

# ***CARBON EQUITY 2030***

***Considering Embodied Carbon on a tight timeline***

**Image:** *Climate Change 2021: The Physical Science Basis, Cover - IPCC, 2021*

# Context: Criteria for Fair Housing

## Fundamental Human Housing Requirements

**Mid 1700's** -----> **2021**



**The Primitive Hut** *An Architectural theory by Marc-Antoine Laugier that explores the anthropological relationship between humans and the natural environment.*

	(Physical)	(Economic)
(Individual)	<b>Health / Safety</b> <input checked="" type="checkbox"/> High indoor air quality Disaster resiliency	<b>Affordability</b> <input checked="" type="checkbox"/> Reliable energy costs 40% Avg Mean Income
(Global)	<b>Low Operational Carbon</b> <input checked="" type="checkbox"/>	<b>Low Embodied Carbon</b> <input checked="" type="checkbox"/>

# Context: North Miller Passive Multifamily (Phius+ 2018)

## Embodied Carbon in Retrofits

**“Am I going to Hell for this?”**

*Michael Robinsons (Builder/Developer) on the use of Closed Cell spray foam*



<b>Health / Safety</b> <input checked="" type="checkbox"/>	<b>Affordability</b> <input checked="" type="checkbox"/>
<b>Low Operational Carbon</b> <input checked="" type="checkbox"/>	<b>Low Embodied Carbon</b> <b>?</b>

# Context: Habitat 4 Humanity + Phius

## Low Income Passive House Development

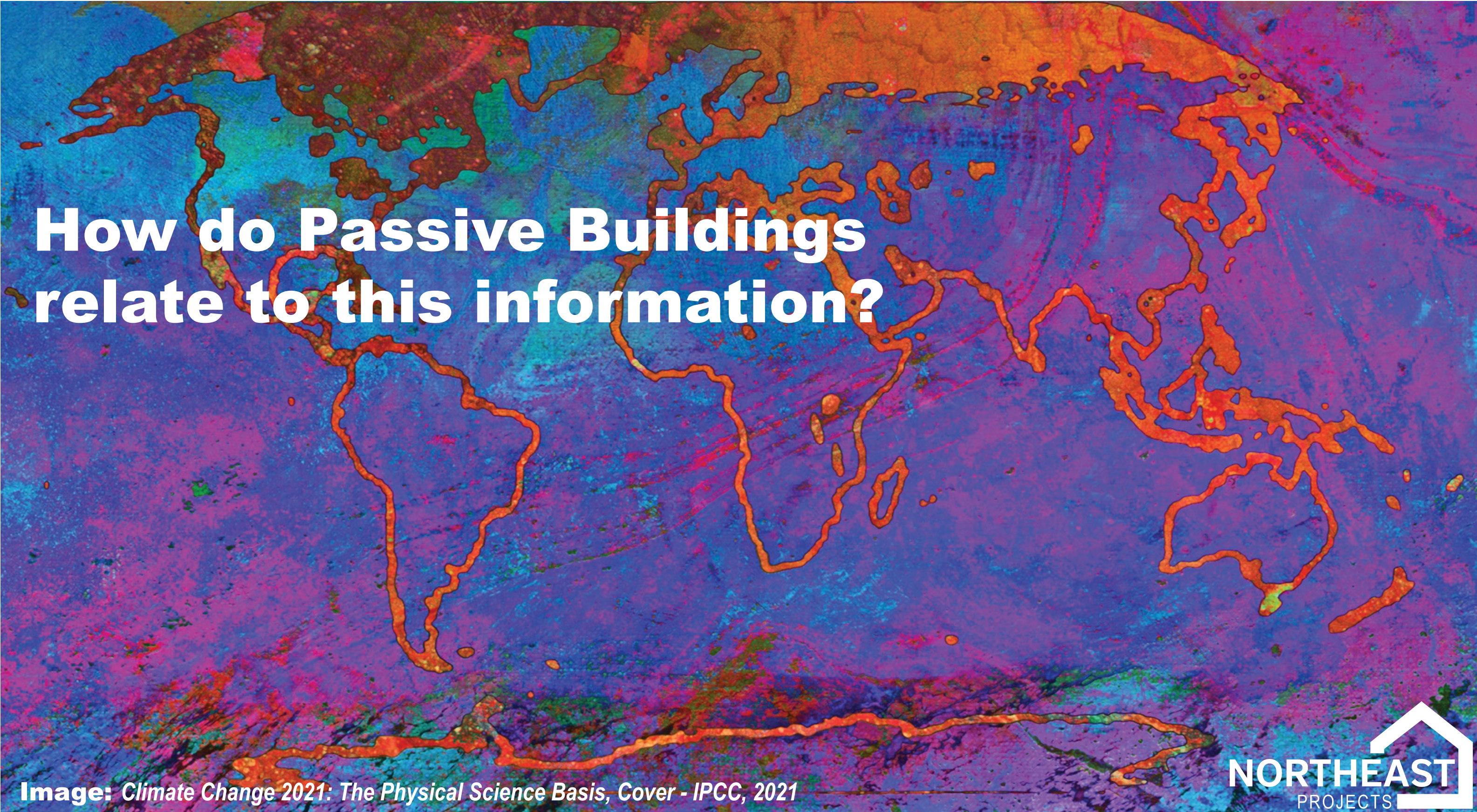
**'Rural Build':** Columbia County Habitat for Humanity, Barlis Wedlick Architects, Northeast Projects, The Levy Partnership, RAPP Construction



<b>Health / Safety</b> ☑	<b>Affordability</b> ☑
<b>Low Operational Carbon</b> ☑	<b>Low Embodied Carbon</b> ?

# **Context: 'Climate Change 2021: The Physical Science Basis'**

*Intergovernmental Panel on Climate Change*



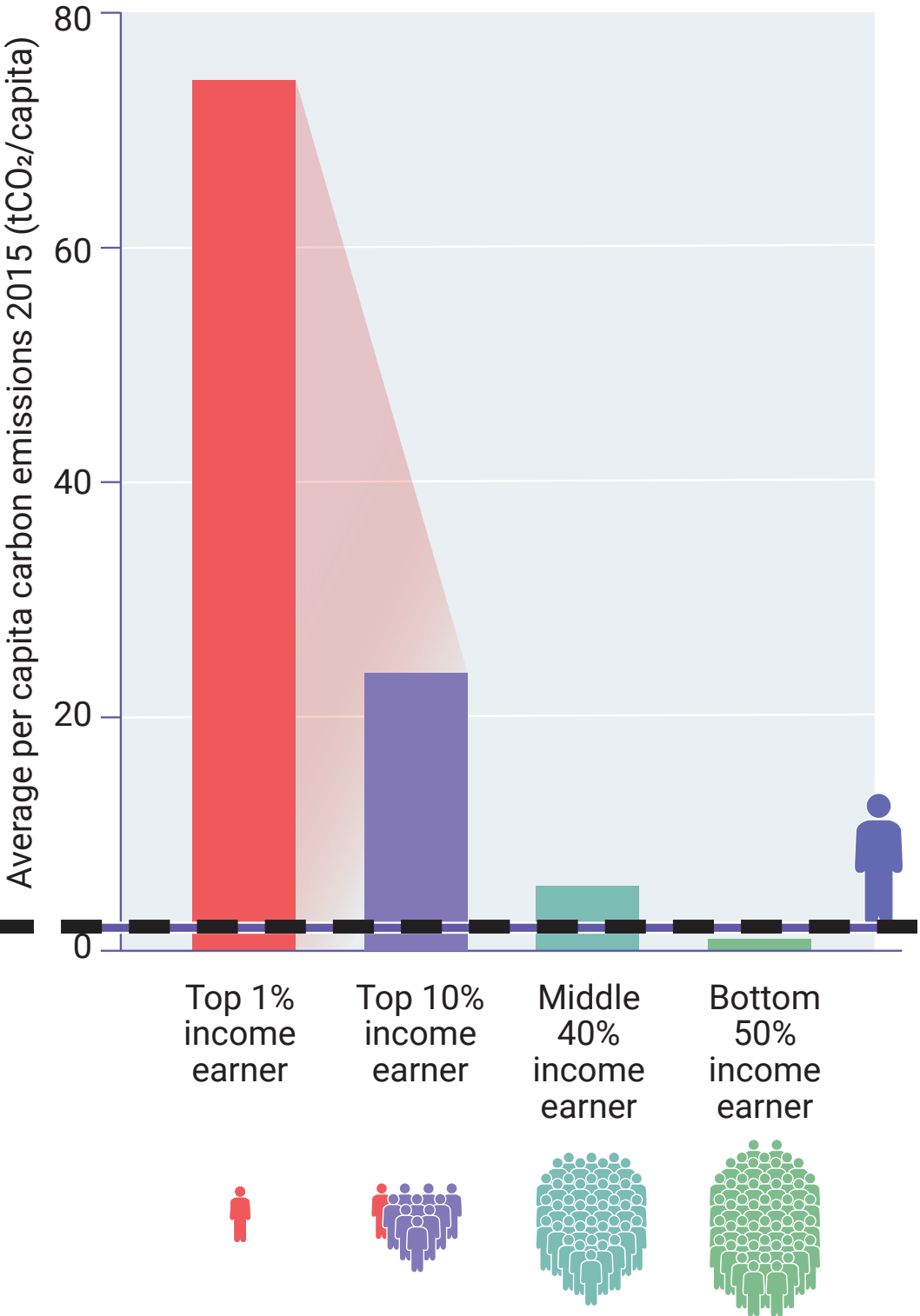
**How do Passive Buildings  
relate to this information?**

