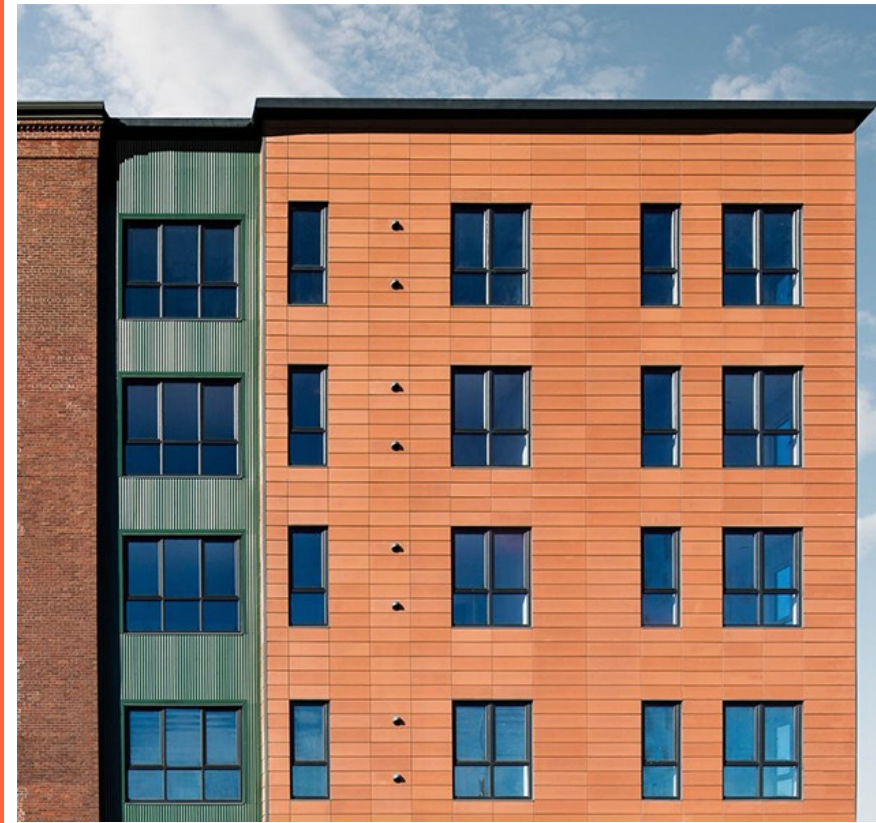


# GREEN BUILDING FOR POLICY MAKERS

MEDFIELD STATE  
HOSPITAL MASTER PLAN



## Can You Find the Passive House?





## Can You Find the Passive House?





# What is Passive House?

## CHARACTERISTICS

Uninterrupted building envelope

Five to six times more airtight

Optimized solar gain

Continuous ventilation with heat recovery

Durable construction details

Resiliency



# Goal:

**90% reduction in  
heating and  
cooling loads  
compared to a  
typical\* building**

\*existing building stock



HEATING AND COOLING DEMAND

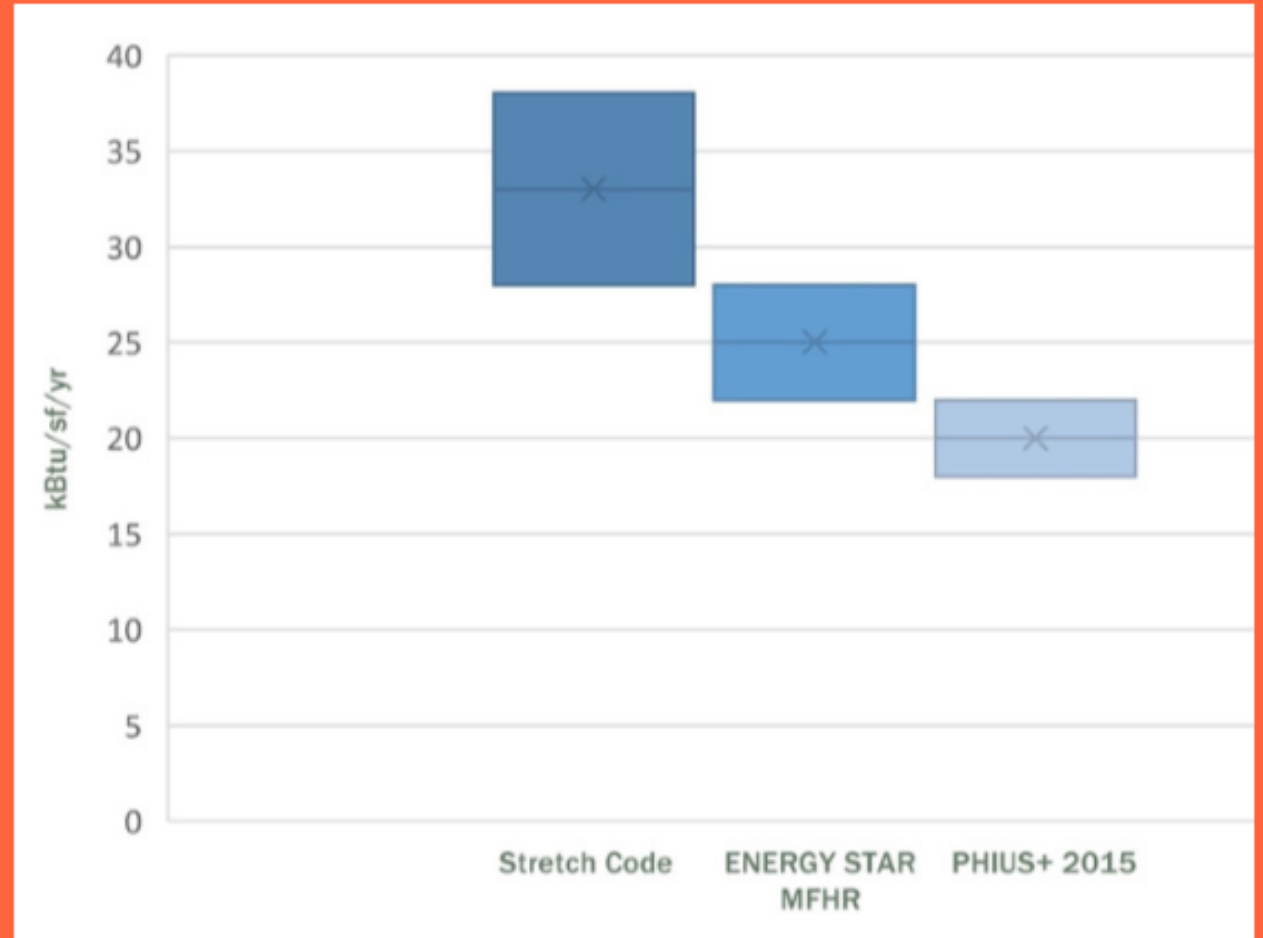
DATA SOURCE: PHIUS

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# Measured Performance:

**30-45% less carbon emissions than MA stretch code buildings**



Source: New Ecology, Inc.





## BENEFITS OF PASSIVE HOUSE FOR MULTIFAMILY

- Very low energy compared to code
- Improved indoor air quality
- Comfortable, temperature controlled units
- Durability of construction
- Quiet
- Ability to shelter in place



# I. MINIMIZE OPERATING ENERGY: LEED VS PASSIVE

- Only 30% LEED points address energy
- Passive House has much lower energy goal and high degree of quality assurance and testing
- Good fit with new construction multi-family
- Good fit with building 10A and 10B
- MassSave incentives for multi-family new construction Passive House





# Medfield State Hospital Master Plan

- New Construction Condos- 10A & 10B should require Passive House certification
- New Construction- Nursing/Memory Care
  - ✓ Potentially require Passive House certification
  - ✓ Negotiate with MassSave on incentives
- New Construction single family
  - ✓ require aggressive HERS rating- 40? or Passive House certification
  - ✓ Likely a Mass Save single family incentive by the time these are built
  - ✓ Consider requiring solar PV for each



# Medfield State Hospital Master Plan



- Historic Rehab- guts with additions should have strong emphasis on envelope improvement
  - ✓ learn from Passive House rehabs
  - ✓ Go to interior on insulation
  - ✓ Buildings will be there another 100 years- this is your only shot at envelope- so make them get it right
- Historic Rehab- Passive House certification probably too expensive but we can point you to rehabs that have done it to learn from



