Smart Homes & Sustainability: Putting Data into Practice

Claire Miziolek, Technology and Market Solutions Senior Manager
Northeast Energy Efficiency Partnerships (NEEP)
BuildingEnergy Boston 3/15/2019

About 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.

Agenda

- (The Who)
- The Why
- The What
- The State of things
- *The What you can do about it*
- The Discussion

Introductions: You!

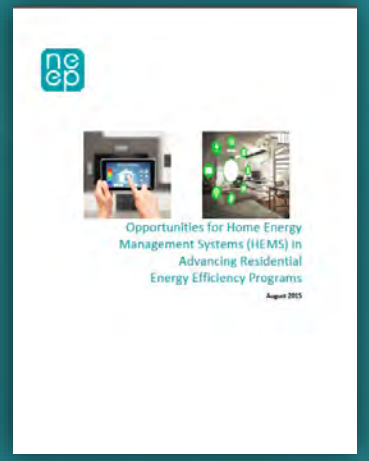
- *show of hands*

Introductions: me (and why I'm talking to you today!)
NEEP's background in the Smart Energy Home

2013

+

2014



Product List

2015

2016

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

2017

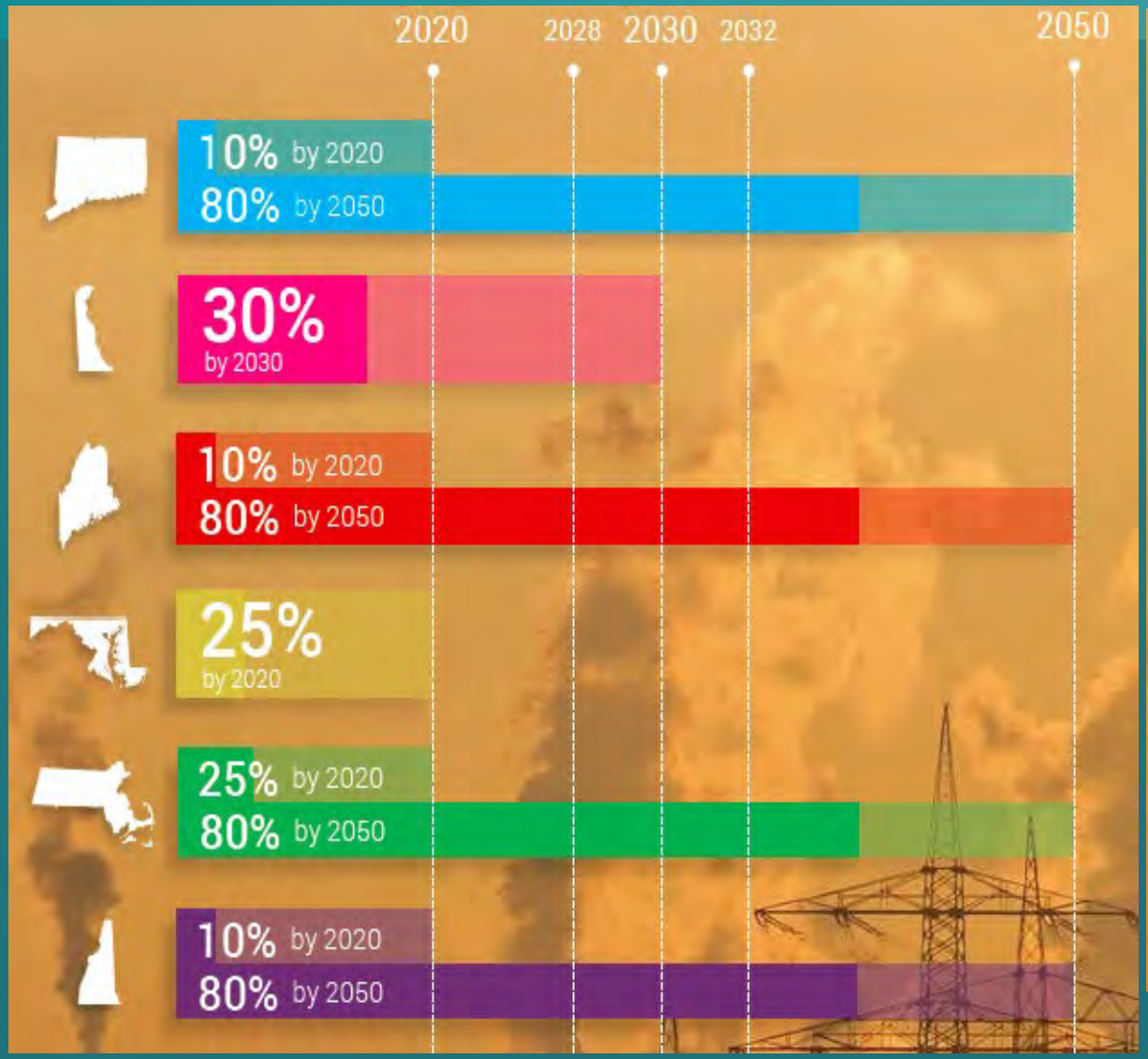
The Smart Energy Home: Driving Residential Decarbonization

