



Evolving Toward Zero in Affordable Multifamily



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Learning Objectives



1. Understand the selection process of high performing assemblies and systems
2. Learn the correlation between state climate initiatives, affordable housing loans and program requirements
3. Identify pay back opportunities through energy & water savings, durability and decreased resident turnover
4. Recognize lessons learned and best practices toward standardization



SUCCESS IS IN THE DETAILS

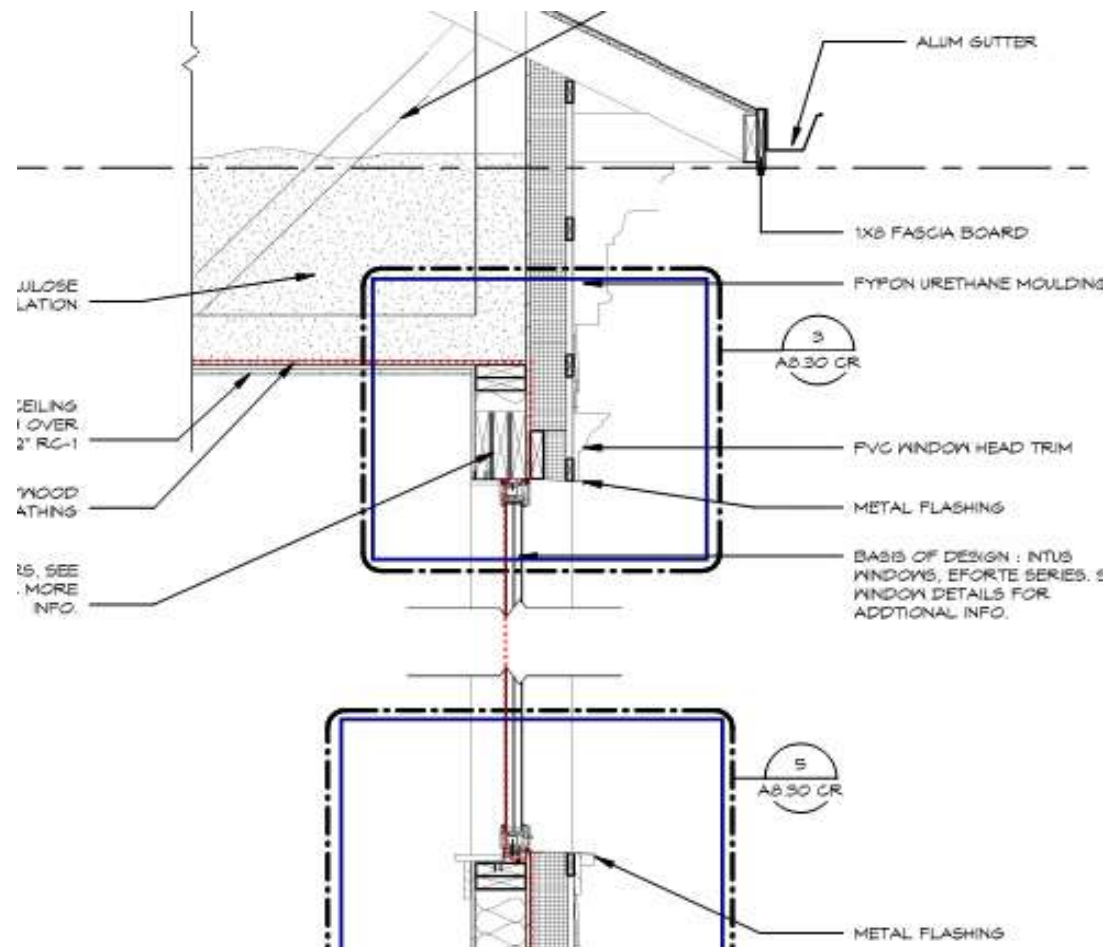


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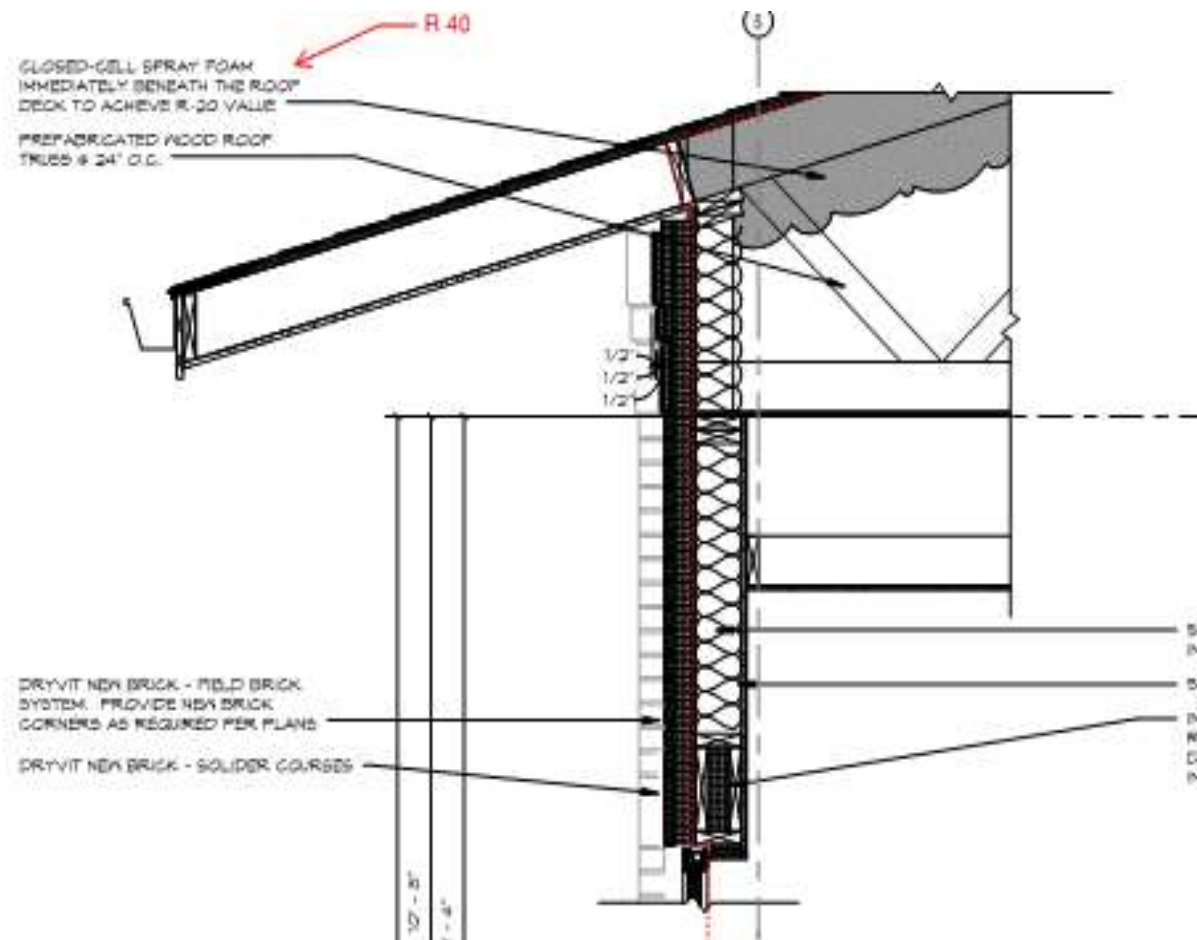
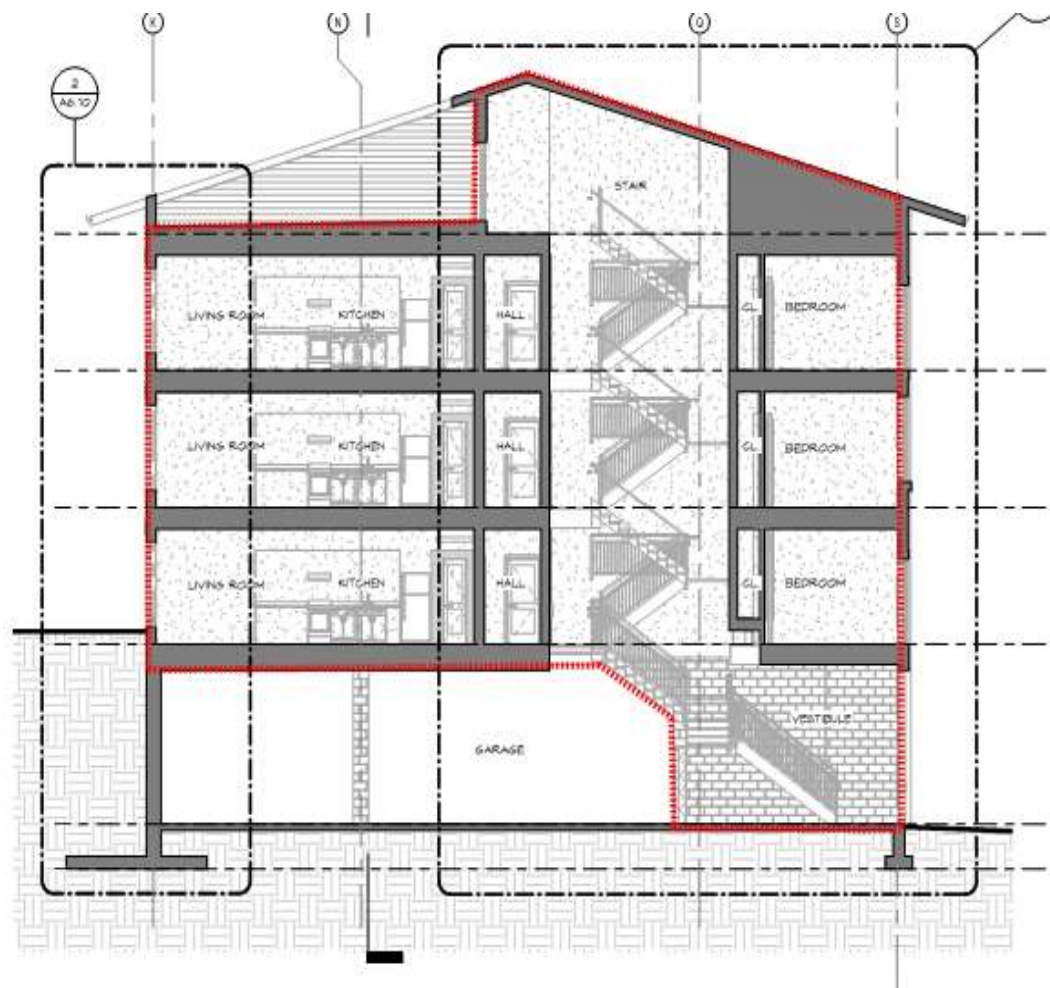
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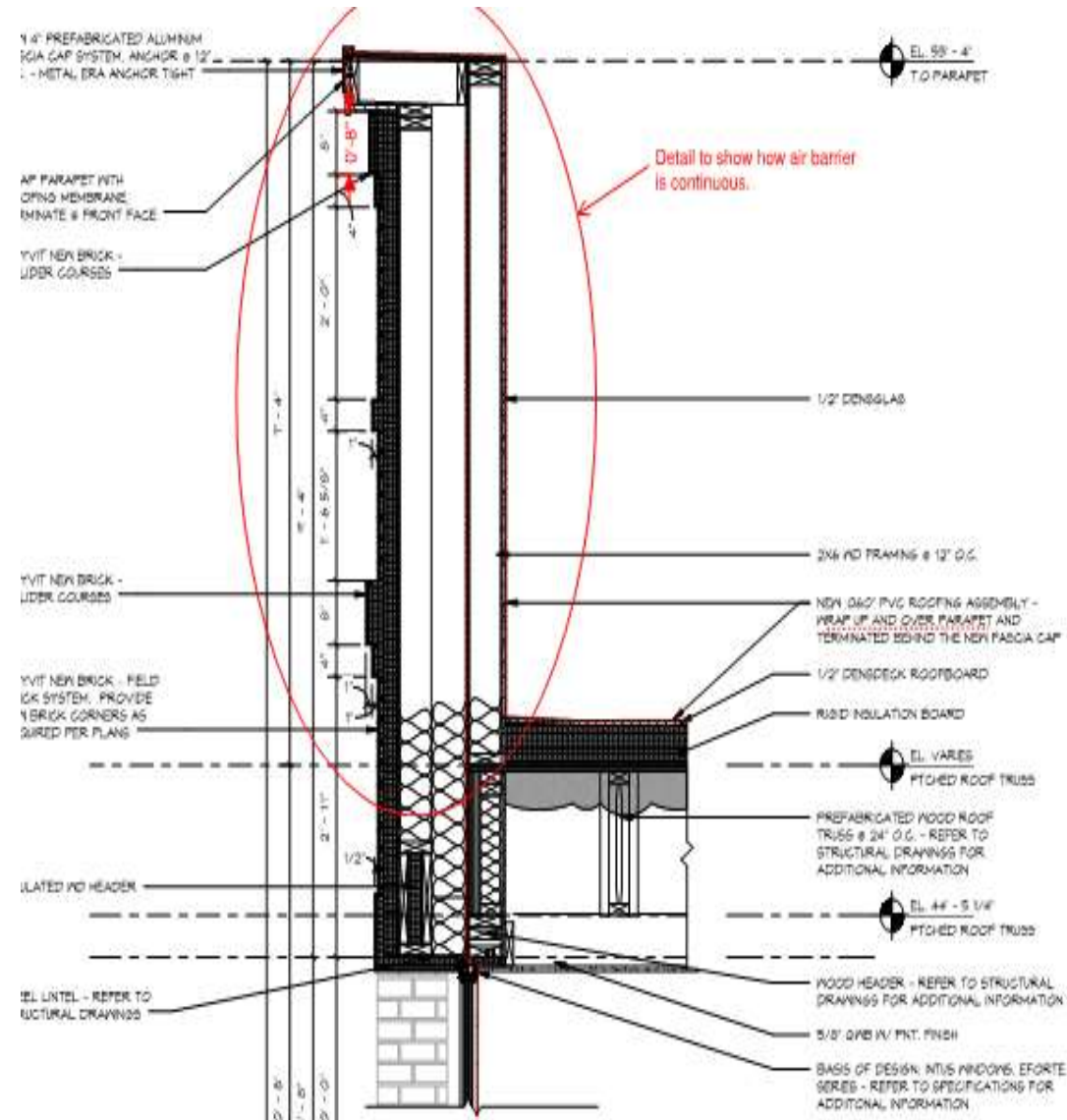
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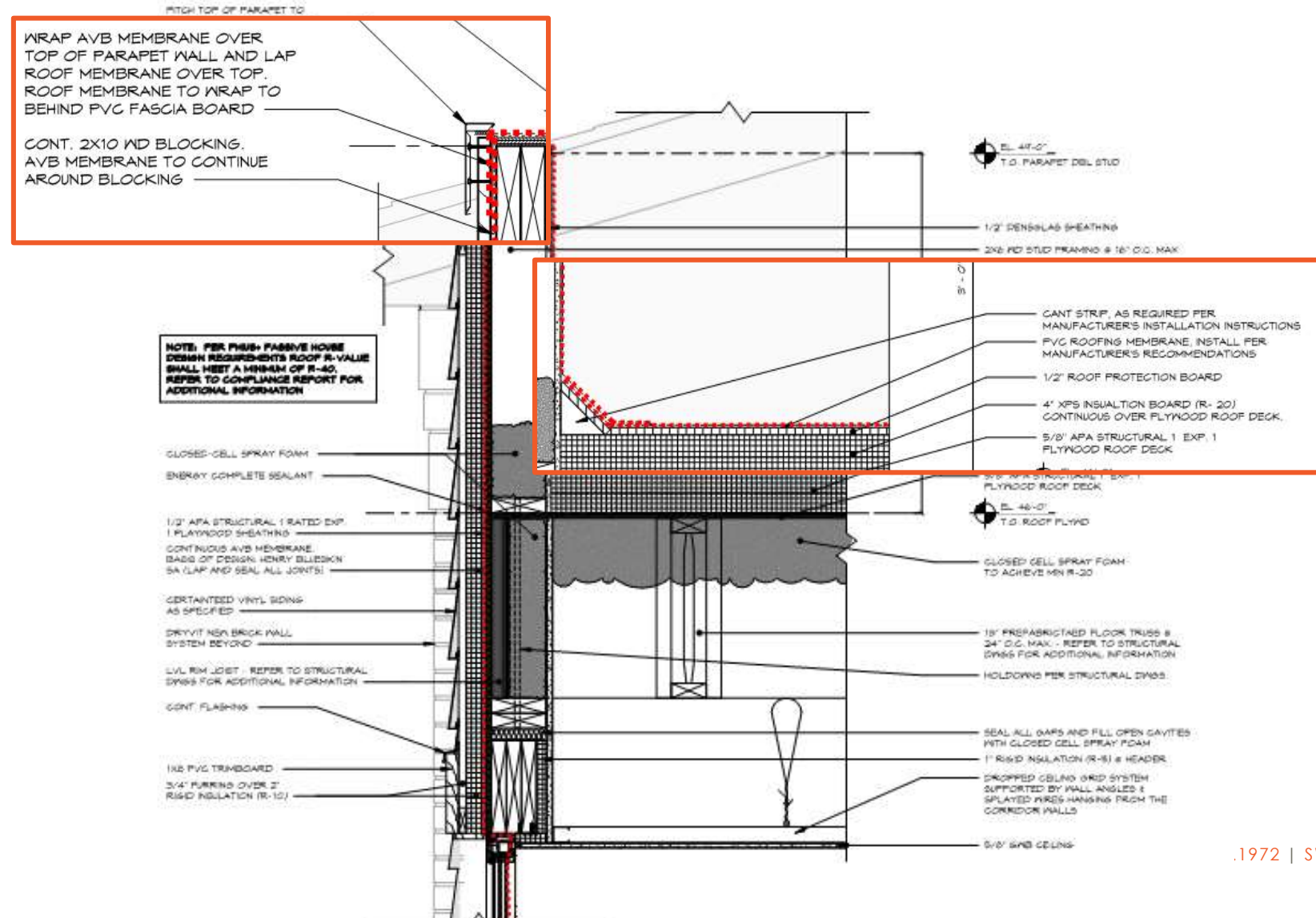
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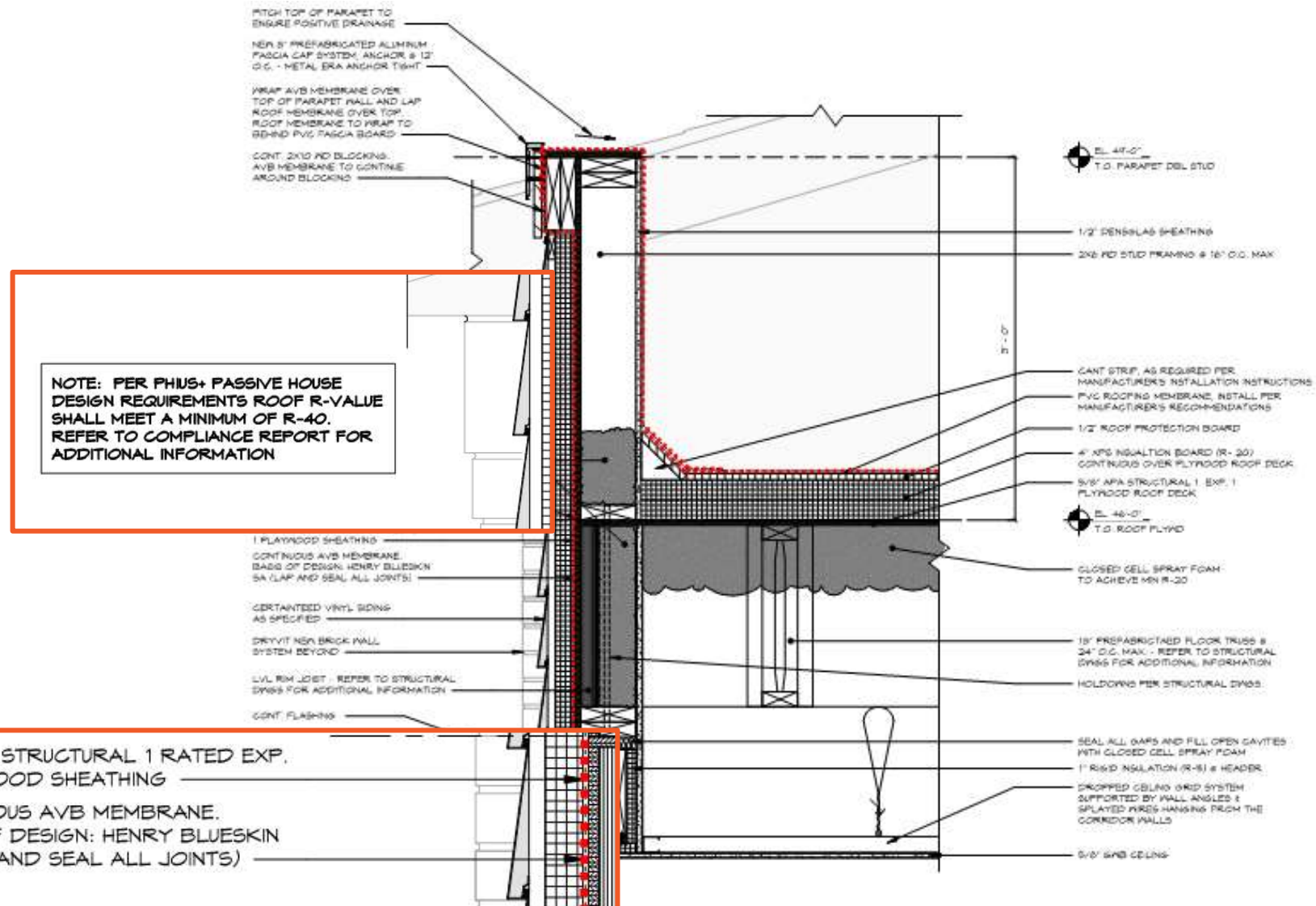
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18

