 (Higher-eff Water Heaters + 2 ACH50 + 0.8 SRE HRVs)			
Climate Design Zone	Total AnnualTotalEnergy CostIncrementalSavingsCosts(\$/dwelling(\$/dwellingunit)unit)		Total Annual Energy Cost Savings (\$/dwelling unit)	Total Incremental Costs (\$/dwelling unit)	Simple Payback (Years)		
4A-NYC	\$337	\$4,648	13.8	\$339	\$5,846	17.2	
4A-balance	\$334	\$4,203	12.6	\$343	\$5,279	15.4	
5A	\$387	\$4,081	10.5	\$353	\$4,263	12.1	
6A	NA	NA	NA	NA	NA	NA	
NY State	\$347	\$4,302	12,4	\$344	\$5,198	15.1	

Table A-12. Energy Cost Savings and Simple Payback for the Multifamily Prototype

Finally, Tables A-13 and A-14 summarize the 10-yr Net Present Value (NPV) of energy savings and the 30-year LCC savings for the single-family and the multifamily units respectively. All economic parameters are maintained the same as the main analysis.

Table A-13. Cost-Effectivenes	s Results for the	Single-family Prototype
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	Sing (High-eff Fu	gle-family Packaç rnace/HP + U-0.2	ge 1 4 Windows)	Single-family Package 2 (High-eff Furnace/HP + 2 ACH50 + High- efficiency Fans)				
CDZ	Total First Year Incremental Costs (\$/dwelling unit)	10-Year NPV of Cost Savings (\$/dwelling unit)	30 Year LCC Savings (\$/dwelling unit)	Total First Year Incremental Costs (\$/dwelling unit)	10-Year NPV of Cost Savings (\$/dwelling unit)	30 Year LCC Savings (\$/dwelling unit)		
4A- NYC	\$3,607	\$3,112	\$137	\$4,444	\$3,737	\$(741)		
4A- balance	\$3,987	\$3,445	\$696	\$4,739	\$4,589	\$238		
5A	\$3,510	\$3,753	\$1,825	\$4,155	\$4,991	\$2,275		
6A	\$2,739	\$4,071	\$2,974	\$3,346	\$4,481	\$2,246		
NY State	\$3,389	\$3,595	\$1,408	\$4,047	\$4,449	\$1,005		

	Mu (Higher-et	Itifamily Package f Water Heaters · Furnace/HP)	e 1 + High-eff	Multifamily Package 2 (Higher-eff Water Heaters + 2 ACH50 + 0.8SRE HRVs)				
CDZ	Total First Year Incremental Costs (\$/dwelling unit)	10-Year NPV of Cost Savings (\$/dwelling unit)	30 Year LCC Savings (\$/dwelling unit)	Total First Year Incremental Costs (\$/dwelling unit)	10-Year NPV of Cost Savings (\$/dwelling unit)	30 Year LCC Savings (\$/dwelling unit)		
4A- NYC	\$4,648	\$3,077	\$(2,246)	\$5,846	\$3,304	\$(4,085)		
4A- balance	\$4,203	\$3,226	\$(1,346)	\$5,279	\$3,515	\$(2,836)		
5A	\$4,081	\$3,573	\$(246)	\$4,263	\$3,449	\$(935)		
6A	NA	NA	NA	NA	NA	NA		
NY State	\$4,302	\$3,292	\$(1,279)	\$5,198	\$3,423	\$(2,618)		

#### Table A-14. Cost-Effectiveness Results for the Multifamily Prototype

# A.6 Conclusions

The additional efficiency credits proposed in section R407 of the draft NYStretch Energy Code version dated January 2019 yield additional positive energy savings of 10–15% over the prescriptive and mandatory provisions of the 2020 NYStretch energy code. An evaluation of two least expensive package options for single-family and multifamily buildings indicates simple paybacks ranging from 8 to 17 years. While the 30-year LCC savings are positive for most single-family buildings, they are negative for multifamily buildings in all climate design zones. It is further noted that because the package combinations are chosen based on the lowest first costs and not optimized based on a LCC perspective, it is possible that some other combinations of the proposed options might be more cost-effective in terms of LCC savings, even if they are more expensive in terms of first costs.

# **Appendix B. Energy Savings for All Models**

This section summarizes the energy cost savings for each model from the prescriptive and mandatory provisions of the 2020 NYStretch energy code over the 2016 New York City Energy Conservation Code (NYCECC) baseline in CDZ 4A-NYC and the 2020 Energy Conservation Construction Code of New York State (ECCC NYS) baseline elsewhere, along with the associated incremental costs, 10-year net present value (NPV) of energy cost savings including replacement costs and 30-year LCC savings.