## 2. NO NATURAL GAS

### ELECTRIFY EVERYTHING

- Efficient Heat Pumps use electricity to heat and cool
- Electricity = Renewables
- Methane a powerful GHG- 84 times more potent than CO<sub>2</sub>
- To achieve 2050 GHG goals must electrify most heating
- Initial install of central air source heat pump is cost comparable to gas heating plus cooling for new
- Large scale hot water is biggest challenge
- If heat pump water heaters not a good fit- consider solar hot water to minimize hot water loads



# Medfield State Hospital Master Plan

## Non-gas heating and cooling options

- Don't incur costs of bringing gas to the site
  - ✓ Air source heat pumps
  - ✓ Ground source heat pumps
  - ✓ Eligible for Alternative Energy Credits
  - ✓ Not sure about district heat
- Ensure historic rehabs have good engineering for heat pump retrofits
  - ✓ Good envelope improvements critical for comfort and keeping electric costs reasonable
- Push for on site and offsite solar for the site





# Medfield State Hospital Master Plan

## Non gas hot water options

- Heat Pump Water Heaters will work for cottages and condos
- If Memory Care or other buildings need central hot water- consider solar hot water to reduce loads- make sure maintenance contract
- Solar Hot Water gets Alternative Energy Credits
- All electric mini split 8 unit with solar hot water  
<https://www.centerforecotechnology.org/auburn-court-solar-hot-water-installation/>



### 3. MINIMIZE EMBODIED CARBON

- Carbon to make building materials can be high, low, or carbon sink
- If building uses 40% less energy still could take 15 years to work off the carbon in materials
- Require developers to calculate embodied carbon
- Use tools to consider alternatives





# SOLAR

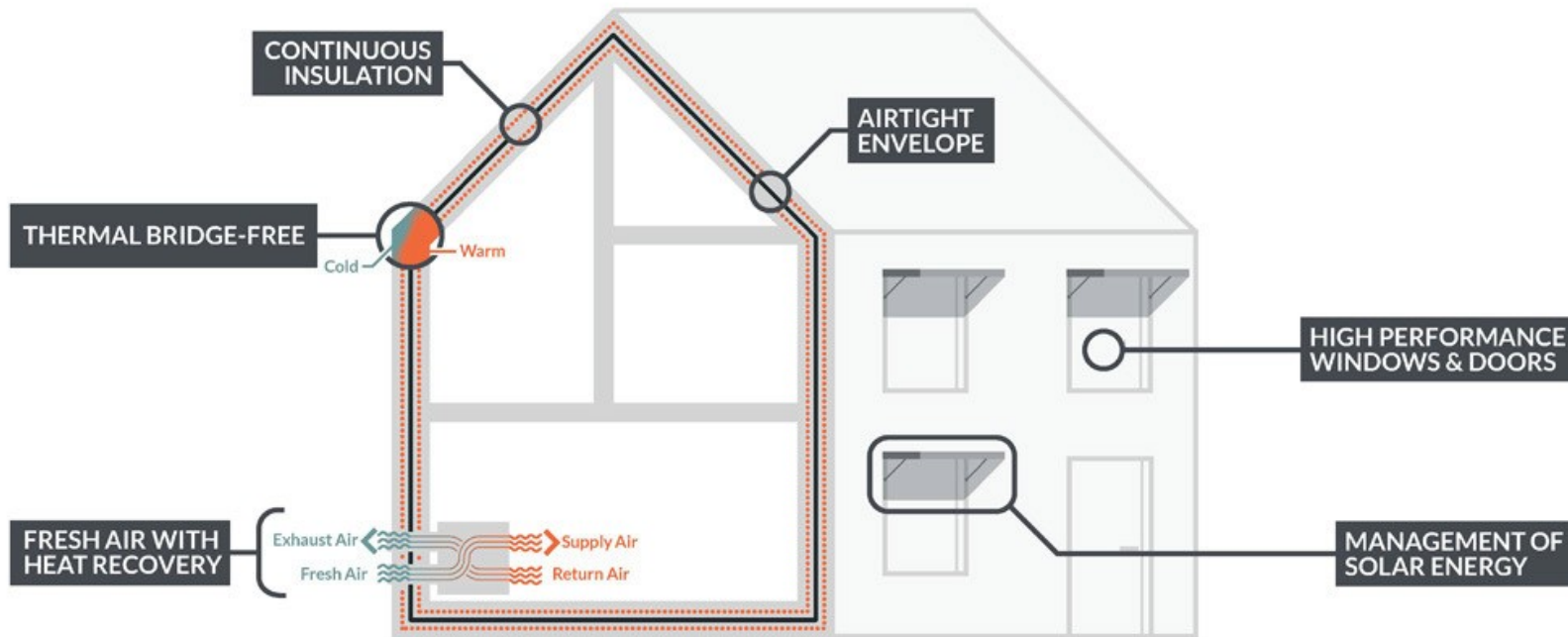
- Solar Ready not same as Installed Solar
- PV has less than 10 year payback
- Power Purchaser Agreements
- Won't ever be able to get to net zero with onsite solar for multi-family projects above 3 floors- probably not for memory care