JAN
T F S
4 5 6
11 12 13
18 19 20
25 26 27

FEB
T F S
1 2 3
8 9 10
15 16 17
22 23 24

MAR
T F S
1 2 3
8 9 10
15 16 17
22 23 24
29 30 31

APR
T F S
5 6 7
12 13 14
19 20 21
26 27 28

EXTERIOR INSULATION
2" POLYISO (R-12)

STUD BAY INSULATION
5 1/2" FG BATT (R-19)

$$T_{\text{BACK OF SHEATHING}} = T_{\text{interior}} - (T_{\text{interior}} - T_{\text{exterior}}) \frac{R_{\text{stud bay}}}{R_{\text{total}}}$$

$$= 68^{\circ} - (68^{\circ} - 26^{\circ}) \frac{19}{31}$$

$$= 68^{\circ} - [42^{\circ} \cdot .6129]$$

$$= 68^{\circ} - 25.7^{\circ}$$

$$= 42.3^{\circ} \quad \text{In trouble if RH exceeds } \pm 38\%$$

JAN
1 2 3 4 5 6
8 9 10 11 12 13
15 16 17 18 19 20
22 23 24 25 26 27
29 30 31

FEBRUARY
1 2 3 4 5 6
8 9 10 11 12 13
15 16 17 18 19 20
22 23 24 25 26 27
29

MARCH
1 2 3 4 5 6
8 9 10 11 12 13
15 16 17 18 19 20
22 23 24 25 26 27
29 30 31

APRIL
1 2 3 4 5 6 7
9 10 11 12 13 14
16 17 18 19 20 21
23 24 25 26 27 28
30

MAY
1 2 3 4 5 6 7
9 10 11 12 13 14
16 17 18 19 20 21
23 24 25 26 27 28
29 30 31

JUNE
1 2 3 4 5 6 7
9 10 11 12 13 14
16 17 18 19 20 21
23 24 25 26 27 28
29 30

JULY
1 2 3 4 5 6 7
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16 17 18 19 20 21
23 24 25 26 27 28
29 30 31

