Deep Energy Retrofit Incentive Programs, The National Grid Pilot

Residential Building Energy Efficiency Meeting
Denver, July 21, 2010

Ken Neuhauser
Partnership for a Pilot

Partnership for a Demonstration, Research and Market Development Pilot:

National Grid
- Program implementation and administration
- Financial resources
- Marketing

Building Science Corporation
- DER experience
- Expertise in energy performance and moisture management
- Measure verification
Pilot Program Overview

- Pilot program for existing MA and RI homes
- Pilot launched June 2009, renewed for 2010 - 2012
  - Initially 1-3 family owner-occupied, comprehensive DER
  - Expanded to include multifamily and “staged” retrofits
- Pilot Outline:
  - DER Projects
  - Workshops
  - Publicity events
  - Evaluation
Pilot Program Overview (continued)

- Ambitions performance goal: 50% overall energy savings
- Significant financial incentives
- Long application process
- BSC serving as Technical Team
  - Evaluation and approval of applications
  - Technical support to project teams
  - Inspection, verification and testing
  - Support program design and administration
We Mean *Deep*!

**Desired Project Characteristics:**

- **5-10-20-40-60**
  - R5 windows
  - R10 slab
  - R20 below-grade wall
  - R40 above-grade walls
  - R60 roof/attic

- Air tightness: 0.1 cfm50 / s.f. enclosure

- Mechanical Ventilation
We Mean Deep!

Performance safeguard requirements:

- Sealed combustion or direct vent appliances
  - Includes heating, water heating, fireplaces, woodstoves...
  - Excludes ovens/ranges, condensing dryers

- Project must resolve known issues
  - Wet basement, asbestos, lead, radon, wood rot...
  - Possible 3rd party inspection to sign-off

- Prove adequate financing
Program Scale

Small number of projects with large number of issues, situations, conditions:

- 2010 Program Goals – 21 units
  - Single family
  - Multifamily
  - Some partial DER

- 3-year program budget approved
  - Massachusetts: ~44 units
  - Rhode Island: ~4 units
Program Scale

- Currently active: 7 projects, representing 10 units
  - 4 projects / 6 units in construction
  - 3 projects / 4 units in application process
  - 1 project complete
- Many prospective participants
Program Incentives

Two tiers of incentives:

- **Level I**: 75% of net incremental measure costs up to a $42K
  - Comprehensive (6-sided) enclosure retrofit
  - Meet or approach Desired Project Characteristics

- **Level II**: additional reimbursement incentive up to $10K
  - Passive House, Thousand Homes Challenge, Net Zero Energy
## Program Incentives

### Maximum Level I Incentives per Building

<table>
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<tr>
<th>Dwelling Units in Facility</th>
<th>Conditioned Floor Area per Unit</th>
<th>Maximum Project Incentive</th>
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<th>Dwelling Units in Facility</th>
<th>Maximum Project Incentive</th>
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<tr>
<td>=&gt;10</td>
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</table>
Program Incentives

- Incentive applicable to net incremental cost
  - Project documents “allowable” and “renovation” costs

Renovation costs:
- New siding, trim and installation
Program Incentives

- Incentive applicable to net incremental cost
  - Project documents “allowable” and “renovation” costs

Example: insulation over roof sheathing

Allowable costs:
- Insulation and installation
- Nail base

Renovation costs:
- Stripping roof
- Re-roofing
Program Incentives

- Incentive applicable to net incremental cost
- Specific limits for mechanical systems 50% of cost up to heating - $4K, cooling - $1K
- Windows reimbursed 100% after $15 / s.f. deductible
- Leveraging certain additional incentives permitted:
  - Tax credits
  - Utility lighting, appliance and equipment incentives
  - Low interest energy efficiency loans
Pilot Project Process

Process designed to protect stakeholder interests:

- Rate payers
- Participating customers
- Contractor
- Program sponsor
- Building industry
Pilot Project Process

Process for Participating Pilot Projects:

- Qualification of contractors and consultants
- Screening
- Application Phase
  - Two(+) stage application
  - Data collection in application
  - Project design guidance, technical support
  - Detailed customer agreement
Pilot Project Process

Process for Participating Pilot Projects (continued):

- Construction support and measure verification
- Incentive payments
Process for Participating Pilot Projects (continued):

- Construction support and measure verification
- Incentive payments
- Post construction monitoring and publicity
Staged or “Partial” DER

- Reality: Opportunities for comprehensive retrofit is rare
- “Staged” DER accommodated in pilot:
  - Incentives prorated
  - Project must save at least 50% of full DER savings
  - Measures and sequence demonstrate sound building science
  - Plan includes details that facilitate completion of full DER at a later date
Pilot Project Examples

Variety of Approaches!

