

A photograph of a modern building's interior courtyard or atrium. The space is characterized by a complex network of white steel beams and glass panels, creating a bright, open environment. Sunlight filters through the glass, casting warm, golden light across the surfaces. In the foreground, there are glass railings and a glass door. The overall aesthetic is clean, industrial, and architectural.

# C406 Points Based Option Packages Proposal

Eric Makela  
Associate Director

# Issue with Current Options Packages

# Office Added Efficiency Option Impact (PNNL)

► How does energy savings compare? Preliminary results:

Modeled Sq.Ft.: 53,633		ANNUAL SAVINGS (Annual use/cost for baseline)				
ENERGY DESIGN MEASURE	Climate Zone	Electric KWH	Nat Gas (Therm)	Energy Savings (\$)	MMBtu	Percent Bldg Cost
Base_Code_Seattle_PkgAC	4C	449,794	1,285	37,593	1,664	100%
C406.2 HVAC efficiency	4C	2,758	58	276	15	0.73%
C406.3 Reduced LPD	4C	25,289	-79	1,977	78	5.26%
C406.5 Renewable PV	4C	12,872	0	1,043	44	2.77%
C406.8 Reduced UA	4C	53	99	93	10	0.25%
C406.9 Reduced Infiltration	4C	-172	30	13	2	0.03%

Modeled Sq.Ft.: 53,633		ANNUAL SAVINGS (Annual use/cost for baseline)				
ENERGY DESIGN MEASURE	Climate Zone	Electric KWH	Nat Gas (Therm)	Energy Savings (\$)	MMBtu	Percent Bldg Cost
Base_Code_Spokane_PkgAC	5B	468,297	2,180	39,898	1,816	100%
C406.2 HVAC efficiency	5B	4,136	170	488	31	1.22%
C406.3 Reduced LPD	5B	25,850	-174	1,937	71	4.86%
C406.5 Renewable PV	5B	12,872	0	1,043	44	2.61%
C406.8 Reduced UA	5B	550	247	267	27	0.67%
C406.9 Reduced Infiltration	5B	-136	74	55	7	0.14%

