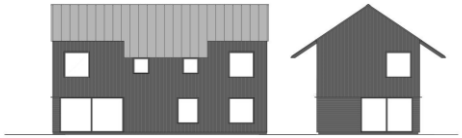
Prescriptive Pathways

Scaling Up
Single Family
Residential
Passive House
in
New York's
Hudson Valley

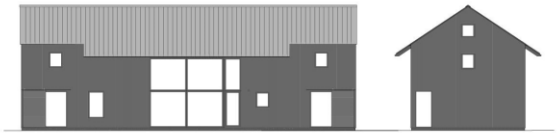
NORTH RIVER

FLEXHOUSE I
1000 sf
1 bedroom, 1 full bath

FLEXHOUSE II
1200 sf
2 bedrooms with sleeping loft, 1 full bath



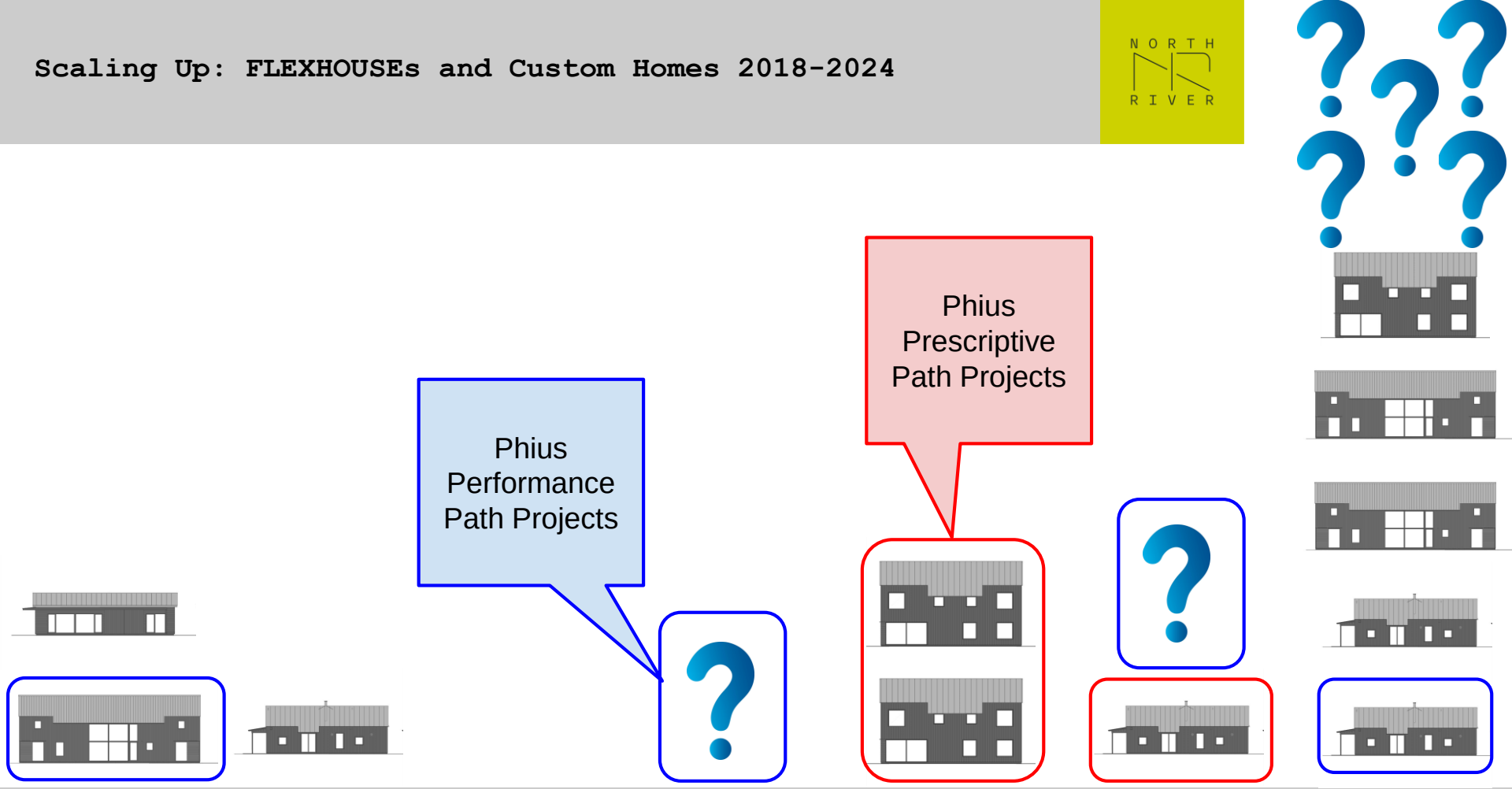
FLEXHOUSE III
2400 sf
3-4 bedrooms, 3 full baths



