

# Deep Energy Retrofit Pilot

Benefits, Challenges and Context

Energy Efficiency Advisory Council  
January 12, 2010



# Deep Energy Retrofit – Council Encouraged

- ◆ Develop a pilot that is consistent with the Governor’s Zero Energy Task Force ... explore
- ◆ 1) Deep Energy Retrofit Pilot Program of existing buildings achieving 50% energy reductions or more ...
- ◆ 2) Zero Energy Pilot Program that encourages diverse paths to Zero Energy.

EEAC Priorities - Item 29 - March 24, 2009



# Deep Energy Retrofit Pilot Goals and Approaches

- ◆ Investigate potential savings of at least 50 percent of **total** on-site energy use compared to **baseline** usage
- ◆ Involves super insulating existing residences with measures such as:
  - ◆ wall or roof build-outs with 4” foam insulation at time of re-siding\shingling
  - ◆ triple glazed, R 5 windows
  - ◆ advanced air sealing
  - ◆ mechanical ventilation and sealed draft HVAC for combustion safety and IAQ
- ◆ Also approach in terms of three “Rs” on the path to Net Zero ... Retrofits, Reductions, Renewables



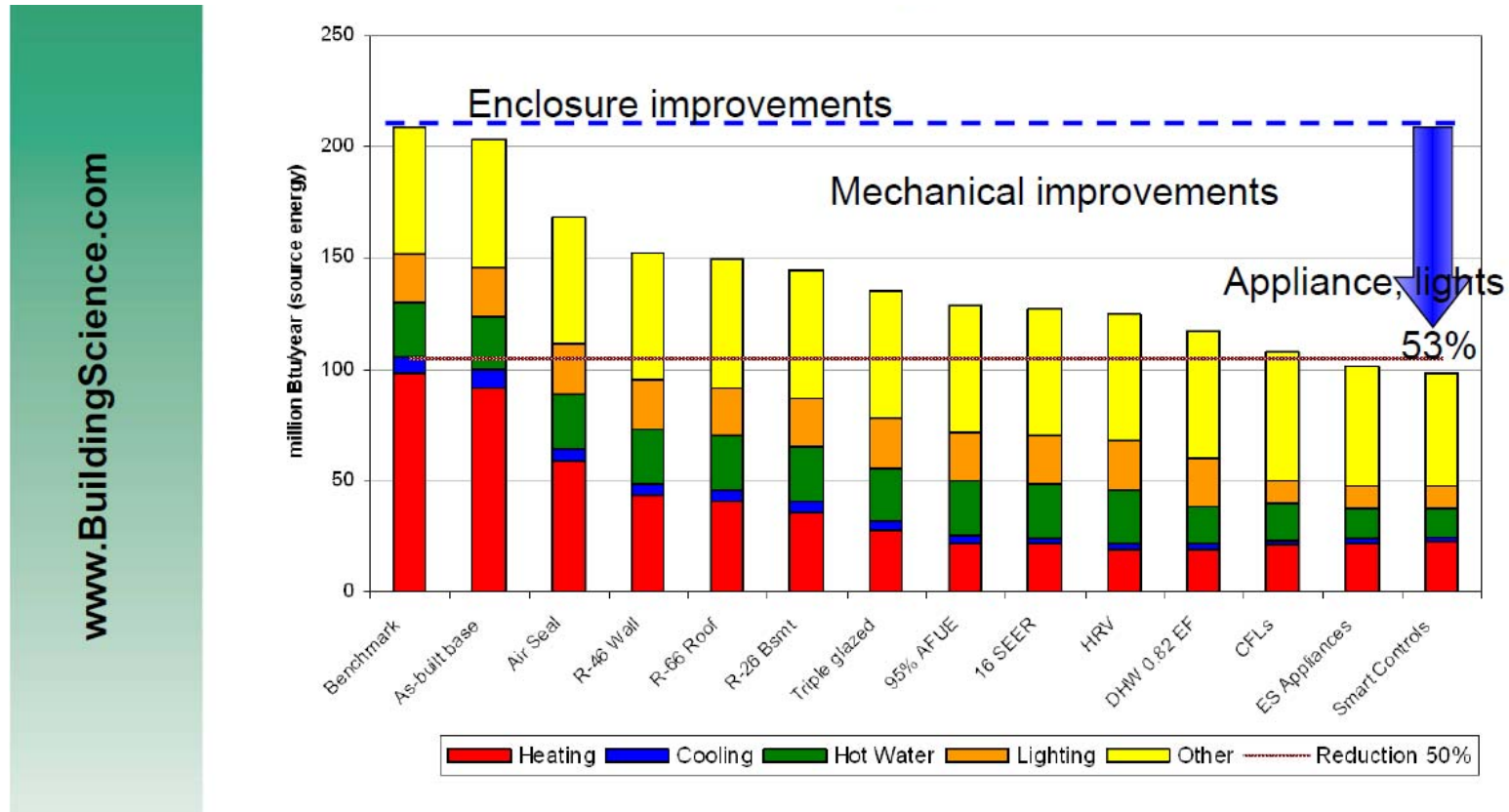
# DER Pilot – Incentives and offerings address the three Rs

