Welcome to the LIFE Webinar Series.
We will be starting soon.
The Low-Income Forum on Energy Presents:

Zero Energy Modular Market Analysis – New York State

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Alison Donovan, Vermont Energy Investment Corporation
Phillip Picotte, Vermont Energy Investment Corporation

August 16, 2018
1:30 p.m. - 2:30 p.m. ET
LIFE, the Low-Income Forum on Energy, is a unique statewide dialogue that brings together organizations and individuals committed to addressing the challenges and opportunities facing low-income New Yorkers as they seek safe, affordable and reliable energy.

Supported by the New York State Public Service Commission and the New York State Energy Research and Development Authority (NYSERDA), the LIFE dialogue encourages an interactive exchange of information and collaboration among the programs and resources that assist low-income energy consumers.
Monthly webinars
City of Utica – Local Microgrid Project
Thursday, September 20, 2018, 10:30 - 11:30 a.m. ET

 HEAP Updates for the 2018-2019 Heating Season
Wednesday, October 17, 2018, 1:00 - 3:00 p.m. ET

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Asking Questions During Today’s Webinar

Welcome!
We will be starting soon.

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Click on the “Chat” icon to activate the chat function.
Zero Energy Modular Market Analysis

Low-Income Forum on Energy Webinar Series
About VEIC

• Nonprofit founded in 1986
• 300+ Employees
• Locations: VT, DC, OH, NY
• Design, deliver, and evaluate programs nationwide:
  • Energy efficiency
  • Transportation
  • Renewable energy

Our Customers:
• Utilities
• Businesses
• Government
• Foundations
• Environmental & Consumer Groups
Agenda

Introduction

Zero Energy Modular

New York State Market Analysis
  • Mobile and Manufactured Homes and Communities
  • Calculating Homeowner Economics
  • Barriers & Opportunities

Questions / Discussion
Introduction

NYSERDA hired VEIC to research what it will take to bring zero energy modular (ZEM) homes to New York State.

During this call, NYSERDA and VEIC will present our research and preliminary conclusions on the opportunities and barriers of ZEM as an affordable housing solution.

We are soliciting comments and input on the findings from stakeholders to include in final report recommendations, and suggested next steps.
A Few Acronyms

LMI = Low and moderate income
MMH = Mobile and manufactured homes
ZEM = Zero energy modular
ROC = Resident owned community, typically a co-op
Zero Energy Modular
Factory-Built Home Types

**Mobile Home**
No code, pre-1976

**Manufactured Home**
Meets HUD code at time of construction, 1976 and later

**Modular Home**
Meets state and local codes at time of construction
ZEM as a Resiliency Response

• Created following Tropical Storm Irene
• MMH residents already subject to:
  • Higher energy burden
  • Twice the energy cost per square foot
  • Greater need for weatherization and LIHEAP assistance
Insulation
Airtight construction
Continuous thermal envelope

High efficiency appliances & lighting
Fresh air ventilation
Air source heat pump heating & cooling
Market Analysis
152,810 occupied MMHs in New York State

Just 2% of housing units statewide

But, 5 – 15% in most upstate counties
Median vintage is 1985

26% rented; 74% owned or financed

36% located in registered mobile home parks
MMH residents face a higher energy burden

MMH LMI Households
11.5%

All LMI Households
9.2%
MMHs Serve Low and Moderate Income Residents

Median Household Income
Source: 2015 AHS

Household Income, MMH Households
Source: 2015 AHS

All Housing
$74,000

Owner
MMH
$42,000

Renter
MMH
$26,200

All Housing
$35,000

Under $20,000
33%

$20,000 - $40,000
17%

$40,000 - $80,000
33%

$80,000 and Above
17%

Source: 2015 AHS
Homeowner Economics
Compared to a standard manufactured home, ZEM homes cost less to live in.
### Building Technical Specifications

<table>
<thead>
<tr>
<th>HUD Code Home</th>
<th>ZEM Home</th>
</tr>
</thead>
<tbody>
<tr>
<td>14’ x 70’; 980 sf; 2 bedroom; open crawl foundation</td>
<td></td>
</tr>
</tbody>
</table>

#### Envelope

<table>
<thead>
<tr>
<th></th>
<th>HUD</th>
<th>ZEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor R-22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walls R-19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Windows U-0.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ceiling R-30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infiltration 8 ACH₅₀</td>
<td>0.60 ACH₅₀</td>
<td></td>
</tr>
</tbody>
</table>

#### Mechanical

<table>
<thead>
<tr>
<th></th>
<th>HUD</th>
<th>ZEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating 75 AFUE</td>
<td>13.5 HSPF</td>
<td></td>
</tr>
<tr>
<td>Cooling 13 SEER</td>
<td>30.5 SEER</td>
<td></td>
</tr>
<tr>
<td>Hot Water 0.92 EF</td>
<td>2.75 EF</td>
<td></td>
</tr>
<tr>
<td>Duct Insulation R22 / R8</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Duct Leakage 0.12</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Exhaust; 50 CFM, 50 W</td>
<td>Balanced, 50 CFM, 62 W</td>
<td></td>
</tr>
</tbody>
</table>

#### Efficient Lighting

<table>
<thead>
<tr>
<th></th>
<th>HUD</th>
<th>ZEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>34%</td>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>

#### Appliances

<table>
<thead>
<tr>
<th></th>
<th>HUD</th>
<th>ZEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional</td>
<td></td>
<td>ENERGY STAR +</td>
</tr>
</tbody>
</table>