**Image:** *Climate Change 2021: The Physical Science Basis, Cover - IPCC, 2021*

# Defining Carbon Fair Share

United Nations, 2020: Emissions Gap Report

**2.1 tCO<sub>2</sub>**  
/ person.yr

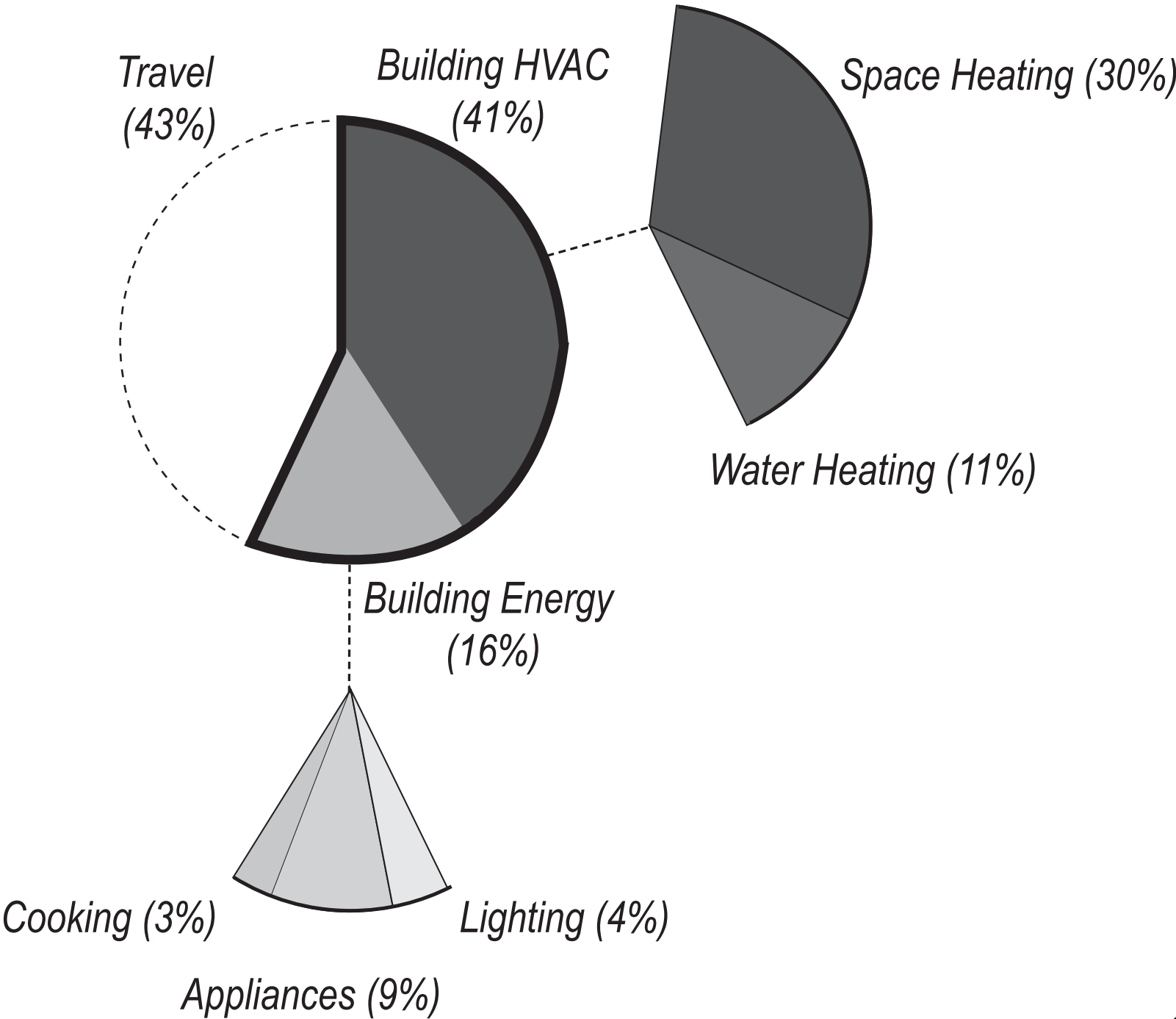


# Defining Carbon Fair Share

## Carbon Contribution per person by sector

**2.1 tCO<sub>2</sub>** =  
/ person.yr

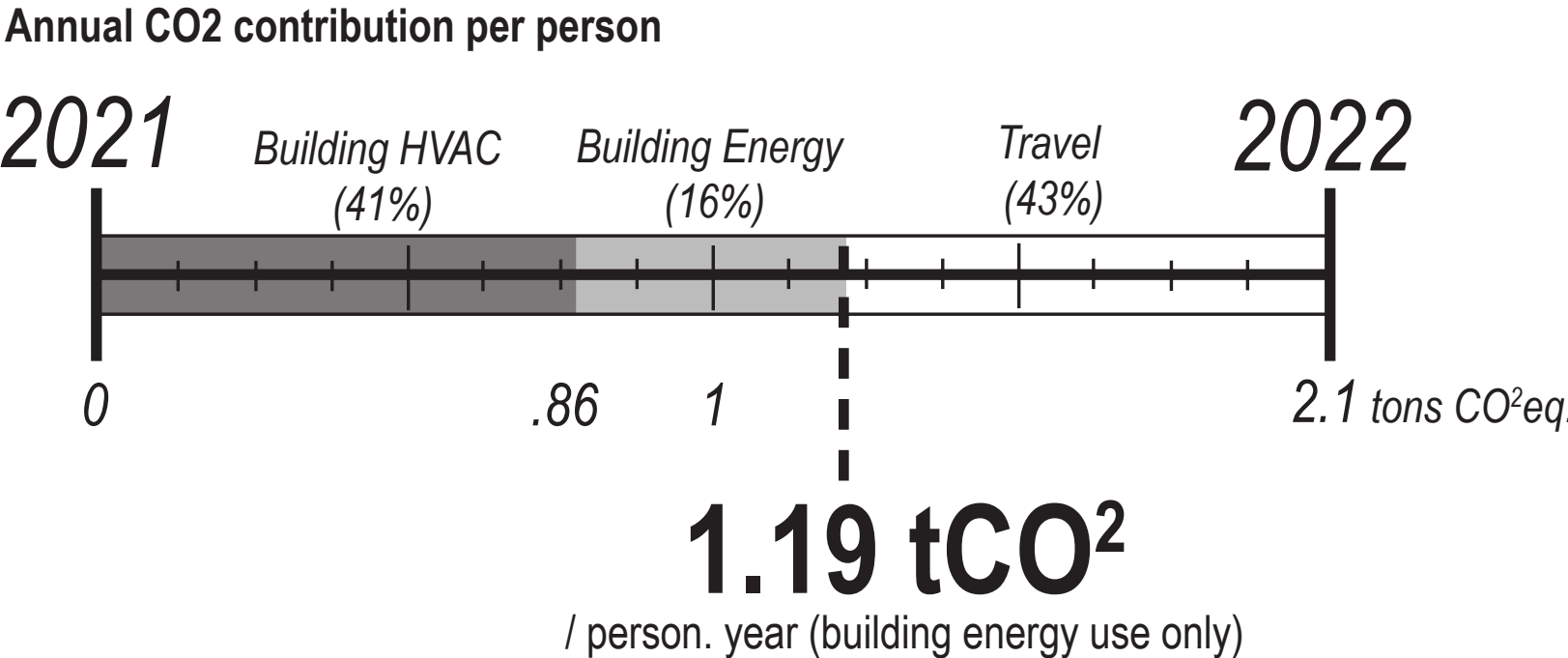
Annual CO<sub>2</sub> contribution per person by sector



