Zero Energy Communities in New Paltz
New Homes with No Energy Bills!

MSRE 517 - SUSTAINABILITY PROPERTY REPORT
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GREEN ACRES – NEW PATLZ, NEW YORK

• Population: 14,003 (2010 Census)
• 80 miles North of New York City and 70 miles South of Albany
• Located along the Interstate 87 in the Lower Hudson River Valley
• Average January high temperature: 34 °F
GREEN ACRES

- New community of Zero Net Energy Homes (ZEH) in the village of New Paltz, New York
- Total of 25 homes on a scenic winding road with majestic views of the Mohonk Mountains
- Walk to shops, theaters, parks, hiking and biking trails, SUNY – New Paltz, bus & train services, restaurants and clubs
ADDITIONAL ZE COMMUNITIES

- *Esopus* – two custom ZE homes for sale
- Coming Soon:
  - *The Preserve at Mountain Vista*
  - *Scenic Meadows*
- All homes built by Greenhill Contracting
- All homes listed by Wendie Reid Realty

Source: http://www.greenacresnewpaltz.com/pages/technology.html
THE EXPECTED OUTCOME

- The homes will consume less energy than they produce (when occupied by an average family)
- Thereby achieving "net zero energy use"

- No Energy Bills

Source: http://www.greenacresnewpaltz.com/pages/technology.html
Through “net metering” the utility company measures net consumption of electricity throughout the day, allowing the resident to produce electricity for the grid during the day while taking electricity at night.

To account for significant seasonal variation in production and consumption, the utility will measure total “net” consumption over the year for final billing reconciliation. The utility will pay the homeowner for any excess electricity produced over the year (at wholesale prices).

Source: http://www.greenacresnewpaltz.com/pages/technology.html
TECHNOLOGY

• Photovoltaic solar panels
• Geothermal heating and cooling
• Super insulation (insulated concrete form walls, triple-pane glass)
• Heat recovery ventilation

Source: http://www.greenacresnewpaltz.com/pages/technology.html
The relatively large residential system (approximately 8 kilowatts) will produce all the home energy needs (for an average family).

The high efficiency of these panels allowed all 45 panels to fit on the relatively small true-solar-south-facing roof.

Source: http://www.greenacresnewpaltz.com/pages/technology.html
TECHNOLOGY – SOLAR PANELS

Photovoltaic System Generation vs. Consumption

David Shepler’s 10-kilowatt solar system produced more energy than his family used during their first year in the house.

Source: http://www.greenacresnewpaltz.com/pages/technology.html
The subject chose to upgrade to a 10-kW system in order to have additional electricity available for accommodating an all-electric vehicle.

Green Acres homes come with an 8-kW system.

Source: http://www.solartoday-digital.org/solartoday/20100708#pg48
Due to the tremendous efficiencies gained by utilizing the lower-variation temperature of the earth, a ground source heat pump (GSHP) provides all the heating and cooling needs of the home, requiring far less electricity than more conventional systems.

Source: http://www.greenacresnewpaltz.com/pages/technology.html
A GSHP circulates an antifreeze solution through a closed loop, installed vertically or horizontally in the earth. The fluid gathers heat from the earth for the house in the winter and reverses itself and pulls heat from the home and places it in the ground in the summer.

Source: http://www.greenacresnewpaltz.com/pages/technology.html
A WaterFurnace Envision Model NDV049A111CTR ground-source heat pump provides heating and cooling and some hot water.

- This model comfortably meets all of the home’s heating and cooling needs
- It also provides some hot water via a preheat tank.
- This reduces the energy demand of the A.O. Smith ProMax+high-efficiency electric water heater.
- Green Acres homes now include a geothermal system that provides all hot water needs.

Source: http://www.solartoday-digital.org/solartoday/20100708#pg48
The homes are built with insulated concrete forms (ICFs) from the foundation to the roof. ICFs are air tight, with layers of polystyrene enveloping 6 inches of reinforced concrete. This creates an extremely strong, durable home with the best insulating properties available.