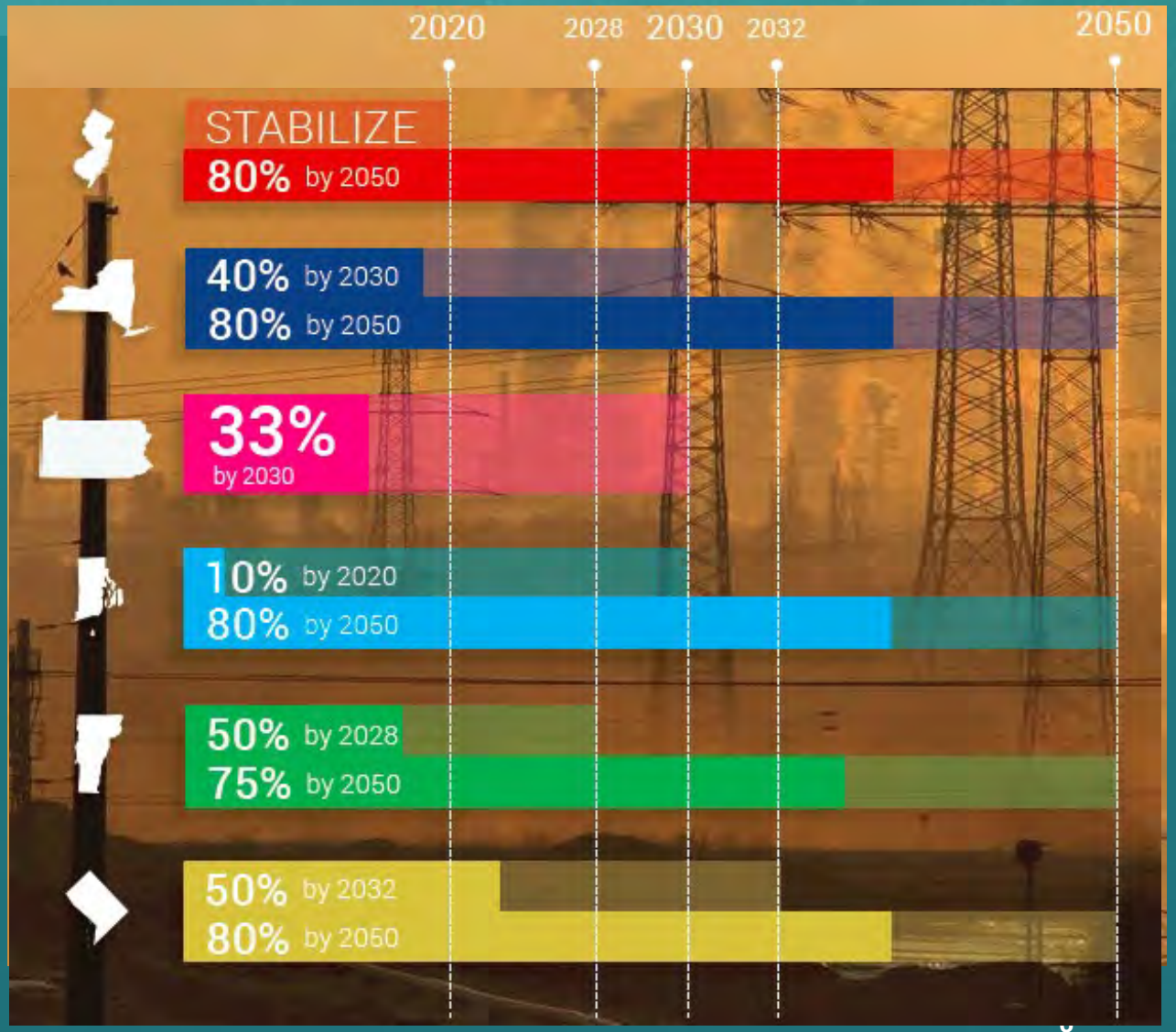
2018

2019

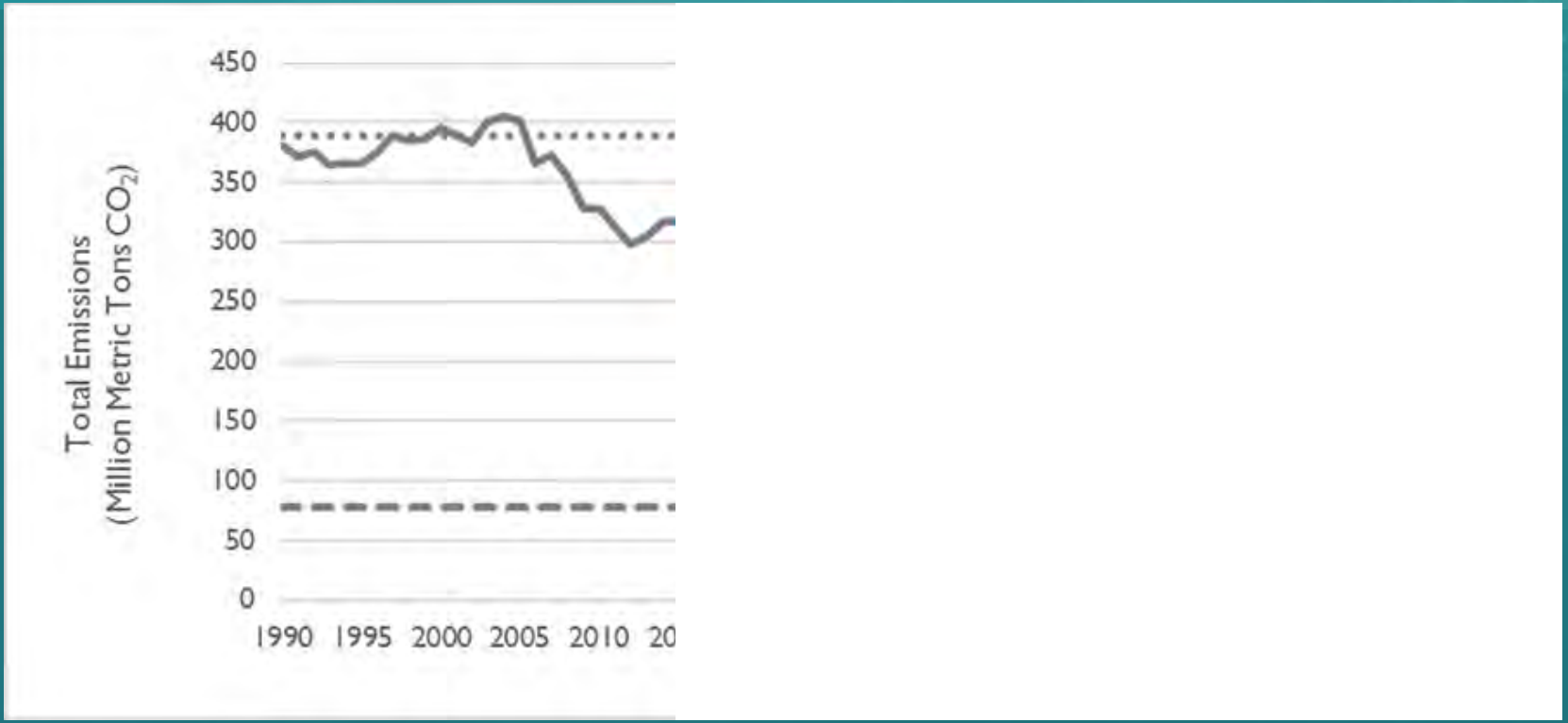
The Why:
Driving Towards Decarbonization

Region's Aggressive Carbon Reduction Targets



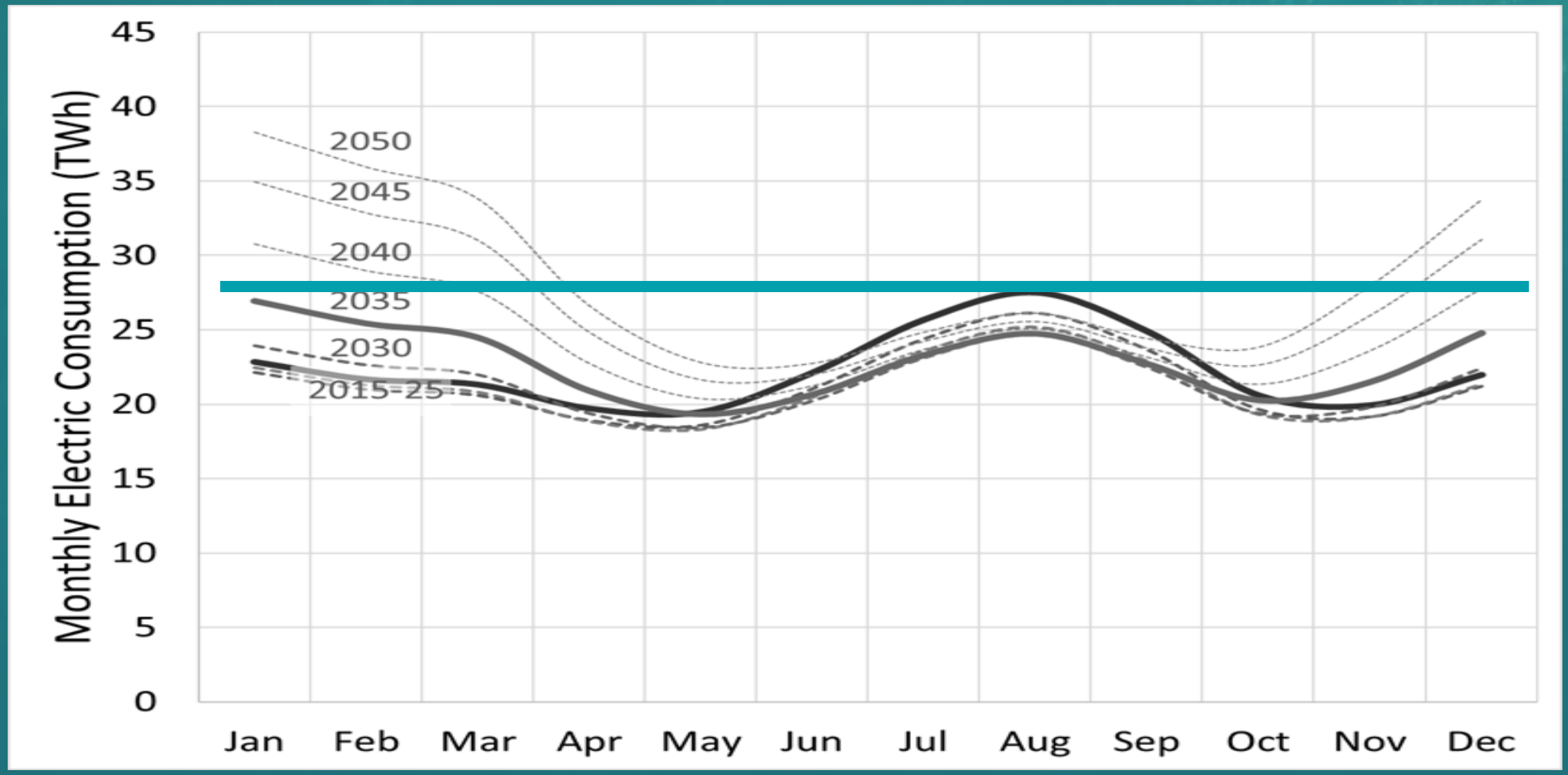


Are we on the path to 80% CO2 reductions?



- Not without strategic electrification, we aren't!

Electrification sounds great, but…
Shifting *seasonal* load shape over the next 30 years



How the Smart Energy Home can drive residential decarbonization

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.

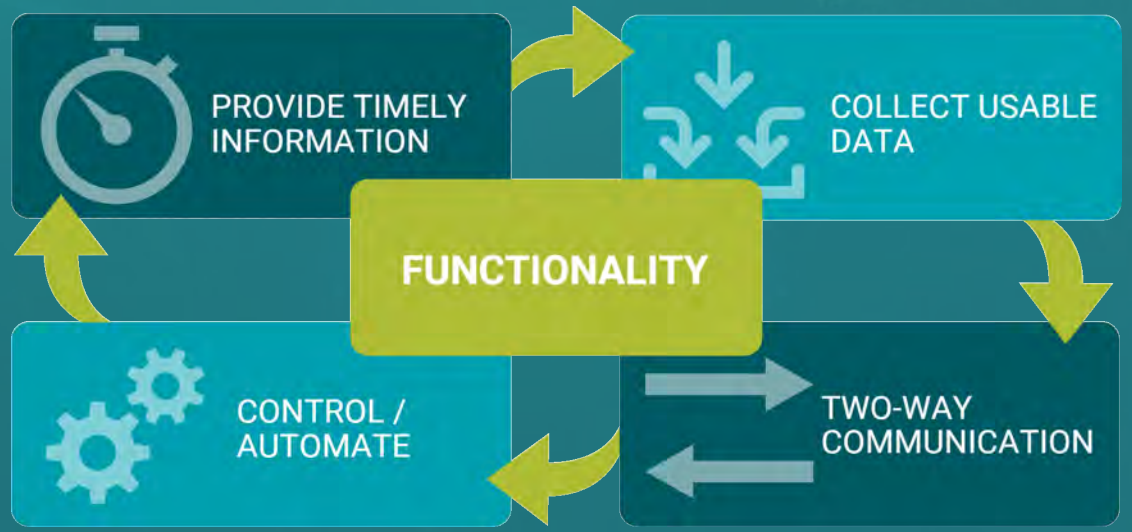
Step 5
- **"Smart" technologies** can manage this **"generation-to-load"** matching.

