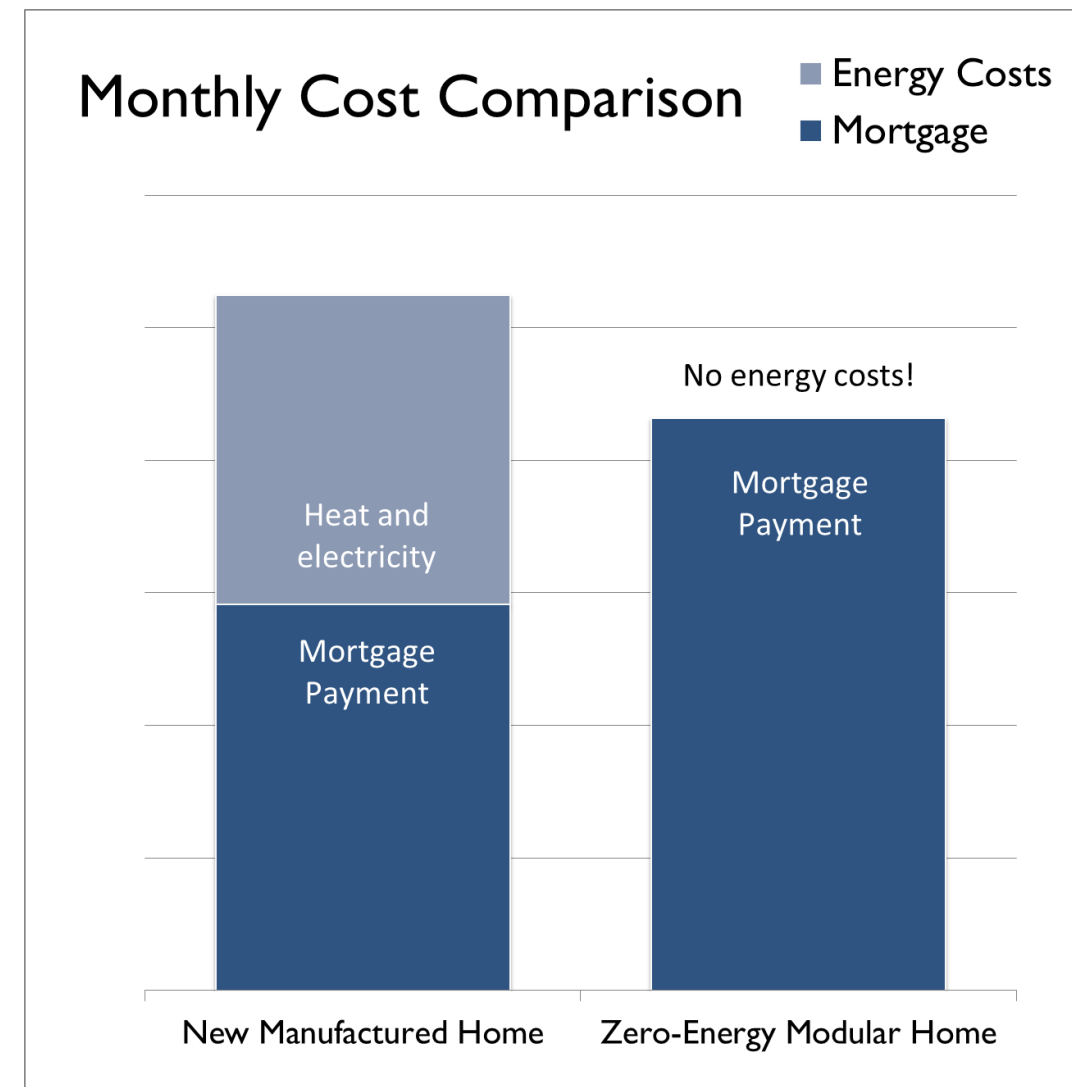


# Zero Energy Modular™ (ZEM™)

## Affordable



**IN THE SHORT TERM:** homeowners save with low-interest financing and no energy costs

**IN THE LONG TERM:** homeowners invest in an asset that holds its value over time



**80 ZEM homes built in VT and DE 2013-2017**



**Current program focus is using ZEM to replace mobile & manufactured housing**

## Case study: McKnight Lane

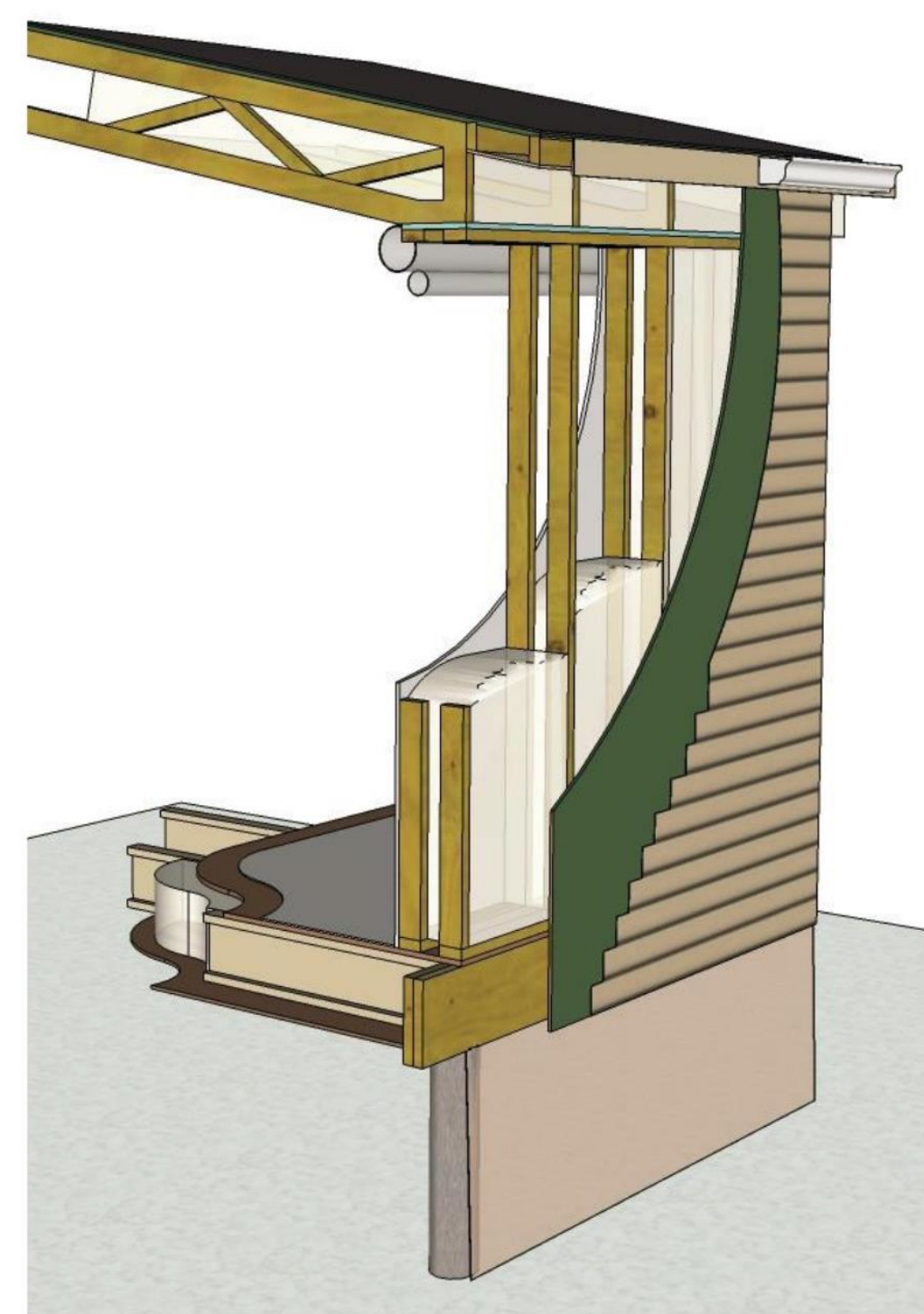
- 14 ZEM homes serve as affordable rental housing in rural Waltham, Vermont
- McKnight Lane community owned and managed by Addison County Community Trust
- All homes feature 6 kW solar + 6kWh Sonnen battery storage
- Batteries are owned and maintained by Green Mountain Power, the local electric utility



## Durable

**FLOOR** R-40  
**WALLS** R-43  
**ROOF** R-60

- 14" roof truss
- Airtight ducts inside house
- 1 foot overhang
- 5/8" sheetrock & low-VOC paints
- Double stud walls, 10" cavity
- Formaldehyde-free plywood decking and sheathing
- 9.5" floor system
- Moisture-tight underbelly
- Frost protected foundation



## Healthy

### HIGH-QUALITY MATERIALS REDUCE OFF-GASSING.

- Hardwood flooring
- Sheetrock walls
- No added urea formaldehyde
- Hardwood cabinets
- Low-VOC countertop
- Low-VOC finishes



### FRESH AIR VENTILATION MAINTAINS SUPERIOR INDOOR AIR QUALITY.

- The CERV ventilation system:
- automatically delivers fresh air when indoor levels of CO2 and VOCs exceed 1000 ppm
  - continuously circulates and filters indoor air to remove contaminants
  - dehumidifies to prevent the the growth of mold and mildew



## How do we achieve zero energy?

- 1 Reduce energy demand & control loss**
- 2 Incorporate efficient mechanical systems**
- 3 Reach zero energy with solar production**

### HIGH LEVELS OF INSULATION

- The walls, floor system, and roof cavity are dense packed with blown-in fiberglass
- Triple-paned windows with insulated frames reduce heat loss



### CONTINUOUS ENVELOPE

- Double stud walls and truss system in roof reduce thermal bridging
- Continuous insulation at eaves eliminates threat of ice dams



### AIRTIGHT CONSTRUCTION

- Construction under controlled conditions includes great attention to air sealing details
- Blower door tests after installation measure infiltration rates below 1 ACH50



