ENERGY SMART SOLUTIONS: A STRATEGIC SIMULATION

RESIDENTIAL ENERGY EFFICIENCY IN CONNECTICUT
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03 ENERGY USAGE PATTERNS IN CONNECTICUT
RESIDENTIAL ENERGY CONSUMPTION IN CT

is primarily driven by fuel oil, natural gas, and electricity

49% of net energy consumption in CT is not sold through a utility

Source: US Energy Information Administration
RESIDENTIAL ENERGY CONSUMPTION is a significant component of the global warming pollution created in CT.

Based on the residential sector’s share of retail electricity sales (42%), the residential sector accounts for an estimated 30% of GHG emissions from fossil fuels in CT.
CT HAS RECENTLY ACHIEVED significant reductions in residential electricity use, but still uses more than leading states.

<table>
<thead>
<tr>
<th>Change in Per Capita Use:</th>
<th>CT</th>
<th>CA</th>
<th>US</th>
<th>NY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990-2009</td>
<td>12.0%</td>
<td>9.3%</td>
<td>20.2%</td>
<td>16.7%</td>
</tr>
<tr>
<td>2005-2009</td>
<td>-10.3%</td>
<td>1.7%</td>
<td>-3.3%</td>
<td>-5.4%</td>
</tr>
</tbody>
</table>

Source: US Energy Information Administration; US Census Bureau
PER CAPITA HOME ENERGY USE in CT of natural gas, heating oil, and other petroleum products is higher than New York, Massachusetts, and Vermont.

Source: US Energy Information Administration; US Census Bureau. Data are not weather-normalized.
# RESIDENTIAL ENERGY CONSUMPTION COST

CT residents $4.8 billion in 2009 – or $3,634 per household

## CTRESIDENTIAL SECTOR ENERGY EXPENDITURE ESTIMATES, 2009 (MILLIONS OF DOLLARS)

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>EXPENDITURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retail electricity</td>
<td>$2,557</td>
</tr>
<tr>
<td>Distillate Fuel Oil</td>
<td>$1,411</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>$652</td>
</tr>
<tr>
<td>LPG</td>
<td>$185</td>
</tr>
<tr>
<td>Wood</td>
<td>$10</td>
</tr>
<tr>
<td>Kerosene</td>
<td>$6</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$4,820</strong></td>
</tr>
</tbody>
</table>

Source: US Energy Information Administration

67% of expenditures on residential energy were made through a utility.
ELECTRICITY RATES ARE SUBSTANTIALLY HIGHER and are rising more quickly than the national average.

Data from CONNECTICUT’S HIGH ELECTRIC RATES AND THE LEGISLATIVE RESPONSE by:
Kevin E. McCarthy, Principal Analyst, CT Office of Legislative Research
ANALYSIS OF DOE RESIDENTIAL ENERGY CONSUMPTION

data for New England states highlights households and housing types that may experience the most severe issues with energy efficiency

- STUDIED DATA ON INTENSITY OF ENERGY USE (kBtu per square foot from all energy consumption), ADOPTION OF EFFICIENCY MEASURES, AND ISSUES WITH INSULATION AND AIR SEALING

- SIGNIFICANT FACTORS APPEAR TO INCLUDE:
  - Tenure (owner / renter)
  - Income
  - Type of home (single family detached, apartment, etc.)
  - Age of home
  - Size of home
  - Potentially, age and ethnic / racial status of householder

- CAVEAT: limited data set. 2005 RECS data studied 387 households in New England. 2009 RECS data studied 437 households in CT, RI, NH, VT, and ME.
LOW-INCOME HOUSEHOLDS ARE MOST AFFECTED
by home energy efficiency issues

Lower-income households are more likely to have gas heat, but also more likely to live in a poorly insulated home.

**Main Heating Fuel Source by Income**

- Under 20,000: 32%, 52%
- 20,000 to 34,999: 45%, 34%
- 35,000 to 49,999: 50%, 30%
- 50,000 to 74,999: 59%, 19%
- 75,000 to 99,999: 54%, 21%
- 100,000 or more: 30%, 19%

**Prevalence of Insulation/Air Sealing Issues by Income**

- Poorly insulated unit:
  - Under 20,000: 50%
  - 20,000 to 34,999: 30%
  - 35,000 to 49,999: 25%
  - 50,000 to 74,999: 20%
  - 75,000 to 99,999: 15%
  - 100,000 or more: 10%

- Unit is drafty "all" or "most" of the time:
  - Under 20,000: 20%
  - 20,000 to 34,999: 15%
  - 35,000 to 49,999: 10%
  - 50,000 to 74,999: 5%
  - 75,000 to 99,999: 0%
  - 100,000 or more: 0%

Source: Analysis of 2009 DOE RECS data for CT, RI, NH, VT, and ME
LOWER-INCOME HOUSEHOLDS ARE LESS LIKELY TO have installed efficiency measures

HOUSEHOLDS UNDERTAKING EFFICIENCY MEASURES, BY INCOME

Source: Analysis of 2009 DOE RECS data for CT, RI, NH, VT, and ME
**RENTAL UNITS SEE HIGHER ENERGY USE**

and are much less likely to have efficiency measures in place; renters pay a greater proportion of their income for energy.

<table>
<thead>
<tr>
<th>TENURE</th>
<th>MEDIAN INTENSITY OF HOME ENERGY USE (KBTU / SQ FT)</th>
<th>MEDIAN PERCENT OF HH INCOME SPENT ON ENERGY COSTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owner-occupant</td>
<td>76</td>
<td>4.9%</td>
</tr>
<tr>
<td>Renter</td>
<td>94</td>
<td>6.5%</td>
</tr>
</tbody>
</table>


**PERCENT OF HOUSEHOLDS WITH INSULATION/AIR SEALING ISSUES, BY TENURE**

<table>
<thead>
<tr>
<th>TENURE</th>
<th>POORLY INSULATED</th>
<th>DRAFTY “ALL” OR “MOST” OF THE TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owners</td>
<td>15%</td>
<td>9%</td>
</tr>
<tr>
<td>Renters</td>
<td>30%</td>
<td>21%</td>
</tr>
</tbody>
</table>

Source: analysis of 2009 US DOE Residential Energy Consumption Survey data for CT, RI, ME, NH, VT

**PERCENT OF HOUSEHOLDS WITH EFFICIENCY MEASURES, BY TENURE**

<table>
<thead>
<tr>
<th>TENURE</th>
<th>ENERGY AUDIT</th>
<th>INSTALLED CFL</th>
<th>PROGRAMMABLE THERMOSTAT</th>
<th>ENERGY STAR REFRIGERATOR</th>
<th>INSTALLED WEATHER STRIPPING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owners</td>
<td>7%</td>
<td>65%</td>
<td>36%</td>
<td>47%</td>
<td>59%</td>
</tr>
<tr>
<td>Renters</td>
<td>2%</td>
<td>48%</td>
<td>13%</td>
<td>28%</td>
<td>21%</td>
</tr>
</tbody>
</table>
**Senior Citizens Pay Higher Energy Costs**

As a percentage of income. Although they use less energy per square foot, they appear slightly less likely to have taken efficiency measures.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Median Intensity of Home Energy Use (kBtu/sqft)</th>
<th>Median Percent of HH Income Spent on Energy Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>65 years or older</td>
<td>74</td>
<td>7.9%</td>
</tr>
<tr>
<td>All others</td>
<td>81</td>
<td>4.6%</td>
</tr>
</tbody>
</table>


**Percent of Households Undertaking Efficiency Measures, by Age**

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Energy Audit</th>
<th>Installed CFL</th>
<th>Programmable Thermostat</th>
<th>Energy Star Refrigerator</th>
<th>Installed Weather Stripping</th>
</tr>
</thead>
<tbody>
<tr>
<td>65 years or older</td>
<td>5%</td>
<td>54%</td>
<td>23%</td>
<td>37%</td>
<td>41%</td>
</tr>
<tr>
<td>All others</td>
<td>5%</td>
<td>61%</td>
<td>30%</td>
<td>42%</td>
<td>47%</td>
</tr>
</tbody>
</table>

Source: analysis of 2009 US DOE Residential Energy Consumption Survey data for CT, RI, ME, NH, VT
Racial and ethnic minorities also appear to be more impacted by energy efficiency issues, due to correlations with income and housing tenure.