- 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

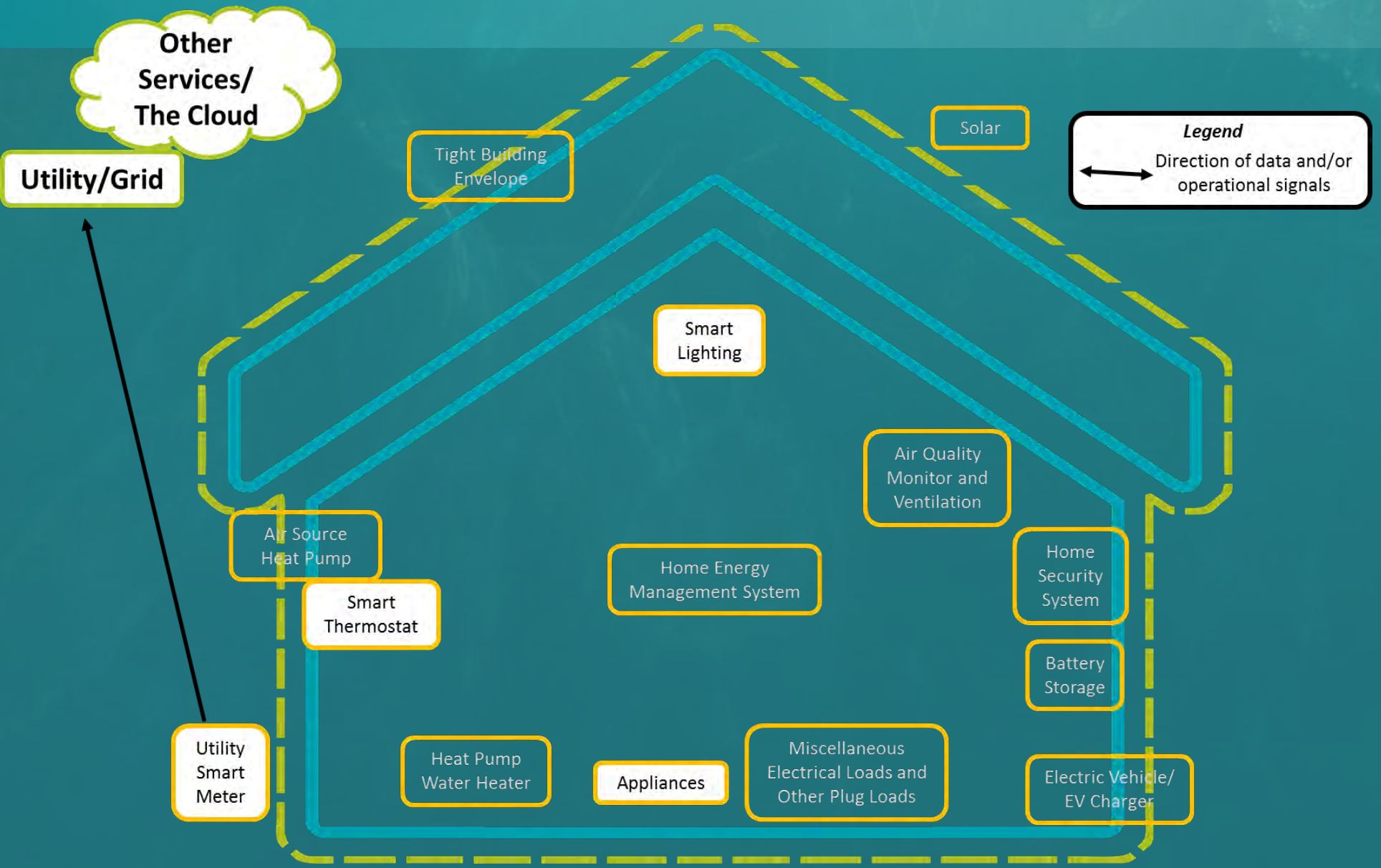
The What:
The Smart Energy Home

What is *Smart*?

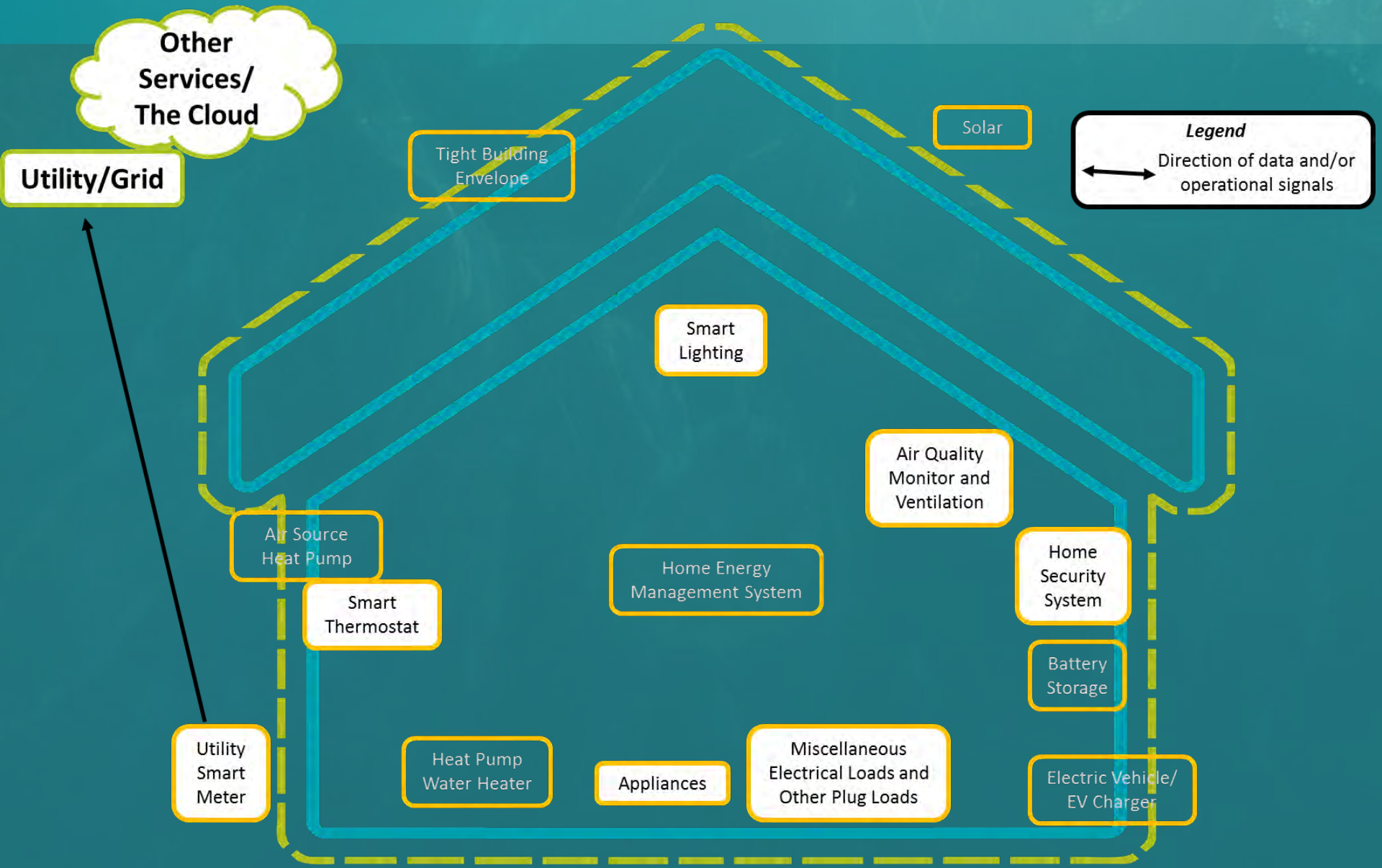
- (*NEEP's definition*) "smart": have a chip/connection, and a mechanism to know what to do with it!
- **Ideally**, smart devices have this functionality:
- Most importantly, they can **send** data and signals about their operations as well as **receive** and interpret signals dictating their operations.