# Defining Carbon Fair Share

Building sector carbon budget per year

**2.1 tCO<sup>2</sup>** =  
/ person.yr

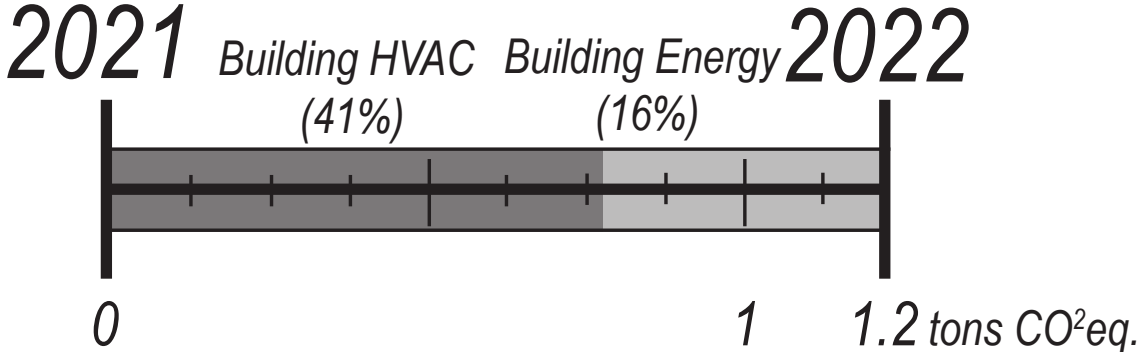




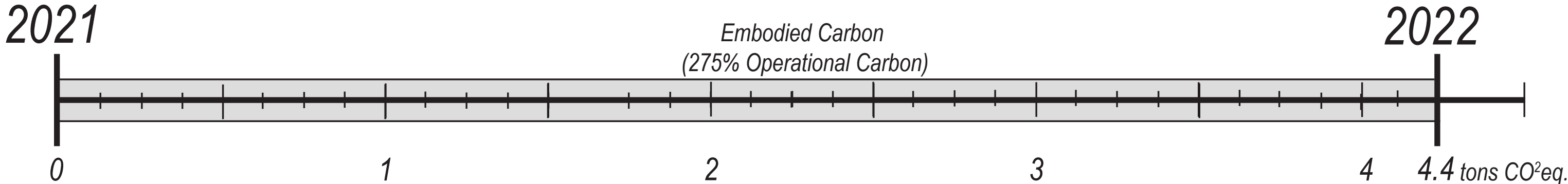
# Defining Carbon Fair Share

## 1.2 tCO<sub>2</sub> Building Budget, but what about embodied carbon?

Annual Operational CO<sub>2</sub> contribution per person



Embodied CO<sub>2</sub> contribution per person during the duration of construction (IECC Baseline)



*Greetings from*

**NEWBURGH**

*New York*

# Welcome to Newburgh, NY

## Site conditions and adjacencies



-  *Vacant Lot*
-  *Existing Building Stock*

# Welcome to Newburgh, NY

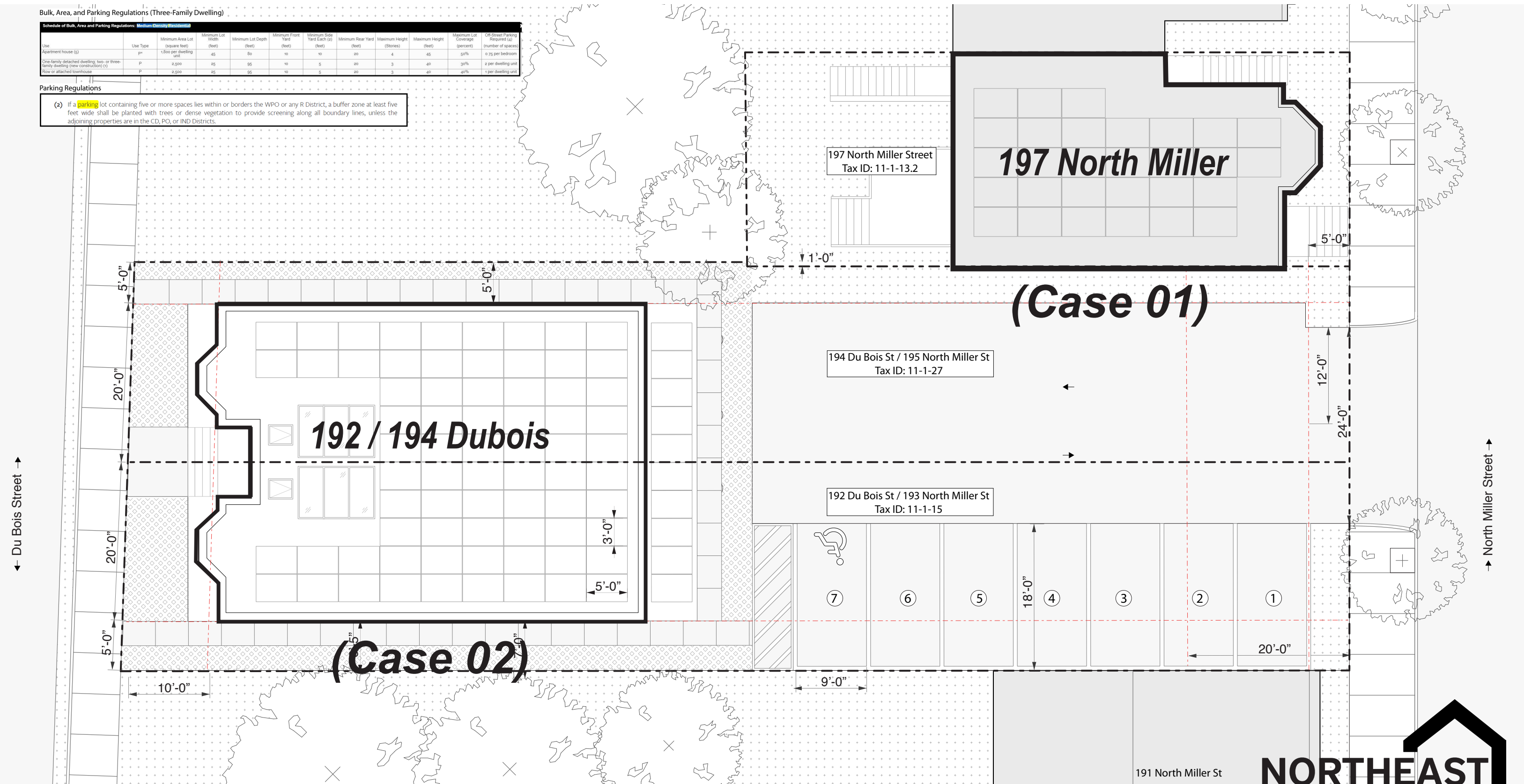
## 5 Adjacent lots between North Miller and Dubois Street

### Bulk, Area, and Parking Regulations (Three-Family Dwelling)

Use	Use Type	Minimum Area Lot (square feet)	Minimum Lot Width (feet)	Minimum Lot Depth (feet)	Minimum Front Yard (feet)	Minimum Side Yard Each (z)	Minimum Rear Yard (feet)	Maximum Height (Stories)	Maximum Height (feet)	Maximum Lot Coverage (percent)	Off-Street Parking Required (z) (number of spaces)
Apartment house (z)	P	1,500 per dwelling unit	45	80	10	10	20	4	45	50%	0.75 per bedroom
One-family detached dwelling, two- or three-family dwelling (new construction) (1)	P	2,500	25	95	10	5	20	3	40	30%	2 per dwelling unit
Row or attached townhouse	P	2,500	25	95	10	5	20	3	40	40%	1 per dwelling unit

### Parking Regulations

- (2) If a parking lot containing five or more spaces lies within or borders the WPO or any R District, a buffer zone at least five feet wide shall be planted with trees or dense vegetation to provide screening along all boundary lines, unless the adjoining properties are in the CD, PO, or IND Districts.




# Case 01: 197 North Miller

## Retrofit, Phius+ 2018

 Project meets all performance standards for **PHIUS+ 2018** Passive House Certification

 Project achieves a **Source Zero** designation (Primary Energy of 0 kWh/person.yr)