			Natural		Total		10-yr NPV Energy	30-yr
		Electricity	Gas	Fuel Oil	Energy		Cost	LCC
ID	CDZ	Savings (\$)	Savings (\$)	Savings (\$)	Savings (\$)	Costs (\$)	Savings (\$)	Savings (\$)
SF_gasfurnace_crawlspace	4A- NYC	149.1	120.0	0.0	269.0	2048.5	2634.4	1262.4
SF_gasfurnace_heatedbsmt	4A- NYC	34.8	56.3	0.0	91.1	2048.5	1092.0	-1956.6
SF_gasfurnace_slab	4A- NYC	133.8	119.4	0,0	253.2	2048.5	2501.3	979.4
SF_gasfurnace_unheatedbsmt	4A- NYC	139.8	114.7	0.0	254.5	2048.5	2508.3	999.2
SF_hp_crawlspace	4A- NYC	621.0	0.0	0.0	621.0	2048.5	5479.4	7449.2
SF_hp_heatedbsmt	4A- NYC	388.3	0.0	0.0	388.3	2048.5	3532.0	3300.5
SF_hp_slab	4A- NYC	601.7	0.0	0.0	601.7	2048.5	5317.3	7103.9
SF_hp_unheatedbsmt	4A- NYC	601.6	0,0	0.0	601.6	2048.5	5317.0	7103.3
SF_oilfurnace_crawlspace	4A- NYC	141.3	0.0	375.7	517.1	2048.5	4662.7	5966.5
SF_oilfurnace_heatedbsmt	4A- NYC	35.3	0.0	172.9	208.2	2048.5	2049,5	260.4
SF_oilfurnace_slab	4A- NYC	126.9	0.0	372,7	499.6	2048.5	4516.4	5652.5
SF_oilfurnace_unheatedbsmt	4A- NYC	131.9	0.0	360.2	492.1	2048.5	4451.6	5505.9
SF_gasfurnace_crawlspace	4A- bal	113.9	180.4	0.0	294.3	2664.5	3509.4	1693.0
SF_gasfurnace_heatedbsmt	4A- bal	-2.5	97.5	0,0	95.0	2664.5	1772.6	-1920.0

# Table B-1. Energy Cost Savings, Incremental Costs and Cost-Effectiveness Results for the Prescriptive and Mandatory Provisions of the 2020 NYStretch Energy Code

	CD7	Electricity Savings	Natural Gas Savings	Fuel Oil Savings	Total Energy Savings	Incremental	10-yr NPV Energy Cost Savings	30-yr LCC Savings
		(\$) 100 F	(२)	(\$)	(7)		(¥) 2269.4	(9)
SF_gastumace_stab	bal	109.5	109.1	0.0	270.0	2004.5	5500.4	1404.5
SF_gasfurnace_unheatedbsmt	4A- bal	104.0	170.2	0.0	274.2	2664.5	3332.1	1326.1
SF_hp_crawlspace	4A- bal	569.5	0.0	0.0	569.5	2664.5	5660.9	6465.9
SF_hp_heatedbsmt	4A- bal	345.5	0.0	0.0	345.5	2664.5	3786,3	2472.4
SF_hp_slab	4A- bal	548.5	0.0	0.0	548.5	2664.5	5485.5	6092.3
SF_hp_unheatedbsmt	4A- bal	549.1	0.0	0.0	549.1	2664.5	5490.1	6102.2
SF_oilfurnace_crawlspace	4A- bal	107,6	0.0	433.1	540.7	2664.5	5481.6	6380.3
SF_oilfurnace_heatedbsmt	4A- bal	-0_9	0.0	229.7	228.8	2664.5	2842.6	618.9
SF_oilfurnace_slab	4A- bal	103.0	0.0	411.9	514.8	2664.5	5262.0	5897.8
SF_oilfurnace_unheatedbsmt	4A- bal	97.5	0.0	409.8	507.2	2664.5	5198.2	5760.5
SF_gasfurnace_crawlspace	5A	3.0	260.4	0.0	263.3	2326.0	2924.0	708,4
SF_gasfurnace_heatedbsmt	5A	-44.6	204.6	0.0	160.0	2326.0	2013.0	-1173.7
SF_gasfurnace_slab	5A	1.1	259.2	0.0	260.3	2326.0	2898.1	654,4
SF_gasfurnace_unheatedbsmt	5A	-0.3	255.8	0.0	255.5	2326.0	2854.7	565.7
SF_hp_crawlspace	5A	683.0	0.0	0.0	683.0	2326.0	6217.3	7997.7
SF_hp_heatedbsmt	5A	544.0	0.0	0.0	544.0	2326.0	5054.2	5519.9
SF_hp_slab	5A	694.3	0_0	0.0	694.3	2326.0	6312.2	8199.9
SF_hp_unheatedbsmt	5A	689.5	0.0	0.0	689.5	2326.0	6271.9	8114.2
SF_oilfurnace_crawlspace	5A	1.9	0.0	614.8	616.7	2326.0	5750.1	7422.9
SF_oilfurnace_heatedbsmt	5A	-41.9	0.0	480.7	438.7	2326.0	4242.1	4118.6
SF_oilfurnace_slab	5A	-0.8	0.0	619.4	618,5	2326.0	5766.2	7460.5
SF_oilfurnace_unheatedbsmt	5A	-1.2	0.0	604.4	603.2	2326.0	5635.4	7171.5
SF_gasfurnace_crawlspace	6A	-3.1	273.1	0.0	270.0	1931.5	2693.1	961.8
SF_gasfurnace_heatedbsmt	6A	-46,7	216.6	0.0	169.9	1931.5	1808.6	-863.1
SF_gasfurnace_slab	6A	-4.8	272.8	0.0	268.1	1931.5	2676.8	927.3
SF_gasfurnace_unheatedbsmt	6A	-6.4	268.8	0.0	262.4	1931.5	2626.3	823.9
SF_hp_crawlspace	6A	751.7	0.0	0,0	751.7	1931.5	6495.1	9348.3
SF_hp_heatedbsmt	6A	614,9	0.0	0.0	614.9	1931.5	5350.2	6909.3
SF_hp_slab	6A	766.6	0.0	0.0	766.6	1931.5	6619.8	9614.1