- ◆ Deep energy retrofit of “Philly style” two family in Medford
  - ◆ Incentives 75% up to \$42,000 for whole house building enclosure  
**Retrofit** super-insulation package
  - ◆ **Reductions** – participant education on lifestyle, lighting and appliances plus lighting upgrades
  - ◆ Level 2 Incentives of \$10,000  
Thousand Homes Challenge candidate, leveraging **Renewables** and advanced HVAC



# Savings opportunities vary by end use for all three Rs

- ◆ After the enclosure, mechanicals and lighting are done appliances and plug loads account for the majority of use



## DER Full value proposition – measure life



- ◆ Measure life is greater than 28 or 30 year max in current models
- ◆ Air Tightness 250 CFM50 in 1986, re-tested @ 250 CFM50 by the now 26 year old pictured on left
- ◆ Original mechanical ventilating system (HRV) and foam and batt insulation performing well

◆ Standard practice - new siding over ½” foam, a missed opportunity to super-insulate w/ 4” foam and 40-50 year life of dramatic savings



# Full value of DERs – carbon reductions

- ◆ Since 75% of currently existing housing will still be in use in 2050 they are key to the 70% or 80% carbon reductions MA has committed to



## 1973 Garrison Ranch - Gloucester

<u>Baseline</u>	<u>Usage</u>		<u>Carbon</u>	
Electricity	6,000	kWh	4.1	tons
Hot Water	180	therms	1.1	tons
Heating	700	therms	<u>4.1</u>	tons
<b>Total</b>			<b>9.2</b>	tons
<b>Retrofit</b>				
Electricity	-1,986	kWh	-1.3	tons
Hot Water	30	therms	0.2	tons
Heating	231	therms	<u>1.4</u>	tons
<b>Total</b>			<b>0.2</b>	tons
Note: Gas used as heating fuel for before and after comparison.				

<b>Attic</b>	<b>R 76</b>
<b>Walls</b>	<b>R 43</b>
<b>Windows</b>	<b>R 5</b>
<b>Air sealing</b>	<b>300 CFM 50</b>
<b>Basement walls and slab - foam insulation</b>	
<b>Appliances\Lighting - LEDs</b>	<b>ENERGY STAR,</b>
<b>7 Solar</b>	<b>PV and Hot Water</b>

# Deep Energy Retrofit Pilot Projects

- ◆ These Electric PAs have projects complete or underway in:

- ◆ Arlington
- ◆ Amherst
- ◆ Auburndale
- ◆ Belchertown
- ◆ Cummington
- ◆ Easthampton
- ◆ Medford



Western Massachusetts  
Electric

The Northeast Utilities System



**NSTAR**  
ELECTRIC  
GAS

nationalgrid

# Deep Energy Retrofit Pilot 2009 - Summary of Results

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Contractor List - 16 contractors, sponsored two state wide trainings  
Outreach through; web, new homes program, DER open houses,  
stakeholder events

Serious Inquiries	94
Applicants	32
Project Agreements Finalized	8
Near NetZero Units	1
Dwelling Units Started	9
Projects Complete in 08 or 09	3
Max Potential Incentives 2009	\$42k + \$10k near NetZero
Average Incentives \ Participating Unit	\$32k
Monitoring Devices at Participant Sites	up to 7
Projects in Ev&M in 09	1

## Deep Energy Retrofit Pilot Experience – responses

- ◆ Growing network of consumers and stakeholders supporting deep energy retrofits (as a vital climate change and green business growth action)
- ◆ About 90% of customers interested “kick the tires” but turn away due to one barrier or another
- ◆ Lack of creative transferable financing, combined with economy and relatively low energy costs in 2009 top the list