11,234 kWh/yr **On-Site Solar generation**

 Project meets all **Energy Star** requirements for reduced energy consumption

**High Performance Tri-paned** windows and doors


**Airtight** building envelope

**Super-insulated** assemblies and **thermal bridge-free** construction

 Project meets all **Energy Star** requirements for reduced energy consumption

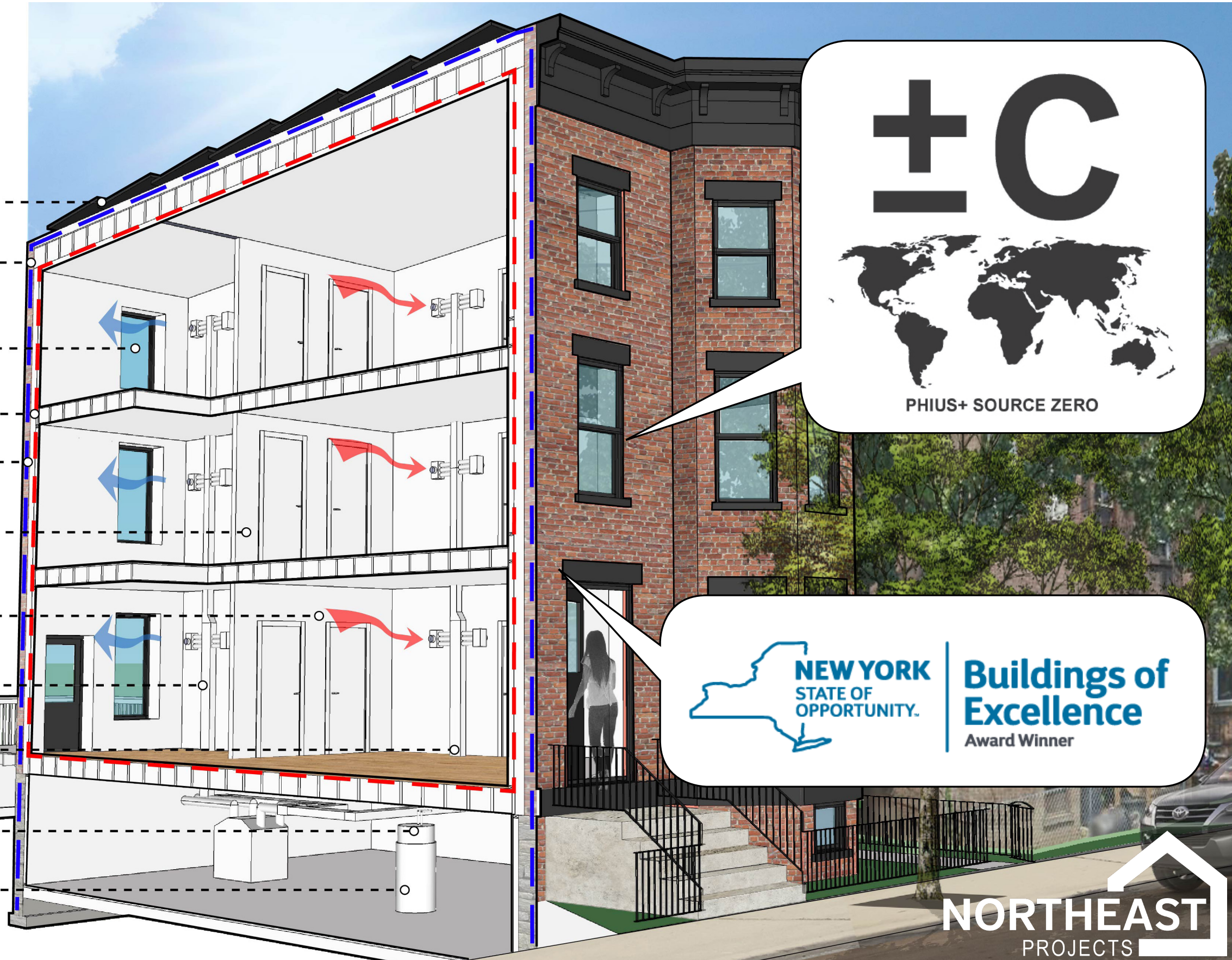
**High efficiency** mini split heat pump cooling and heating at each unit

Balanced **Heat Recovery Ventilation** provides filtered fresh air at high efficiencies


 Project meets all **EPA airPLUS** requirements for vapor control, air quality and radon mitigation

**Heat pump hot water** heater with 'on command' recirculation at each unit

 Plumbing system conforms with all **EPA Watersense** criteria



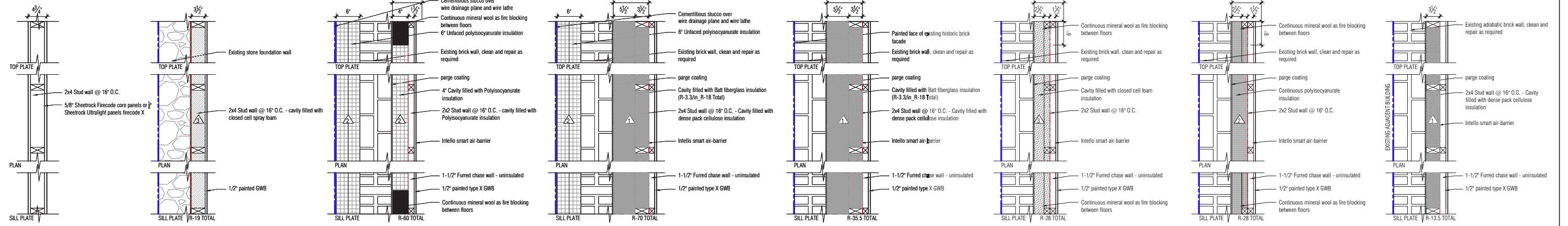
**±C**



**PHIUS+ SOURCE ZERO**

 **NEW YORK**  
STATE OF OPPORTUNITY.

**Buildings of Excellence**  
Award Winner



**G** Rated partition  
1 HR fire rating

**F** Basement wall  
NTS

**E** South wall - thin  
(1 Hr Fire Rating)

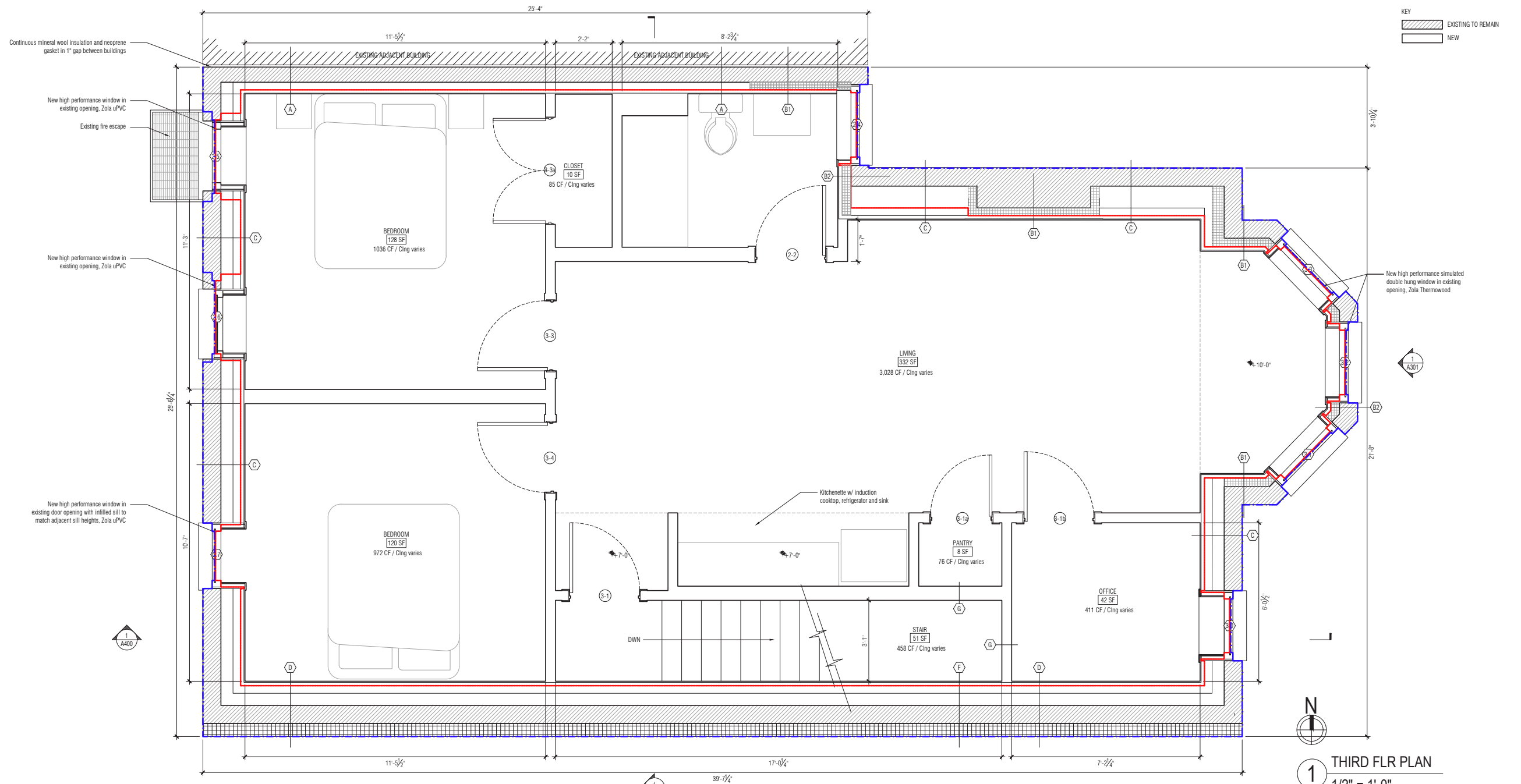
**D** South wall  
(1 Hr Fire Rating)