FLEXHOUSE IV
2880 sf
3-4 bedrooms with sleeping loft, 3 full baths

Custom Design

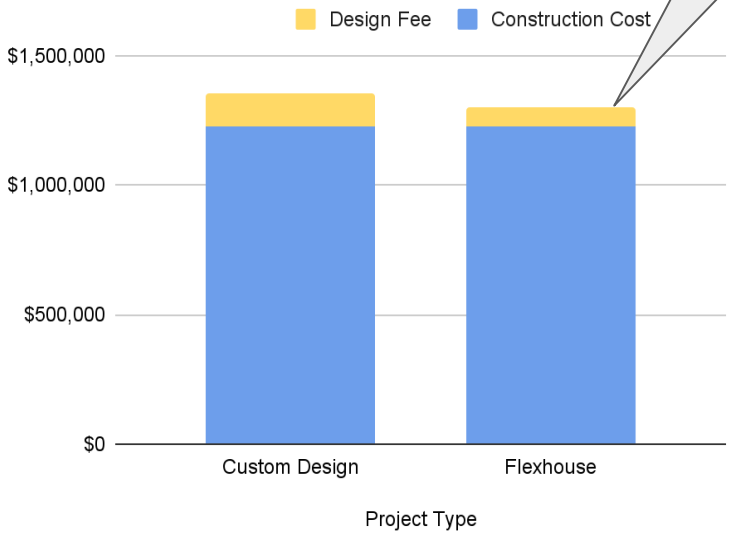
Scaling Up: FLEXHOUSEs and Custom Homes 2018-2024



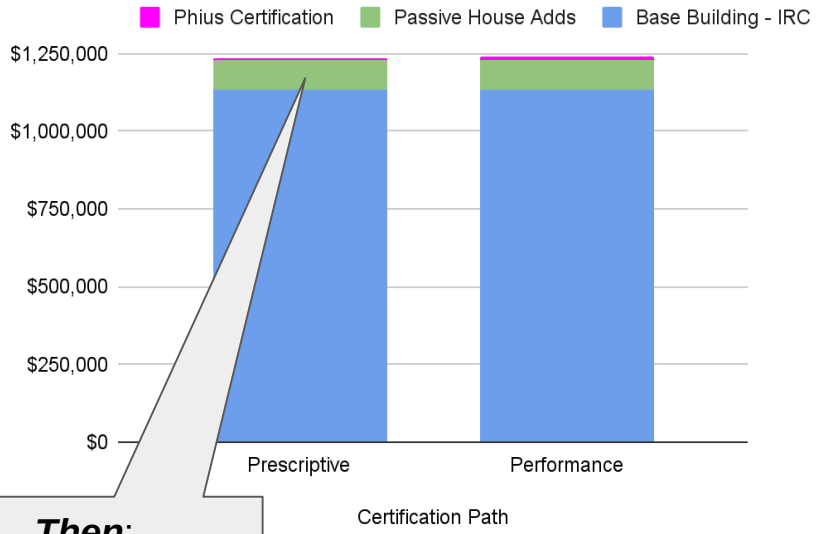
Psst:
Certification is <u>not</u> a primary cost driver