**Median Intensity of Home Energy Use (kBtu/sq ft) by Race/Ethnicity, New England States**

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>Median Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>White, non-hispanic</td>
<td>78</td>
</tr>
<tr>
<td>Black, non-hispanic</td>
<td>139</td>
</tr>
<tr>
<td>Latino</td>
<td>81</td>
</tr>
<tr>
<td>Asian</td>
<td>104</td>
</tr>
</tbody>
</table>


**Percent of Households Undertaking Efficiency Measures, by Minority Status**

<table>
<thead>
<tr>
<th>Minority Status</th>
<th>Energy Audit</th>
<th>Installed CFL</th>
<th>Programmable Thermostat</th>
<th>Energy Star Refrigerator</th>
<th>Installed Weather Stripping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minority</td>
<td>5%</td>
<td>46%</td>
<td>23%</td>
<td>26%</td>
<td>30%</td>
</tr>
<tr>
<td>White</td>
<td>5%</td>
<td>62%</td>
<td>29%</td>
<td>44%</td>
<td>49%</td>
</tr>
</tbody>
</table>

Source: analysis of 2009 US DOE Residential Energy Consumption Survey data for CT, RI, ME, NH, VT
OLDER BUILDINGS ARE LESS ENERGY EFFICIENT AND consume a greater portion of occupants’ budget for energy use.

**Median Intensity of Home Energy Use (kBtu per sq ft) by Building Age**

<table>
<thead>
<tr>
<th>Building Age</th>
<th>Median Percent of HH Income Spent on Energy Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before 1940</td>
<td>5.8%</td>
</tr>
<tr>
<td>1940 to 1959</td>
<td>5.4%</td>
</tr>
<tr>
<td>1960 to 1979</td>
<td>4.5%</td>
</tr>
<tr>
<td>1980 to 1999</td>
<td>4.5%</td>
</tr>
</tbody>
</table>

HOMES BUILT BEFORE 1970 make up 59% of Connecticut’s stock.
LARGER HOMES HAVE LOWER ENERGY INTENSITY (usage per square foot) but higher overall consumption.

ENERGY CONSUMPTION BY SQUARE FOOTAGE OF HOME

Note that unit size also correlates with occupant income and tenure.

### EXPLORATORY REGRESSION ANALYSIS

to predict intensity of household energy use

<table>
<thead>
<tr>
<th>VARIABLE (LISTED IN ORDER OF EFFECT SIZE AS MEASURED BY BETA COEFFICIENTS)</th>
<th>EFFECT ON ENERGY USE (KBTU FROM ALL SOURCES) PER SQUARE FOOT, AFTER CONTROLLING FOR THE OTHER VARIABLES LISTED IN THIS TABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owner occupancy*</td>
<td>Lower for owner occupants</td>
</tr>
<tr>
<td>Housing type*</td>
<td>Higher for single-family detached homes compared to other housing types</td>
</tr>
<tr>
<td>Fuel type</td>
<td>Higher for homes using fuel oil compared to other sources</td>
</tr>
<tr>
<td>Size of home</td>
<td>Lower for larger homes</td>
</tr>
<tr>
<td>Time at home</td>
<td>Higher for households where someone is home most of the day</td>
</tr>
<tr>
<td>Household size</td>
<td>Higher for households with more people</td>
</tr>
<tr>
<td>Age of home</td>
<td>Higher for older homes</td>
</tr>
<tr>
<td>Household income</td>
<td>Lower for higher-income households</td>
</tr>
<tr>
<td>Minority status</td>
<td>Lower for minorities</td>
</tr>
</tbody>
</table>

- *= SIGNIFICANT AT P<.01 IN UNWEIGHTED REGRESSION
- HEATING AND COOLING DEGREE DAYS WERE ALSO INCLUDED AS CONTROL VARIABLES.
- CAVEAT: R-SQUARED OF REGRESSION IS ONLY 0.30

21 ENERGY EFFICIENCY OPPORTUNITIES IN RESIDENTIAL BUILDINGS IN CONNECTICUT
According to McKinsey and Company, all of these measures have positive economic returns. New builds offer a significant target of opportunity, but the largest and fastest abatement potential lies in existing buildings.

EFFICIENCY CASE STUDY #1:
hypothetical home in Hartford

<table>
<thead>
<tr>
<th>INITIAL CONDITION</th>
<th>RECOMMENDED UPGRADES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Built 1930</td>
<td>Air sealing to achieve 25% air leakage reduction</td>
</tr>
<tr>
<td>2 stories, 1,800 square feet</td>
<td>Insulate walls (R-11) and floors</td>
</tr>
<tr>
<td>Oil boiler installed 1987</td>
<td>Add attic insulation to R-49</td>
</tr>
<tr>
<td>Double pane windows, partial insulation (R-19 in attic)</td>
<td>Upgrade oil boiler and water heater to Energy Star</td>
</tr>
<tr>
<td>Married couple with a child</td>
<td>Energy Star appliances when replacing them (cost is incremental cost of Energy Star only)</td>
</tr>
<tr>
<td></td>
<td>Efficient lighting</td>
</tr>
<tr>
<td></td>
<td>Programmable thermostat</td>
</tr>
<tr>
<td></td>
<td>Boiler pipe insulation</td>
</tr>
</tbody>
</table>

Source: Lawrence Berkeley National Labs, Home Energy Saver model
**EFFICIENCY CASE STUDY #1:**

hypothetical home in Hartford

<table>
<thead>
<tr>
<th>TOTAL COST OF RETROFORMS</th>
<th>$10,630</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual energy savings</td>
<td>$1,670</td>
</tr>
<tr>
<td>Payback time</td>
<td>6 years</td>
</tr>
<tr>
<td>ROI</td>
<td>15%</td>
</tr>
<tr>
<td>Avoided emissions / year</td>
<td>12,750 lbs CO₂</td>
</tr>
<tr>
<td>Fuel oil savings / year</td>
<td>465 gallons</td>
</tr>
<tr>
<td>Electricity savings / year</td>
<td>1,834 kWh</td>
</tr>
<tr>
<td>Cost of upgrades</td>
<td>$10,630</td>
</tr>
</tbody>
</table>

Source: Lawrence Berkeley National Labs Home Energy Saver model. High end of cost range used for boiler replacement and wall insulation; average of cost range used for other improvements.
**EFFICIENCY CASE STUDY #1:**

hypothetical home in Hartford

### YEARLY ENERGY COSTS

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Heating</th>
<th>Cooling</th>
<th>Hot Water</th>
<th>Large Appliances</th>
<th>Small Appliances</th>
<th>Lighting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Existing Home</strong></td>
<td>$4,653</td>
<td>$3,269</td>
<td>$87</td>
<td>$255</td>
<td>$512</td>
<td>$250</td>
<td>$280</td>
</tr>
<tr>
<td><strong>With Upgrades</strong></td>
<td>$2,983</td>
<td>$1,876</td>
<td>$92</td>
<td>$190</td>
<td>$477</td>
<td>$250</td>
<td>$98</td>
</tr>
<tr>
<td><strong>Savings</strong></td>
<td>$1,670</td>
<td>$1,393</td>
<td>$-5</td>
<td>$65</td>
<td>$35</td>
<td>$0</td>
<td>$182</td>
</tr>
</tbody>
</table>

*Important Note: These are initial estimates only, and results may vary. If the owner has not already done so, we strongly recommend that they retain a professional energy auditor to develop a detailed work scope and budget for improving the home. We also recommend the Home Performance with ENERGY STAR program when considering home improvements.*

Screen shot from Lawrence Berkeley Labs Home Energy Saver model
### EFFICIENCY CASE STUDY #2:
Hypothetical home in Essex