**C** Exposed Brick wall  
NTS

**B2** Thin wall  
NTS

**B1** Thin wall  
NTS

**A** Adiabatic wall  
NTS



**1** THIRD FLR PLAN  
1/2" = 1'-0"

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**PROJECT**  
197 NORTH MILLER STREET  
DRAWING  
THIRD FLOOR PLAN

**DATE**  
12/13/2018

**SCALE**  
1/2" = 1'-0"

**SHEET**

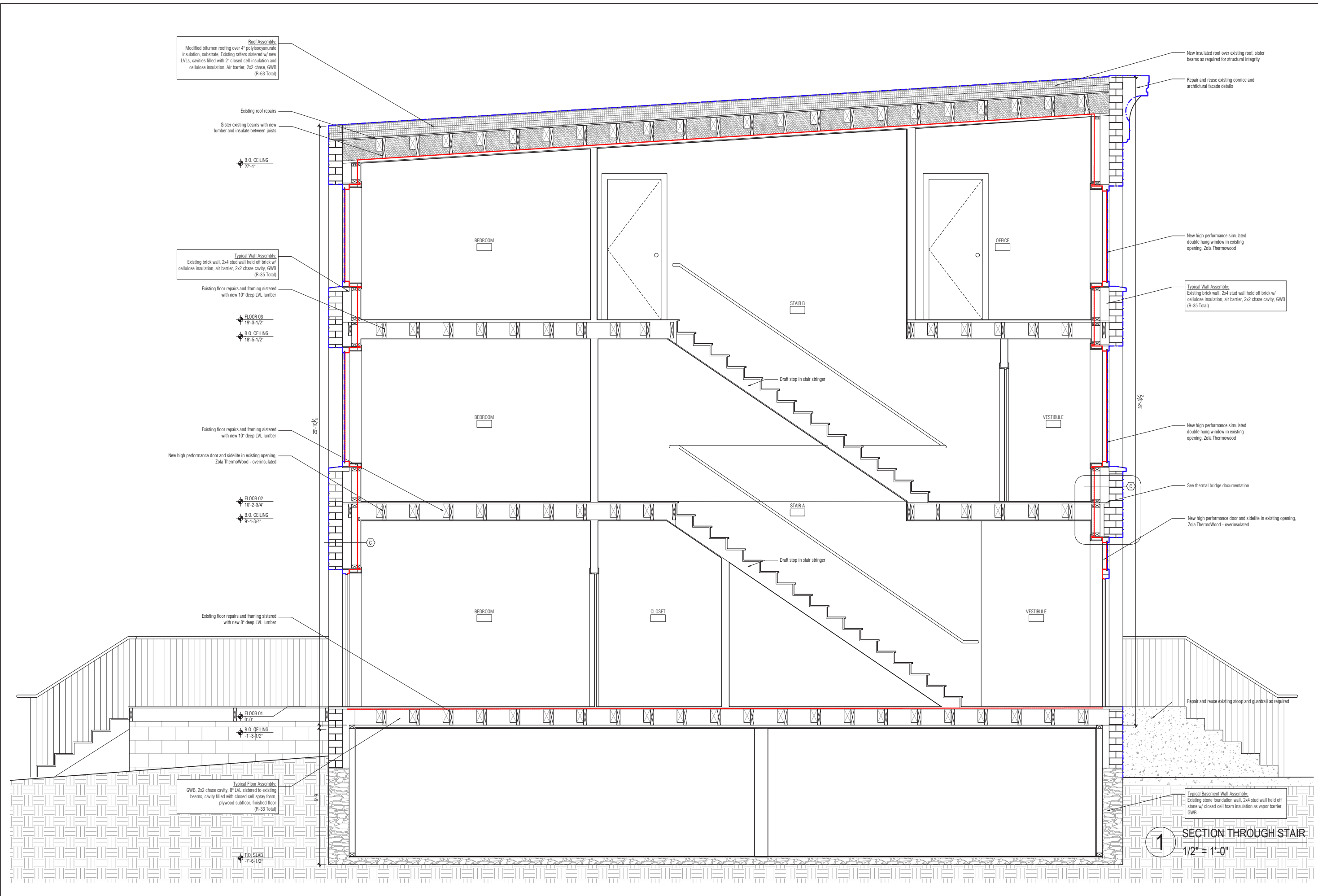
**A-103**

**Roof Assembly:**  
Modified bitumen roofing over 4" polystyrene insulation, substrate. Existing rafters sistered w/ new LVLs, cavities filled with 2" closed cell insulation and cellulose insulation, Air barrier, 2x2 chase, GWB (R-63 Total)

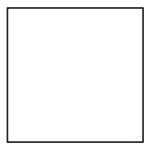
**Typical Wall Assembly:**  
Existing brick wall, 2x4 stud wall held off brick w/ cellulose insulation, air barrier, 2x2 chase cavity, GWB (R-55 Total)

**Typical Floor Assembly:**  
GWB, 2x2 chase cavity, 8" LVL sistered to existing beams, cavity filled with closed cell spray foam, plywood subfloor, finished floor (R-53 Total)

**Typical Basement Wall Assembly:**  
Existing stone foundation wall, 2x4 stud wall held off stone w/ closed cell foam insulation as vapor barrier, GWB



**1 SECTION THROUGH STAIR**  
1/2" = 1'-0"



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**PROJECT**  
197 NORTH MILLER STREET  
**DRAWING**  
SECTION THROUGH STAIRS