First:
Save +/- $50,000 in design fees

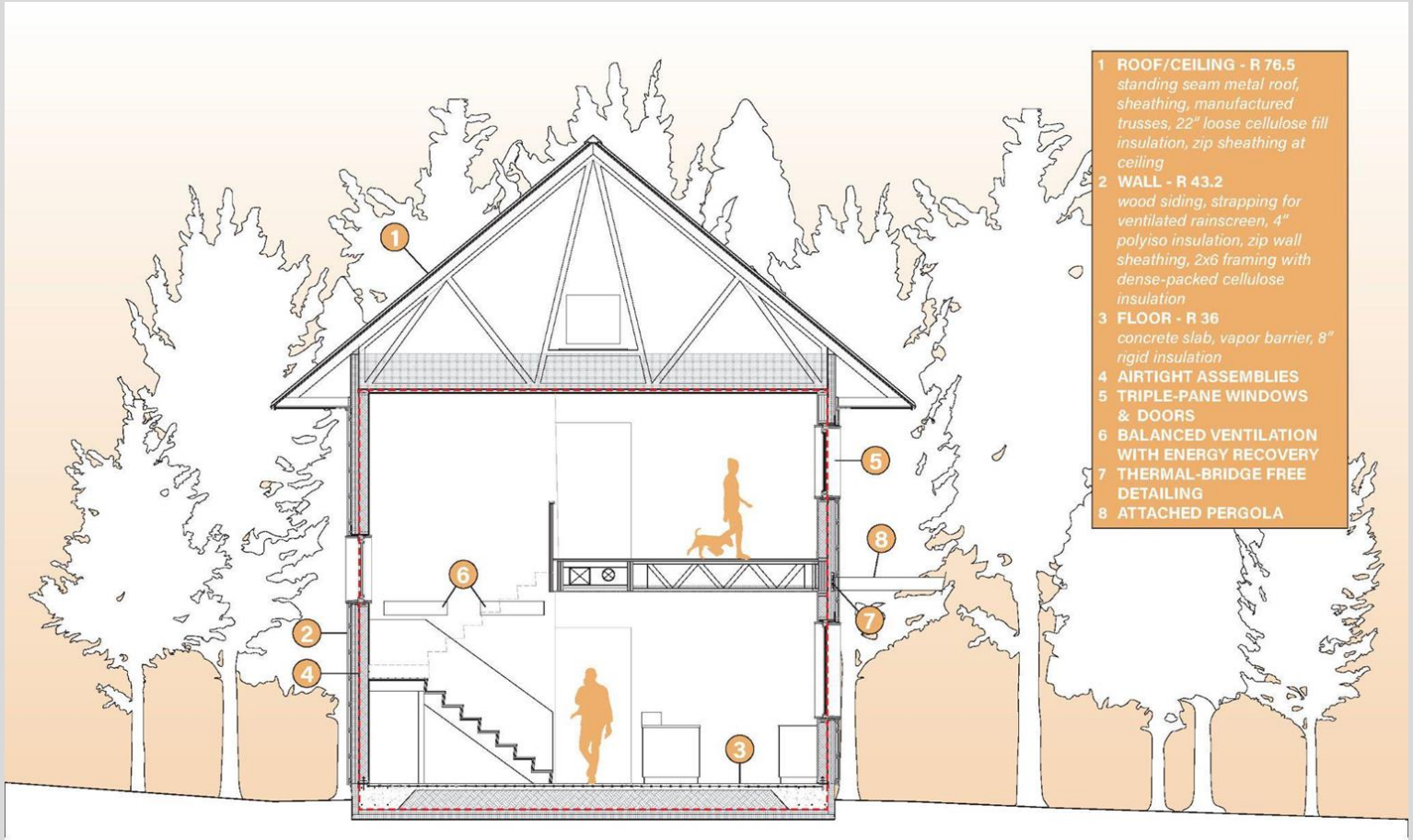
Project Costs: Flexhouse vs Custom Design



Cost of Passive House: Prescriptive vs Performance



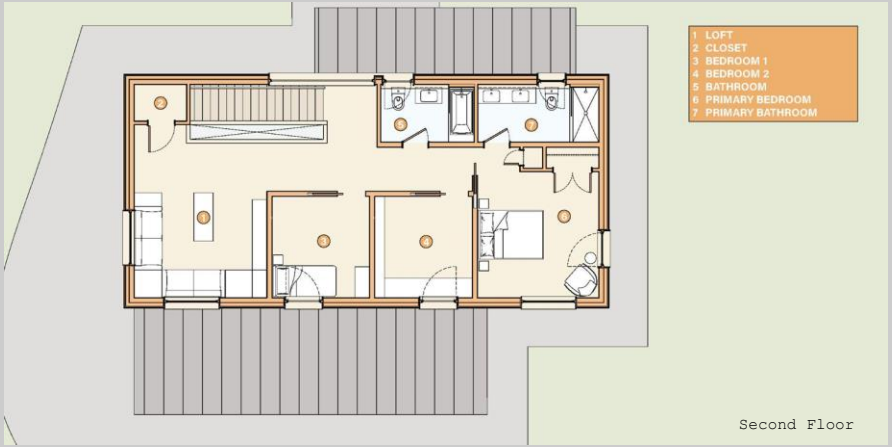
Then:
Partial offset of +/- $90k in Passive House Add Costs