<table>
<thead>
<tr>
<th>INITIAL CONDITION</th>
<th>RECOMMENDED UPGRADES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Built 1990</td>
<td>Install CFLs in high-use fixtures</td>
</tr>
<tr>
<td>2 stories, 2,400 square feet</td>
<td>Programmable thermostat</td>
</tr>
<tr>
<td>Oil boiler and water heater installed 2007</td>
<td>Add R-25 floor insulation; upgrade attic insulation to R-49</td>
</tr>
<tr>
<td>Double pane windows, insulated walls, R-27 insulation in attic</td>
<td>Air sealing for 25% air leakage reduction</td>
</tr>
<tr>
<td>Married couple with one child</td>
<td>When replacing clothes washer and oil water heater, choose Energy Star models (cost is incremental cost of Energy Star only)</td>
</tr>
<tr>
<td></td>
<td>When replacing refrigerator, choose 15% better than Energy Star (cost is incremental cost only)</td>
</tr>
</tbody>
</table>

Source: Lawrence Berkeley National Labs, Home Energy Saver model
## Efficiency Case Study #2:
hypothetical home in Essex

<table>
<thead>
<tr>
<th>TOTAL COST OF RETROFITS</th>
<th>$4,821</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual energy savings</td>
<td>$964</td>
</tr>
<tr>
<td>Payback time</td>
<td>5</td>
</tr>
<tr>
<td>ROI</td>
<td>20%</td>
</tr>
<tr>
<td>Avoided emissions / year</td>
<td>7,453 lbs CO&lt;sub&gt;2&lt;/sub&gt;</td>
</tr>
<tr>
<td>Fuel oil savings / year</td>
<td>246 gallons</td>
</tr>
<tr>
<td>Electricity savings / year</td>
<td>1,388 kWh</td>
</tr>
<tr>
<td>Estimated cost of upgrades</td>
<td>$4,821</td>
</tr>
</tbody>
</table>

Source: Lawrence Berkeley National Labs Home Energy Saver model.
Average of cost range used for all improvements.
EFFICIENCY CASE STUDY #2:
hypothetical home in Essex

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Heating</th>
<th>Cooling</th>
<th>Hot Water</th>
<th>Large Appliances</th>
<th>Small Appliances</th>
<th>Lighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Home</td>
<td>$3,619</td>
<td>$2,235</td>
<td>$87</td>
<td>$255</td>
<td>$512</td>
<td>$250</td>
<td>$280</td>
</tr>
<tr>
<td>With Upgrades</td>
<td>$2,655</td>
<td>$1,535</td>
<td>$105</td>
<td>$190</td>
<td>$477</td>
<td>$250</td>
<td>$98</td>
</tr>
<tr>
<td>Savings</td>
<td>$964</td>
<td>$700</td>
<td>$-18</td>
<td>$65</td>
<td>$35</td>
<td>$0</td>
<td>$182</td>
</tr>
</tbody>
</table>

Important Note: These are initial estimates only, and results may vary. If the owner has not already done so, we strongly recommend that they retain a professional energy auditor to develop a detailed work scope and budget for improving the home. We also recommend the Home Performance with ENERGY STAR program when considering home improvements.
Typical conversion cost of ~ $7,500

Household savings of approximately $1,200 / YEAR

CT DEEP 10-year plan to convert 265,000 customers to gas would save:

- **5.5 MILLION** barrels of oil per year
- **1 MILLION** tons of greenhouse gases per year

CONNECTICUT IS SEEN AS A STRONG PERFORMER in energy efficiency

- ACEEE scorecard ranks Connecticut 8th in the nation on overall energy efficiency performance

- SOME ROOM FOR IMPROVEMENT, PER ACEEE:
  - CT scored 12 out of a possible 20 points for “Utility and Public Benefits Fund Efficiency Programs and Policies”
  - Scored 5.5 out of a possible 7 points for “Building Energy Code”
RESIDENTIAL EFFICIENCY PROGRAMMING IN CT – Connecticut Energy Efficiency Fund

- **HOME ENERGY SOLUTIONS PROGRAM AND LOW-INTEREST FINANCING**

  - **“Core Services”** – contractor performs energy assessment and direct installation of basic efficiency measures in residences (air sealing, CFL install, low-flow showerheads and aerators); incentives offered for further upgrades. Fee is charged; waived for income-qualifying customers.

  - **“Home Performance”** – assistance with and rebates for deeper whole-house retrofits or major upgrades. Low-cost financing available through Connecticut Housing Investment Fund (CHIF); rates of 2.99% – 4.99% (0% for insulation measures)

- **RETAIL DISCOUNTS ON EFFICIENT PRODUCTS**

- **MULTI FAMILY HOUSING INITIATIVE**

- **RESIDENTIAL NEW CONSTRUCTION PROGRAM**

- **CONNECTICUT EFFICIENT HEALTHY HOMES INITIATIVE FOR LOWER-INCOME HOUSEHOLDS**
HOME ENERGY SOLUTIONS (HES) PROGRAM: 
Nexant formal evaluation of 2008 program results

- 9,107 “core” participants: gross measured energy savings of 10,679,399 kWh and 42,614 MMBtu
- 1,182 “home performance” participants: calculated gross energy savings of 415,238 kWh and 1,526 MMBtu
- After adjusting for energy savings observed in the control group, savings directly attributable to the HES program are about 55-57% of unadjusted savings:
  - 6,255,749 kWh for electricity
  - 21,767 MMBtu for gas

COST PER PARTICIPANT VARIES WITH HOME HEATING FUEL SOURCE BUT AVERAGES APPROXIMATELY $750

(Connecticut Power & Light data for 2011)

UNADJUSTED HES PARTICIPANT SAVINGS

<table>
<thead>
<tr>
<th>Heating Fuel</th>
<th>Baseline Year 2007</th>
<th>Post-Retrofit Year 2009</th>
<th>% Savings (kWh)</th>
<th>% Savings (MMBtu)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Energy Use (kWh)</td>
<td>Gas Use (MMBtu)</td>
<td>Energy Use (kWh)</td>
<td>Gas Use (MMBtu)</td>
</tr>
<tr>
<td>Gas</td>
<td>8,140</td>
<td>84.4</td>
<td>7,285</td>
<td>78.7</td>
</tr>
<tr>
<td>Electric</td>
<td>15,929</td>
<td></td>
<td>14,004</td>
<td></td>
</tr>
<tr>
<td>Oil &amp; Other</td>
<td>14,088</td>
<td></td>
<td>12,843</td>
<td></td>
</tr>
</tbody>
</table>

# HOME ENERGY SOLUTIONS (HES):
2011 savings estimates for Connecticut Power & Light

## HES SINGLE FAMILY CORE SERVICES

<table>
<thead>
<tr>
<th>HEATING FUEL TYPE</th>
<th>PARTICIPANTS</th>
<th>AVERAGE HEATED SURFACE FT²</th>
<th>AVERAGE COST /PARTICIPANT</th>
<th>ANN KWH SAVINGS /PARTICIPANT</th>
<th>ANN CCF SAVINGS /PARTICIPANT</th>
<th>ANN OIL SAVINGS /PARTICIPANT</th>
<th>ANN PROP SAVINGS /PARTICIPANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>1,584</td>
<td>1,845.92</td>
<td>$641.13</td>
<td>1,885</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Gas</td>
<td>3,140</td>
<td>2,166.25</td>
<td>$760.33</td>
<td>665</td>
<td>84</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Oil</td>
<td>9,528</td>
<td>2,513.27</td>
<td>$812.40</td>
<td>764</td>
<td>0</td>
<td>63</td>
<td>0</td>
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<tr>
<td>Propane</td>
<td>545</td>
<td>2,686.51</td>
<td>$795.70</td>
<td>825</td>
<td>0</td>
<td>0</td>
<td>87</td>
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</tbody>
</table>