Source: http://www.solartoday-digital.org/solartoday/20100708#pg48
Triple-paned, krypton-filled windows rated U-value 0.22 or better complete the envelope of the house.

Twice the insulation required by Energy Star is used beneath the slab (4 inches total rigid insulation providing R-20) to complete a ground-to-roof, energy efficient thermal envelope.

Source: http://www.greenacresnewpaltz.com/pages/technology.html
Open-cell foam insulation buries the 2x12 rafters achieving up to R-60 in the roof.

Almost all Green Acres Homes’ windows are oriented to the south to take advantage of passive solar heating and cooling effects, while ensuring abundant light on all floors.

Energy Star raters attained an average reading of 0.65 ACH50, a level considered very difficult to achieve.

Source: http://www.solartoday-digital.org/solartoday/20100708#pg48
Source: http://www.greenacresnewpaltz.com/pages/technology.html
Heat recovery ventilation system is used to “recover” energy from outgoing tempered air that is completely lost in conventional homes (recovering up to 80% of the energy)

The system also ensures consistent, superior air quality as an added benefit.

Source: http://www.greenacresnewpaltz.com/pages/technology.html
A Lifebreath heat recovery ventilator (HRV) recovers up to 80 percent of the energy from outgoing tempered air.

HRV panels in the bathrooms, laundry and kitchen allow users to control humidity levels.

Source: http://www.solartoday-digital.org/solartoday/20100708#pg48
In addition to the elimination of energy bills are the considerable cost savings resulting from state and federal incentives.

When these savings are taken into account, the monthly cost of ownership is dramatically reduced relative to a traditional home.

Source: http://www.greenacresnewpaltz.com/pages/economics.html
ECONOMICS – STATE/FEDERAL INCENTIVES

- State of New York: $5,000 tax credit for solar system on top of the considerable rebate that is applied already at installation.

- IRS: tax credit of 30% of the cost of solar panels and geothermal heating/cooling (after state rebates).

- Total minimum federal credit of $25,000 as a result of a $40,000 8kW-solar system cost and $40,000 geothermal cost (plus an additional $1,500 maximum credit for superior windows, doors, and insulation).

Source: http://www.greenacresnewpaltz.com/pages/economics.html
ECONOMICS – TOTAL INCENTIVES

- Net received: **$30,000 in tax credits** (note: the credit can be collected over multiple years if the buyer's tax burden in the first year is less than $30,500)

- Also, it's important to recognize that this is a dollar-for-dollar credit, not a write off

- Example: ZE home offered in New Paltz purchased at $600,000 results in the same monthly costs as a $453,000 traditional home.

Source: http://www.greenacresnewpaltz.com/pages/economics.html
ECONOMICS - EXAMPLE

Assumptions:
- Mortgage interest rate = 5%
- Cost of oil/gas/electricity equates to $5,500 in utility savings as a result of ZE
- For this example, the savings resulting from the federal and state tax credits allow the buyer to place a higher down payment on the ZE home.
- The example was used for a buyer at a federal marginal tax rate of 28%.

Results:
- A $600,000 ZE home is equivalent in yearly cost to a $451,830 traditional home. The savings is approximately $34,400 in mortgage, interest, tax (and for the traditional home energy utilities).