BASTEN FARM FLEXHOUSE III **NORTH**

BASTEN FARM FLEXHOUSE III **SOUTH**

Second Floor



Second Floor

First Floor

First Floor

Basten Farm North - Flexhouse III

Stone Ridge, NY

Basten Farm South - Flexhouse III

Stone Ridge, NY

Phius CORE Prescriptive Certification Snapshot

Phius CORE Prescriptive 2021 Snapshot

Input or select data in teal cells

State	NEW YORK
City	STEWART FIELD
ASHRAE (169-2021) Climate Zone	5A
iCFA* (ft²)	2287
Number of Bedrooms*	3
Number of Stories	2

*per dwelling unit

1 General				
1.1.2	iCFA divided by Number of Bedrooms	Maximum Limit	900	ft²
	(Calculated Value based on Inputs)	*OK, Meets Limit*	762	ft²
3 Compactness				
3.1.1	Envelope Area	Maximum	6548	ft²
	(Maximum Envelope to Floor Area Ratio)		2.86	
4 Solar Protection				
4.1.1	Whole Window SHGC	Maximum	NR	
4.4.1	Projection Factor for Fixed Overhangs	Minimum	NR	
5 Thermal Enclosure				
5.1.1a	Fenestration / Openings	Maximum Whole U-Value	0.17	(BTU/h.ft².°F)
5.1.1b	Walls & Overhang Floors - Effective R-value	Minimum Effective R-Value	41	(ft².°F.h/BTU)
5.1.1c	Roofs / Ceilings	Minimum Effective R-Value	72	(ft².°F.h/BTU)
5.1.1d	Whole Slab Foundations, Below-Grade Walls, Floors of Conditioned Basements & Crawl Spaces	Minimum Effective R-Value	21	(ft².°F.h/BTU)
5.1.1e	Ceilings of Unconditioned Basements or Crawl Spaces & Pier and Beam Floors	Minimum Effective R-Value	26	(ft².°F.h/BTU)
6 Moisture Risk Limitation				
6.2.1	Fenestration Condensation Resistance	Minimum	63%	
7 Mechanical Ventilation				
7.2.1	Sensible Recovery Efficiency, Heating Mode	Minimum	80%	
7.2.2	Total Recovery Efficiency, Cooling Mode	Minimum	NR	
7.2.5	Total Length of Fresh Air Ducts to Outside	Maximum	27	ft
8 Mechanical Systems				
	Select System Type			
8.2.1	Air Source Heat Pump	Minimum COP @ 5F	1.8	
		Minimum SEER	15.0	

Basten Farm North - Flexhouse III

Phius CORE Prescriptive 2021 Snapshot

Input or select data in teal cells

State	NEW YORK
City	STEWART FIELD
ASHRAE (169-2021) Climate Zone	5A
iCFA* (ft²)	2094
Number of Bedrooms*	3
Number of Stories	2