AUGUST
1 2 3 4 5 6 7
9 10 11 12 13 14
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23 24 25 26 27 28
29 30 31

SEPTEMBER
1 2 3 4 5 6 7
9 10 11 12 13 14
16 17 18 19 20 21
23 24 25 26 27 28
29 30

OCTOBER
1 2 3 4 5 6 7
9 10 11 12 13 14
16 17 18 19 20 21
23 24 25 26 27 28
29 30 31

NOVEMBER
1 2 3 4 5 6 7
9 10 11 12 13 14
16 17 18 19 20 21
23 24 25 26 27 28
29 30

$$T_{\text{back of sheathing}} = T_{\text{interior}} - (T_{\text{interior}} - T_{\text{exterior}}) \frac{R_{\text{stud bay}}}{R_{\text{total}}}$$

$$= 68^{\circ} - (68^{\circ} - 26^{\circ}) \frac{26.2}{32.8}$$

$$= 68^{\circ} - [42^{\circ} \cdot 0.79878]$$

$$= 68^{\circ} - 33.5^{\circ}$$

$$T_{\text{back of sheathing}} = 34.5^{\circ} \quad \text{In trouble if RH exceeds } \pm 28\%$$

2" INSULATED ZIP (R-9.6)

$$T = 68^{\circ} - (68^{\circ} - 26^{\circ}) \frac{26.2}{35.8}$$

$$= 68 - [42 \cdot .7318]$$

$$= 37.3^{\circ} \quad \text{In trouble if RH exceeds } \pm 32\%$$

2 1/2" INSULATED ZIP (R-12.6)

$$T = 68^{\circ} - (68^{\circ} - 26^{\circ}) \frac{26.2}{38.8}$$

$$= 68^{\circ} - [42^{\circ} \cdot .6752]$$

$$= 39.7^{\circ} \quad \text{In trouble if RH exceeds } \pm 35\%$$

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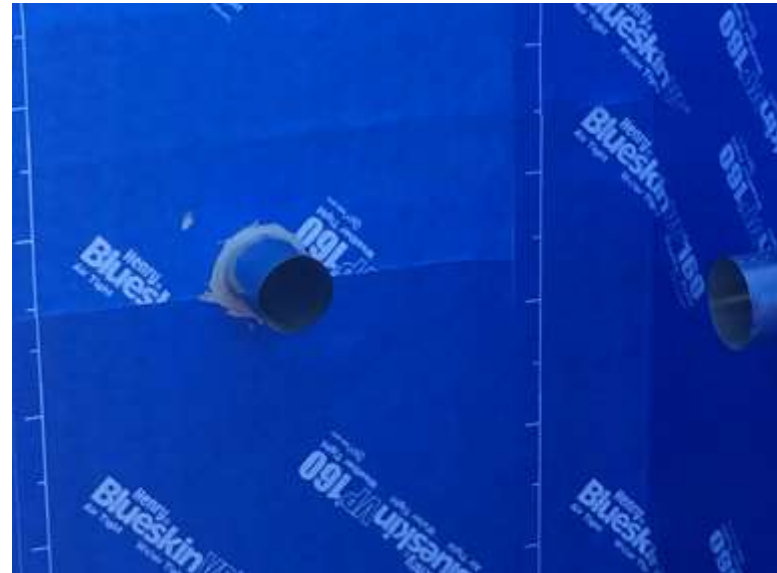
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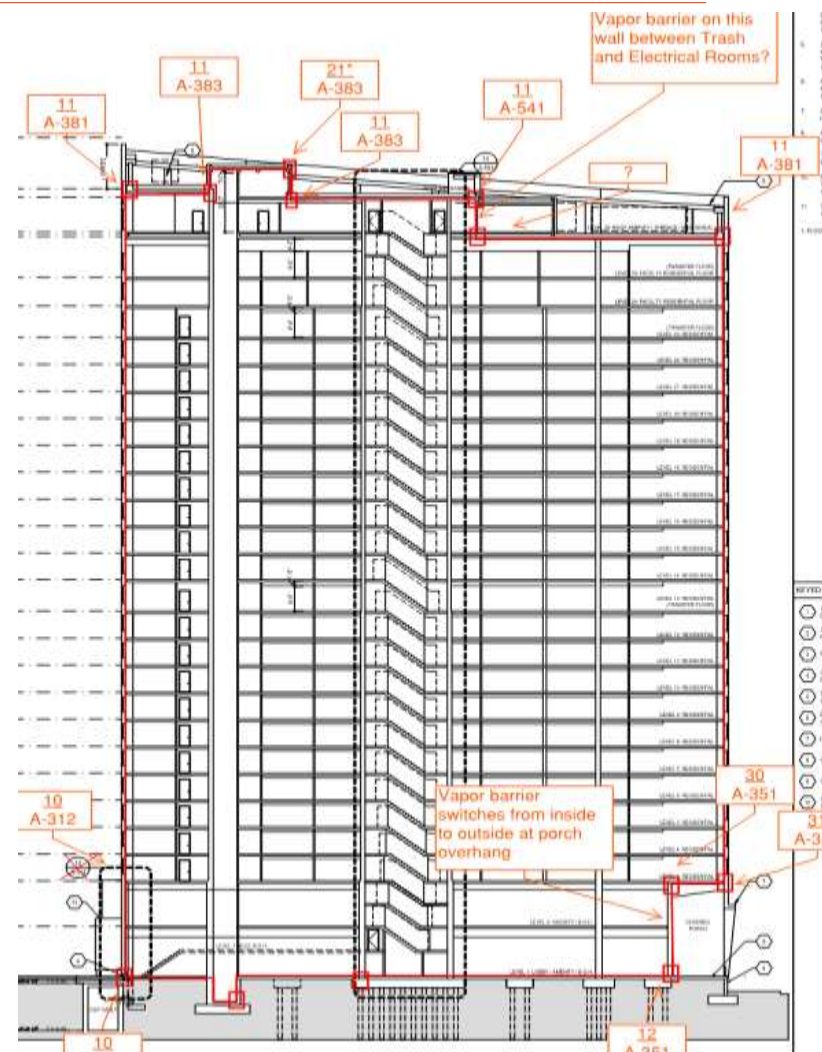
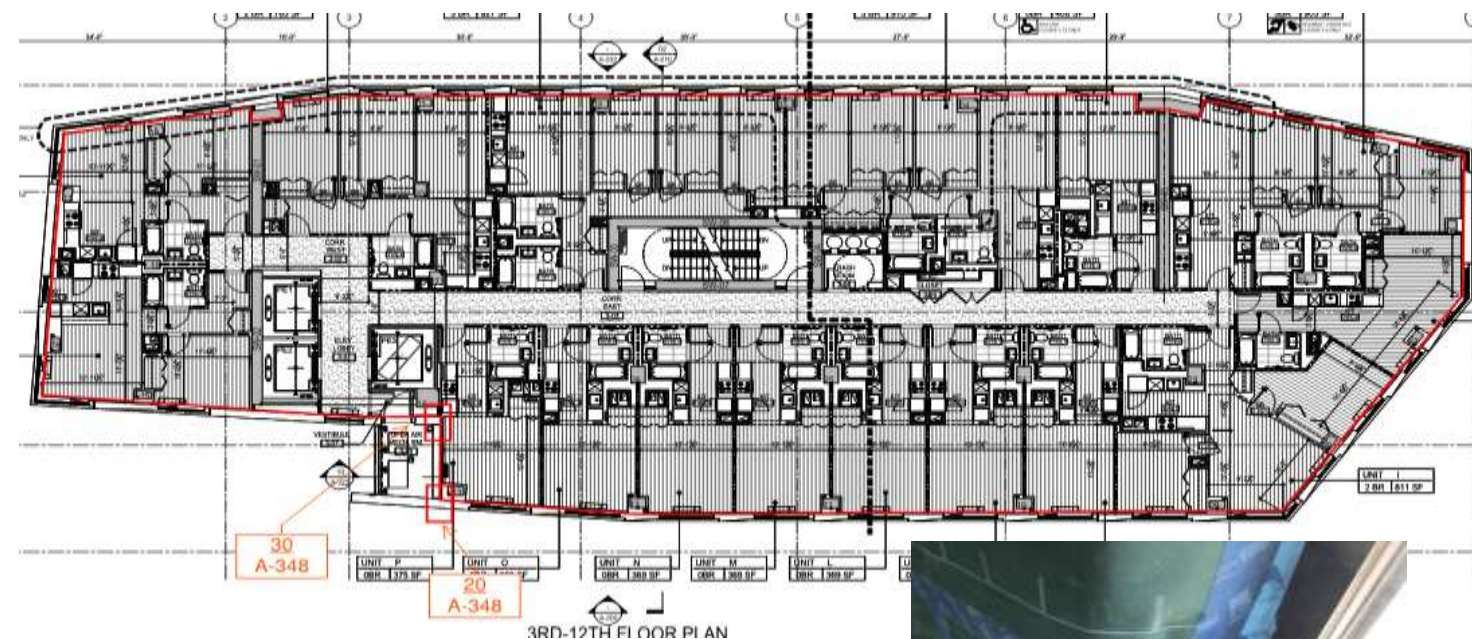
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THE COMPOSITION OF A WALL