## HES INCOME-ELIGIBLE SINGLE FAMILY CORE SERVICES

<table>
<thead>
<tr>
<th>HEATING FUEL TYPE</th>
<th>PARTICIPANTS</th>
<th>AVERAGE COST /PARTICIPANT</th>
<th>ANN KWH SAVINGS /PARTICIPANT</th>
<th>ANN CCF SAVINGS /PARTICIPANT</th>
<th>ANN OIL SAVINGS /PARTICIPANT</th>
<th>ANN PROP SAVINGS /PARTICIPANT</th>
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<tbody>
<tr>
<td>Electricity</td>
<td>4,597</td>
<td>$121.50</td>
<td>703</td>
<td>0</td>
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<td>3,495</td>
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<td>1,202</td>
<td>65</td>
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<tr>
<td>Oil</td>
<td>6,358</td>
<td>$231.36</td>
<td>836</td>
<td>0</td>
<td>32</td>
<td>0</td>
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<tr>
<td>Propane</td>
<td>121</td>
<td>$320.13</td>
<td>821</td>
<td>0</td>
<td>0</td>
<td>68</td>
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</tbody>
</table>
MANY NEW ENGLAND HOUSEHOLDS HAVE NOT taken even basic efficiency measures

- 48% of households say their home is “too drafty” at least some of the time in winter
- 54% of households have not installed weatherstripping
- 21% of households report that their home is poorly insulated
- Only 37% of households have a programmable thermostat
- Only 5% of households have had an energy audit
- 26% of households rely on heating equipment that is 10 or more years old

<table>
<thead>
<tr>
<th>APPLIANCE</th>
<th>HOUSEHOLDS WITH ENERGY STAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refrigerator</td>
<td>41%</td>
</tr>
<tr>
<td>Dishwasher</td>
<td>57%</td>
</tr>
<tr>
<td>Clothes washer</td>
<td>41%</td>
</tr>
</tbody>
</table>

Source: Analysis of 2009 Residential Energy Consumption data for CT, RI, NH, VT and ME
Proposed 2012 residential efficiency programs base budget of $30.6 million

“Increased savings scenario” would roughly double budgets and pursue goal of weatherizing 80% of CT homes by 2030 (roughly 58,000 homes per year)

Connecticut has been trending in a positive direction, but still must almost double its highest annual number of participants to achieve its stated goals.

### Combined Electric Companies - Customer Program Participation

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Home Energy</td>
<td>13,827</td>
<td>9,190</td>
<td>13,825</td>
<td>16,046</td>
<td>29,642</td>
<td>82,530</td>
</tr>
<tr>
<td>Solutions Participants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: 2012 Electric and Natural Gas Conservation and Load Management Plan
POTENTIAL IMPACTS OF ENERGY EFFICIENCY INVESTMENT: Environmental Benefits

- The average 2008 HES “core” participant saved **855 KWH** of electricity and **5.7 MMBTU** of gas (not adjusting for control group savings)

- At average carbon intensity of grid for CT Power & Light, this translates into annual savings of **1,376 LBS CO₂** per customer

- Signing up **58,000** additional households for HES could therefore save ~**79.8 MILLION LBS CO₂**

- LBL Home Energy Saver model examples suggest that deeper retrofits could yield 2x or more this level of savings per household, at least for the hypothetical homes studied
Environment Northeast estimates that making all cost-effective investments in efficiency in CT would save consumers over $400 million in energy costs per year.

(Limited) utility revenue decoupling for both electricity and natural gas

State appliance efficiency standards

Energy Building codes meeting 2009 IECC standards

Sales tax exemption for energy efficiency products

Participant in the Regional Greenhouse Gas Initiative (RGGI) – has funded $34.6MM through 2010 in efficiency and renewables investments
39 BARRIERS TO SCALING RESIDENTIAL ENERGY EFFICIENCY IMPROVEMENTS
“The bad news is that there is limited program experience with reliably motivating large numbers of Americans to invest in comprehensive home energy improvements, especially if they are being asked to pay for a majority of the improvement costs. Thus far programs have not succeeded in delivering these investments at a scale commensurate with either a) the energy and climate challenges, or b) the potential for savings in the residential sector that has been touted for decades.”

FULLER ET. AL. (2010). “DRIVING DEMAND FOR HOME ENERGY IMPROVEMENTS.” LAWRENCE BERKELEY NATIONAL LABORATORY.
BARRIERS TO SCALE UP RESIDENTIAL ENERGY EFFICIENCY

DISPERSED AND DIVERSE AUDIENCES

LACK OF KNOWLEDGE OF BUILDING PERFORMANCE & ENERGY SAVINGS POTENTIAL

OBTUSE LANGUAGE AROUND ENERGY EFFICIENCY THAT FAILS TO CONNECT TO CONSUMERS

UP FRONT COSTS

INABILITY TO CAPTURE THE VALUE OF EFFICIENCY IMPROVEMENTS UPON RESALE

TRANSACTIONS COSTS

COMPLICATED, TIME CONSUMING PROGRAM PROCESSES

PERFORMANCE RISK

CONTRACT SUPPLY AND SKILLSETS

SPLIT INCENTIVES
There is no one large decision maker to which we can “sell” residential energy efficiency – instead we are dealing with millions of property owners.

Nor do property owners share similar demographics, incomes or attitudes – they represent the full gamut of society.

One size does not fit all for marketing and program design.

**EXAMPLE:** Senior citizens will have very different concerns about and motivations for energy efficiency retrofits than a double-income, no-kids professional couple or a low-income Latino family. Despite this fact, most energy efficiency programs broadcast generalized, mass-marketing messages (such as utility inserts) that do not reflect the particular interests or concerns of a target audience.
There were 923,990 homeowner households and 434,819 renter households in Connecticut in 2010. Of homeowner households, 29% did not have a mortgage.

Source: US Census, 2010 American Community Survey
Owners and landlords are unlikely to have any comparative sense of the efficiency of their buildings relative to others.

They are also unlikely to know where the greatest opportunities for efficiency may lie.

Even after the fact, the energy savings from most improvements must be estimated or modeled rather than directly observed.

**EXAMPLE:** Most homeowners are unaware of the potential energy savings from simple measures such as air sealing, and tend instead to think about more visible measures such as replacing windows or even renewables like solar.
LANGUAGE AROUND HOME ENERGY EFFICIENCY IS AT BEST OBTUSE, AND SOMETIMES OFF-PUTTING

- Who wants a home energy “AUDIT”? 
- What is a “RETROFIT”? 
- What is a “HERS RATING” or “AIR CHANGE PER HOUR”? 
- Efficiency programs may not adequately connect to the motivations for improvements from the customer’s perspective:
  - Money they are currently losing due to energy loss
  - Comfort
  - Health or safety benefits
  - Becoming more self-reliant and reducing their energy dependence
  - Maintaining your most important asset (your home)
  - Social norms (Are your neighbors doing it?)
  - Supporting the community
Owners may have insufficient cash and be unable to borrow to make improvements such as adding insulation or replacing HVAC systems.

Barriers are likely greatest for low-income households and landlords of small rental properties.

Unsubsidized, unsecured financing for energy efficiency measures tends to be high cost and short term, leading to negative net impact on borrower cash flow (debt service is greater than energy savings).

**EXAMPLE:** Homeowners who already have high debt ratios, or whose homes have declined in value, can’t borrow a home equity line of credit for energy improvements even if the energy savings from the improvements will be greater than the debt service on the new loan.
ABILITY TO CAPTURE THE VALUE OF ENERGY-EFFICIENCY IMPROVEMENTS UPON RESALE

- Homebuyers receive information on utility costs but no information on the energy performance of the home relative to other homes of the same size.
- Neither home nor multifamily appraisals provide a detailed evaluation of energy costs.
- The energy efficiency of a home is usually not taken into consideration when underwriting a mortgage loan.

SUBSTANTIAL WORK AND “HASSLE” FOR THE OWNER TO:

- Arrange for an energy audit
- Interpret results
- Select equipment and materials (e.g. furnaces, insulation types, windows)
- Select contractors
- Evaluate the work performed
- Compile paperwork and apply for utility rebates, if applicable

RAISES THE ACTUAL COST FOR THE OWNER above the pure labor and materials costs of the project
Retrofit programs often involve complicated processes with the intention of ensuring that customer incentives are well spent.

**Example:** (from Fuller et al, 2010)

Each step in the process represents potential delay and an opportunity for the customer to drop out.