*per dwelling unit

1 General				
1.1.2	iCFA divided by Number of Bedrooms	Maximum Limit	900	ft²
	(Calculated Value based on Inputs)	*OK, Meets Limit*	698	ft²
3 Compactness				
3.1.1	Envelope Area	Maximum	6180	ft²
	(Maximum Envelope to Floor Area Ratio)		2.95	
4 Solar Protection				
4.1.1	Whole Window SHGC	Maximum	NR	
4.4.1	Projection Factor for Fixed Overhangs	Minimum	NR	
5 Thermal Enclosure				
5.1.1a	Fenestration / Openings	Maximum Whole U-Value	0.17	(BTU/h.ft².°F)
5.1.1b	Walls & Overhang Floors - Effective R-value	Minimum Effective R-Value	41	(ft².°F.h/BTU)
5.1.1c	Roofs / Ceilings	Minimum Effective R-Value	72	(ft².°F.h/BTU)
5.1.1d	Whole Slab Foundations, Below-Grade Walls, Floors of Conditioned Basements & Crawl Spaces	Minimum Effective R-Value	21	(ft².°F.h/BTU)
5.1.1e	Ceilings of Unconditioned Basements or Crawl Spaces & Pier and Beam Floors	Minimum Effective R-Value	26	(ft².°F.h/BTU)
6 Moisture Risk Limitation				
6.2.1	Fenestration Condensation Resistance	Minimum	63%	
7 Mechanical Ventilation				
7.2.1	Sensible Recovery Efficiency, Heating Mode	Minimum	80%	
7.2.2	Total Recovery Efficiency, Cooling Mode	Minimum	NR	
7.2.5	Total Length of Fresh Air Ducts to Outside	Maximum	26	ft
8 Mechanical Systems				
	Select System Type			
8.2.1	Air Source Heat Pump	Minimum COP @ 5F	1.8	
		Minimum SEER	15.0	

Basten Farm South - Flexhouse III

Phius CORE Prescriptive 2021 Snapshot

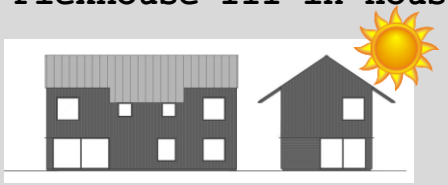
Input or select data in teal cells

State	TEXAS
City	HOUSTON BUSH INTERCONTI
ASHRAE (169-2021) Climate Zone	2A
iCFA* (ft²)	2287
Number of Bedrooms*	3
Number of Stories	2

*per dwelling unit

1 General				
1.1.2	iCFA divided by Number of Bedrooms	Maximum Limit	900	ft²
	(Calculated Value based on Inputs)	*OK, Meets Limit*	762	ft²
3 Compactness				
3.1.1	Envelope Area	Maximum	6548	ft²
	(Maximum Envelope to Floor Area Ratio)		2.86	
4 Solar Protection				
4.1.1	Whole Window SHGC	Maximum	0.25	
4.4.1	Projection Factor for Fixed Overhangs	Minimum	0.58	
5 Thermal Enclosure				
5.1.1a	Fenestration / Openings	Maximum Whole U-Value	0.29	(BTU/h.ft².°F)
5.1.1b	Walls & Overhang Floors - Effective R-value	Minimum Effective R-Value	24	(ft².°F.h/BTU)
5.1.1c	Roofs / Ceilings	Minimum Effective R-Value	54	(ft².°F.h/BTU)
5.1.1d	Whole Slab Foundations, Below-Grade Walls, Floors of Conditioned Basements & Crawl Spaces	Minimum Effective R-Value	8	(ft².°F.h/BTU)
5.1.1e	Ceilings of Unconditioned Basements or Crawl Spaces & Pier and Beam Floors	Minimum Effective R-Value	13	(ft².°F.h/BTU)
6 Moisture Risk Limitation				
6.2.1	Fenestration Condensation Resistance	Minimum	66%	
7 Mechanical Ventilation				
7.2.1	Sensible Recovery Efficiency, Heating Mode	Minimum	NR	
7.2.2	Total Recovery Efficiency, Cooling Mode	Minimum	60%	
7.2.5	Total Length of Fresh Air Ducts to Outside	Maximum	27	ft
8 Mechanical Systems				
	Select System Type			
8.2.1	Air Source Heat Pump	Minimum HSPF	9.6	
		Minimum SEER	18.0	