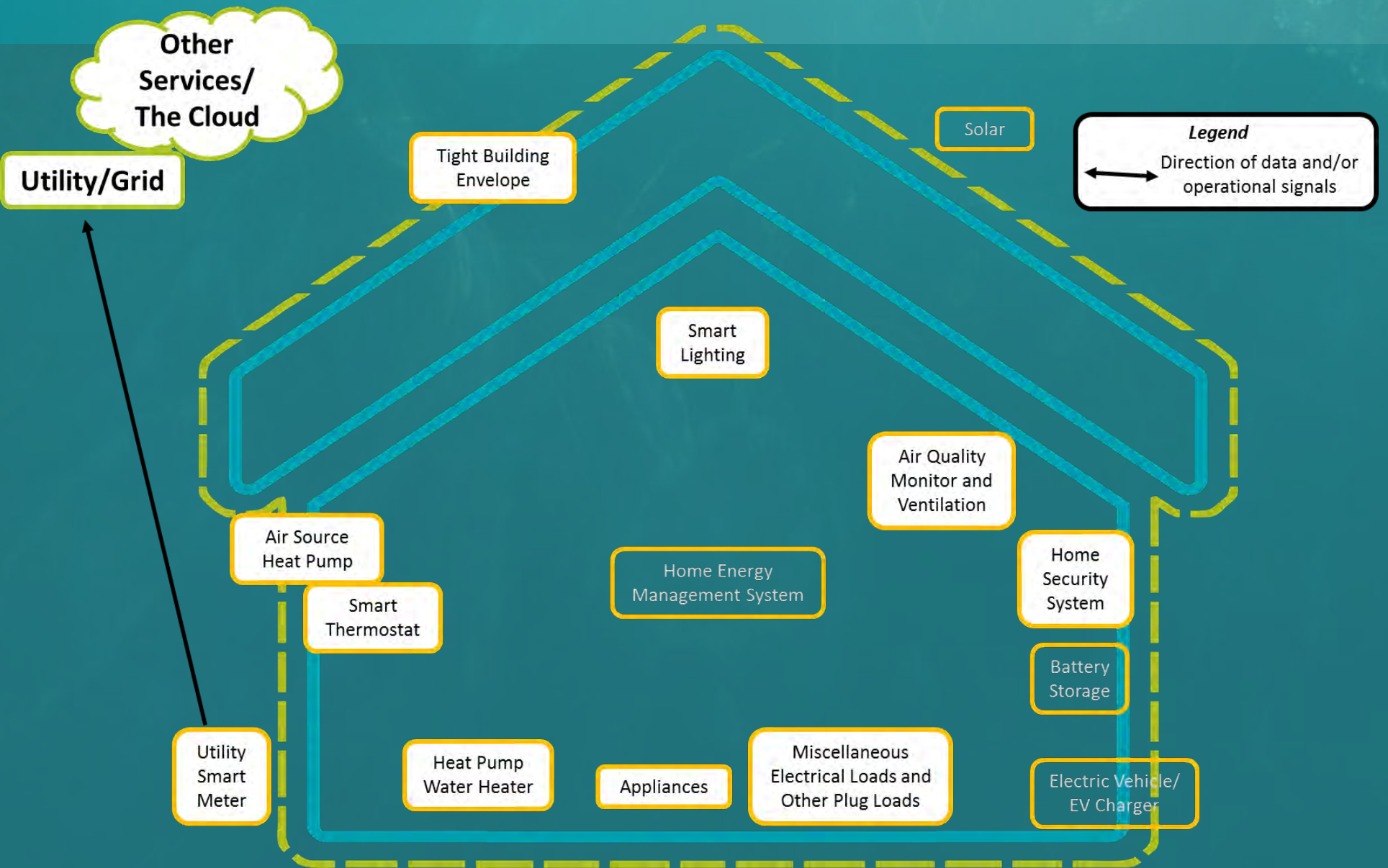
Most “smart” homes today



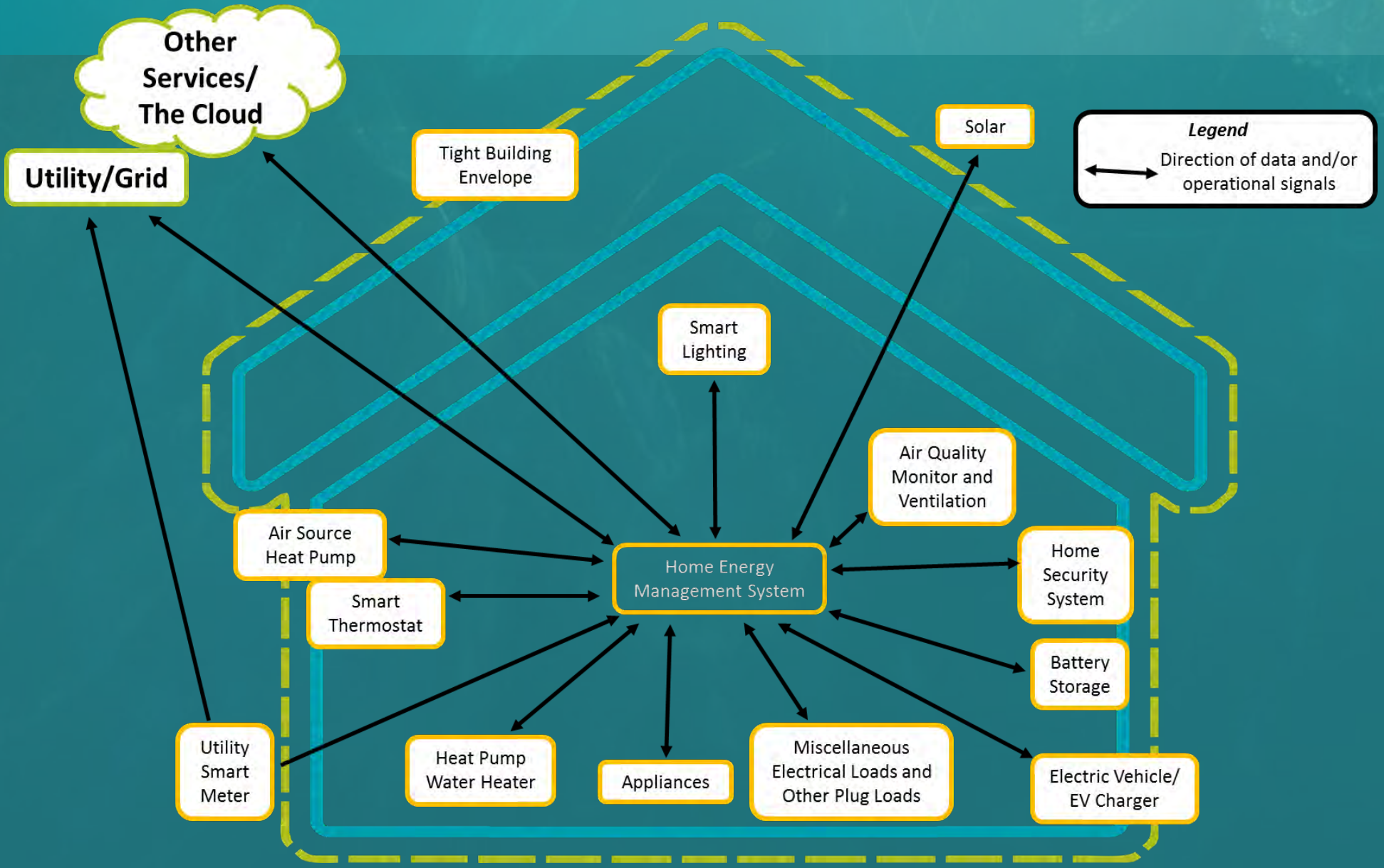
Just around the corner…



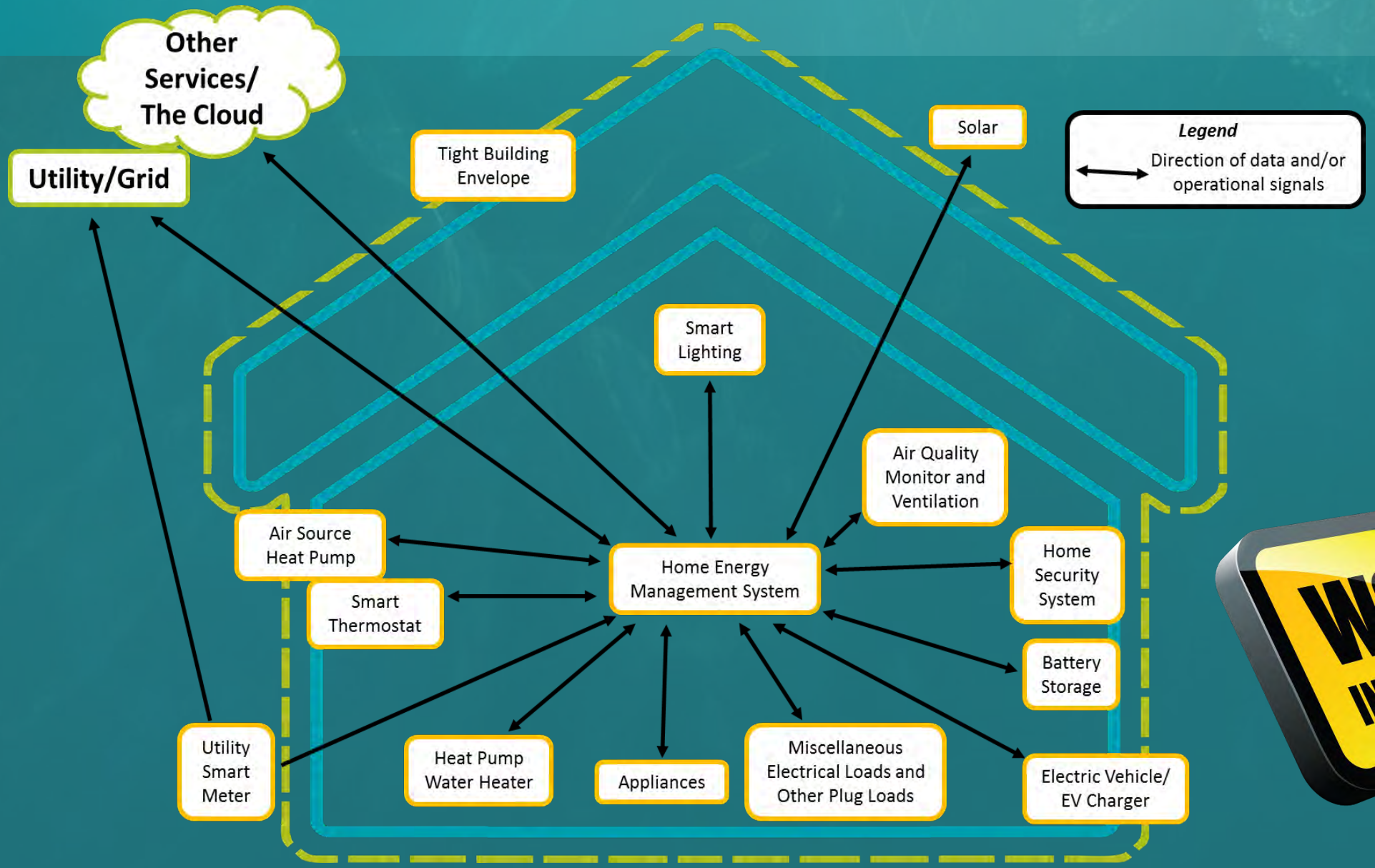
Add Key Strategic Electrification Considerations