ID	CDZ	Electricity Savings (\$)	Natural Gas Savings (\$)	Fuel Oil Savings (\$)	Total Energy Savings (\$)	Incremental	10-yr NPV Energy Cost Savings (\$)	30-yr LCC Savings (\$)
MF_gasfurnace_crawlspace	4A- NYC	84.4	58.8	0.0	143.2	1763.2	1530.6	-481.9
SF_hp_unheatedbsmt	6A	759.2	0.0	0.0	759.2	1931.5	6558.1	9482.6
SF_oilfurnace_crawlspace	6A	-4.3	0.0	644.1	639,8	1931.5	5650.3	7989.0
SF_oilfurnace_heatedbsmt	6A	-44.1	0.0	508.4	464.3	1931.5	4162.8	4727.4
SF_oilfurnace_slab	6A	-5.8	0.0	642.2	636.4	1931.5	5621.4	7926.3
SF_oilfurnace_unheatedbsmt	6A	-7.6	0,0	634.4	626,8	1931.5	5540.4	7748.3
MF_gasfurnace_heatedbsmt	4A- NYC	12.6	40.0	0.0	52.6	1763.2	756.5	-2111.2
MF_gasfurnace_slab	4A- NYC	86.1	57.4	0.0	143.5	1763.2	1531.9	-477.7
MF_gasfurnace_unheatedbsmt	4A- NYC	85.3	57,7	0.0	143.0	1763.2	1527.8	-486.6
MF_hp_crawlspace	4A- NYC	275.6	0.0	0.0	275.6	1763.2	2588.6	1833.8
MF_hp_heatedbsmt	4A- NYC	153.2	0.0	0.0	153.2	1763.2	1564.5	-348.0
MF_hp_slab	4A- NYC	274.8	0.0	0.0	274.8	1763.2	2582.3	1820.4
MF_hp_unheatedbsmt	4A- NYC	274.7	0.0	0.0	274.7	1763.2	2581.5	1818.7
MF_oilfurnace_crawlspace	4A- NYC	78.4	0.0	191.6	270.0	1763.2	2568.9	1922.9
MF_oilfurnace_heatedbsmt	4A- NYC	13.7	0.0	123.7	137.4	1763.2	1450.5	-506.1
MF_oilfurnace_slab	4A- NYC	79.9	0.0	186.6	266.4	1763.2	2538.5	1854.7
MF_oilfurnace_unheatedbsmt	4A- NYC	79.1	0.0	187.6	266.7	1763.2	2541.1	1861.0
MF_gasfurnace_crawlspace	4A- bal	66.3	81.0	0.0	147.2	1689.7	1796.9	316,7
MF_gasfurnace_heatedbsmt	4A- bal	1,0	56.6	0.0	57.6	1689.7	1026.4	-1299.2
MF_gasfurnace_slab	4A- bal	67.5	79.4	0.0	146.9	1689.7	1792.6	309.2
MF_gasfurnace_unheatedbsmt	4A- bal	66.5	80.0	0.0	146.5	1689.7	1789.7	302.4
MF_hp_crawlspace	4A- bal	245.9	0.0	0.0	245.9	1689.7	2554.4	2015.6
MF_hp_heatedbsmt	4A- bal	135.4	0.0	0.0	135.4	1689.7	1629.8	45.8