- Customer receives utility bill insert
- Goes online to apply for assessment.
- Four weeks later a program representative schedules the appointment, requiring the customer to take a day off work
- Five weeks after the assessment an assessment report arrives in the mail and is nearly unintelligible
- Customer locates 3 contractors and solicits bids. Contractors may say they need to re-do the energy assessment (more scheduling).
- Customer gets cost estimate from contractor and must line up financing, schedule the contractor’s visit, and take off work to oversee the work
- Efficiency program may conduct a quality assurance check, which customer has to manage, and then customer must manage any call-backs

“IT IS NOW TEN MONTHS LATER, THE HOMEOWNER STILL DOES NOT UNDERSTAND” the full range of benefits from the improvements, has taken multiple days off work, and has paid $7,000 – what does she tell her neighbors about this experience?”
Currently, even many programs cited as “best practices” have complex processes.
PERFORMANCE RISK

- RISK THAT equipment may not function as well as advertised or that adverse effects may result from making the improvement (e.g. poor light quality or lower-than-expected product lifetime from CFLs; air quality issues from over-tightening the home’s envelope)

- RISK THAT energy-efficiency gains will be lower than expected

- “WIDESPREAD MISTRUST of contractors only makes the situation worse” (ACEEE)

CONTRACTOR SUPPLY AND SKILLSETS

- LIMITED NUMBER OF CONTRACTORS who are currently well-versed in providing energy audits and installing retrofits

- CONTRACTORS ARE RELUCTANT to invest in new skills, equipment and hiring when they are uncertain if market demand exists

- CONTRACTORS MAY NOT have appropriate information to effectively sell efficiency improvements to homeowners

- ABOUT 2/3 OF CONTRACTORS in the US are specialists and therefore have difficulty generating whole-house recommendations for efficiency

SPLIT INCENTIVES (RENTAL PROPERTIES ONLY)

- 32% of housing units in CT are renter occupied
- If renter pays utilities, landlords have little incentive to invest in building shell or HVAC improvements
- If landlord pays utilities, renters have little incentive to conserve
People who “TAKE THE FIRST STEP” and make small energy efficiency improvements may actually be LESS LIKELY to make further investments, believing they have done enough to address the issue.

This “SINGLE ACTION BIAS” is a potential barrier to deep retrofits, particularly for programs that focus first on helping customers take immediate small steps (such as replacing light bulbs).

Behavioral research offers differing perspectives on this point, with other researchers suggesting that big commitments are MORE LIKELY after small commitments.

Source: Fuller et. al. (2010), “Driving Demand for Home Energy Improvements”
BECAUSE OF THESE BARRIERS, MANY CONSUMERS do not implement efficiency measures even when the financial payback is very high.

- Households report that they would not install efficient lighting if it does not pay back within 2 YEARS, translating to a discount rate of 40% (US DOE Lighting Market Characterization Study).

- Air sealing can payback in less than 5 YEARS (sometimes in 1 year), but 54% of households in New England have not installed weatherstripping (2009 DOE RECS data for CT, RI, ME, NH, VT).

- Typical ROI on installing a programmable thermostat is OVER 100% (<1 year payback), but only 37% of households in New England have one (2009 DOE RECS data for CT, RI, ME, NH, VT).

- Simply presenting a consumer with an attractive economic proposition is not enough to induce them to take action.
Model Approaches to Scaling Residential Efficiency
It is not enough to provide information and financing; programs must **sell something people want** – high home energy use is not currently a pressing issue for many people; **find a more appealing draw** such as health, comfort, energy security, competition, or social norms / community engagement.

A blanket marketing campaign to reach everyone will likely be ineffective and expensive, especially at the start. **Target early adopters.** Tailor messages to this audience. **Segment the market** by demographics, personal values, interest in hot issues such as health concerns, or likelihood of getting savings.

**Partner with trusted messengers** – **have a local face**, with buy-in from community leaders and local organizations.

Source: Merriam Fuller et. al., “Driving Demand for Home Energy Improvements”
SUMMARY OF LESSONS LEARNED IN MARKETING
“Driving Demand” Report

- **LANGUAGE IS POWERFUL** – avoid words like “RETOFIT” and “AUDIT.” Use specific, vivid examples, personalize material, frame statements in terms of loss rather than gain, and induce a public commitment from homeowners.

- **CONTRACTORS ARE PROGRAM AMBASSADORS** – the public face and primary sales force. WORK CLOSELY WITH CONTRACTORS. Avoid poor first impressions or shoddy work by contractors which can reflect poorly on the program.

- **ONE TOUCH IS NOT ENOUGH** – The majority of people need to be exposed to a product message at least three times before they buy into it. Need a LAYERED MARKETING AND OUTREACH APPROACH that achieves multiple touches on potential participants.

Source: Merrian Fuller et. al., “Driving Demand for Home Energy Improvements”
SUMMARY OF LESSONS LEARNED IN PROGRAM DESIGN

“Driving Demand” Report

- **MAKE IT EASY, MAKE IT FAST**: offer seamless, streamlined services that give people fewer reasons to decide against home improvements

- **CONTRACTORS SHOULD BE FULL PARTNERS** – it is imperative to design a program that contractors want to sell, and convince them that the opportunity is worth the time and money to get the appropriate training and equipment

- **REBATES, FINANCING AND OTHER INCENTIVES DO MATTER.** They can be extremely important to get a program off the ground.

Source: Merrian Fuller et. al., “Driving Demand for Home Energy Improvements”
SUMMARY OF LESSONS LEARNED IN PROGRAM DESIGN
“Driving Demand” Report

- **A WELL-QUALIFIED WORKFORCE AND TRUSTWORTHY WORK ARE VITAL**—solid performance builds trust with customers by reliably producing energy savings as well as the health, safety, and comfort benefits of home energy improvements.

- **PERSISTENCE AND CONSISTENCY ARE VALUABLE**—consistent programs that last for more than a year or two can create a more robust market for home energy improvements; ephemeral programs can undermine trust.

- **KNOW SUCCESS AND FAILURE BY MEASURING IT, AND EXPERIMENT TO FIGURE OUT WHAT WORKS.** Designing for data collection and evaluation at the start allows for mid-stream adjustments, better selection among strategies, and knowing success when it arrives. It is important to pilot strategies before launching full-scale programs and to test a variety of strategies to learn what works.

Source: Merrian Fuller et. al., “Driving Demand for Home Energy Improvements”
DOE’s brief case write-ups can be accessed via:

Austin Energy: Austin, TX. Launched Home Performance with Energy Star program in 2006. Since then it has helped more than 8,800 homeowners complete energy upgrades. www.austinenergy.com

NYSERDA (New York State Energy Research and Development Authority). Better Buildings funded program has conducted more than 15,000 energy evaluations, implemented 4,720 efficiency upgrades and closed 502 loans in its first 9 months. www.nyserda.ny.gov

RePower Bainbridge: Bainbridge Island, WA. Funded by DOE Better Buildings Neighborhood Program. Conducted 1,200 home energy checkups and completed 200 upgrades in the first 4 months of operations. www.repowerbainbridge.org

EnergySmart: Boulder, CO. Funded by DOE Better Buildings Neighborhood Program. Served 2,980 residential and business participants within 6 months of program launch, completing 688 energy efficiency upgrades. www.energysmartYES.com


Rutland HEAT Squad: Rutland County, VT. In its first 6 months, completed 386 home energy evaluations with 196 upgrades completed (a 51% conversion rate). www.heatsquad.org

Clean Energy Works: Portland, OR. Within 4 months, conducted 1,222 home energy evaluations and completed 541 home energy upgrades. www.cewo.org

Efficiency Maine: statewide program. In the first 14 months of launching its DOE-funded Better Buildings program, Efficiency Maine’s customers completed 2,500 efficiency upgrades. www.efficiencymaine.com


Community Power Works (Seattle, WA). Conducted 305 home energy evaluations in the first 5 months. www.communitypowerworks.org
All of the full case studies cited below can be accessed in the full “Driving Demand” report at: [http://drivingdemand.lbl.gov/](http://drivingdemand.lbl.gov/)

- **Bonneville Power Administration: Pacific Northwest.** Over more than a decade (1980 to 1992), Bonneville Power Administration (BPA) weatherization programs completed approximately 900,000 home energy improvements in the Pacific Northwest, reaching more than half of eligible customers.