# Retail Added Efficiency Option Impact (PNNL)

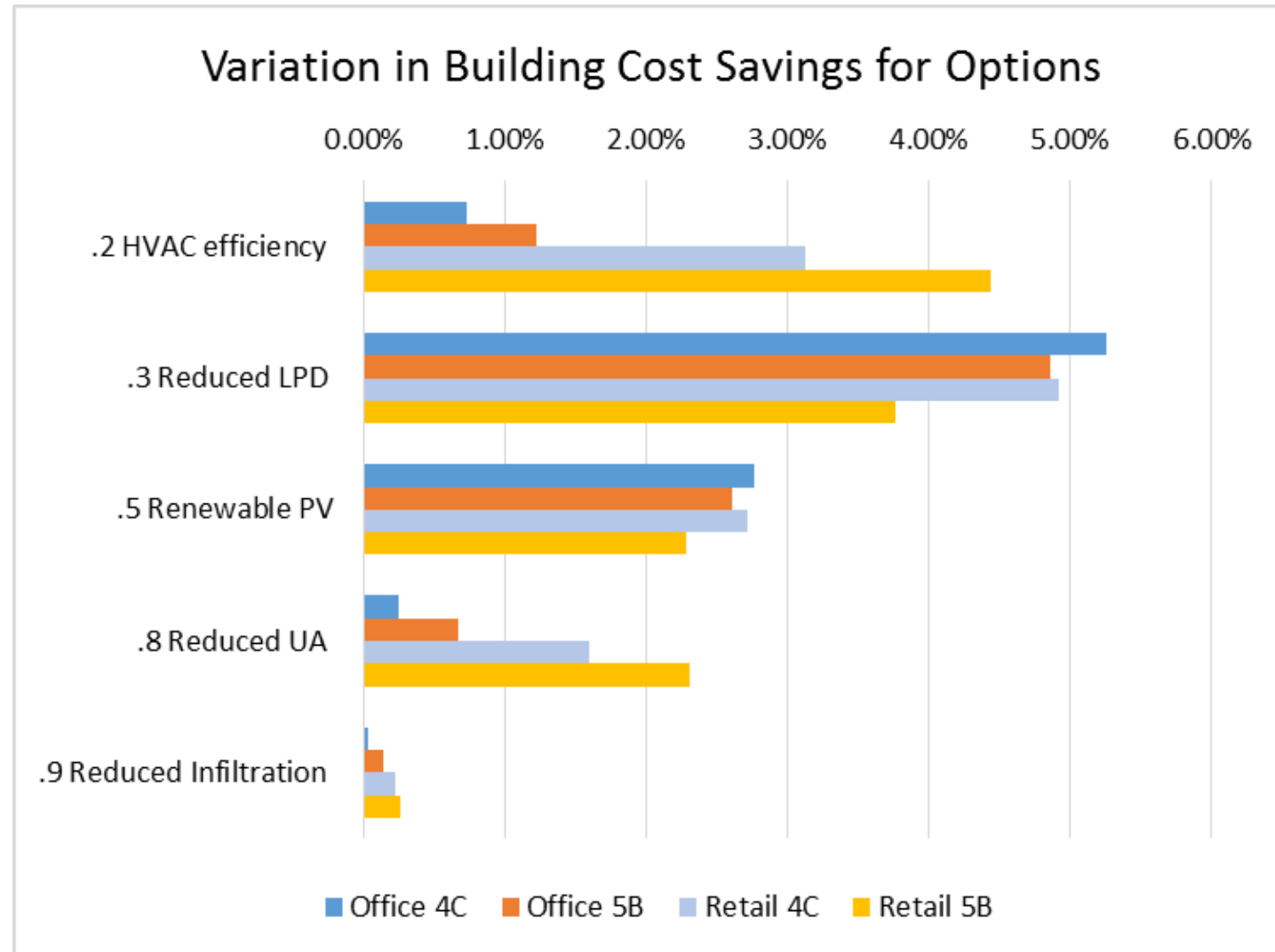
► How does energy savings compare? Preliminary results:

Modeled Sq.Ft.:	24,695	ANNUAL SAVINGS (Annual use/cost for baseline)				
ENERGY DESIGN MEASURE	Climate Zone	Electric KWH	Nat Gas (Therm)	Energy Savings (\$)	MMBtu	Percent Bldg Cost
Base_Code_Seattle_PkgAC	4C	244,378	3,451	22,903	1,179	100%
C406.2 HVAC efficiency	4C	1,058	332	385	37	3.12%
C406.3 Reduced LPD	4C	24,544	-258	1,756	58	4.92%
C406.5 Renewable PV	4C	9,384	0	760	32	2.72%
C406.8 Reduced UA	4C	133	185	177	19	1.60%
C406.9 Reduced Infiltration	4C	-17	27	22	3	0.22%

Modeled Sq.Ft.:	24,695	ANNUAL SAVINGS (Annual use/cost for baseline)				
ENERGY DESIGN MEASURE	Climate Zone	Electric KWH	Nat Gas (Therm)	Energy Savings (\$)	MMBtu	Percent Bldg Cost
Base_Code_Spokane_PkgAC	5B	259,242	5,208	25,690	1,405	100%
C406.2 HVAC efficiency	5B	1,911	559	658	62	4.44%
C406.3 Reduced LPD	5B	24,911	-322	1,728	53	3.76%
C406.5 Renewable PV	5B	9,384	0	760	32	2.28%
C406.8 Reduced UA	5B	753	299	330	33	2.31%
C406.9 Reduced Infiltration	5B	25	36	35	4	0.26%

# Added Efficiency Options (PNNL)

- ▶ How five of the options now compare



# Additional Efficiency Package Formats (PNNL)

- ▶ **Simplified Point Table.** Each point worth half a percent building savings
- ▶ **Limited Table.** Limited packages per building type
  - **Extensive Table** or **Package Database** are also options
- ▶ **Flexible Point System.** Trade-off points for target
- ▶ Decision point: Allow simple tradeoffs for simple buildings?