#### PV System

<table>
<thead>
<tr>
<th></th>
<th>HUD</th>
<th>ZEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate Zone 4A; 5A; 6A</td>
<td>N/A</td>
<td>5 kW; 6 kW; 7.5 kW</td>
</tr>
</tbody>
</table>
# Energy Modeling Results

<table>
<thead>
<tr>
<th></th>
<th>Climate Zone 4A</th>
<th>Climate Zone 5A</th>
<th>Climate Zone 6A</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fuel Consumption</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity (kWh)</td>
<td>7,935</td>
<td>7,970</td>
<td>7,910</td>
</tr>
<tr>
<td>Propane (gal)</td>
<td>459</td>
<td>624</td>
<td>718</td>
</tr>
<tr>
<td>PV Production (kWh)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total (MMBtu)</td>
<td>69</td>
<td>84</td>
<td>93</td>
</tr>
<tr>
<td><strong>Fuel Costs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity</td>
<td>$1,432</td>
<td>$1,439</td>
<td>$1,428</td>
</tr>
<tr>
<td>Propane</td>
<td>$1,424</td>
<td>$1,935</td>
<td>$2,228</td>
</tr>
<tr>
<td>PV Production</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Total</td>
<td>$2,857</td>
<td>$3,373</td>
<td>$3,655</td>
</tr>
<tr>
<td><strong>Energy Cost Savings</strong></td>
<td>$2,890</td>
<td>$3,456</td>
<td>$3,610</td>
</tr>
</tbody>
</table>

Baseline heating fuel/system: Propane furnace
Fuel cost assumptions: $0.18/kWh, $3.10/gal propane, $3.22/gal fuel oil
Cash Flow Results

• Higher first cost is more than offset by lower combined mortgage and energy costs
  • Lower financing cost
    • ZEM Home: 30 Years at 4.75%
    • Traditional HUD Home: 15 Years at 9%
  • Low or no energy costs
    • ZEM: $34/month, mostly electricity service charges
• Residents pay less each month to live in a more comfortable, efficient home
Opportunities
Where are there opportunities?

<table>
<thead>
<tr>
<th>Owned Unit</th>
<th>Owned Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owned Land</td>
<td>Leased Land</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Leased Unit</th>
<th>Leased Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owned Land</td>
<td>Leased Land</td>
</tr>
</tbody>
</table>
Owned Unit / Owned Land

91,000 MMH estimated units in NYS

Opportunities & Barriers

- ZEM to replace owned MMH on owned land
- ZEM would qualify for conventional mortgage financing
- Leverage existing infrastructure and land
- Need funds for disposal of existing unit
- Existing MMH may be owned outright, owners adverse to debt
- Requires individual outreach; program difficult to scale

Medium opportunity for ZEM pilot
Owned Unit / Owned Land (ROC or Coop)

1,000 MMH estimated units in NYS

Opportunities & Barriers

- ZEM to replace owned MMH in Resident Owned Community (ROC)
- Leverage existing infrastructure and land
- Vacant lots attractive for ZEM
- Need conventional mortgage product
- Existing MMH may be owned outright, homeowners adverse to debt
- Easy to scale through ROC partners

High opportunity for ZEM pilot
Owned Unit / Leased Land (Park Conversion)

1,900 Private Parks

Opportunities & Barriers

- Focused effort to increase conversion of private parks to ROC or non-profit ownership
- Units could be mix of rental and owned
- Could be scaled through ROC and other affordable housing developers
- Need increased funding to finance park purchase
- Need better understanding of private park sales

High (?) opportunity for ZEM pilot
Urban Infill / Neighborhood Development

Technical Potential TBD

Opportunities & Barriers

- Abandoned or “zombie” properties are a problem for cities
- ZEM home would be less expensive than stick built, and build tax base and improve streetscape
- ZEM would qualify for conventional mortgage financing
- Leverage existing infrastructure and land

High (?) opportunity for ZEM pilot
Statewide Impacts of ZEM

• ZEM Development Opportunities
  • Estimate technical potential for ZEM to replace existing MMH in multiple land homeownership scenarios
  • Estimate technical potential for infill in urban downtowns

• ZEM Energy Savings
  • Estimate for multiple baseline scenarios

• Estimate number of ZEMs
  • 11-year scenario planning
### Statewide Impacts of ZEM

**Preliminary Draft**

**Estimated Benefits of ZEM**

**2019-2030**

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of years</td>
<td>11</td>
</tr>
<tr>
<td>Number of homes</td>
<td>10,000</td>
</tr>
<tr>
<td>Electric savings (kWh)</td>
<td>68,435,697</td>
</tr>
<tr>
<td>Oil savings (gal)</td>
<td>2,845,738</td>
</tr>
<tr>
<td>Propane savings (gal)</td>
<td>2,834,211</td>
</tr>
<tr>
<td>Energy cost savings</td>
<td>$28,942,986</td>
</tr>
<tr>
<td>Avoided emissions (lbs. CO₂)</td>
<td>185,107,471</td>
</tr>
</tbody>
</table>
Discussion
Questions

• How could ZEM fit into the work you are already doing?
  • For example, ZEM homes as
  • Mobile home replacement
  • New construction affordable housing (infill or PUD)
  • Nonprofit purchase of an existing mobile home park to redevelop with ZEM for rental or homeownership

• Is there enough regional demand to support a local modular factory to build ZEM homes?
Thank you!

Alison Donovan
adonovan@veic.org

Interested in ZEM progress?

Contact John to sign up for the NYS ZEM listserv:
John.Scicchitano@nyserda.ny.gov
Additional Slides
Home Replacement in Coop Park
New Park or Duplex Development
Urban and Village Infill
Join us for upcoming webinars.

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