- **Energy Smackdown: Boston, MA.** Energy Smackdown pits neighborhood teams against one another in a competition to reduce greenhouse gas emissions.

- **Hood River Conservation Project: Hood River, OR.** Early 1980’s. Provided free installation of any cost-effective weatherization measures identified through an energy assessment. 85% of eligible households implemented conservation measures.

- **Residential Energy Efficiency Program: Houston, TX.** Offers free weatherization services for low income households. Reached 95% of eligible homes in one neighborhood.

- **Jasper Energy Efficiency Program: Alberta, Canada.** Reduced residential peak electricity demand by more than 20% in the early 1990’s, getting participation from 70% of households in targeted (not comprehensive) energy improvements.

- **Keystone Home Energy Loan Program: Pennsylvania.** Has made 5,500 loans over a 4-year period, focusing on customers who have already made the decisions to make an energy related investment (such as replacing equipment) and encouraging them to use a more energy efficient option.

- **Long Island Green Homes: Babylon, NY.** Has helped 250 homes from late 2008 through 2010 and achieved a 70% conversion rate of homeowners receiving energy assessments.
- **Marshfield Energy Challenge: Marshfield, MA.** Over 2 years, 1,300 homeowners received energy assessments and 90% installed at least one efficiency measure.
- **New London Resource Project: New London, WI.** 750 customers (25% of total utility customers) got energy assessments over a 3-year period.
- **NYSERDA Home Performance with ENERGY STAR: New York state.** From 2001 to 2010, upgraded 33,000 homes.
- **Take Charge Challenge: Kansas.** Led to more than 7 million kWh in annual savings across 6 towns participating in an energy use reduction competition.
- **Twin Cities One Stop Program: Minneapolis – St Paul, MN.** Home Energy Squad program has visited 1,800 homes, typically achieving 10% to 15% energy reductions in each home.
- **Vermont Community Energy Mobilization (VCEM) Project: Vermont.** Pilot volunteer program got 700 homes to participate in 5 months across 9 towns.
- **Weatherize DC: Washington, DC.** Uses outreach micro-targeting tactics, similar to political campaigns, to reach out to homeowners. The project website (weatherizeddc.org) reports helping 255 homeowners in 2010.
- **SustainableWorks: Washington State.** Had about 500 homeowners sign up for an energy assessment in its first 7 months, close to 10% of eligible homeowners in the target neighborhoods. Conversion rate of sign-ups to completed improvements has been about 56%.
METHOD

NEIGHBORWORKS OF WESTERN VERMONT (NWWVT) enlisted well-respected local citizens and organization to spread the word about home energy efficiency upgrade opportunities.

- Created “HOME EFFICIENCY ASSISTANCE TEAM” or the H.E.A.T. SQUAD to work with local organizations to conduct phone-a-thons, direct outreach, and personalized home visits to develop public interest in energy efficiency.

- Local hotline to educate homeowners about energy efficiency and to sign them up for an evaluation.

- Staff provide “energy concierge” services to help homeowner through every step of the process, including managing the contractor, interpreting evaluation results, and arranging for financing and rebates.

Source: Merrian Fuller et. al., “Driving Demand for Home Energy Improvements”
NEIGHBOR-TO-NEIGHBOR OUTREACH

- Neighbor to neighbor phone-a-thons
- Influential community members as spokespeople
- Marketing scripts geared towards target audiences
- Incentives: up to $2,500 in rebates after evaluation and installations; $75 upfront home energy check-up; low-cost financing
- Newspaper column
- User-friendly website
- Local phone hotline

RESULTS (WITHIN 6 MONTHS)

- 386 evaluations conducted
- 196 residential energy upgrades completed
- 51% conversation rate from evaluation to upgrade

DRIVING DEMAND:
Low-cost evaluations

WORKFORCE:
Expanding local contractor base

FINANCING:
Low-interest, unsecured loans for up to 10 years

CASE STUDY
RUTLAND COUNTY, VERMONT

OTHER ELEMENTS
ASSUMPTIONS

- Rutland County residents have strong relationships in their communities.
- The most trusted messengers are neighbors, rather than the government or utilities.

KEY TAKEAWAYS

- Understand who is trusted most in your community before determining the best voice for your program.
- Leverage relationships within your community and across the state to identify resources and spread the word widely.
- Adjust tactics quickly in response to stakeholder feedback.

FOOD FOR THOUGHT:
WHO ARE THE MOST TRUSTED MESSENGERS IN CONNECTICUT?
PROFILE/APPEAL:

- You are self-reliant, inventive and strong willed. You value Vermont’s working landscape and its heritage, and you embody its spirit of independence. You are concerned about the increasing cost of living – it’s the main topic of conversation among your friends and neighbors. You worry about affordability – not just for you and your family today, but also for your kids.

- You worry about tax rates, affordable healthcare, and the need for more jobs and higher wages. You like to handle certain home improvement projects yourself, so you know they are done right. You’re a proud Vermonter, and you probably still have the first dime you ever earned.

- So, why are you letting money fly up your chimney?

Outreach Campaign for H.E.A.T. Squad - 4.22.11
**KEY BENEFITS/TALKING POINTS:**

- Death, Taxes…and Home Heating Costs. YOU CAN control the latter!
- Money doesn’t grow on trees…so why are you burning it like firewood?
- You CAN’T AFFORD to lose your heat! Wasted energy is money up your chimney.
- Simple improvements can make it more AFFORDABLE to heat your home, and it will be MORE COMFORTABLE.
- A H.E.A.T. Squad Energy Check-Up is just $75 and will help show you where you are losing heat from your home.
- Just a few simple improvements will make a big difference in your budget…many you can do yourself.
- Contractors are LOCAL, pre-screened by the agency, and trustworthy. By participating, you are also *putting a neighbor to work.*
- Up to $2500 in incentives/rebates are available. Affordable financing is available for improvements.
- Many of your neighbors have already gotten the Energy Check-Up, ask them about their savings.
- You know us…NeighborWorks has been lending a helping hand to your friends and neighbors for 25 years.
SAMPLE THEMATIC COPY:

- WORRIED ABOUT THE RISING COSTS OF HEATING YOUR HOME?
  YOU’RE NOT ALONE! The good folks down the road at NeighborWorks of Western Vermont are worried, too, and they’ve been working with some of your neighbors on this very issue. They’ve come up with some ways to help you CONTROL those rising energy costs, and help you SAVE MONEY all year long.

- ALL YOU HAVE TO DO IS CALL the NeighborWorks H.E.A.T. Squad for a home energy check-up. For $75, they’ll show you what you can do to make a difference in your energy costs, and make it MORE AFFORDABLE to heat your home. You can qualify for up to $2,500 in rebates!

- TAKE THE FIRST STEP. Call the H.E.A.T. Squad today and schedule your Home Energy Check-up. Tell ‘em Rusty sent ya.
RUTLAND COUNTY OUTREACH STRATEGY FOR RURAL POPULATION

CELEBRITIES/SPOKESPERSONS:

Rusty DeWees

COMMUNITY LEADERS/TESTIMONIALS:

Town Officials, Community Volunteers, Residents participating in the program, Farmers

HOW DO WE REACH THEM:

to be disseminated primarily through a Neighbor-to-Neighbor campaign, via local community groups, town landfills, hardware stores, church suppers, game suppers, town meeting, anywhere the rural population congregates socially, civically, or otherwise.
IMPROVING OWNER INFORMATION
REDUCING TRANSACTIONS COSTS & HASSLE
MANAGING PERFORMANCE RISK
OVERCOMING SUPPLY-SIDE BARRIERS
FINANCING
• **REPOWER BAINBRIDGE:** Uses “ENERGY ADVISOR VISITS” – visual inspection of areas of energy lost, custom recommendations including low- and no-cost steps, installs CFLs and high-efficiency showerheads. Option to get an in-depth “HOME ENERGY ASSESSMENT” with an Energy Performance Score (EPS), including expected monetary and energy savings potential of recommended improvements.