Bring in the Distributed Energy Resources and Connectivity



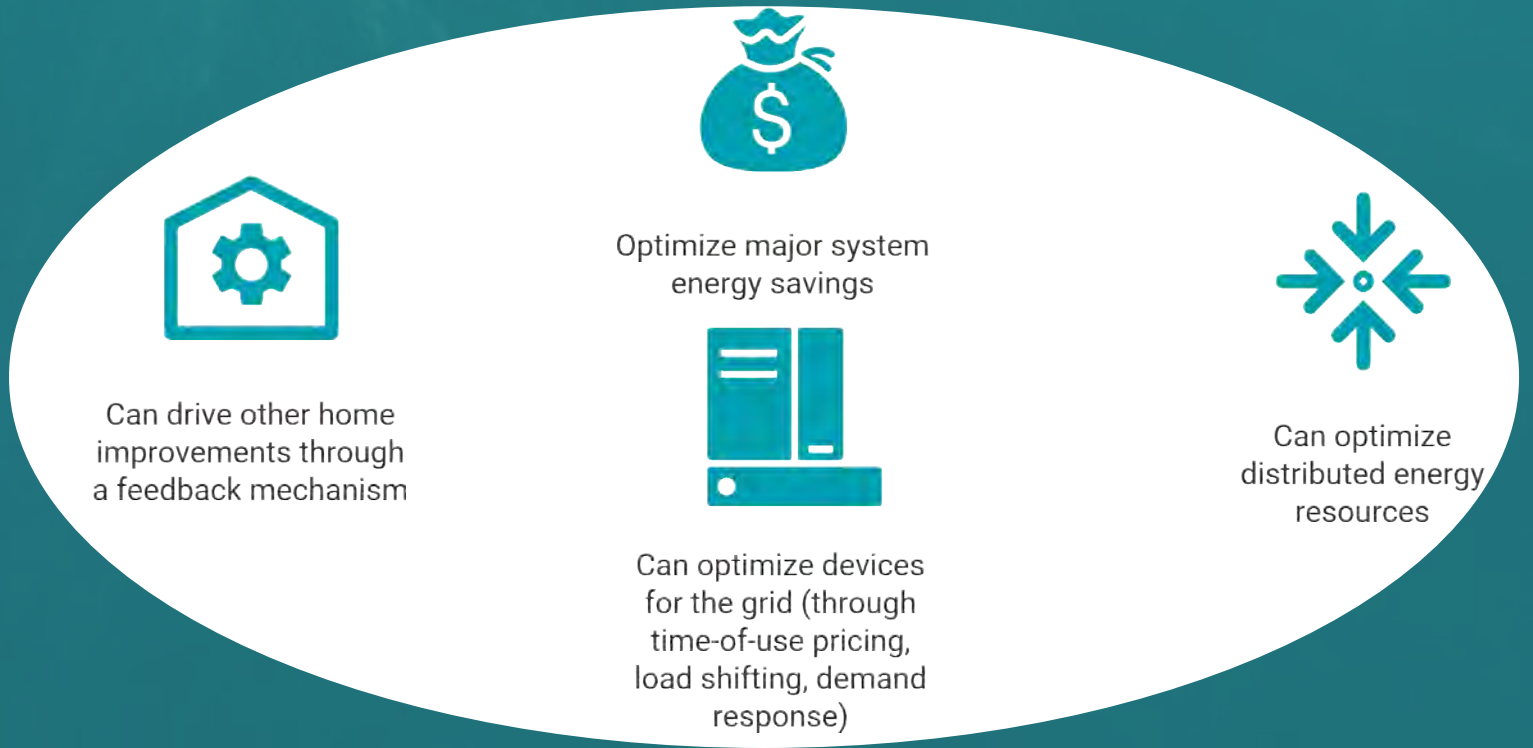
The Vision of the Smart Energy Home of the Future!



We've got goals, Baby!

Regional Market Transformation goal NEEP set forward in our 2016 Market Transformation report

By 2030, more than 50% of total homes (75% of new construction) in the Northeast and Mid-Atlantic have at least two "energy smart" major systems (HVAC, water heating, plug load/appliances). This means they:



The State of Things

State of the Market: Opportunity for savings?

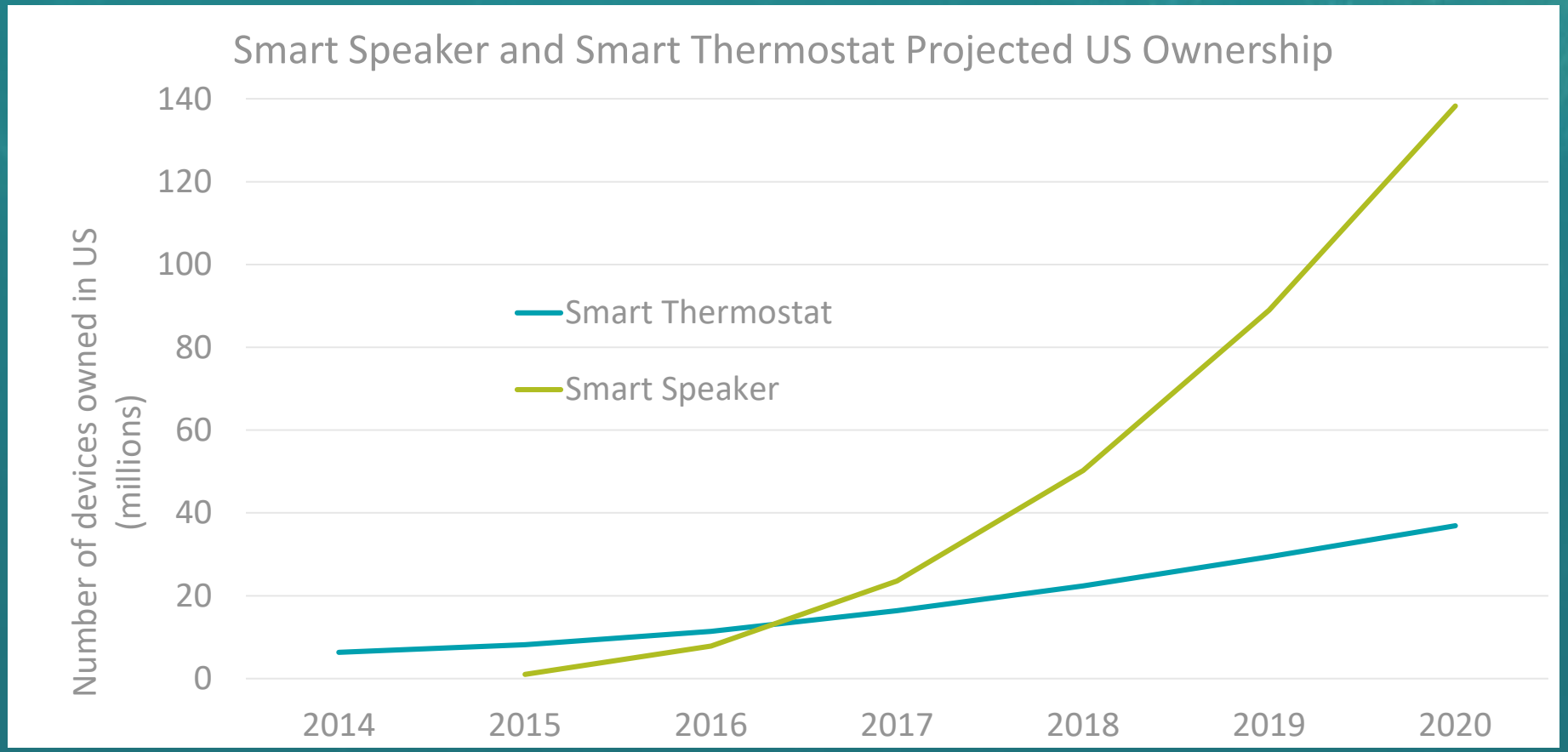
- NYSERDA Pilot findings for energy savings
- Heat chart of opportunity

Smart Product	EE	DR	Load shifting	DER integration
Smart Thermostat/Smart HVAC				
Smart Water Heater				
Smart Appliances: Flexible timing (clothes dryers, clothes washers, dishwashers, refrigerator?)				
Smart plug, outlet, or switch				
Smart Home Platform/hub/display				
Smart Appliances: Inflexible timing (stoves, ovens, small appliances)				
Smart Lighting				

Table S-1. Base-Load Simulation Model Maximum Annual Savings Potential by End Use

Smart Device	Electricity Savings (kWh/year)	Heating Fuel Savings (therms/year)	Cost Savings* ($/year)	Assumptions
Smart Thermostat	688	52	$174	No existing setback controls
Smart Outlets	341		$58	15-minute occupied delay
Smart Lamps or Switches	212		$36	Controls only
Total HEMS Savings	1,241	52	$268	

State of the Market: What's hot in the smart home?