- Variety of housing types
- Interior/exterior insulation
- Conditioned/unconditioned basement
- Conditioned/unconditioned attic
- Window replacement/retrofit
- Forced air/hydronic heating
- Mix of fuels
Pilot Project Examples

18th Century Cape
Small 1950s Cottage Home
Philadelphia (2 family) Gambrel ~1910

1980s Contemporary
1905 Bungalow
1960s Garrison Colonial
Pilot Project Example – 18c Cape

Pre-Retrofit Conditions:
- Heat by woodstove only
- Water flowing through basement
- Poor/absent flashing details
- >10,000 cfm 50!

Standing water in basement
Pilot Project Example – 18c Cape

- Extensive basement water remediation
  - Trenching with pipes to daylight
  - Yards and yards of gravel
- Extensive drainage plane remediation

Siding removed to remediate flashing

Basement gravel fill and chimney demolition

Basement prepared for slab
Pilot Project Example – 18c Cape

- New stud wall constructed to interior
- Closed-cell spray foam

*Siding removed to remediate flashing*  
*Stud wall constructed to interior*
Pilot Project Example – 18c Cape

Post-Retrofit:

- High R enclosure
- 96 AFUE variable speed furnace
  - High SEER coil for future ASHP
  - Total duct leakage <100 cfm25
- Heat recovery ventilation
- Water-managed, insulated and conditioned basement
- 468 cfm50 <2.0 ACH50 (pre-retrofit >10,000)

Irene and Alex Clark during home renovation
Pilot Project Example – Early 20c Duplex

Pre-Retrofit Conditions:
- Uninsulated wall assembly
- Steam heating
- ~5,300 cfm (units 1&2 combined)

24-26 Princeton Street, Medford
Steam boiler in basement
DER project plan:
- Aiming for THC and Passive House airtightness
- High R enclosure:
  - Thick insulating wall sheathing
  - Cellulose cavity, attic insulation
  - Strategic spray foam
  - Triple-glazed windows
- Unconditioned basement
- Condensing water heater
- Hydronic radiant heating
- PV + solar water heating

24-26 Princeton Street, front elevation
Pilot Project Example – 1950s Cottage

Pre-Retrofit Conditions:
- Heating by oil-fired hydronic, pellet stove
- High cooling energy use

DER project plan:
- Air barrier and Insulating sheathing on walls and roof
- High efficiency ducted mini splits
- CFIS ventilation
- New tankless water heater

Tweedly residence pre-retrofit

Project Highlight (lowlight):
- Significant moisture damage uncovered in retrofit
Pilot Project Example – 1920s Duplex

DER project highlights:
- Aggressive air barrier targets in contract
- Insulating sheathing on walls and roof
- “Chainsaw” retrofit
- Conditioned basement with uninsulated slab
Pilot Project Example – 1905 Bungalow

DER project highlights:
- Zero Net Energy target
- Excavated basement slab
- Raise roof
- Embedded structure roof panels
- PV and solar water heating

1905 Bungalow
Pilot Lessons

- Each project presents a unique situation – No standard solutions
  - Despite common target, multiple paths to success
  - Non-energy objectives are drivers

- Water management is absolutely critical!
  - Homeowners and contractors not sufficiently aware of risks
  - Homeowners and contractors not sufficiently aware of existing problems
  - Correcting moisture issues could (should) be a major motivation for DER (insurance, preservation, …)
Pilot Lessons (continued)

- Energy is only one of the benefits
  - Energy is seldom the most valuable benefit
  - Inappropriate to saddle energy savings with the entire cost burden (beware: SBC, “cost effectiveness”, etc.)
Major DER Challenge / Opportunity

Opportunity:

- Huge number of projects involving major component retrofit:
  - Re-siding, re-roofing, window replacement, replace mechanical equipment…

Challenge:

- Capture the opportunity
  - When a component is retrofit it is inoculated against further improvement for the life of the component
  - How to change the decision making of building owners, contractors, suppliers, financial institutions, insurers…
Capturing DER Opportunity

Desiderata:

- Move away from code as standard of care / basis of design (it’s not a bar, it’s a floor!)
- Move away from evaluation based on current energy costs
- Move away from evaluation based on energy

Education:

- Building owners, insurers – likelihood of current moisture issues and of moisture risk reduction in DER
- Contractors, suppliers – it can be done