• **REPOWER BAINBRIDGE:** Partnered with their utility (PSE) to distribute the OPower Home Energy Report, which shows how HOMEOWNERS’ ENERGY USE COMPARES TO 100 OF THEIR NEIGHBORS. [Note that in areas of CT not served by utility gas, such reports would be limited to electrical usage].

For a description of OPower visit [www.opower.com](http://www.opower.com)
REDUCING TRANSACTIONS COSTS

- **RUTLAND HEAT SQUAD AND CLEAN ENERGY WORKS** both use an “ENERGY ADVISOR” providing concierge-like services to help the customer understand energy assessment results, arrange for financing, select and manage the contractor, and do paperwork. **FULLER ET AL (2010) CAUTION** that contractors may not like programs that “get between the customer and the contractor.”

- Many programs provide a PRE-APPROVED LIST OF BPI-CERTIFIED CONTRACTORS including Rutland HEAT Squad, Long Island Green Homes, and New London Resource Project.

- Various: use of CUSTOMER RELATIONSHIP MANAGEMENT SOFTWARE, such as [www.snugghome.com](http://www.snugghome.com) or [www.energysavvy.com](http://www.energysavvy.com), to schedule and manage each step in the work flow including customer outreach, energy audit, financing approvals, implementation of retrofits, test-out and rebate tracking.

- **“SMALL CONCESSIONS” APPROACHES:** These approaches seek to engage people in the community with actions that are easier (such as changing a light bulb) and then, through additional program contact, encourage them to make larger changes. Both the **TWIN CITIES ONE STOP PROGRAM** and **VCEM** used home visits to provide homeowners with information, conduct an energy assessment, and make small energy improvements during the home visit with the goal of trying to convince the homeowner to make more comprehensive improvements. **FULLER ET AL (2010) CAUTION** that some research on “single action bias” shows that taking “one small step” can allay the guilt and concern of participants enough that they decide not to take further action.

- **TWIN CITIES ONE STOP PROGRAM:** Uses “ENERGY SQUADS” to deliver energy efficiency education, energy assessments, and home energy improvement services in one coordinated process.
MANAGING PERFORMANCE RISK

- **Austin Energy**: performs QUALITY INSPECTIONS ON 100% of contractor work for customers.

- **NYSERDA** and many others: requires that contractors carry certification from the BUILDING PERFORMANCE INSTITUTE (BPI).

- **Most Programs**: offer a PRE-APPROVED LIST OF CONTRACTORS to do the work.
OVERCOMING SUPPLY-SIDE BARRIERS

- **KEYSTONE HELP**: provides technical training and financial incentives for contractors to encourage them to move from single-measure replacements to more substantial upgrades.

- **REPOWER BAINBRIDGE**: Formed a Trade Ally Network among contractors and partnered with Olympic Community College to train additional energy advisors and weatherization professionals.

- **AUSTIN ENERGY**: launched a major promotional campaign during a traditionally slow time of year for their region to try to smooth out contractor workloads.

- **AUSTIN ENERGY**: has communicated a long-term commitment to supporting energy efficiency, to reduce the perceived risk for contractors of investing time and money into technical training and equipment upgrades.

- **RUTLAND HEAT SQUAD**: holds regular meetings with contractors to get feedback on plans, evaluate what is working and what is not, and understand contractor needs.
OVERCOMING SUPPLY-SIDE BARRIERS (CONTINUED)

- **Rutland Heat Squad:** Provides low-interest loans to contractors to purchase equipment and free training to get contractors Building Performance Institute (BPI) certified. Is also creating an in-house, trained labor pool of weatherization works that contractors can contract on a temporary basis to meet spikes in demand.

- **Clean Energy Works:** operates under a “High Road Agreement” establishing qualifications and requirements for contractors including provision of adequate wages, health benefits, and commitment to diversity.

- **Efficiency Maine:** provides training for contractors on customer interaction techniques and how best to sell efficiency upgrades. More than 100 contractors have participated. Trained contractors are recorded in a ZIP-code searchable database and ranked by the number of upgrades they have completed.

- **EnergyWorks:** Offers participating contractors special discounts on buildings materials
**FINANCING**

- **CLEAN ENERGY WORKS AND COMMUNITY POWER WORKS:** Both initiatives provide financing through Craft3 (formerly Enterprise Cascadia), [www.craft3.org](http://www.craft3.org) and [www.sbpac.com](http://www.sbpac.com). Financing is repaid through the utility-bill ("on-bill financing"). Rates range from 3.99% to 5.99%. A portion of loan proceeds may be used to address obstacles to proceeding with energy remodels in older homes, such as wiring replacement, asbestos and metal siding replacement.

- **NEW LONDON RESOURCE PROJECT:** Used on-utility-bill financing tailored so that energy bill savings exceeded loan payments.

- **EFFICIENCY MAINE:** Has a Property Assisted Clean Energy (PACE) program offering 4.99% over 15 years, secured by a junior property tax lien. Financing is marketed through inserts on property tax bills. > 50 loans closed in the first 4 months of the program.

- **NYSERDA: GREEN JOBS – GREEN NEW YORK** Loan program provides unsecured loans of up to $25,000, with rates as low as 3.49% and terms up to 15 years. Income eligible residents can receive a 50% direct rebate off the cost of the improvements.
FINANCING (CONTINUED)

- **BOULDER ENERGYSMART**: Micro-loans of $500 to $3,000 with a maximum 2.5% interest rate.

- **RUTLAND HEAT SQUAD**: Loans of up to $10,000 at a 10-year term and 4.99% interest, unsecured and with flexible underwriting. Offers additional rehab loans at a sliding interest rate to address obstacles to proceeding with energy remodels in older homes, such as wiring replacement and structural repairs.

- **ENERGYWORKS (PA)**: Homeowners selecting “GOLD STAR” retrofit projects (whole-house improvements guided by a comprehensive energy assessment) may receive a loan of up to $15,000 at a 0.99% fixed interest rate for 10 years.

- Note that on-bill financing may provide one avenue to tackle the “SPLIT INCENTIVES” barriers to adopting energy efficiency for residential rental properties.
APPEALING TO SOCIAL NORMS
MESSAGING STRATEGIES EMPHASIZING BENEFITS
TARGETED MARKETING AND OUTREACH
PARTNERING WITH TRUSTED MESSENGERS
CONTRACTORS AS MARKETING AGENTS
INCENTIVES

GENERAL AWARENESS-RAISING ACTIVITIES
TO CREATE MULTIPLE “TOUCHES” WITH THE CUSTOMER
Rutland Heat Squad, Jeep (Jasper), and Long Island Green Homes:
These programs all played to social norms by using program participants as ambassadors and/or highlighting peer experiences in their marketing. FULLER ET. AL. (2010) REPORT on experimental research finding that energy savings behaviors are more strongly correlated with the belief that other people are conserving energy than with any other motivators – even though people were not likely to cite social norms as an important influence in their decision.

Energy Smackdown uses a fun ‘competition’ with the idea that bringing people together to play a game is more likely to encourage meaningful action than simply making energy efficiency information available. The Kansas Take Charge Challenge is another example. FULLER ET. AL (2010) CAUTION that competitions may be a good first step but “it is important to consider how to move people beyond minor improvements and changes in habit to more comprehensive energy improvements.”

Several programs, including New Kensington Community Development Corporation in Philadelphia and SustainableWorks in Washington State, have created Volunteer Block Captain Programs to conduct door-to-door canvassing and hold house meetings to encourage their neighbors to save energy. New Kensington Community Development Corporation’s program also asks residents to make a “Green Pledge” including pledging to save energy.
OTHER MESSAGING STRATEGIES

- **GREENHOMES AMERICA** (a national contractor network) emphasizes, “save money and live more comfortably,” as well as “breathe healthier air indoors,” “help the environment” and “achieve energy independence.” See [www.greenhomesamerica.com](http://www.greenhomesamerica.com)
OTHER MESSAGING STRATEGIES

- **Marshfield Energy Challenge** used a message “YOU LIVE HERE, THIS IS THE BIGGEST INVESTMENT YOU HAVE, AND WE WANT TO HELP IMPROVE THE RETURN ON YOUR INVESTMENT.”