- Utilities are loving smart thermostats
  - especially ENERGY STAR
- Customers are loving voice control
  - Recent E-Source Report

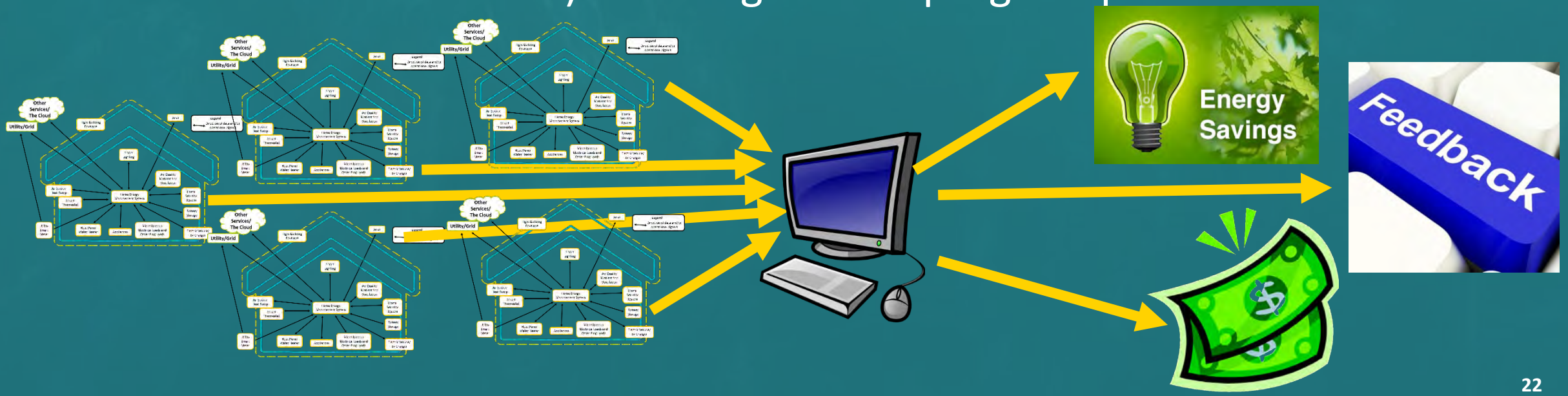
State of the Market: What about the Smart Energy Home?

- More **smart** products across the board
  - Growing, but still low rates
- Residential **solar** steadily growing
- **EVs** increasing in demand
- Low rates and limited availability of residential **storage**
- **Air Source Heat Pumps** slowly getting connected (i.e. D6, MassSave rebates)
- **Water heating** steadily getting smarter
  - Retrofit (i.e. Aquanta)
  - Built in (i.e Econet)
  - Port (i.e. CTA-2045)
- **Installation** through DIY, DIFM, and "ready" at construction

ENERGY STAR Connected Products	
Product Category	**% connected models November 2018**
Clothes Dryers	3.7%
Clothes Washers	1.6%
Dishwashers	0.7%
EV Supply Equipment	**29%**
Freezers	2.5%
Light bulbs	0.4%
Light Fixtures	1.2%
Refrigerator	3.4%
Room AC	1.9%

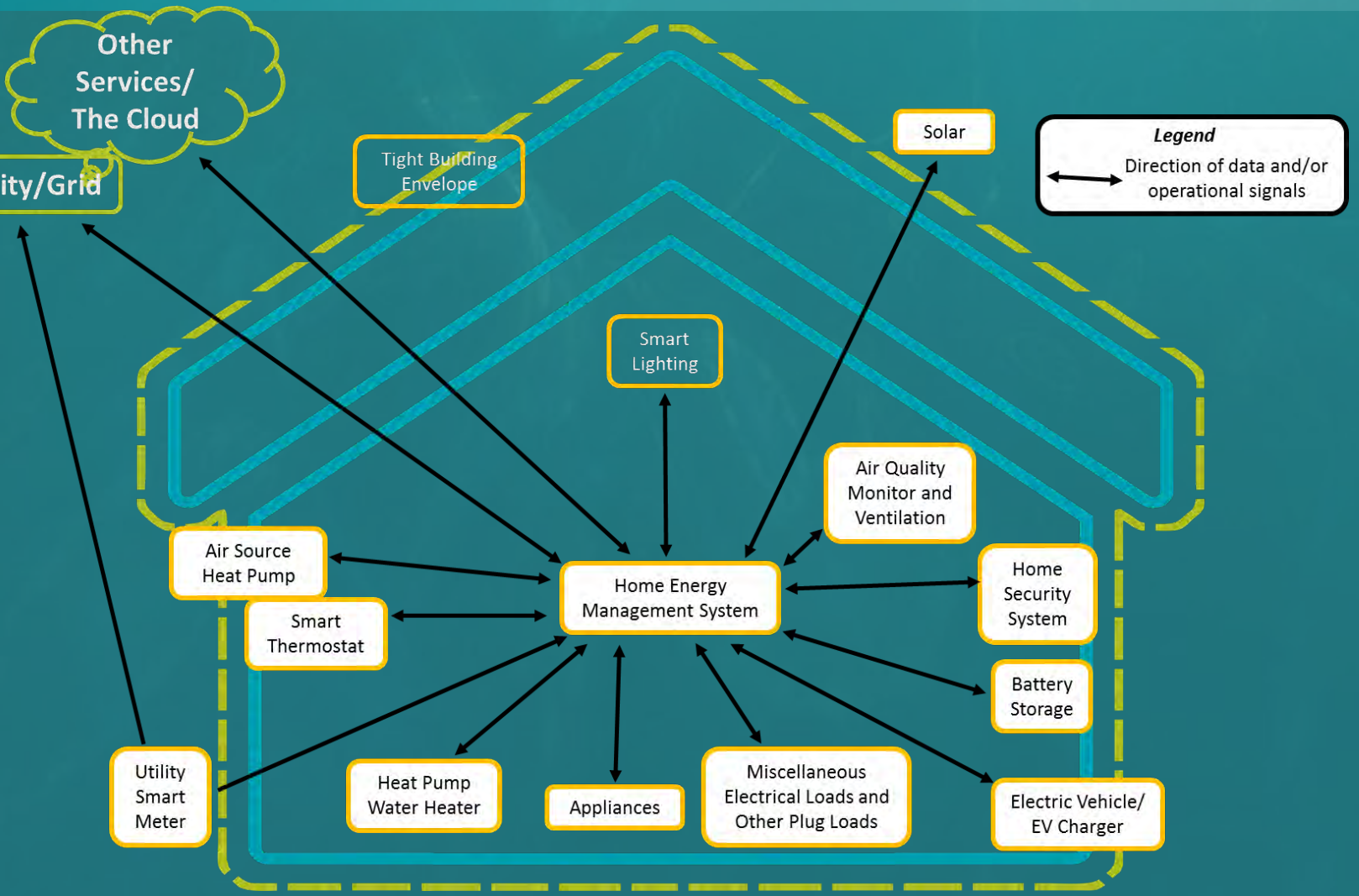
The State of Data: Real Time Data Driven Measurement and Verification (M&V 2.0)

- Example: CT pilot (funded by US DOE) with utilities, CT energy department, Lawrence Berkeley National Lab, and NEEP
- Looking to take large set of data from homes and run through advanced analytical tools to measure energy savings (from whole-home retrofits) and insights into program performance



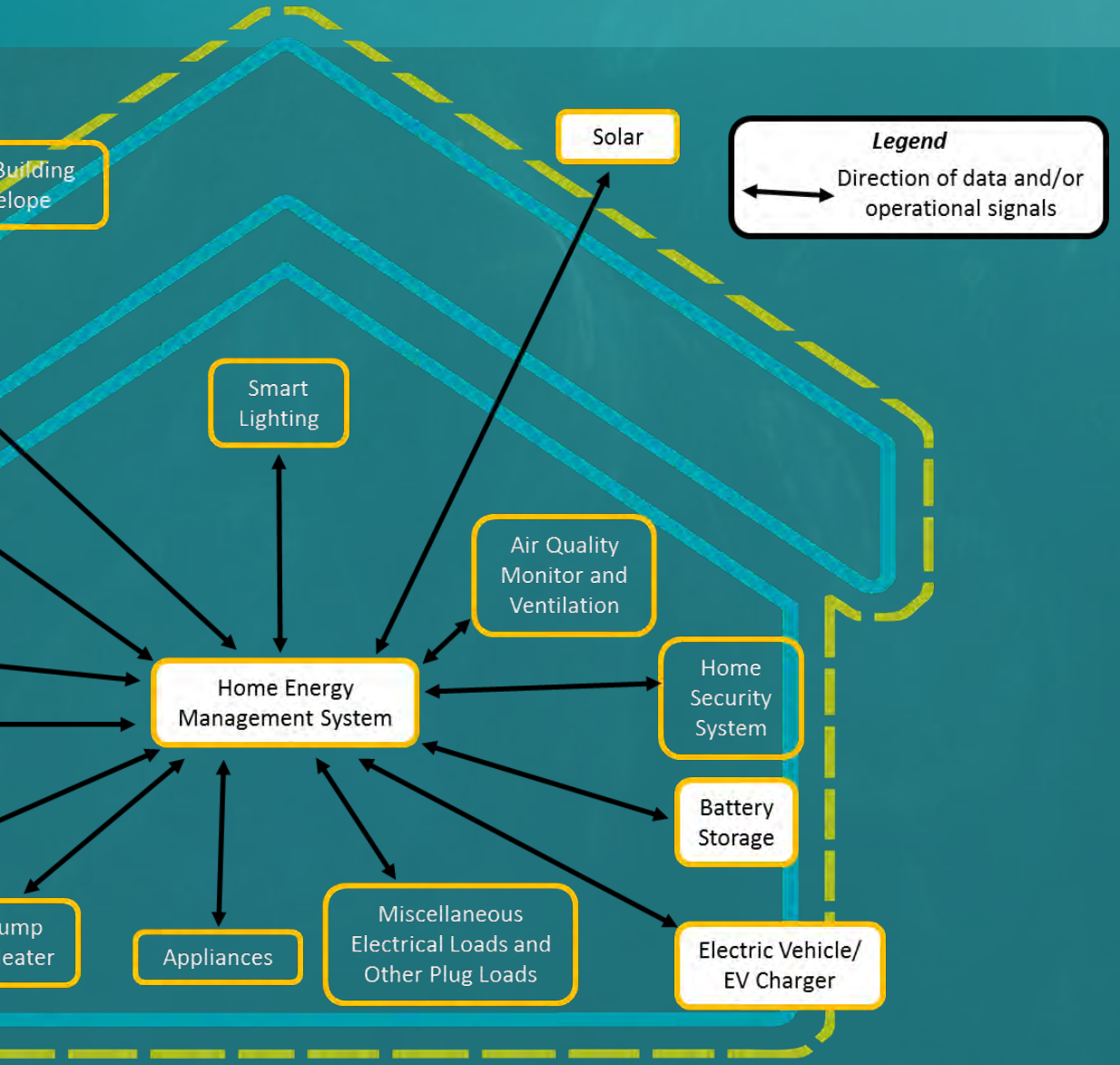
What you can do about it!
Moving to Practice