Thermal Barrier



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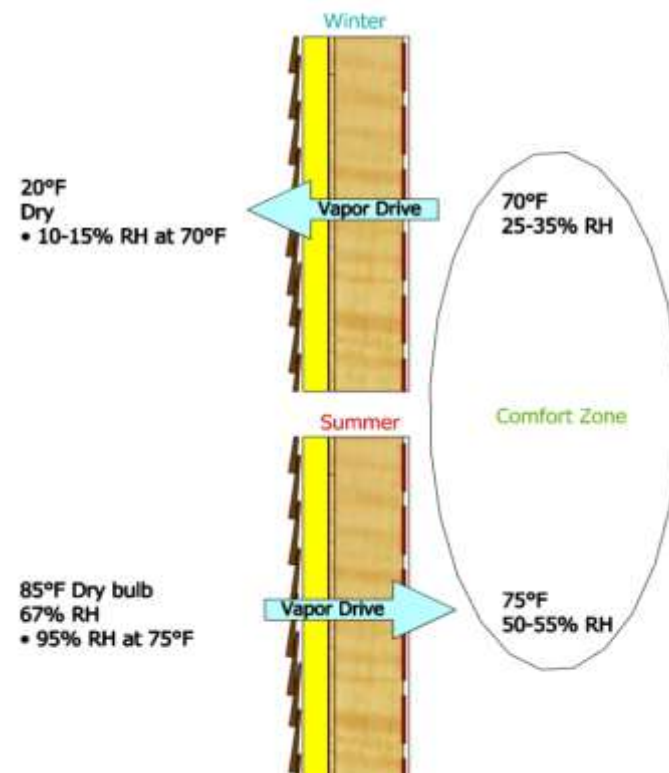
Thermal Barrier

Average Daily Temperature Dec./Jan./Feb (T _{outdoor})	Minimum Recommended Exterior RFB R-Value	
	R21 Cavity	R15 Cavity
34	4.0	3.0
32	5.5	4.0
30	7.0	5.0
28	8.5	6.0
26	10.0	7.0

Bridgeport 32.5° F

Hartford 28.4° F

Worcester, MA 26.1° F



$$T_{\text{interface}} = T_{\text{indoor}} - [(T_{\text{indoor}} - T_{\text{outdoor}}) \times (R_{\text{cavity}}/R_{\text{total}})]$$

Thermal Barrier



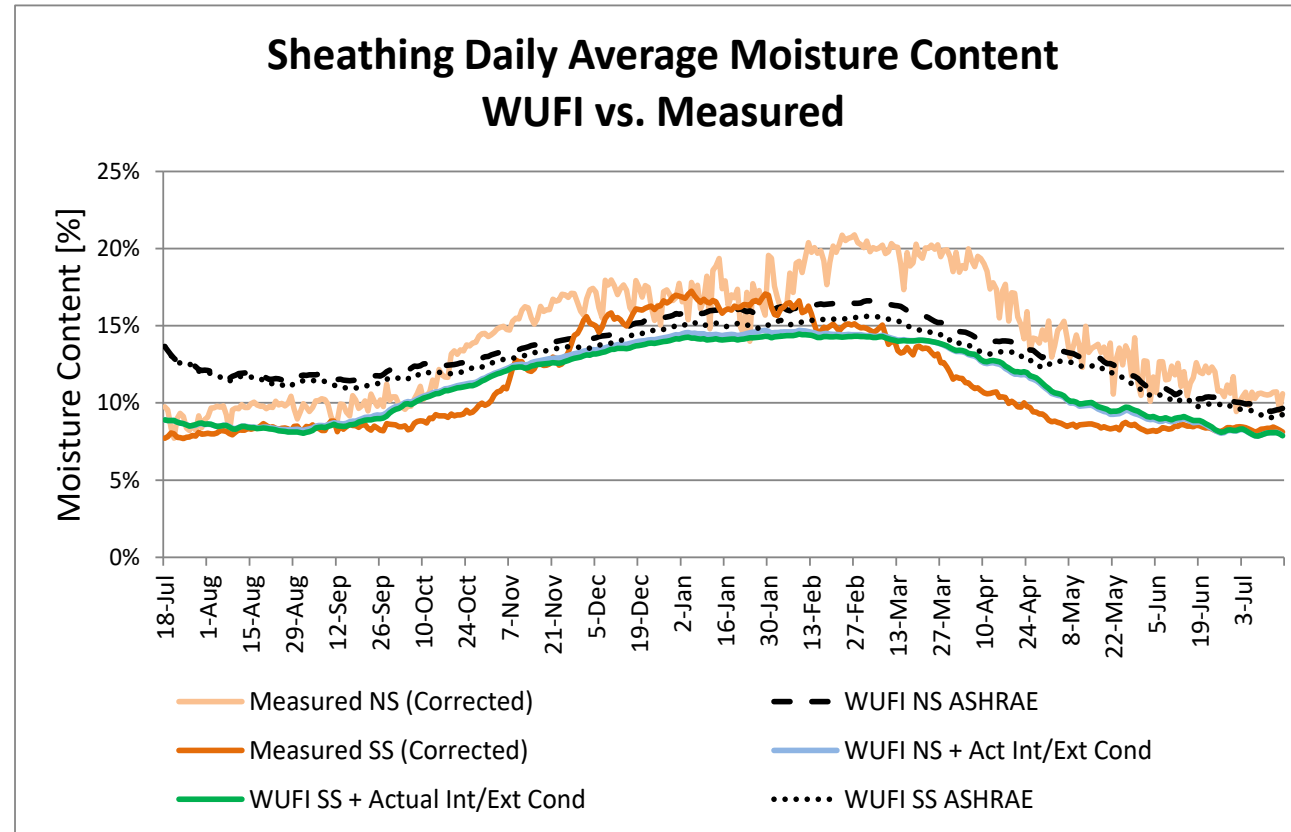
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Thermal Barrier