**DATE**  
12/13/2018

**SCALE**  
1/2" = 1'-0"

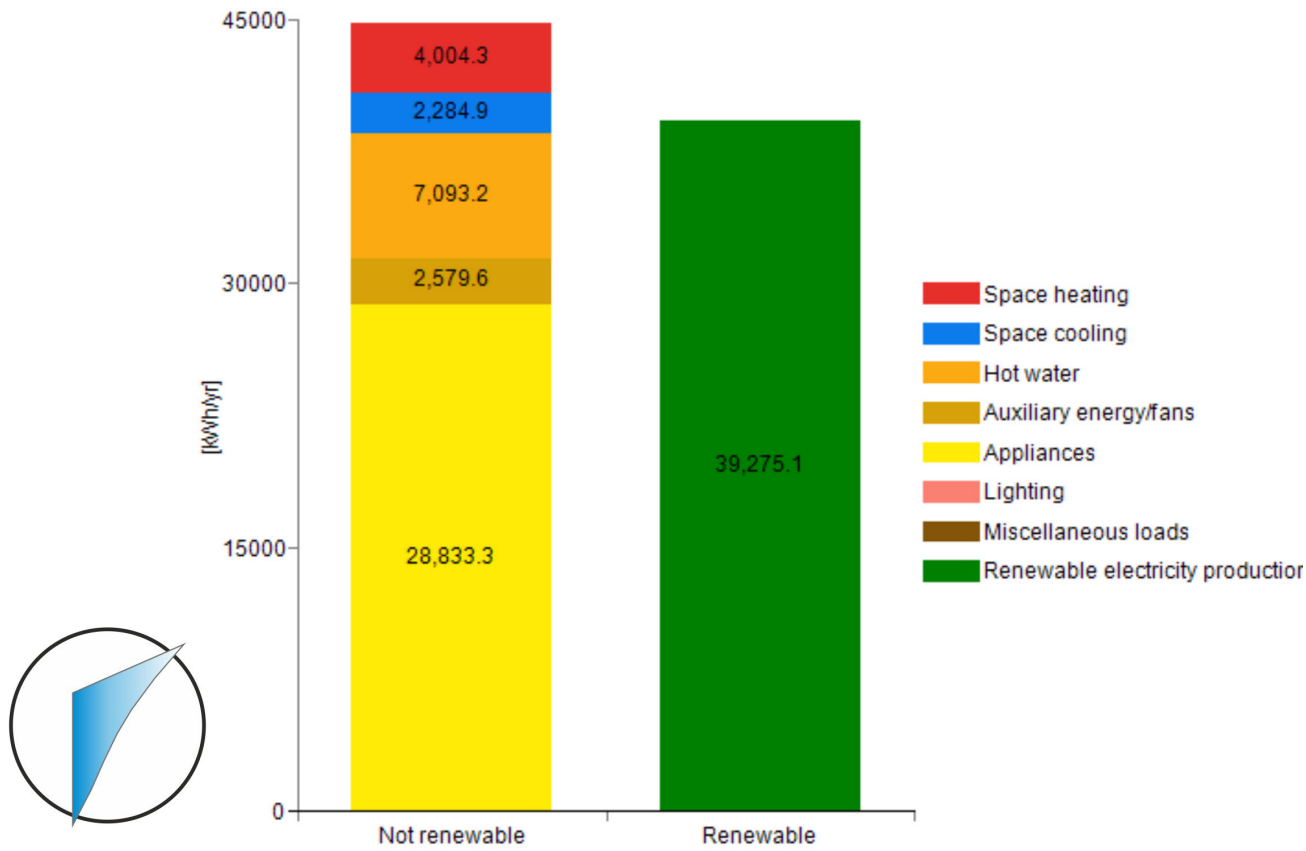
**SHEET**

**A-400**

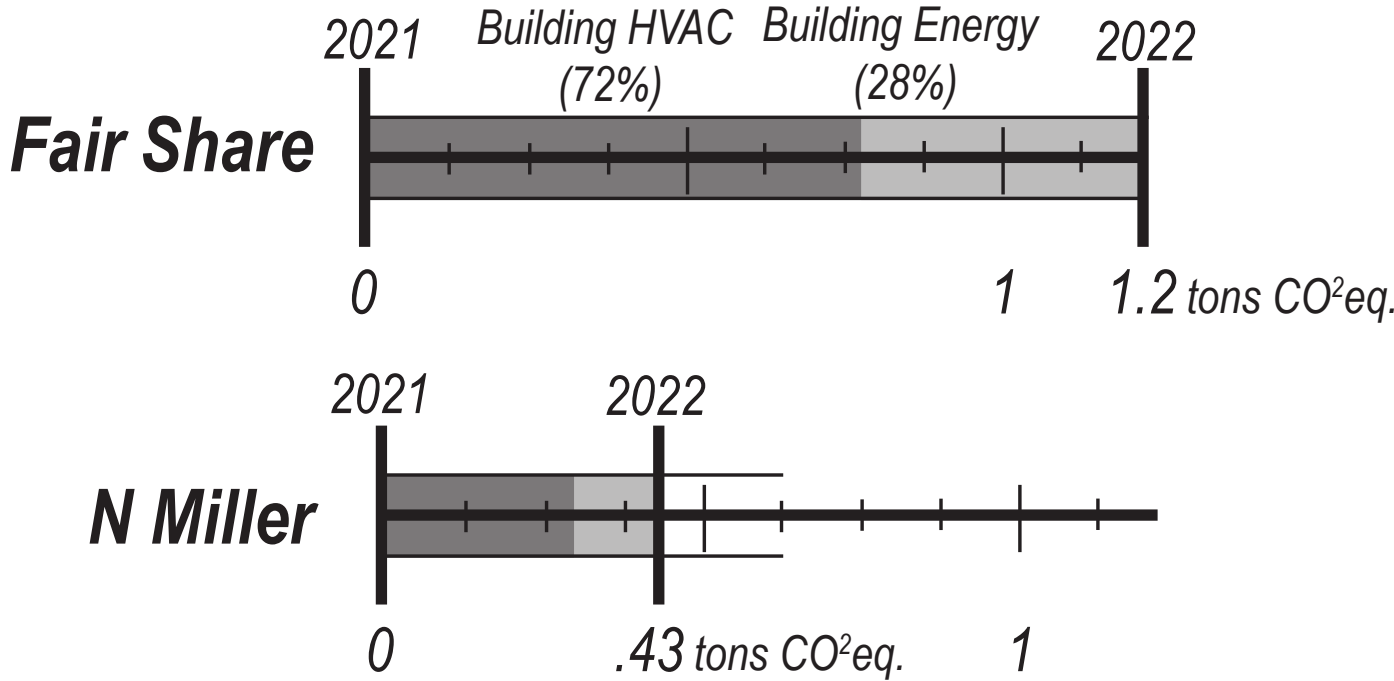
# Case 01: 197 North Miller

## Operational Carbon Analysis

WUFI, Source Energy Report



Annual Operational CO2 contribution per person

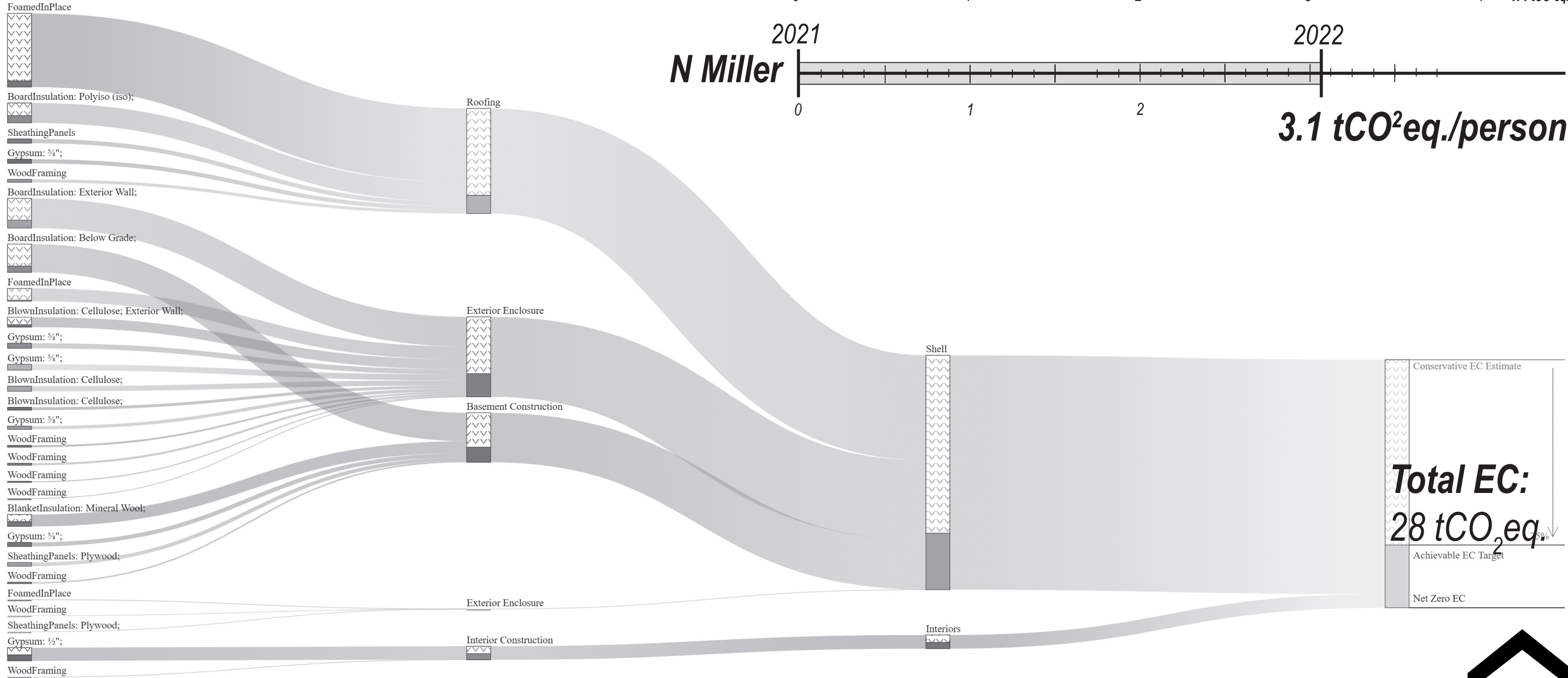
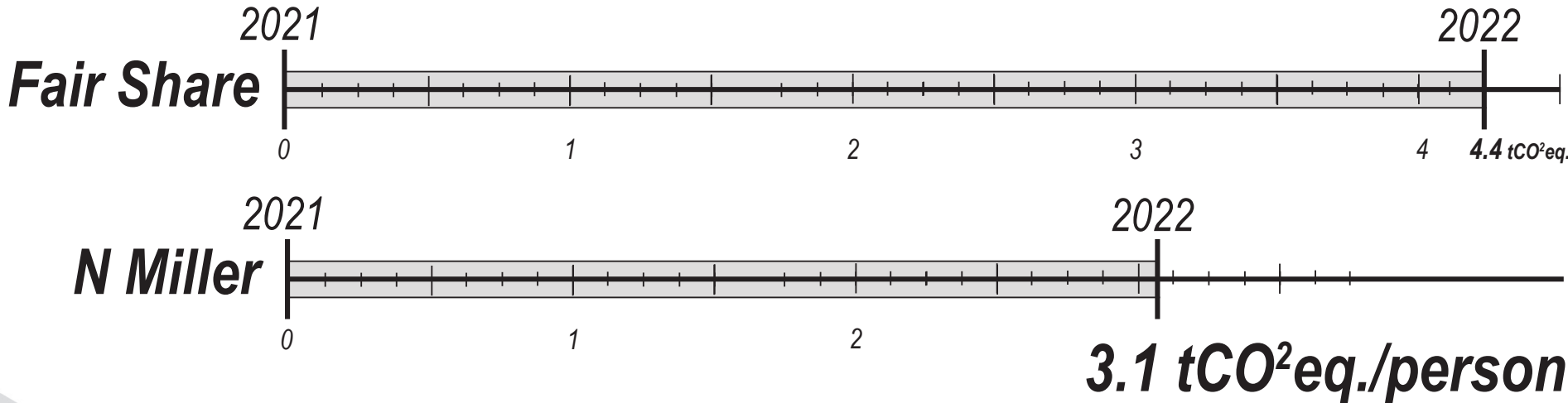




# Case 01: 197 North Miller

## Embodied Carbon Analysis

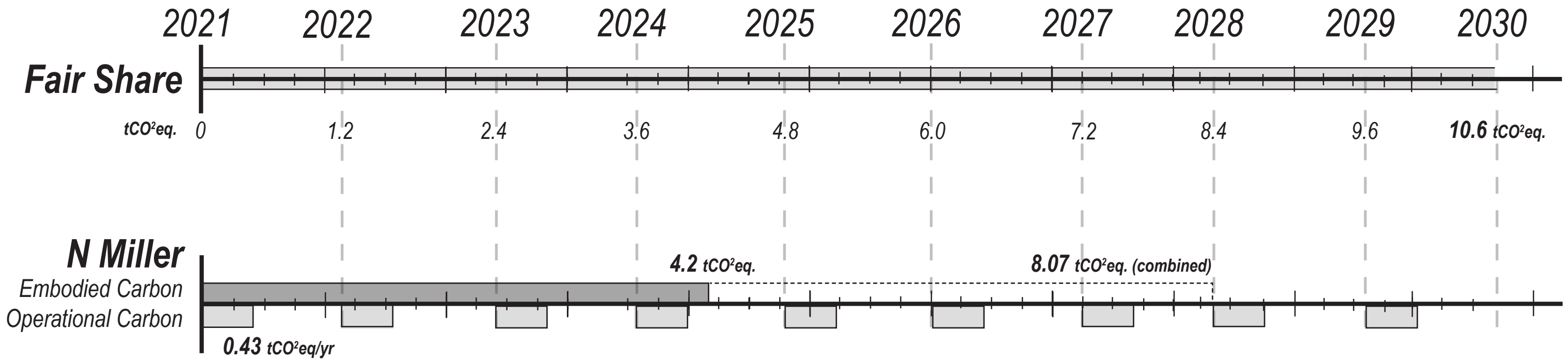
Annual Embodied CO2 contribution per person during the duration of construction