Source: http://www.greenacresnewpaltz.com/pages/economics.html
# Economics - Example

<table>
<thead>
<tr>
<th></th>
<th>Regular</th>
<th>ZE</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>House Cost (3,000 sqft)</td>
<td>$451,830.00</td>
<td>$600,000.00</td>
<td></td>
</tr>
<tr>
<td>Down Payment</td>
<td>$89,500.00</td>
<td>$120,000.00</td>
<td></td>
</tr>
<tr>
<td>Financed</td>
<td>$362,330.00</td>
<td>$480,000.00</td>
<td></td>
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<tr>
<td>Mortgage Interest rate</td>
<td>5.0%</td>
<td>5.0%</td>
<td></td>
</tr>
<tr>
<td>Yearly mortgage payment</td>
<td>($23,340.79)</td>
<td>($30,920.93)</td>
<td>Note: The difference in down payment offset by tax credits (see below).</td>
</tr>
<tr>
<td>R&amp;E Tax</td>
<td>($12,000.00)</td>
<td>($12,000.00)</td>
<td>ZE assessed lower than purchase price</td>
</tr>
<tr>
<td>Utilities (annual)</td>
<td>($5,500.00)</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>Marginal tax rate</td>
<td>28%</td>
<td>28%</td>
<td></td>
</tr>
<tr>
<td>Deductible Interest</td>
<td>$6,404.71</td>
<td>$8,484.70</td>
<td></td>
</tr>
<tr>
<td><strong>Total Yearly Cost</strong></td>
<td>($34,436.08)</td>
<td>($34,436.22)</td>
<td></td>
</tr>
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## Federal and State Tax Credits for a ZE Home

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<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Total geothermal cost</td>
<td>$40,000.00</td>
</tr>
<tr>
<td>Total solar cost</td>
<td>$40,000.00</td>
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<tr>
<td>Current incentive (%)</td>
<td>30%</td>
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<tr>
<td>Federal tax credit for windows, doors, insulation</td>
<td>$1,500.00</td>
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<td>Federal tax credit (on all)</td>
<td>$25,500.00</td>
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<tr>
<td>NY State tax credit (on Solar)</td>
<td>$5,000.00</td>
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<tr>
<td><strong>Total Tax Credit</strong></td>
<td>$30,500.00</td>
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For this example, we roll this tax credit into a larger down payment for the ZE home above.

Source: http://www.greenacresnewpaltz.com/pages/economics.html
# ECONOMICS – ZE VS. TRADITIONAL HOME

<table>
<thead>
<tr>
<th>ZE Home Cost</th>
<th>Equivalent Traditional Home</th>
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<tbody>
<tr>
<td>$355,000.00</td>
<td>$206,833.23</td>
</tr>
<tr>
<td>$365,000.00</td>
<td>$216,833.08</td>
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<tr>
<td>$500,000.00</td>
<td>$351,833.08</td>
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<tr>
<td>$525,000.00</td>
<td>$376,833.23</td>
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<tr>
<td>$550,000.00</td>
<td>$401,833.18</td>
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<td>$575,000.00</td>
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<td>$600,000.00</td>
<td>$451,833.06</td>
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<td>$625,000.00</td>
<td>$476,833.22</td>
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<td>$675,000.00</td>
<td>$526,833.11</td>
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<td>$795,000.00</td>
<td>$646,833.22</td>
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<tr>
<td>$850,000.00</td>
<td>$701,833.14</td>
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</table>

**Date of Calculations:** 12-Feb-11

**Assumptions:**
1. Yearly cost of fuel/utilities for traditional home = $5,500
2. 20% down payment on mortgage
3. 5% APR mortgage interest rate
4. 28% income bracket for yearly interest write-off
5. All current NY state and Federal tax credits apply.

Source: http://www.greenacresnewpaltz.com/pages/economics.html
CONCLUSION

- Homes in New Paltz, NY are able to achieve net zero energy efficiency in a **cold climate**

- This is done through a combination of **new technology** and **net metering**

- Each house in the ZE neighborhoods will **consume less energy than they produce over the course of one year**
REFERENCES

- http://zestoforange.com/blog/?p=5704
- http://www.solartoday-digital.org/solartoday/20100708#pg48
- http://www.dailyfreeman.com/articles/2009/01/16/life/doc49700e0a4adeb617416886.txt
- http://www.dailyfreeman.com/articles/2009/01/16/life/doc49700e0a4adeb617416886.txt
THANK YOU....