The Smart Energy Home: Driving Residential Building Decarbonization

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Opening Scene

Hey, is that low carb?

No! It’s DEcarb!
Agenda & Logistics

• Welcome
• Background on Smart Energy Home Initiative
• New Report!
• Context Setting—the “Collective Vision”
• Policy Considerations of Note
• Common Barriers and Opportunities
• Strategies Moving Forward
• Conclusion and Q&A

• Logistics:
  – All lines will remain muted
  – Type in questions at any time, but will be reviewed at the end of webinar as time allows
  – Presentation is being recorded. Slides and recording will be posted online and sent out to registrants tomorrow
Thank you for joining today! Who are you? Polls
Who are we?
Northeast Energy Efficiency Partnerships (NEEP)

“Assist the Northeast and Mid-Atlantic region to reduce building sector energy consumption 3% per year and carbon emissions 40% by 2030 (relative to 2001)”

Mission
We seek to accelerate regional collaboration to promote advanced energy efficiency and related solutions in homes, buildings, industry, and communities.

Vision
We envision the region’s homes, buildings, and communities transformed into efficient, affordable, low-carbon, resilient places to live, work, and play.

Approach
Drive market transformation regionally by fostering collaboration and innovation, developing tools, and disseminating knowledge.

One of six REEOs funded in-part by U.S. DOE to support state and local efficiency policies and programs.
It’s in the name! Couldn’t be done without *partnerships*!
Thank you to our Smart Energy Homes Initiative Supporters!

Foundations:

States:

Allies:
Background on Smart Energy Home Initiative
NEEP’s background in the Smart Energy Home

Product List
2015

2013
2014

Briefs and Trainings:
• Claiming Savings from Smart Thermostats: Guidance Document,
• The Smart Energy Home and Cross-Promotional Opportunities in Energy Efficiency,
• The Smart Home Interface: A Tool for Comprehensive Residential Energy Efficiency
• The Contractors Guide to the Smart Home

The Smart Energy Home: Driving Residential Building Decarbonization
2017

2018
2019
2019 NEEP Smart Energy Homes Initiative

• Full project brief here

• Initiative Mission:
  – *Enabling residential decarbonization by transforming homes to be efficient and flexible grid assets.*

• Long Term Market Transformation Goals:
  – 2022: Virtually all smart products are DER-ready and can work as part of an integrated Smart Energy Home system.
  – 2030:
    • 50% of Northeast homes are “energy smart” (i.e., have at least two “energy smart” systems - HVAC, water heating, plug loads/appliances).
    • 30% of existing homes and buildings are benchmarked and retrofitted to reduce carbon emissions 50%.

• Look out for this year:
  – Home Energy Management Systems Working Group
  – Driving Decarbonization webinar series
New Report!
It’s here!!

Available from
- https://neep.org/smart-energy-home-driving-residential-decarbonization
- Thank you to our reviewers and contributors!!

- NEEP Staff
- Harsh Engineer
- ACEEE
- Cadmus
- CLEAResult
- Con Edison
- CT DEEP
- Daikin
- E Source
- Ecobee
- Efficiency Vermont
- Embertec
- Energy Futures Group
- Eversource
- Franklin Energy
- Fraunhofer
- Fujitsu
- Home Performance Coalition
- ICF
- LG
- Lockheed Martin Energy
- MEEA
- National Grid
- NREL
- NRDC
- NH PUC
- NYSERDA
- Optimal Energy
- Pacific Gas and Electric
- Panasonic
- Performance Systems Development
- United Illuminating
- U.S. DOE
- U.S. EPA
- WattTime
- WECC (now Slipstream)
- Xergy Consulting.
The report is chock full of content