Putting Data to use from the Smart Energy Home



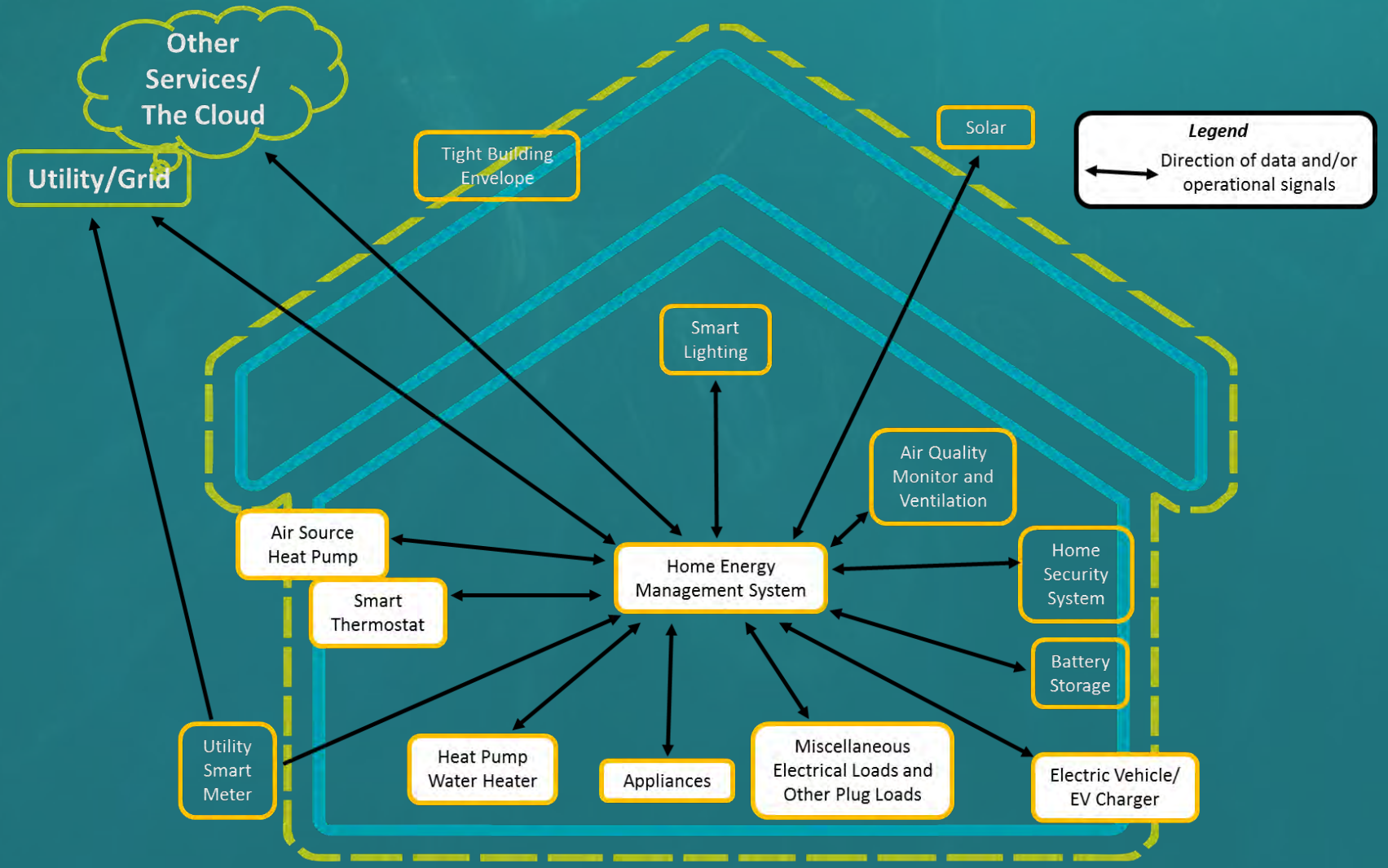
- Lots of sources
- Practitioner benefits
  - Engaging with customers
  - Better understanding or work
  - Tracking longer term operations
- Improved performance
- System alerts *before* it fails
- EM&V improvements for programs
- Software vs. Hardwire

DERS: Getting to the “ready” home



- EV ready—guidance exists
  - ENERGY STAR offers SMART EVSE
  - Building blocks to EV-Ready:
    - 240V 40 amp dedicated breaker
    - 240V dedicated socket
    - Installed in garage or on the property.
    - Now “ready” to plug in the EV charger.
  - Study in NW found Average price to make homes EV Ready was $200
- Solar ready:
  - Location (south, low shade)
  - Access (utility room, chimneys, obstructions)
  - Wiring (3/4” conduit)
  - Smart inverter? CA’s doing it! (rule 21)
- Storage ready? Location and power considerations

It's Electric! Ready for Electric HVAC, Water Heating, and more!



- ASHP provide heating *and* cooling
  - Do you want a backup heat source?
- HPWHs need more space
  - ideally conditioned and away from main living areas
- Construction to supports air flow and (smart) ventilation
- Select smart appliances from the start
  - Need strong wifi!
- Smart outlets? Plugs?
  - Jury still out

Conclusion, Resources, and Discussion

- The Smart Energy Home is (almost) here!
  - You can help make it a reality!
- More Resources:
  - HPC smart homes track! Right there in 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
- Let's talk more!

THANK YOU!

Claire Miziolek
cmiziolek@neep.org
781-860-9177 x115

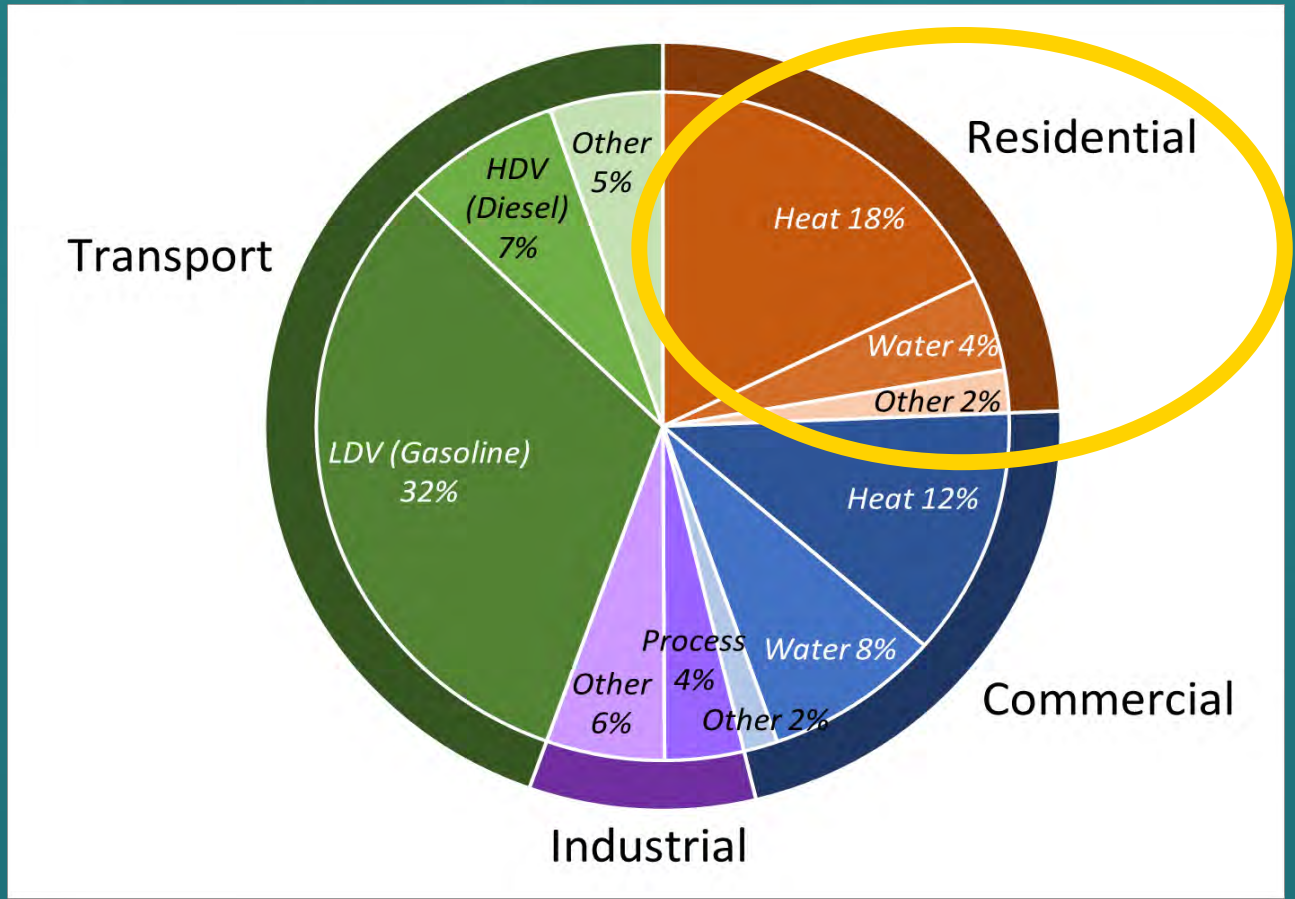
81 Hartwell Avenue Lexington, MA 02421
P: 781.860.9177
www.neep.org