## DER Barriers – Costs and Timing Affect Everything

- ◆ “The estimated additional cost of super-insulating (compared with only doing required regular maintenance) is \$25,000 to \$50,000 per home” NZE Task Force
- ◆ Consumers aren’t typically renovating\refinishing their whole house. (e.g. finishing a basement and residing, new windows, roof all at the same time)
- ◆ Getting those consumers to take deep action on the whole house means they incur more super-insulating and refinishing costs. Total is often over \$100,000.
- ◆ Employing climate, energy and life cycle cost considerations with optimal building science has many benefits but presents more challenges and higher initial costs

# Deep Energy Retrofit Pilot for 2010-12

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- ◆ DER Pilots offered statewide by gas and electric PA's
- ◆ Expand to multifamily
- ◆ Heating fuel determines which PA funds project
- ◆ Incentives may be tiered based on the number of apt. units
- ◆ Many more projects, goals 150 + units over 3 years
- ◆ Partial and staged DERs for synchronization with home remodeling and maintenance schedules
- ◆ Non Energy Benefits study
- ◆ State wide PA DER working group, collaborate on many aspects including evaluation

## Deep Energy Retrofit Pilot Focus

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- ◆ Great opportunities for savings, climate action, economic benefits and job creation
- ◆ Focus on the physics of building science as well as time and money to:
  - ◆ gain optimal efficiency while promoting occupant health, safety and comfort
  - ◆ deploy best practices for measure and building durability and sustainability
  - ◆ strengthen cadre of quality, qualified contractors
  - ◆ be prudent in terms of likely future energy costs and efficient home values

# DER Case Example – Belchertown 1700's Farmhouse

- ◆ Super-insulation levels of spray foam from inside done in conjunction with full interior “gut” remodeling
- ◆ Heard of pilot through MASS-Save auditor referral
- ◆ Heating savings estimate >75%



# Deep Energy Retrofit References

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## Deep Energy Retrofit Resources and Examples

Building Science Corporation Projects <http://www.buildingscience.com/search?SearchableText=deep+energy+retrofits>

Energysmiths Projects (Marc Rosenbaum) <http://www.energysmiths.com/index.php>

Coldham and Hartman - Info on Deep Retrofit and examples <http://www.coldhamandhartman.com/>

## DER Related Resources

Building Science Corporation Recent Presentations: <http://www.buildingscienceseminars.com/presentations/index.html>

Thousand Homes Challenge <http://www.affordablecomfort.org/initiatives.php?PageID=16>

National Grid DER Pilot Website including contractor listing <https://www.powerofaction.com/der/>

## Approaching Net Zero Energy in Existing Homes

CMHC report detailing benefits, barriers, and progression to net zero energy

[http://www.affordablecomfort.org/images/Uploads/cmhc\\_nze\\_exisitng\\_henderson\\_full\\_2008\\_s60376\\_w\\_.pdf](http://www.affordablecomfort.org/images/Uploads/cmhc_nze_exisitng_henderson_full_2008_s60376_w_.pdf)

Report of the Massachusetts Zero Net Energy Buildings Task Force - March 11, 2009

[http://www.mass.gov/Eoeea/docs/eea/press/publications/zneb\\_taskforce\\_report.pdf](http://www.mass.gov/Eoeea/docs/eea/press/publications/zneb_taskforce_report.pdf)

# DER – Photo Credits and additional resources

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Slide 2 and Slide 10 top photos – Four Square DER in Concord, MA courtesy Building Science Corp

<http://www.buildingscience.com/documents/case-studies/cs-0016-concord-four-square-retrofit/?topic=/doctypes/casestudy>

Slide 3 and slide 8 upper right photo – Alex Cheimets’ two family DER in Arlington, MA (NStar Electric DER pilot participant)

[http://news.cnet.com/8301-11128\\_3-10123367-54.html](http://news.cnet.com/8301-11128_3-10123367-54.html) and <http://superinsulating.blogspot.com>

Slide 8 upper right photo – Eric Friedman’s 1920’s Arts and Crafts DER in Auburndale, MA (NStar Electric DER pilot participant)

Photo source <http://auburndalegreenrenovation.blogspot.com/2009/05/exterior-foam-installed.html>

<http://www.wickedlocal.com/newton/news/lifestyle/x743982093/The-fight-for-airtight-Newton-couple-insulates-home-from-the-outside>

Slide 7 photo – John Livermore’s Raised Ranch in Gloucester, MA

<http://www.greenbuildsessexcounty.org/gloucesterresident/GResidenthomenew.html>

All other photos of DER projects in MA by David Legg of National Grid

# Thank you

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“Thank you for your stand for efficient, conscious energy consumption; and for creating the space for us to manifest our commitment to the same.”

Alex Clark