- This webinar is a complement to the report, not a supplement
- (Check out this TOC!)
  - Executive Summary
  - Introduction and Context Setting
    - Technological Definitions
    - The State of the Market
    - The Smart Energy Home: Driving Residential Decarbonization
  - Impacts, Trends, and Policies
    - Load Shaping: Teaching the Duck to Fly
    - State of Related Policies in the Market
    - Demand Response, Dynamic Rates, and the Role of a Smart Meter
  - Real World Examples and Case Studies**
  - Barriers and Opportunities Analysis
  - Recommendations, Strategies, and Next Steps
- Conclusion
- Appendix A**: Smart Energy Home Market Characterization Details
  - Smart Device Characterization
  - Other Developments in the Smart Home Space
- Appendix B**: Distributed Energy Resources Market Characterization Details
  - Residential Solar Market
  - Residential Electric Vehicle Market
  - Residential Battery Storage Market
- Appendix C**: Strategically Electrified Space, Water Heating, and Home Performance Market Characterization Details
  - ASHP Market
  - HPWH Market
  - The Need for Thermal Efficiency
Context Setting
Region’s Aggressive Carbon Reduction Targets
Are we on the path to 80% CO2 reductions?

- Not without strategic electrification, we aren’t!
To get there, need a 3 pronged strategy:

- Use less energy
- Have clean generation for electricity
  *Strategically* shift energy use towards electricity
Electrification sounds great, but...
Shifting *seasonal* loads over the next 30 years
How the Smart Energy Home can drive residential decarbonization (in 5 easy steps!)

Step 1
- Electric loads of homes will **grow**.

Step 2
- Many end-use loads can be **shifted** to be used or charged at strategically beneficial times.

Step 3
- **Renewable generation** is growing, but it is more variable.

Step 4
- **Flexible end uses** are critical to managing this growing electric need.

Step 5
- “**Smart**” technologies can manage this **“generation-to-load”** matching.

- Customers are buying many smart products
- Many smart devices have lower barrier to entry than other major EE investments
- Many opportunities for integration and matching
What is *Smart*?

- *(NEEP’s definition)* “smart”: have a chip/connection, and a mechanism to know what to do with it!
- **Ideally**, smart devices have this functionality:
Report contributors felt if we could agree upon the end goal, we’d have an easier time working towards it.

Not one adoption curve....

Report provides more details on the state of the various markets (in Appendices), including:

- Smart devices
- Residential distributed energy resources (DERS)
- Strategically electrified technologies (HVAC, water heating, and thermal efficiency)
The Vision of the Smart Energy Home of the Future!

Legend
Direction of data and/or operational signals
A Few Notes...

• About the HEMS...
  – Right now, most smart home controls are at the device level, optimizing for consumer preference
  – Some homes (and more buildings) have DERMS managing DERs, optimizing for grid benefit
  – Our goal: These systems work together. Doesn’t need to be a physical “thing”, just needs to be able to interface together these connected systems and send/receive have optimization signals (i.e. for consumer, for grid, for carbon)

• About the Smart Meter (AKA advanced metering infrastructure AKA AMI)....
  – Not really “smart” by our definitions, BUT AMI will be necessary for dynamic rate structures
  – Without AMI, dynamic pricing and more widespread demand response are not possible at scale.
  – States that haven’t already made the AMI investment face challenge justifying the expense.
    • There is some current work arounds leveraging AMR that may be worthwhile to consider.
Prioritized electricity charging during solar production

Let’s take this smart energy home for a test drive....
Let’s take this smart energy home for a test drive….
Policy considerations of note
(3000 Words, or A Tale in Three Pictures)
Let's teach this duck to Fly!
Time Varying Rates

Residential Customers on Time Varying Rates

AMI vs AMR
Common Barriers and Opportunities
Common Barriers

Distributed Energy Resources Barriers
- Value proposition unclear
- Interoperability
- Flat utility rates
- Winter challenges
- Regulation/policies don’t support
- Limited availability

Smart Energy Homes Barriers
- Quality (unknown or concerns)
- Customer misconceptions
- Cost
- Value proposition unclear to builders/installers