# Case 01: 197 North Miller

## Relative to Fair Share carbon

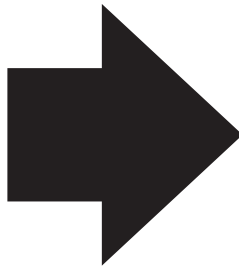
Annual Embodied CO2 contribution per person during the duration of construction



# Case 01: 197 North Miller

*Affordability: Development costs + Business model*

*Total cost of Construction:*     **\$452,607**  
*NYSERDA:*                         **\$66,322**  
*Adjusted cost:*                 **\$386,285**  
*Gross ft<sup>2</sup>:*                         **\$3,972**



*Avg Income, Newburgh:*     **\$41,769/yr**  
*40% Avg Income:*             **\$16,707/yr**  
  **\$1,392/mo**

**Cost / FT<sup>2</sup>:**                         **\$97.25**

**Utility-included Rent:**  
**\$1450/mo**

# Case 02: 124 / 126 Dubois

## Street Perspective





# Case 02: 124 / 126 Dubois

*Section perspective through mechanical closets*



# Case 02: 124 / 126 Dubois

Section perspective through bedroom and private balcony



# Case 02: 124 / 126 Dubois

Section perspective through living area and lightwell

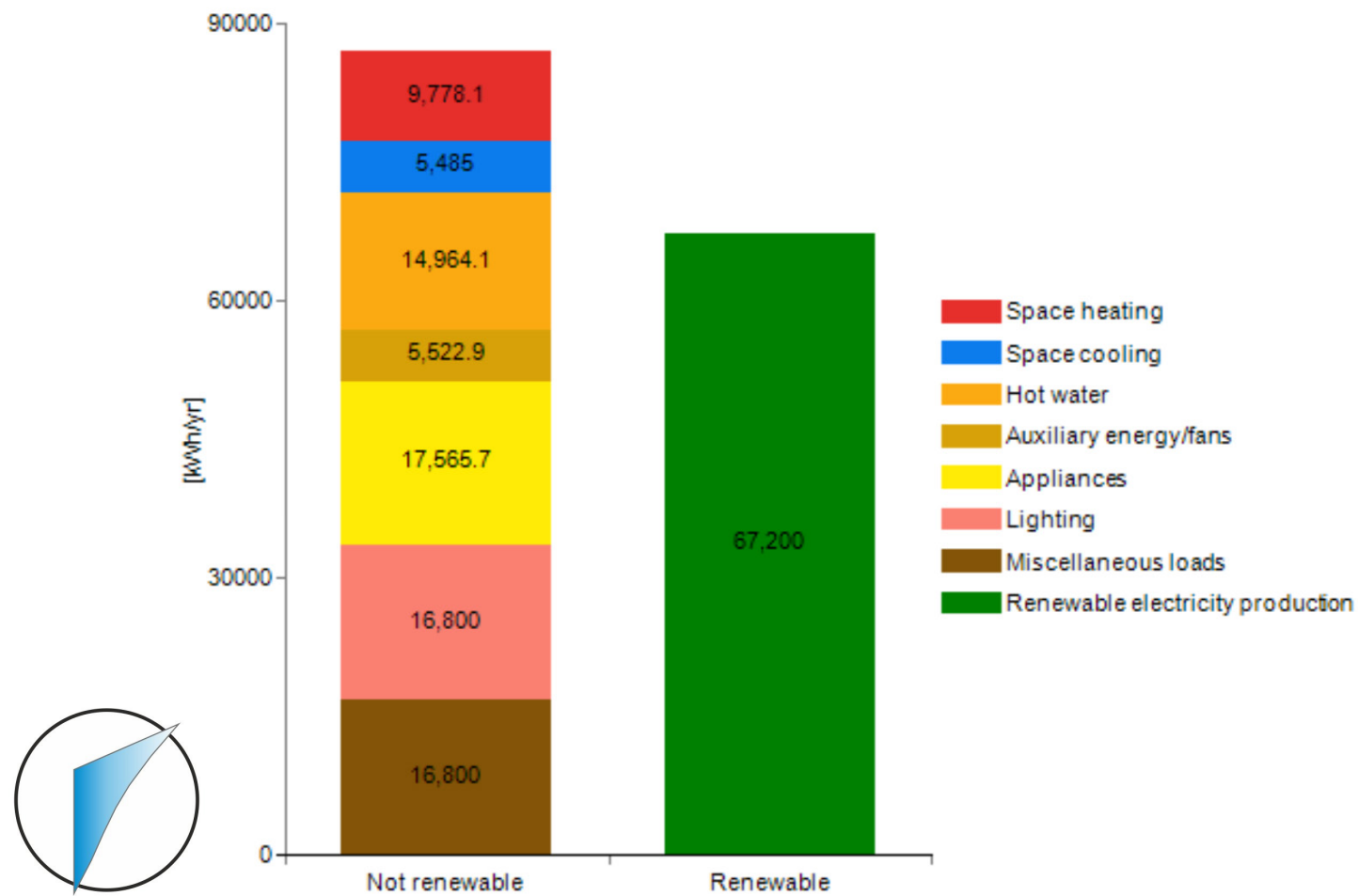




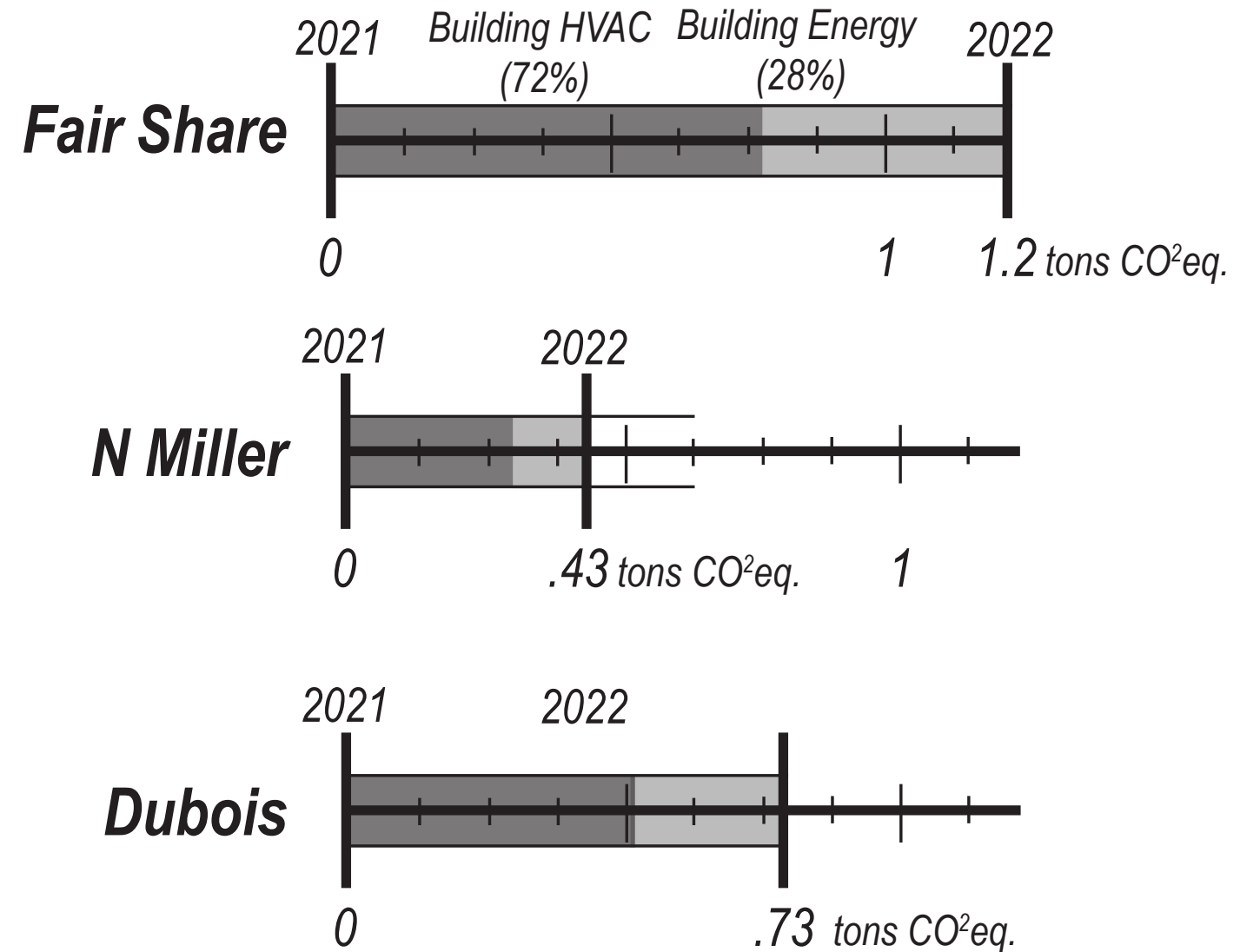
# Case 02: 124 / 126 Dubois

## Operational Carbon Analysis

WUFI, Source Energy Report



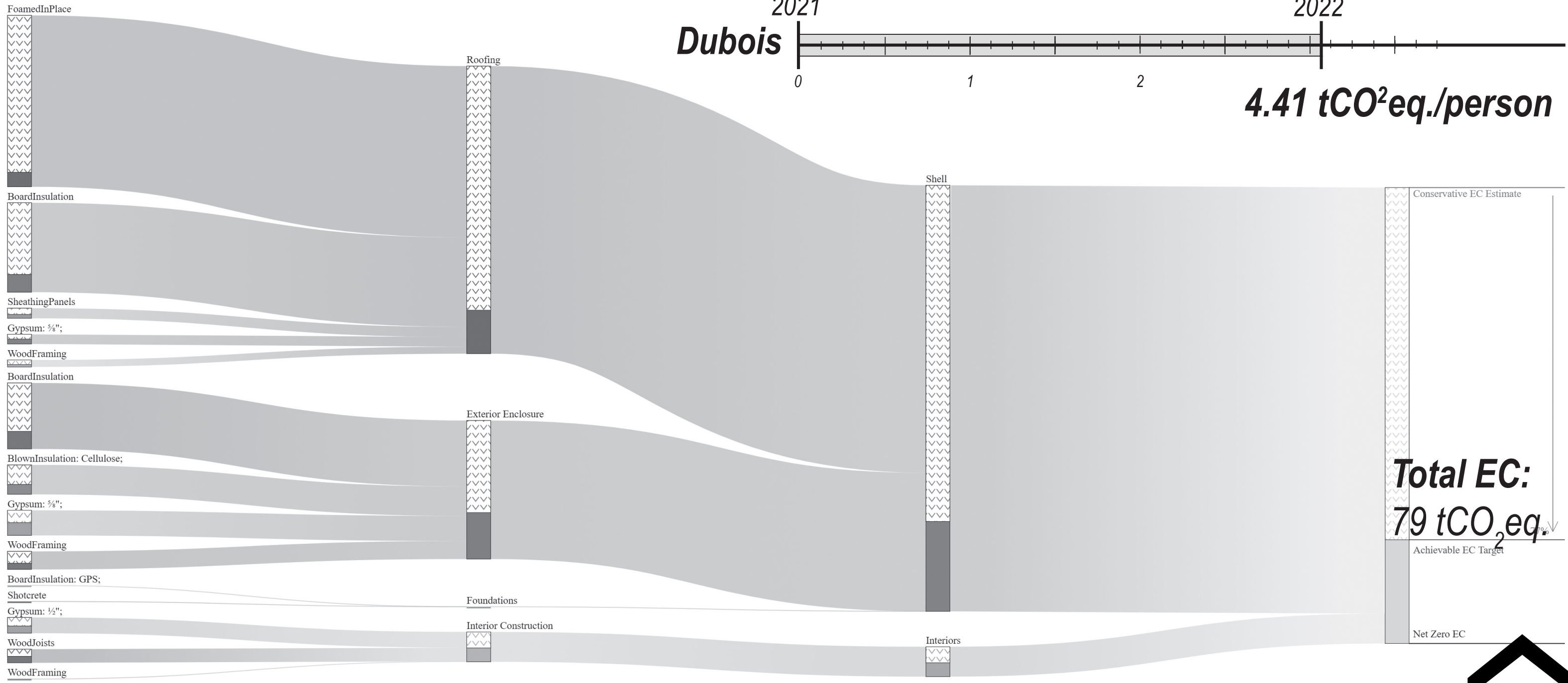
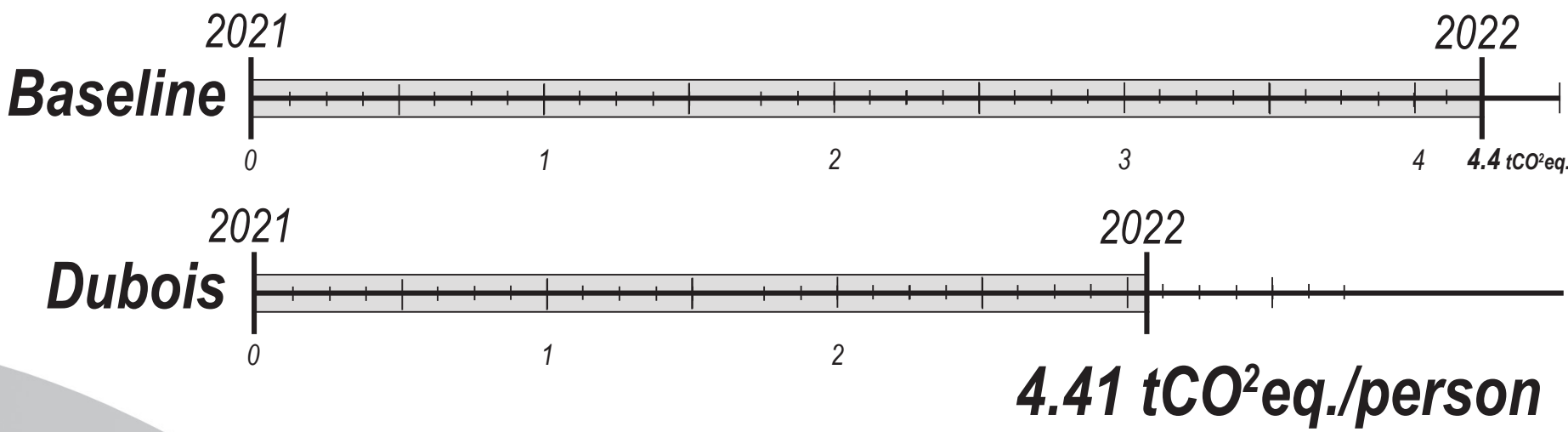
Annual Operational CO2 contribution per person



# Case 02: 124 / 126 Dubois

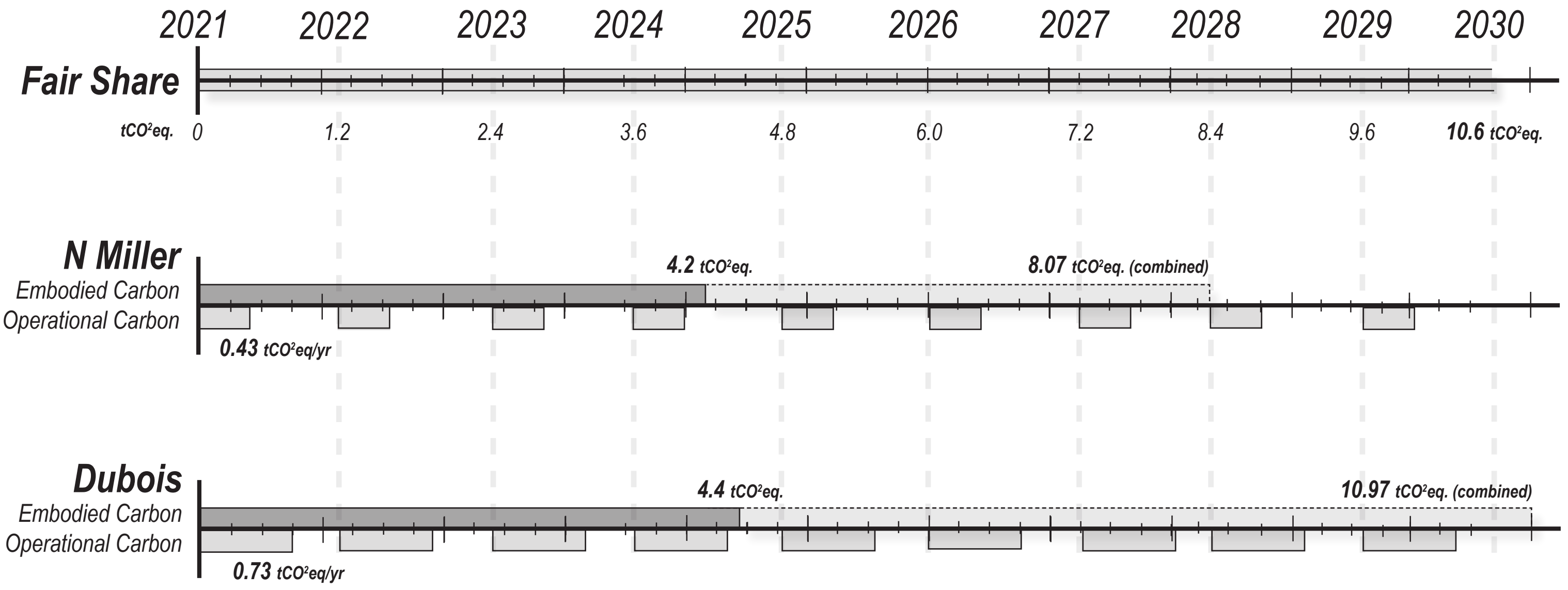
## Embodied Carbon Analysis

Annual Embodied CO2 contribution per person during the duration of construction



# Summary

## Total Carbon per person by 2030 (Building sector only)





# ***CARBON EQUITY 2030***

***Considering Embodied Carbon on a tight timeline***

***Thank You***  
***John Loercher, CPHC***  
***John@ne-projects.com***