  It also ensured messaging consistency by training and distributing laminated “answer cards” to all advocates who were promoting the program.

- **Take Charge Challenge** focused on monetary savings, energy savings, and competition.

- **Weatherize DC** focused on energy cost savings, benefits to the environment, and local job creation due to focus group results, but learned that increased comfort was a major motivator in practice.
Both CALIFORNIA and OREGON have conducted market segmentation analyses of residents identifying segments that are most likely to adopt efficiency practices and the marketing messages that may be most appealing for them. Chart below is excerpted from Fuller et al (2010).

<table>
<thead>
<tr>
<th>Segments</th>
<th>The Leading Achiever</th>
<th>The Striving Believer</th>
<th>The Practical Spender</th>
<th>The Thrifty Conserver</th>
<th>The Disconnected</th>
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<td>24%</td>
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<td>Low</td>
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<tr>
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<td>Low</td>
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<td>Low</td>
</tr>
<tr>
<td>Concern for Convenience &amp; Comfort</td>
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<td>Higher</td>
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<td>Higher</td>
</tr>
<tr>
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<td>25–54</td>
<td>55+</td>
<td>25–34 &amp; 65+</td>
<td>18–34</td>
</tr>
<tr>
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<td>$50k–$100k</td>
<td>$30k–$75k</td>
<td>$&lt;50k</td>
<td>$&lt;50k</td>
</tr>
<tr>
<td>Owner/Renter</td>
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<td>Renter</td>
<td>Owner</td>
<td>Renter</td>
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<td>61%</td>
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<td>10%</td>
<td>11%</td>
</tr>
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<td>Other</td>
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<td>2%</td>
<td>1%</td>
</tr>
</tbody>
</table>

**Figure 4.** California Market Segmentation for Smart Energy Practices (Chart adapted from Fogel 2010; data from Opinion Dynamics 2009b)
TARGETED MARKETING AND OUTREACH (CONTINUED)

- **RUTLAND HEAT SQUAD**: Makes targeted presentations to community groups, emphasizing benefits likely to be important to that group (for example, talking about home comfort and help in ensuring properly done contractor work when meeting with seniors groups).

- **BETTERBUILDINGS FOR MICHIGAN**: Conducts neighborhood “sweeps” targeting one 420-home neighborhood at a time with a blitz of outreach, contractor scheduling, and short-term efficiency promotions. Each “sweep” is structured as a mini-experiment to test which variations of program offerings most effectively persuade consumers to upgrade their homes. Customer feedback is journaled during each sweep to identify refinements that are needed in messaging and approach.

- **WEATHERIZEDC** targeted homes using the information on the date of construction of the home (to find homes that were more likely to need efficiency improvements) and household income (to find people who could afford to do the work, since the program did not have access to financing or incentives).

- **LONG ISLAND GREEN HOMES** pre-screens applicants for energy usage patterns and conditions that suggest they stand to benefit significantly from energy improvements.

- As discussed in the “SOCIAL NORMS” section, many programs target “early adopters” and then seek to use these early adopters as messengers to get other households to make improvements.
PARTNER WITH TRUSTED MESSENGERS

- **LONG ISLAND GREEN HOMES**: Is training local opinion leaders, who were among the first participants in the program, to make community presentations. “SUCCESS IS WHEN PARTICIPANTS BECOME PROSELYTIZERS” – SAMMY CHU, PROGRAM DIRECTOR

- An evaluation of the **RCS PROGRAM** in Minnesota found that efficiency programs run by community groups were more effective than those run by private companies or utilities. Another study from the mid-1980s found that “the most successful program were operated by trusted local organizations and marketed by word-of-mouth and other aggressive, direct methods.” (Stern 1986 and Stern 1985 in Fuller et al 2010)

- **COMMUNITY POWER WORKS (SEATTLE)**: works with 40 partner organizations including community-based organizations with expertise in 15 languages. Offers $50 per customer referred by local nonprofit organizations who implement energy efficiency improvements.

- **BETTERBUILDINGS FOR MICHIGAN AND RUTLAND HEAT SQUAD**: Both programs have solicited “early adopters” to act as energy efficiency champions helping to market the program directly to their peers.

- **RUTLAND HEAT SQUAD**: following the principles of social-norm-based marketing, the HEAT Squad holds community phone-a-thons and personalized home visits where neighbors contact their neighbors to encourage participation in the program.

- **VCEM**: used community volunteers to install initial efficiency measures and have a “kitchen table” conversation with the homeowner to discuss the benefits of making additional home energy improvements.
CONTRACTORS AS MARKETING AGENTS

- **NYSERDA**: operates a one-day sales and marketing training program for contractors. Does collaborative marketing with contractors through the Home Performance with Energy Star program.

- **Keystone Help** targets “REACTIVE CUSTOMERS” (e.g. customers whose furnace breaks in the winter), using contractors as its primary marketing resource.
Multiple programs offer (or offered) **free energy assessments**, including Clean Energy Works, Bonneville Power, Energy Smackdown, Hood River, Houston REEP, and Marshfield Energy Challenge. Others offer deep discounts; for example Vermont HEAT Squad was offering the energy assessment for $50 and New London Resource Project charged $35. (A typical assessment costs in the neighborhood of $500 in most places).

Note that other programs, such as Long Island Green Homes, **charge more for the energy assessment** ($250 in LIGH’s case) to separate “serious candidates from tire-kickers.”

Some programs, including Hood River Conservation Project and Houston REEP, provided **efficiency measures for free**. Bonneville Power came close to that as well, offering a **free energy assessment plus rebates of up to 85% of costs**.

**MARSHFIELD ENERGY CHALLENGE:** free CFLs, a $150 refrigerator rebate, no-cost air sealing and insulation, a free HVAC equipment tune-up, and installation of solar PV systems at 1/3 of the market value.

**TWIN CITIES ONE STOP** charged customers **only $30 for a visit** valued at $400.
- **RePower Bainbridge**: Instant rebate of $350 for homeowners who complete a home energy assessment with an Energy Performance Score. Additional rebates or rewards up to $450 if customers implement recommendations.

- **EnergySmart Boulder**: Reduces price of an energy evaluation from $555 to $120 for homeowners. Installation of free, instant energy savers including CFLs, low-flow showerheads, and pipe insulation.

- **Austin Energy**: Launched a “best offer ever” where the customer could get both a rebate and low cost financing, for a combined value of approximately $2,300 per household. Sped up payment of rebates from a 6 week to a 2 week timeframe.

- **Efficiency Maine**: Put a 6-month time window for residents to receive a large rebate ($3,000 for a 50% increase in energy efficiency), using the deadline to try to motivate homeowners to act.

- **Community Power Works**: (Seattle) Provides a rebate based on carbon emissions reductions to households: $10 per ton, with an average expected incentive of $700 per home.
Many programs combine general awareness-raising activities with targeted outreach, thus exposing potential customers to multiple “TOUCHES.”

**MARSHFIELD ENERGY CHALLENGE** provided an energy lecture series, breakfast meetings, and activities at schools, concerts, fairs, and on election day.

**REPOWER BAINBRIDGE**: Installed “energy dashboards” that show real-time energy use around the island to raise resident awareness. Also created “Electric Avenue,” a street painting displaying the collective energy savings of two neighborhoods on the island.

**BOULDER ENERGYSMART**: Teach for Sustainability campaign reaches schoolchildren through characters like Kilowatt Kid, Count Plugula, and Dr. Drafty (www.teachforsustainability.com). Runs a contest – the Kilowatt Kidz EnergySmart Channge – to reduce energy use by 5% at home.

**BEDFORD, NY** (part of the NYSERDA program) has a web portal that makes it easy to sign up and that emphasizes neighbor-to-neighbor testimonials. [http://energizebedford.org/](http://energizebedford.org/)

**NEW LONDON RESOURCE PROJECT** hosted energy fairs, and gave “pass it on” cards for program participants to give to friends or neighbors.

**HOUSTON REEP** organized block parties and placed advertisements in newspapers, radio and TV as well as on the transit system.