		Electricity Savings	Natural Gas Savings	Fuel Oil Savings	Total Energy Savings	Incremental	10-yr NPV Energy Cost Savings	30-yr LCC Savings
ID	CDZ	(\$)	(\$)	(\$)	(\$)	Costs (\$)	(\$)	(\$)
MF_hp_slab	4A- bal	245.2	0.0	0.0	245.2	1689.7	2548.9	2003.8
MF_hp_unheatedbsmt	4A- bal	245.3	0.0	0.0	245.3	1689.7	2549.2	2004.4
MF_oilfurnace_crawlspace	4A- bal	61.1	0.0	204.7	265.8	1689.7	2750.1	2572.3
MF_oilfurnace_heatedbsmt	4A- bal	2.3	0.0	134.8	137.1	1689.7	1663.2	209.1
MF_oilfurnace_slab	4A- bal	62.1	0.0	201.0	263.1	1689.7	2727.2	2521.2
MF_oilfurnace_unheatedbsmt	4A- bal	61.2	0.0	201.3	262.5	1689.7	2722.2	2510.6
MF_gasfurnace_crawlspace	5A	-27.5	139.8	0.0	112.3	1875.2	1382.0	-1453.7
MF_gasfurnace_heatedbsmt	5A	-62.4	124.4	0.0	62.0	1875.2	948.0	-2362.2
MF_gasfurnace_slab	5A	-27.6	138.2	0.0	110.6	1875.2	1365.9	-1486.3
MF_gasfurnace_unheatedbsmt	5A	-27.7	138.6	0.0	110.9	1875.2	1369,1	-1480.1
MF_hp_crawlspace	5A	283.8	0.0	0.0	283.8	1875.2	2699.5	1499.8
MF_hp_heatedbsmt	5A	211.0	0.0	0.0	211.0	1875.2	2091.0	203.4
MF_hp_slab	5A	281.2	0.0	0.0	281.2	1875.2	2678.4	1454.9
MF_hp_unheatedbsmt	5A	282.5	0.0	0.0	282.5	1875.2	2688.9	1477.3
MF_oilfurnace_crawlspace	5A	-24.0	0.0	342.5	318.5	1875.2	3039.1	2457.6
MF_oilfurnace_heatedbsmt	5A	-56.6	0.0	296.9	240.3	1875.2	2378.2	1018.3
MF_oilfurnace_slab	5A	-24.7	0.0	337.6	312.9	1875,2	2991,1	2351.8
MF_oilfurnace_unheatedbsmt	5A	-24.6	0.0	339.0	314.4	1875.2	3003.8	2380.0
SF_gasfurnace_crawlspace	4A- NYC	149.1	120.0	0.0	269.0	2048.5	2634.4	1262.4
SF_gasfurnace_heatedbsmt	4A- NYC	34.8	56.3	0.0	91.1	2048.5	1092.0	-1956.6
SF_gasfurnace_slab	4A- NYC	133.8	119.4	0.0	253.2	2048.5	2501.3	979.4
SF_gasfurnace_unheatedbsmt	4A- NYC	139.8	114.7	0.0	254.5	2048.5	2508.3	999.2
SF_hp_crawlspace	4A- NYC	621.0	0.0	0.0	621.0	2048.5	5479.4	7449.2
SF_hp_heatedbsmt	4A- NYC	388.3	0.0	0.0	388.3	2048.5	3532.0	3300.5
SF_hp_slab	4A- NYC	601,7	0.0	0.0	601.7	2048.5	5317.3	7103.9
SF_hp_unheatedbsmt	4A- NYC	601.6	0.0	0.0	601.6	2048.5	5317.0	7103.3