- 2 Incorporate efficient mechanical systems**



### APPLIANCES & LIGHTING

- ENERGY STAR® appliances and LED lighting reduce electric demand
- Ventless heat pump dryer maintains airtight envelope



### AIR SOURCE HEAT PUMP

- Air source heat pump provides all heating, cooling, and dehumidification
- No supplemental heating source required



### FRESH AIR VENTILATION

- Energy recovery uses exhaust air to heat/cool supply air
- Integrated hole-house HVAC controls



### HEAT PUMP WATER HEATER

- Heat pump water heater is 3x as efficient as a standard water heater
- Low-flow fixtures reduce hot water demand

- 3 Reach zero energy with solar production**



### ROOF-MOUNTED SOLAR ARRAY

- Roof-mounted solar panels are designed to produce as much electricity as the home uses over the course of a year
- Solar array is connected to the electric grid and net-metered
- Solar credits last for 12 months; high solar production in the summer offsets high electric usage during the winter
- The 80 ZEM homes in Vermont and Delaware average true zero energy usage – about half of owners have significant solar credits year round, while other the half of owners have small electric bills in the winter due to above average electric usage

## Benefits of back up battery storage

**RESILIENCY:** Back up battery automatically kicks in during outages to power critical loads (lights, refrigerator, ventilation system, heat pump), and solar can directly recharge battery during a prolonged outage





**ENERGY ARBITRAGE:** Utility can charge or discharge the batteries based on market prices

**ALLEVIATE GRID CONGESTION:** Store energy at time of high PV penetration to "soak up" excess solar in a certain area

**T & D DEFERRAL:** Small amounts of distributed energy storage may delay or completely alleviate the need for expensive wire or transformer upgrades



## Is ZeMod Right For You?

-  Are you on a tight budget?
-  Do you want to downsize?
-  Do you want solar electricity?
-  Do you seek energy efficiency?



**Grants & Down-Payment  
Assistance Available!**

**302-422-8255**

**ZeModDelaware.com**

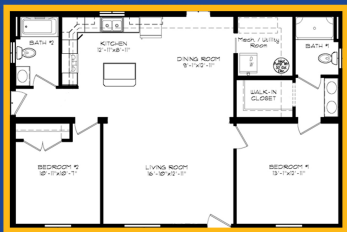


An Energize Delaware Program



## WHY ZEMOD?

- ✓ Low Maintenance & Energy Costs
- ✓ Energy Produced = Energy Used
- ✓ ENERGY STAR® Appliances
- ✓ Most Efficient Heating & Cooling System
- ✓ Super-Insulated Building & Windows
- ✓ No Oil, Gas or Other Combustible Heat Source



Open Floor Plans  
Bamboo Floors  
High Ceilings  
Optional Deck & Porch

## BENEFITS

**AFFORDABLE:** In a ZeMod home with low electric & solar electricity, you'll pay less per month in combined mortgage and energy costs than in a new manufactured home.






**SUSTAINABLE:** With durable construction & solar electricity, ZeMod homes deliver quality that lasts, savings that grow over time.

**INCENTIVES:** Grants and down-payment assistance available to those who qualify.



Call MHDC at 302-422-8255 to learn more about how we put affordability into action.

## Is ZeMod Right For You?

-  Are you on a tight budget?
-  Do you want to downsize?
-  Do you want solar electricity?
-  Do you value clean air quality?
-  Do you seek energy efficiency?



**Grants & Down-Payment  
Assistance Available!**

**302-422-8255**

[ZeModDelaware.com](http://ZeModDelaware.com)

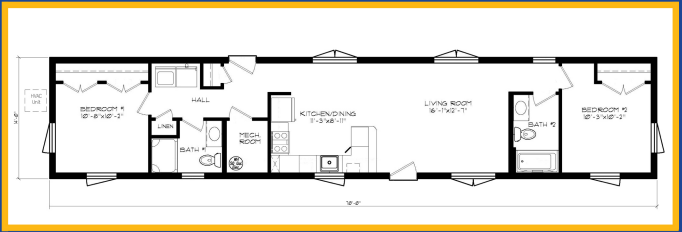


An Energize Delaware Program



## WHY ZEMOD?

- ✓ Low Maintenance & Energy Costs
- ✓ Energy Produced = Energy Used
- ✓ ENERGY STAR® Appliances
- ✓ Most Efficient Heating & Cooling System
- ✓ Super-Insulated Building & Windows
- ✓ No Oil, Gas or Other Combustible Heat Source



## BENEFITS

**AFFORDABLE:** In a ZeMod home with low electric & solar electricity, you'll pay less per month in combined mortgage and energy costs than in a new manufactured home.

**SUSTAINABLE:** With durable construction & solar electricity, ZeMod homes deliver quality that lasts, savings that grow over time.

**INCENTIVES:** Grants and down-payment assistance available to those who qualify.



Call MHDC at 302-422-8255 to learn more about how we put affordability into action.