Strategic Electrification and Decarbonization Barriers
- EM&V Challenges

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Common Opportunities

- Distributed Energy Resources Opportunities
  - Load shaping
  - Customer amenity
  - Rebates/incentives in place

- Low carbon
  - New construction

- Smart Energy Homes Opportunities
  - Wide diversity of products
  - Grid benefits

- Strategic Electrification and Decarbonization Opportunities
Strategies Moving Forward
Recommendations

• Area of Focus #1: Policy and Carbon
  – In order for a decarbonized residential building stock to be fully appreciated, incentivized, and realized, public policies must evolve to recognize and value carbon reductions as a critical consideration and motivator for decision making.
Recommendations

• Area of Focus #2: Utility Regulatory Structure
  – Future utility programs will take into account carbon reductions, promote lower-carbon strategic electrification activities, have dynamic pricing, and serve as a “one-stop-shop” for smart energy homes and their associated components.
Recommendations

• Area of Focus #3: Smart Energy Homes Drive Smart Home Performance
  – As the grid decarbonizes and strategic electrification efforts increase, peak events are likely to move towards the winter; tight, low-load homes are critical to the success of strategic electrification and broader residential decarbonization. Low home electric loads will be reinforced by smart energy home efforts that increase the performance of existing homes.

Bundle and Improve Smart Energy Home Offerings

Push Home Performance Through Smart Technology

Raise Awareness of and Promote Smart Home Performance Across all Customers
• Area of Focus #4: Quality Assurance and Transparency in Technology
  – Products installed in smart energy homes of the future are high quality, easy to find, and work well together to enable a low-carbon residential sector.

Recommendations

- Expand Qualified Products
- Improve Interoperability Between Products
- Increase Information Transparency and Awareness
• Area of Focus #5: Focus on the Locational Value of Smart Energy Homes and Energy Efficiency
  – A modernized grid that can take into account a range of grid constraints when sending and receiving demand signals, particularly around location and geo-targeting of savings.

Recommendations

Expand Upon Existing, While Keeping Grid Modernization in Sight

Support Development of Geo-targeting Programs

Ensure Equity in Locational Efforts
Recommendations

• Area of Focus #6: New Construction and Smart Energy Home Integration with Building Codes
  – New buildings are built to meet the future vision of flexible, low-load, electric homes.

Evolve New Construction Programs

Embrace the Smart Energy Home in Residential Labeling/Code Efforts

Enable Success Through Codes and Building Energy Standards
Conclusion and Discussion
Conclusion

• Smart energy homes sit at the center of residential building decarbonization success.
• Through dedicated focus and collaboration, we can reach our goals!
• An evolution in efficiency program structure and changes in policies will go a long way towards helping the markets grow
  — but it is also incumbent on customers and industry players to create interconnection between smart technology and other residential products such as electric vehicles, solar, battery storage, ASHPs, and HPWHs
• Home energy management systems (HEMS) being tested today are showing potential to manage a home full of smart end uses and pairing with a grid full of renewable energy.
  — Commercially-available products must integrate further to achieve this reality.
The Smart Energy Home is (almost) here!
   - You can help make it a reality!

More Resources:
   - HPC smart homes track! Chicago 4/1-4/4!
     - Including 9 session track and contractor training
   - HEMS Working Group—let me know if you want to talk more
   - NEEP Webinar series and NEW report
   - Sign up for Decarb Central!

Let’s talk more!
   - cmiziolek@neep.org
Can’t get enough?! More from NEEP

Beyond the Walls of a High Performance School
Insights from a School District and Updates to NE-CHPS
MAR 25 // 2 PM ET

Introducing NEEP’s New Product List & Subscription Program
APR 17 // 1 PM ET

HERS, ASHP, HEMS, PV, EV: The Alphabet Soup of Selling A High Performance Home
APR 24 // 1 PM ET

ANNUAL PUBLIC MEETING
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Q&A

THANK YOU!

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