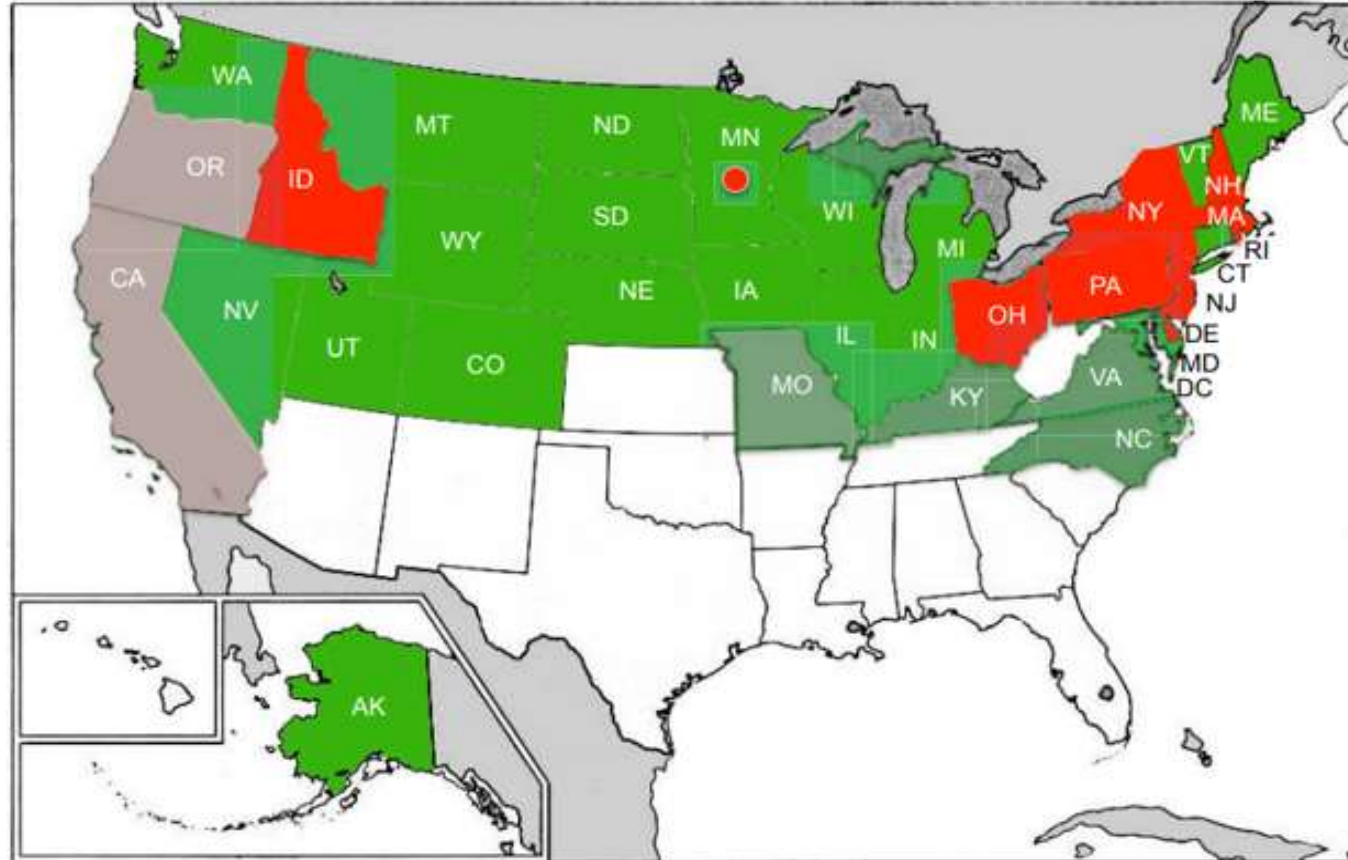
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INCENTIVIZING HIGH PERFORMANCE



Affordable Housing Financing



- HFA's committed to PH
- HFA's implementing PH strategies
- HFA's interested ...

Image credit: The PHFA Project by Tim McDonald,
Temple University Architect Research Center



Affordable Housing Financing

Green Rewards for existing multifamily:

- ASHRAE Level 2 audit paid for
- Lower pricing than “non-green” loans
- Underwriting 75% of owner’s projected savings
- Underwriting 25% of tenant’s projected costs

Green Preservation Plus:

- Awards for updating equipment & reducing costs

New Construction Certified Projects:

- Lower all-in interest rate with “green bundling” loans





Affordable Housing Financing

"Residents of Crescent Crossings, the majority of whom are members of low-income households, can live both comfortably and sustainably at Crescent Crossings. This is of particular importance in a community of predominantly older, less efficient homes

... may have formerly had to choose the necessities of rent or food over their utility bills, residents are able to stress less without sacrificing comfort during cold winters and humid summers."

their sustainable homes and enjoy learning how to conserve energy by using their sustainable home's features, such as programmable thermostats.

"Especially in our affordable housing communities, utility savings for residents is very valuable and directly impacts their daily lives."

in tending to their lives at work and school. Orientation training provided by staff educates residents on the functionality of their new apartments and the benefits they receive which helps reduce maintenance requests.

These are lessons they will take with them wherever they go, bringing the message of conservation to the wider community. Finally, Crescent Crossings is an example to the greater affordable housing community of how sustainable building design is achievable, desirable, and marketable."

- Dan Montanaro, JHM Group:



CASE IN POINT

Evolving Toward Zero



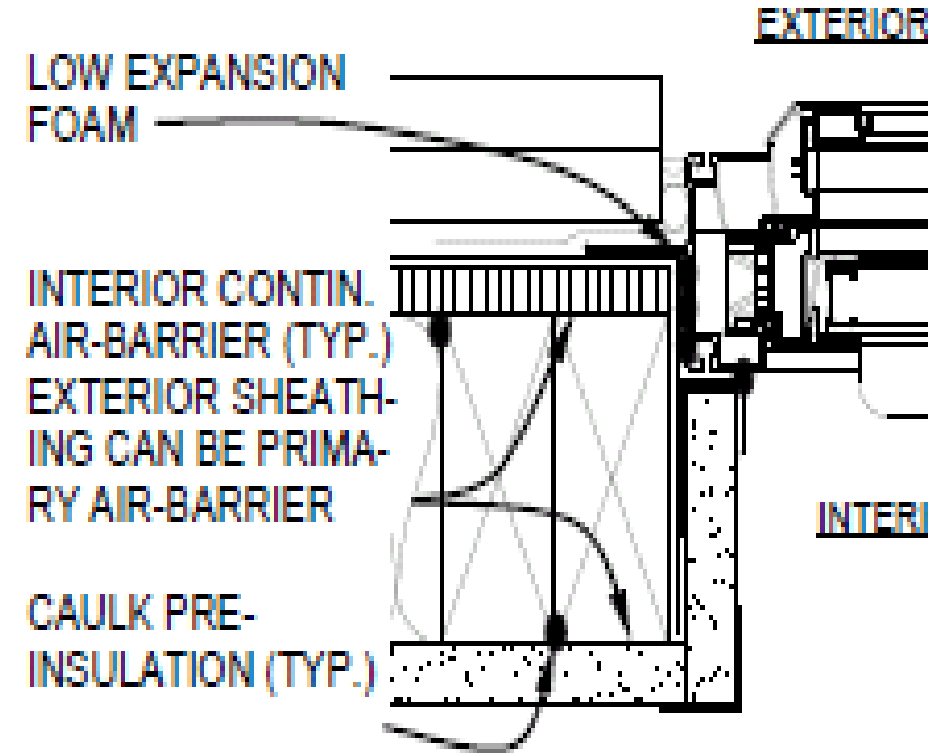
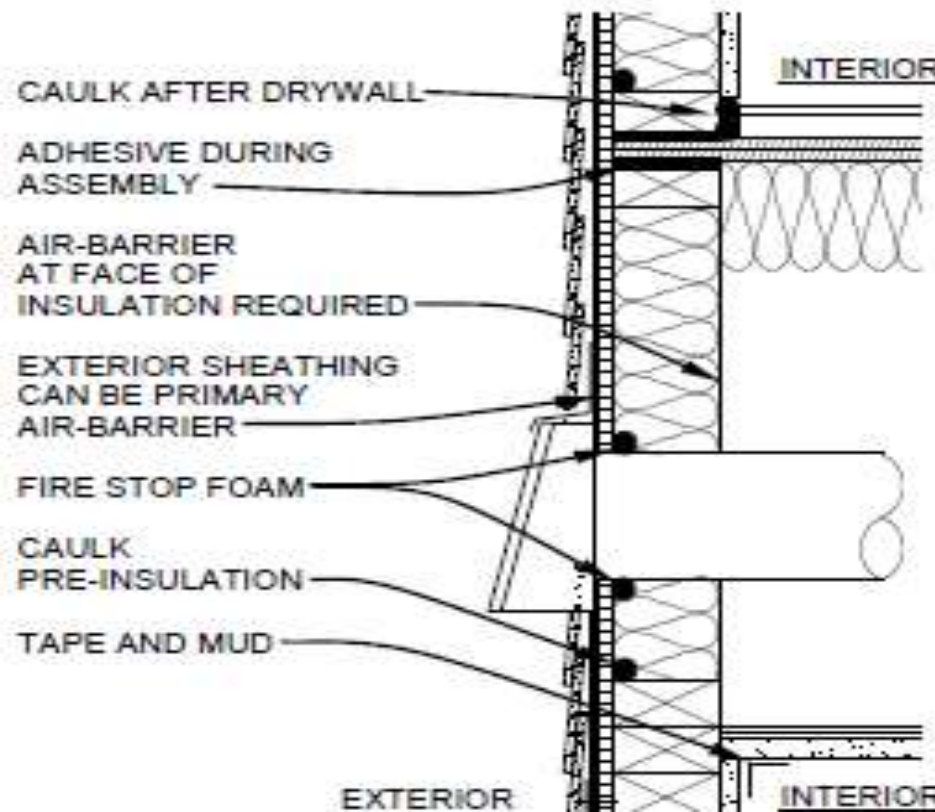
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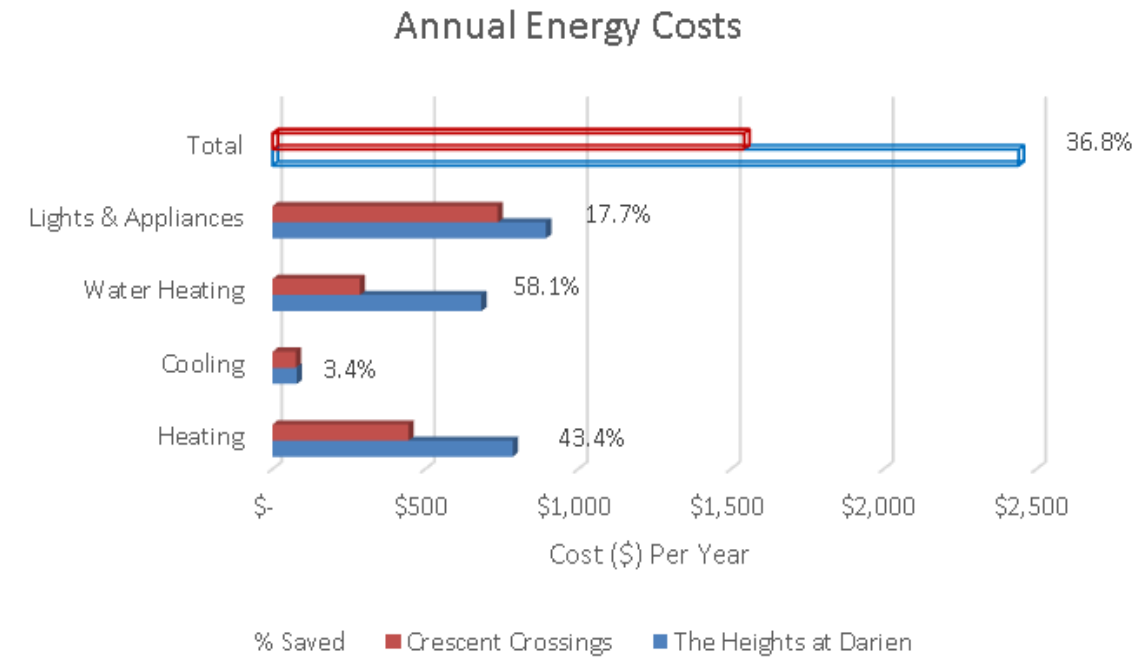


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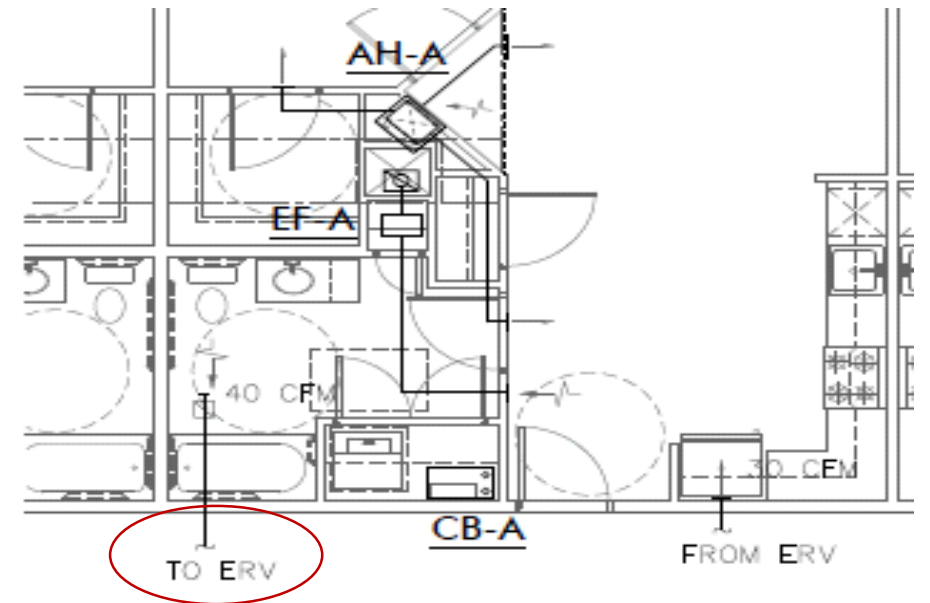


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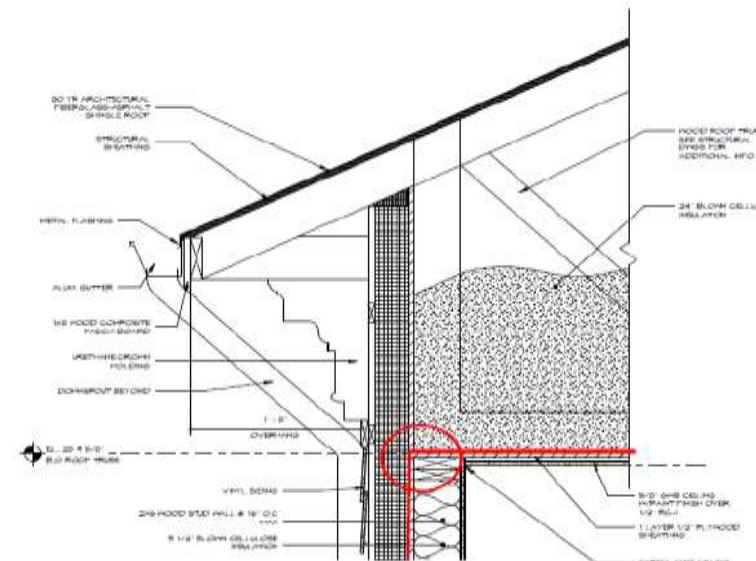
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Marina Village 2, Bridgeport (PHIUS+)

<u>Envelope Component</u>	<u>Recommendation</u>
Roofs	R-86
Above-Grade Walls	R-39
Cantilevered Floors	R-58
Ground Slab	R-10
Window U _{glass}	0.106
Window U _{frame}	0.167
Window Edge Psi	0.037
Window SHGC	0.4
Glass Exterior Doors U _{glass}	0.125; SHGC 0.4
Glass Exterior Doors U _{frame}	0.25
Exterior Solid Doors	R-8





Evolving Toward Zero

Willow Creek 3, Hartford (PHI)