*Simple Point Table Example – 406 Additional Efficiency Package Options*

<b>8 points required</b>	<b>5B Office</b>	<b>5B Retail</b>	<b>5B Rest'nt</b>	<b>4C Office</b>	<b>4C Retail</b>	<b>4C Rest'nt</b>
+15% HVAC Efficiency	4	8	9	2	6	7
SHW + Fryer Efficiency	N/A	N/A	9	N/A	N/A	9
Renewable PV	5	4	2	5	5	3
15% LPD Reduction	6	7	4	6	10	3
25% LPD Reduction	9	3	6	10	4	5
Envelope Improvement	2	3	2	1	2	1

# Proposed Points Table

Code Section	Commercial Building Occupancy					
	Group R-1	Group R-2	Group B	Group E	Group M	All Other Groups
	Additional Efficiency Credits					
<u>1. More efficient HVAC performance in accordance with Section C406.2.</u>	2.0	3.0	3.0	2.0	1.0	2.0
<u>2.1 Reduced lighting power: Option 1 in accordance with Section C406.3.1.</u>	1.0	1.0	2.0	2.0	3.0	2.0
<u>2.2 Reduced lighting power: Option 2 in accordance with Section C406.3.2.</u>	2.0	3.0	4.0	4.0	6.0	4.0
<u>3. Enhanced lighting controls in accordance with C406.4.</u>	NA	NA	1.0	1.0	1.0	1.0
<u>4. On-site supply of renewable energy in accordance with C406.5.</u>	3.0	3.0	3.0	3.0	3.0	3.0
<u>5. Dedicated outdoor air system in accordance with C406.6<sup>1</sup>.</u>	4.0	4.0	4.0	4.0	4.0	4.0
<u>6.1 High-efficiency service water heating in accordance with Section C406.7.1 and C406.7.2.</u>	7.0	8.0	NA	NA	NA	8.0
<u>6.2 High-efficiency service water heating equipment in accordance with Section C406.7.1 and C406.7.3.</u>	5.0	5.0	NA	NA	NA	5.0
<u>7. Heat pump water heating equipment in accordance with Sections C406.7.1 and C406.7.4.</u>	7.0	7.0	NA	NA	NA	7.0
<u>8. Enhanced envelope performance in accordance with Section C406.8.</u>	3.0	6.0	3.0	3.0	3.0	4.0
<u>9. Reduced air infiltration in accordance with Section C406.9.</u>	1.0	2.0	1.0	1.0	1.0	1.0
<u>10. Efficient kitchen appliances in accordance with C406.10.</u>	5.0	NA	NA	NA	5.0	5.0 (Group A-2 only)
<b>1.</b>	<b>This option is not available to buildings subject to the prescriptive requirements of Section C403.3.5.</b>					

# How Were the Points Generated?



# Data for Points

- PNNL Initial Analysis
- Analysis for New York Stretch Code
  - Analysis performed by PNNL
  - 20% Savings Over ASHRAE 90.1-2013
- Analysis for Multifamily Guide
  - Analysis performed by Seventhwave