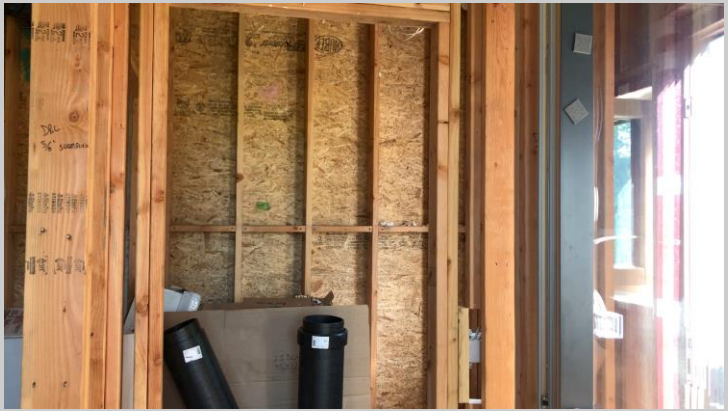
Flexhouse III in Houston



Basten Farm South - Flexhouse III

Climate Zone 5A
iCFA 2,094 ft2

Prescriptive Path	Target	Actual
Building Enclosure Area	6,180 ft2	5,830 ft2
Window-to-Wall Ratio (WWR)	≤18%	18%
Fenestration U-Value (max)	0.17	0.17
Exterior Walls R-Value (min)	44	43
Roof/ceiling R-Value (min)	74	76.5
Slab R-Value (min)	22	52
ERV Efficiency (max)	720 W/cfm	468 W/cfm
ERV total duct length	26 ft	20 ft
Heat Pump Efficiency (min)	1.75 COP @ 5F 15 SEER	1.69 COP 18.4

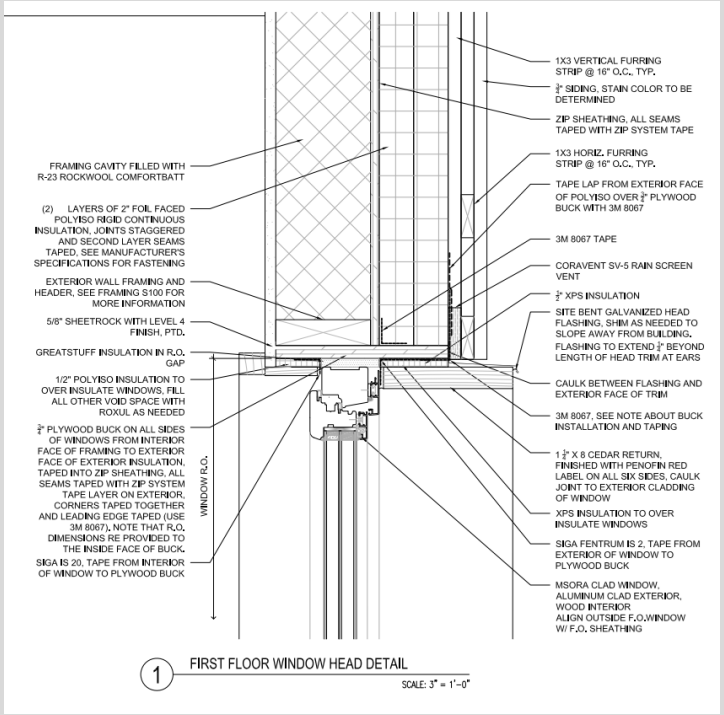


Basten Farm North - Flexhouse III

Climate Zone 5A
iCFA 2,287 ft2

Prescriptive Path	Target	Actual
Building Enclosure Area	6,550 ft2	6,424 ft2
Window-to-Wall Ratio (WWR)	≤18%	18%
Fenestration U-Value (max)	0.17	0.165
Exterior Walls R-Value (min)	41	43
Roof/ceiling R-Value (min)	72	73
Slab R-Value (min)	22	52
ERV Efficiency	720 W/cfm	468 W/cfm
ERV total duct length	27 ft	20 ft
Heat Pump Efficiency (min)	1.75 COP @ 5F 15 SEER	1.66 COP 17.8

Prescriptive Certification - Design Stress Points



Air Source Heat Pump Efficiency

Minimum 1.75 COP at 5F

Problem: Hyperheat models' efficiency too low, 1.66 & 1.69 COP at 5F

Solution: Waiver from Phius was necessary

Exterior Wall R-value

Minimum R-44 for Basten Farm North, Checklist V2.1

Minimum R-41 for Basten Farm South, Checklist V2.6

Problem: Dense-pack cellulose insulation resulted in R-43 wall

Solution: Prescriptive Path offers UA Alternative

Net Zero Energy - Sizing Renewables

Problem: Prescriptive Path does not generate an estimate of annual electrical usage