Criteria for Certification	PHIUS Requirement	SWA Model
Space Heating Demand (kBTU/ft ² ·yr)	5.20	3.58
Space Cooling Demand (kBTU/ft ² ·yr) ft ² ·yr	3.50	2.86
Space Heating Load (BTU/hr·ft ²) Space Cooling Load	4.20	3.99
Space Cooling Load (BTU/hr·ft ²)	4.30	2.41
Primary Energy (kWh/person·yr)	6,200	4,724
Pressurized Airtightness (ACH ₅₀)	0.6	0.59

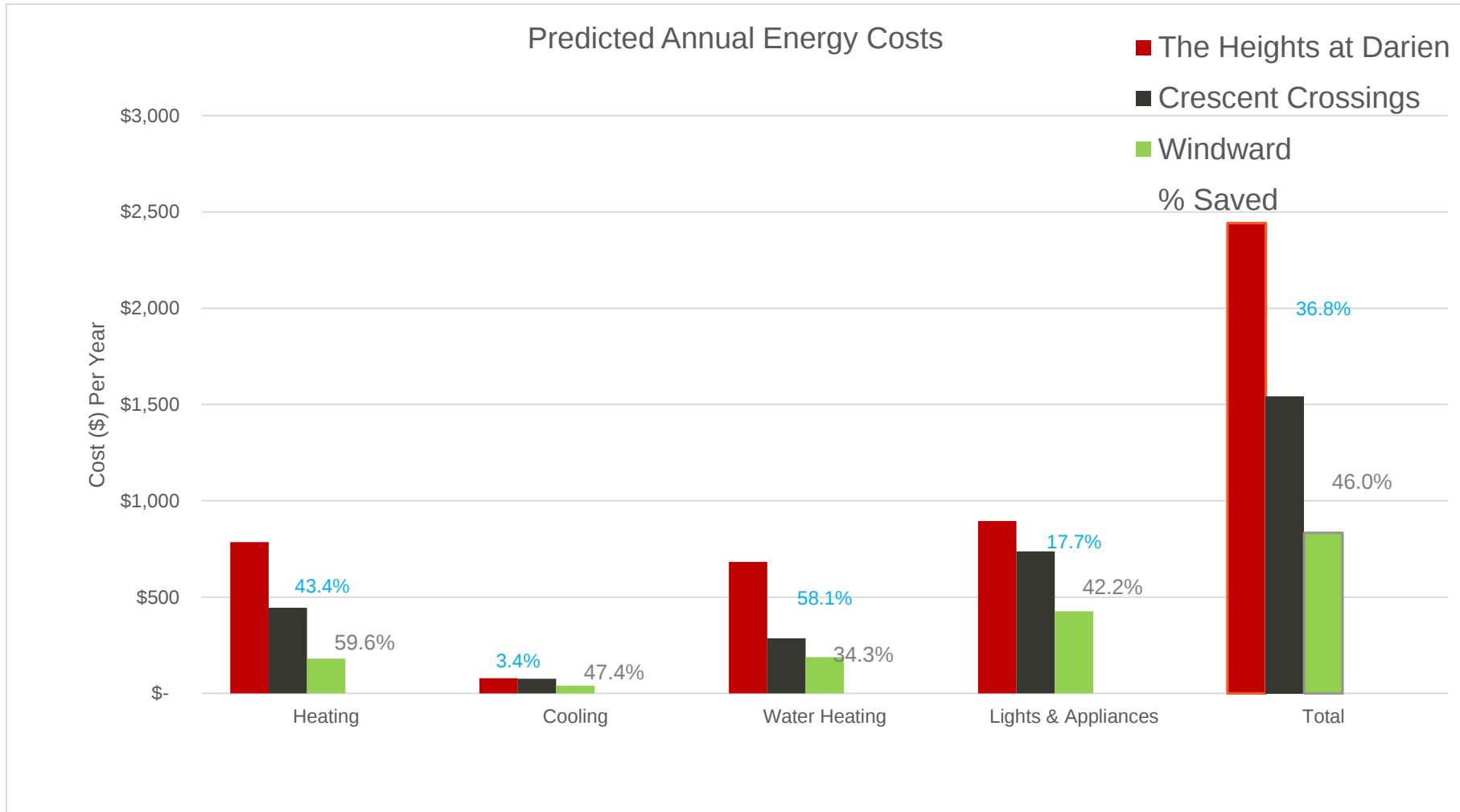
Marina Village 2, Bridgeport (PHIUS+)

Criteria for Certification	PHIUS Requirement	SWA Model
Space Heating Demand (kBTU/ft ² ·yr)	4.90	4.73
Space Cooling Demand (kBTU/ft ² ·yr) ft ² ·yr	3.20	3.15
Space Heating Load (BTU/hr·ft ²) Space Cooling Load	4.10	3.77
Space Cooling Load (BTU/hr·ft ²)	4.00	1.96
Primary Energy (kWh/person·yr)	6,200	5,096
Pressurized Airtightness (ACH ₅₀)	0.6	0.59

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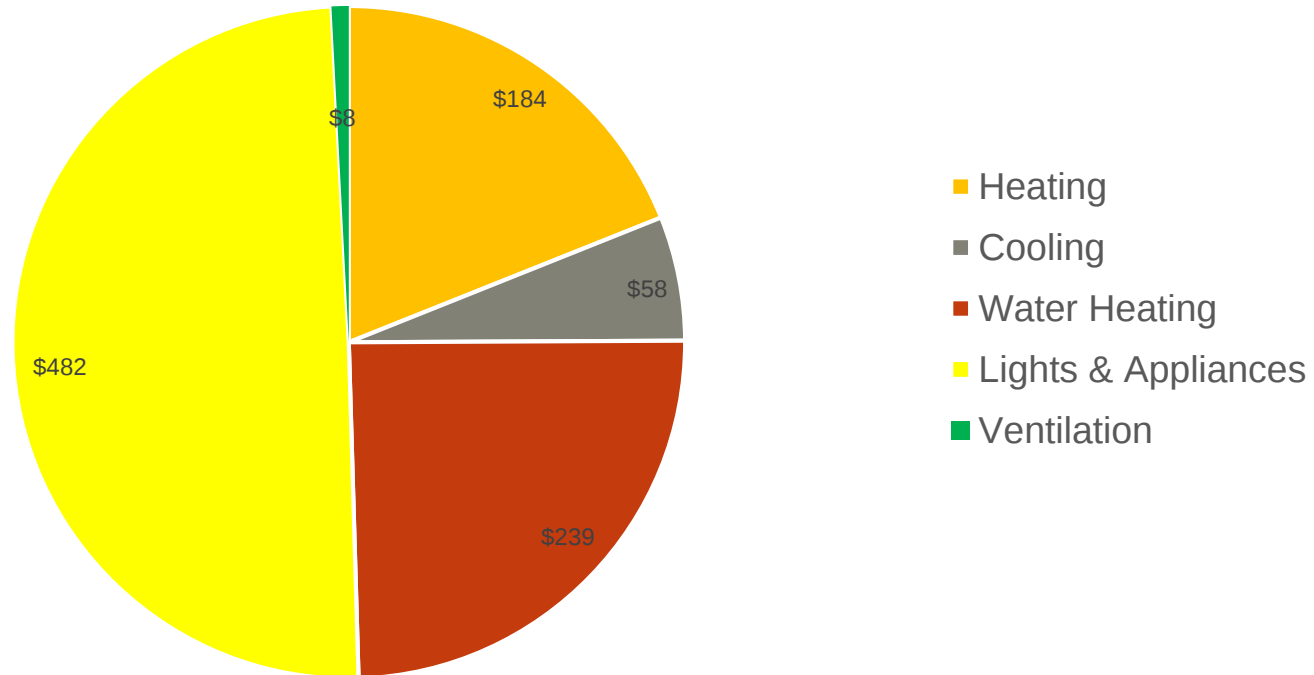
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Evolving Toward Zero

Marina Village 2 bedroom: Predicted Annual Energy Cost





In Summary

- ✓ • Identifying the air barrier at design helps ensure a successful installation
- ✓ • Assemblies vary but the end result is thermal bridge free construction
- ✓ • Incentives matter
- ✓ • Evolving toward zero can mean one (effective) step at a time



Thank You! Any Questions?

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