Extra slides to potentially  
help answer questions

# Passive House Principles



## PASSIVE HOUSE PRINCIPLES

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# Air Tightness Standard

MA Energy Code

3

ACH50

(air changes per hour at 50 Pascals)

Passive House\*

0.6

ACH50

(air changes per hour at 50 Pascals)

\*Passive House International (PHI)



# Certification Options



**PHIUS+ standards adjust energy  
requirements based on regional climate**



## AREAS TO FOCUS ON

**INSULATION** High levels of insulation in the slab, walls and roof that may far exceed building code.

**AIR SEALING** Minimize leaks and cracks, penetrations through walls and roofs (typically for exhaust, plumbing stacks, etc).

**HVAC** Mini split air to air heat pumps provide heat and cooling, or other high efficiency heating options. Often heating loads are so low that traditional HVAC systems are significantly oversized.

**VENTILATION** Energy recovery ventilation (ERV) or heat recovery ventilation (HRV) takes the air exhausting from kitchens and bathrooms and before sending the air out, it captures the waste heat and uses it to preheat the incoming fresh air from outside.





## AREAS TO FOCUS ON

**WINDOWS** Windows and doors that are well insulated and well sealed (often triple glazed windows are used in PH). Casement and awning windows seal better than double hung or sliders. South and west facing windows may require shading.

**COMBUSTION** Use of combustion appliances (fireplaces, wood stoves, gas ranges) are typically very limited in Passive House projects, especially in multi-family.