Measures Modeled	Language			
	20% Stretch Code	New York		AB-MFG
		NYStretch Code 2018	ASHRAE 90.1 - 2016	
<b>Base Measures</b>				
Enhanced insulation for roofs and walls	X	X		
Enhanced windows	X	X		X
Solar Gain Reduction	X			
Air leakage testing for large buildings (0.4 CFM/sf)	X	X		X
Thermal bridging reduction	X	X		X
Reduced LPD for interior lighting and high efficacy lights in dwelling units	X	X		X
Occupancy sensors in all spaces and automatic lighting controls including egress lighting	X	X		X
Daylight Control	X			
Exterior lighting control	X	X		X
Exterior lighting power reduction	X	X		
Fan power limit: 0.8 W/cfm VAV and 0.65 W/cfm CAV	X	X		
Fan Efficiency				X
High efficiency cooling towers	X	X		
Ventilation Optimization	X			
Ventilation Prerequisites				X
ERV for apartment makeup air units		X		
Hotel guestroom HVAC vacancy control	X	X		
Dwelling Unit and Common Areas HVAC Controls				X
SWH waste heat recovery	X	X		
Demand-based recirculated DHW controls			X	
Plug load reduction	X	X	X	
Energy Star Kitchen Appliances	X	X		
Energy Star Laundry Appliances				X
Efficient elevator		X		
<b>Package Options</b>				
DX Equipment Efficiency and Condensing Boilers	X	X		
System Selection plus DOAS	X			
GSHP				X
HRV				X
Radiant Heating/Cooling				X
HPWH				X
Reduced LPD (exceed base by 10%)		X		
Enhanced Envelope Performance (exceed base UA by 10%)		X		X
30% WWR	X			
Reduced Air Infiltration (0.25 CFM/sf)		X		

# NYStretch 2018

		Baseline	10 - Story Apartment	20 - Story Apartment	Large Hotel	Large Office	Secondary School	Stand-alone Retail
	Size		84,360	168,720	122,132	498,000	210,900	24,695
	Construction Weight		10.1%	16.9%	11.4%	9%	25.3%	27.6%
CZ 4A	Total Savings (EEM 1-16)	ASHRAE 90.1-2013	<b>31.7%</b>	<b>31%</b>	<b>19.5%</b>	<b>5.8%</b>	<b>17.8%</b>	<b>14.7%</b>
	NYS+HVAC		1.0%	1.2%	1.1%	1.7%	0.7%	0.6%
	NYS+light	NYS 2018	0.3%	0.3%	0.6%	0.9%	0.9%	2.2%
	NYS+Envelope		1.2%	1.2%	0.5%	0.7%	0.2%	1.0%
	NYS+Infiltration		1.1%	1.0%	0.2%	0.3%	0.1%	0.0%
CZ 5A	Total Savings (EEM 1-16)	ASHRAE 90.1-2013	<b>32.7%</b>	<b>32.0%</b>	<b>20.6%</b>	<b>7.1%</b>	<b>17.9%</b>	<b>14.8%</b>
	NYS+HVAC		1.2%	1.3%	1.8%	2.4%	1.0%	0.5%
	NYS+light	NYS 2018	0.2%	0.2%	0.6%	1.0%	0.9%	2.8%
	NYS+Envelope		1.5%	1.6%	0.7%	0.8%	0.1%	2.4%
	NYS+Infiltration		1.2%	1.2%	0.3%	0.3%	0.2%	0.0%
CZ 6A	Total Savings (EEM 1-16)	ASHRAE 90.1-2013	<b>34%</b>	<b>33.2%</b>	<b>21.6%</b>	<b>7.3%</b>	<b>18.3%</b>	<b>15.9%</b>
	NYS+HVAC		1%	1.2%	1.6%	2.3%	0.8%	0.4%
	NYS+light	NYS 2018	0.2%	0.3%	0.5%	0.5%	0.9%	2.1%
	NYS+Envelope		1.4%	1.6%	0.6%	0.7%	0.3%	1.3%
	NYS+Infiltration		1.2%	1.2%	0.3%	0.3%	0.2%	0.0%
	<b>Total Weighted Savings (EEM 1-16)</b>	ASHRAE 90.1-2013	<b>31.8%</b>	<b>31%</b>	<b>20.3%</b>	<b>6%</b>	<b>17.9%</b>	<b>15%</b>

# Points Criteria

- Points based on occupancy type
  - Reflects energy impact of measures on specific occupancies
- Points kept to whole numbers
- Each point represents approximately 1% savings

**Thanks!**

Eric Makela  
ericm@newbuildings.org