Solution: Recommend full coverage on south-facing roof slopes

Glazing Area & Orientation

Problem: Designs exceed Prescriptive limit of total glazing area - 33-37% vs 15% max

Solution: Adequate Exposure Diversity (AED) alternative compliance

Limited Design Optimization

Problem: Prescriptive Path does not reward airtightness above baseline (0.04 cfm/ft2)

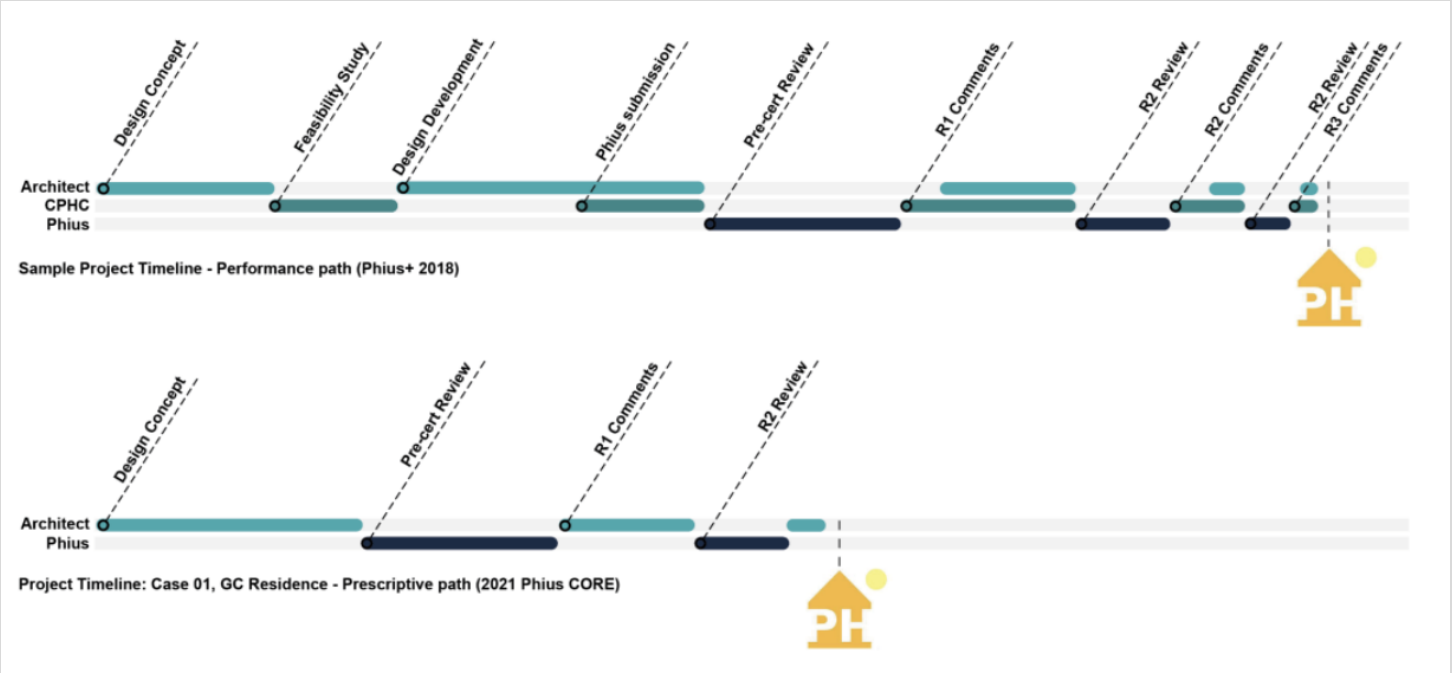
Performance Path allows envelope and/or HVAC modifications correlated with actual airtightness

Toolkit for Scaling Up Single Family Passive House

- Prescriptive Path Certification
- Patternbook design offerings
- Standard construction methods & materials
- Simplified HVAC
- Workforce training/Subcontractor buy-in

Passive House Wish List

- More Phius Raters!
- Restoration of incentive funding for single family
- Homeowner buy-in for ductless mini-splits
- Building code support for Passive House
- Green Appraisals
- Smaller mini-splits
- North American window manufacturers



Thank you.

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NORTH RIVER