**THERMAL BREAKS** Minimize areas where materials are continuous between interior and exterior.

# ELM PLACE

**Milton, VT**

**Completed:** 2017

**# of Units:** 30

**Total Floor Area:** 27,690 s.f.

**Architect:** Duncan Wisniewski Architects

**General Contractor:** ReArch

**CHPC:** Chris West

**Building Type:** Affordable senior housing

**Roof Insulation:** R70. Spray foam + fiberglass

**Wall Insulation:** 2x6 stud wall with fiberglass + 4" exterior polyiso

**Floor/Slab Insulation:** Concrete over R40 foam

**Doors/Windows:** U-1.28 Schuco uPVC tilt/turn

**Heating/Cooling:** Mitsubishi Hyper Heat

**Ventilation:** Daikin ERU Renuwaire HE 1.5X

**Renewable Energy:** 15kW PV

**EUI:** 20.2 kBtu/sf/yr

**Special Features:** Parking under living spaces





# VILLAGE CENTRE

**Brewer, ME**

**Completed:** 2016

**# of Units:** 48

**Total Floor Area:** 51,778 s.f.

**Architect:** CWS Architects

**General Contractor:** Wright-Ryan Construction

**CHPC:** Colin Schless

**PH Consultant:** ThorntonTomasetti

**Building Type:** Affordable housing

**Roof Insulation:** Polyisocyanurate foam (R-57)

**Wall Insulation:** 2x6 wood stud wall + 2x4 metal stud wall with spray cellulose (R-40)

**Floor/Slab Insulation:** 4" XPS under slab (R-20)

**Doors/Windows:** Unilux triple pane, U-0.18

**Heating/Cooling:** Electric baseboard (6 ft per unit), Natural gas boiler

**Ventilation:** Renewaire ERV (3:1)

**Renewable Energy:** Rooftop PV





# GILFORD VILLAGE KNOLLS III

Gilford, NH

**Completed:** 2018

**# of Units:** 24

**Total Floor Area:** 20,571 s.f.

**Developer:** Laconia Area Community Land Trust

**Architect:** Stewart Associates Architects LLC

**General Contractor:** Martini Northern

**CHPC:** Michael Hindle, Mike Duclos

**PH Consultant:** GDS Associates

**Building Type:** Affordable senior housing

**Roof Insulation:** R-75

**Wall Insulation:** 2x8 with blown in fiberglass

**Floor/Slab Insulation:** 6" EPS

**Doors/Windows:** Yaro Economy

**Heating/Cooling:** Mitsubishi Mr. Slim 8:1

**Ventilation:**

**Renewable Energy:** 104.92-kilowatt rooftop solar array



# BEACH GREEN NORTH

**Far Rockaway, NY**

**Completed:** 2017

**# of Units:** 101

**Total Floor Area:** 93,894 s.f.

**Architect:** Curtis + Ginsberg Architects LLP

**General Contractor:** The Bluestone Organization

**CHPC:** Lisa White

**PH Consultants:** De Nardis Engineering, LLC,  
Tectonic, GDSNY

**Building Type:** Affordable housing

**Roof Insulation:** Concrete + polyiso (R-40)

**Wall Insulation:** ICF construction (R-24)

**Floor/Slab Insulation:** Mineralwool + concrete  
(R-28)

**Doors/Windows:** Rehau 4500

**Heating/Cooling:** LG VRF

**Ventilation:** RenewAire EV90

**Renewable Energy:** 129.5 kW PV, 10 kW  
microturbine





# DISTILLERY NORTH

**South Boston, MA**

**Completed:** 2017

**# of Units:** 28

**Total Floor Area:** 27,840 s.f.

**Developer:** Second Street Associates, LLC

**Architect:** ICON Architecture

**General Contractor:** Commodore Builders

**CHPC:** Mark Anstey

**Building Type:** Market-rate housing

**Roof Insulation:** Open web truss with cellulose + 2" EPS

**Wall Insulation:** 2x8" cellulose with 3" rockwool exterior insulation (R-37)

**Floor/Slab Insulation:**

**Doors/Windows:** R-7 triple paned, tilt turn

**Heating/Cooling:** Mitsubishi air source heat pumps in each unit; natural gas hot water

**Ventilation:** HRV 95% efficient

**Renewable Energy:** PV, near net zero

**Special Features:** LEED-H Midrise Platinum, Public café, a street-level commercial space, interior parking with EV charging stations





# BAYSIDE ANCHOR

Portland, ME

**Completed:** 2017

**# of Units:** 45

**Total Floor Area:** 38,500 s.f.

**Developer:** Portland Housing Authority/Avesta Housing

**Architect:** Kaplan Thompson Architects

**General Contractor:** Wright-Ryan Construction

**CHPC:** Jesse Thompson

**Building Type:** Affordable + Market-Rate Housing

**Roof Insulation:** Polyiso (R-50)

**Wall Insulation:** Double stud wall with dense pack cellulose (R-34)

**Floor/Slab Insulation:** 3" EPS (R-16)

**Doors/Windows:** R-5, triple glazed

**Heating/Cooling:** Electric resistance baseboard

**Ventilation:** Renewaire 450 ERV ECM

**Renewable Energy:** 50 kW PV array

**Special Features:** Storm water collection, Community garden



# TRACY COMMUNITY HOUSING

Lebanon, NH

**Completed:** TBD- Summer 2019

**# of Units:** 29

**Total Floor Area:** 27,000 s.f.

**Developer:** Twin Pines Housing

**Architect:** Maclay Architects

**General Contractor:** Estes & Gallup

**CHPC:** Chris West, Eco Houses of VT

**Building Type:** Affordable housing

**Roof Insulation:** R-60 11" polyiso

**Wall Insulation:** R-38 2x6 cellulose + 4" polyiso

**Floor/Slab Insulation:** R-20 5" rigid foam

**Doors/Windows:** U-0.22, (R-4.5) SHGC 0.41

**Heating/Cooling:** Mitsubishi air source heat  
pumps, electric hot water

**Ventilation:** Rooftop Daikin DPS 007A

**Renewable Energy:** 180 kW PV

**Special Features:** Net zero