		Electricity Savings	Natural Gas Savings	Fuel Oil Savings	Total Energy Savings	Incremental	10-yr NPV Energy Cost Savings	30-yr LCC Savings
ID ID	CDZ	(\$)	(\$)	(\$)	(\$)	Costs (\$)	(\$)	(\$)
SF_oilfurnace_crawlspace	4A- NYC	141,3	0.0	375.7	517.1	2048.5	4662.7	5966.5
SF_oilfurnace_heatedbsmt	4A- NYC	35.3	0.0	172.9	208.2	2048.5	2049.5	260.4
SF_oilfurnace_slab	4A- NYC	126.9	0,0	372.7	499.6	2048.5	4516.4	5652.5
SF_oilfurnace_unheatedbsmt	4A- NYC	131.9	0.0	360.2	492.1	2048.5	4451.6	5505.9
SF_gasfurnace_crawlspace	4A- bal	113.9	180.4	0.0	294.3	2664.5	3509.4	1693.0
SF_gasfurnace_heatedbsmt	4A- bal	-2.5	97.5	0.0	95.0	2664.5	1772.6	-1920.0
SF_gasfurnace_slab	4A- bal	109.5	169.1	0.0	278,6	2664.5	3368.4	1404.5
SF_gasfurnace_unheatedbsmt	4A- bal	104.0	170.2	0.0	274.2	2664.5	3332.1	1326.1
SF_hp_crawlspace	4A- bal	569.5	0.0	0.0	569.5	2664.5	5660.9	6465.9
SF_hp_heatedbsmt	4A- bal	345.5	0.0	0.0	345.5	2664.5	3786.3	2472.4
SF_hp_slab	4A- bal	548.5	0.0	0.0	548.5	2664.5	5485.5	6092.3
SF_hp_unheatedbsmt	4A- bal	549.1	0.0	0.0	549.1	2664.5	5490.1	6102.2
SF_oilfurnace_crawlspace	4A- bal	107.6	0.0	433.1	540.7	2664.5	5481.6	6380.3
SF_oilfurnace_heatedbsmt	4A- bal	-0.9	0.0	229.7	228.8	2664.5	2842,6	618.9
SF_oilfurnace_slab	4A- bal	103.0	0.0	411.9	514.8	2664.5	5262.0	5897.8
SF_oilfurnace_unheatedbsmt	4A- bal	97.5	0.0	409.8	507.2	2664.5	5198.2	5760.5
SF_gasfurnace_crawlspace	5A	3.0	260.4	0.0	263.3	2326.0	2924.0	708.4
SF_gasfurnace_heatedbsmt	5A	-44.6	204.6	0.0	160.0	2326.0	2013.0	-1173.7
SF_gasfurnace_slab	5A	1.1	259.2	0.0	260.3	2326.0	2898.1	654.4
SF_gasfurnace_unheatedbsmt	5A	-0.3	255.8	0.0	255.5	2326.0	2854,7	565.7

# Endnotes

- https://www.nyserda.ny.gov/-/media/Files/Programs/energy-code-training/2019-01-07-draft-NYStretch-energy-code.pdf
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- https://www.energy.gov/energysaver/water-heating/drain-water-heat-recovery
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- <sup>10</sup> https://www.nachi.org/hot-water-recirculation-systems.htm
- https://www1.nyc.gov/assets/buildings/apps/pdf\_viewer/viewer.html?file=2016ECC\_CHR4.pdf &section=energy\_code\_2016
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- <sup>17</sup> http://www.freddiemac.com/pmms/pmms30.html (accessed June 12, 2019)
- 18 https://www.bls.gov/
- <sup>19</sup> https://www.eia.gov/outlooks/aco/data/browser/#/?id=3-AEO2019&region=1-2&cases=ref2019&start=2017&end=2050&f=A&linechart=ref2019-d111618a.3-3-AEO2019.1-2&map=ref2019d111618a.4-3-AEO2019.1-2&sourcekey=0
- <sup>20</sup> https://www.tax-brackets.org/newyorktaxtable
- <sup>21</sup> Draft NYStretch Energy Code-2019 dated January 2019
- <sup>22</sup> This observation is further explained in section A.3 Single-Family Prototype Packages.
- <sup>23</sup> https://aceee.org/sites/default/files/pdf/conferences/hwf/2017/Delforge Session4B HWF17 2.28.17.pdf
- <sup>24</sup> http://www.mnshi.umn.edu/kb/scale/hrverv.html
- <sup>25</sup> https://www.homewyse.com/costs/cost\_of\_heat\_recovery\_systems.html
- <sup>26</sup> https://efiling.energy.ca.gov/GetDocument.aspx?tn=74627&DocumentContentId=16036
- <sup>27</sup> http://ma-eeac.org/wordpress/wp-content/uploads/RES19\_Task5\_FinalReport\_v3.0\_clean.pdf
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New York State Energy Research and Development Authority

17 Columbia Circle Albany, NY 12203-6399 toll free: 866-NYSERDA local: 518-862-1090 fax: 518-862-1091

info@nyserda.ny.gov nyserda.ny.gov



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