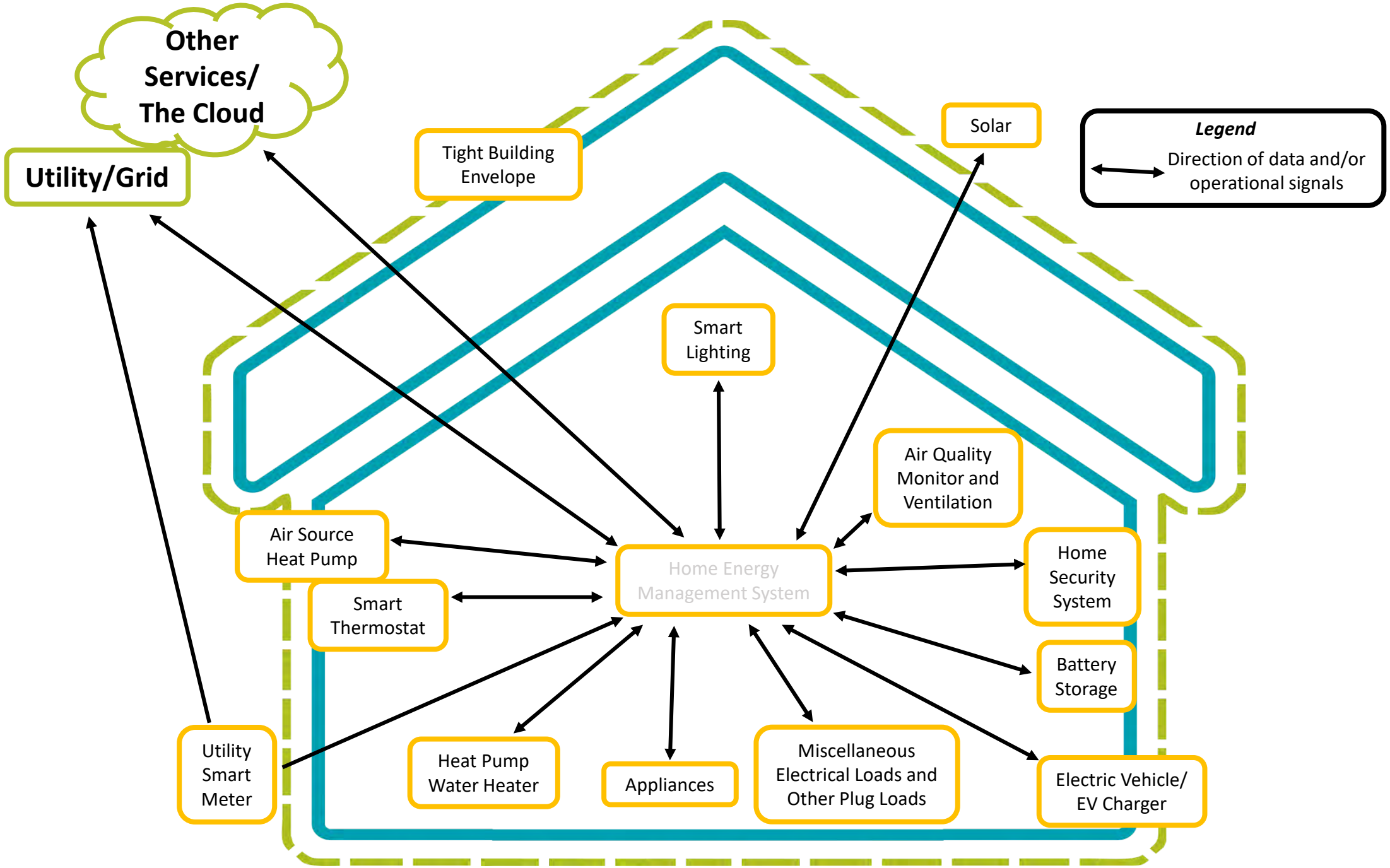
Backup Slide(s)

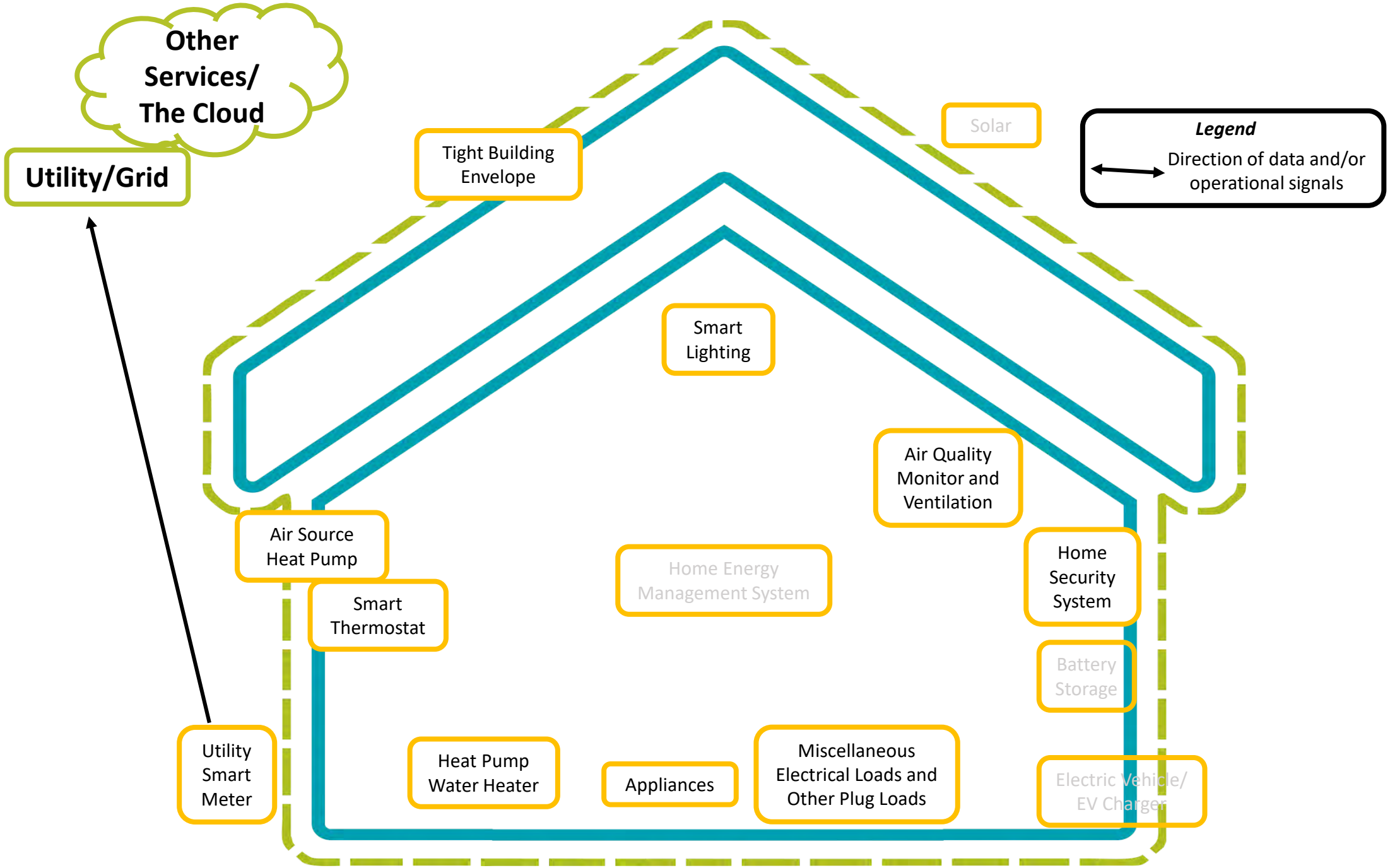
How are we using fossil fuel now?
Direct Use in New York and New England

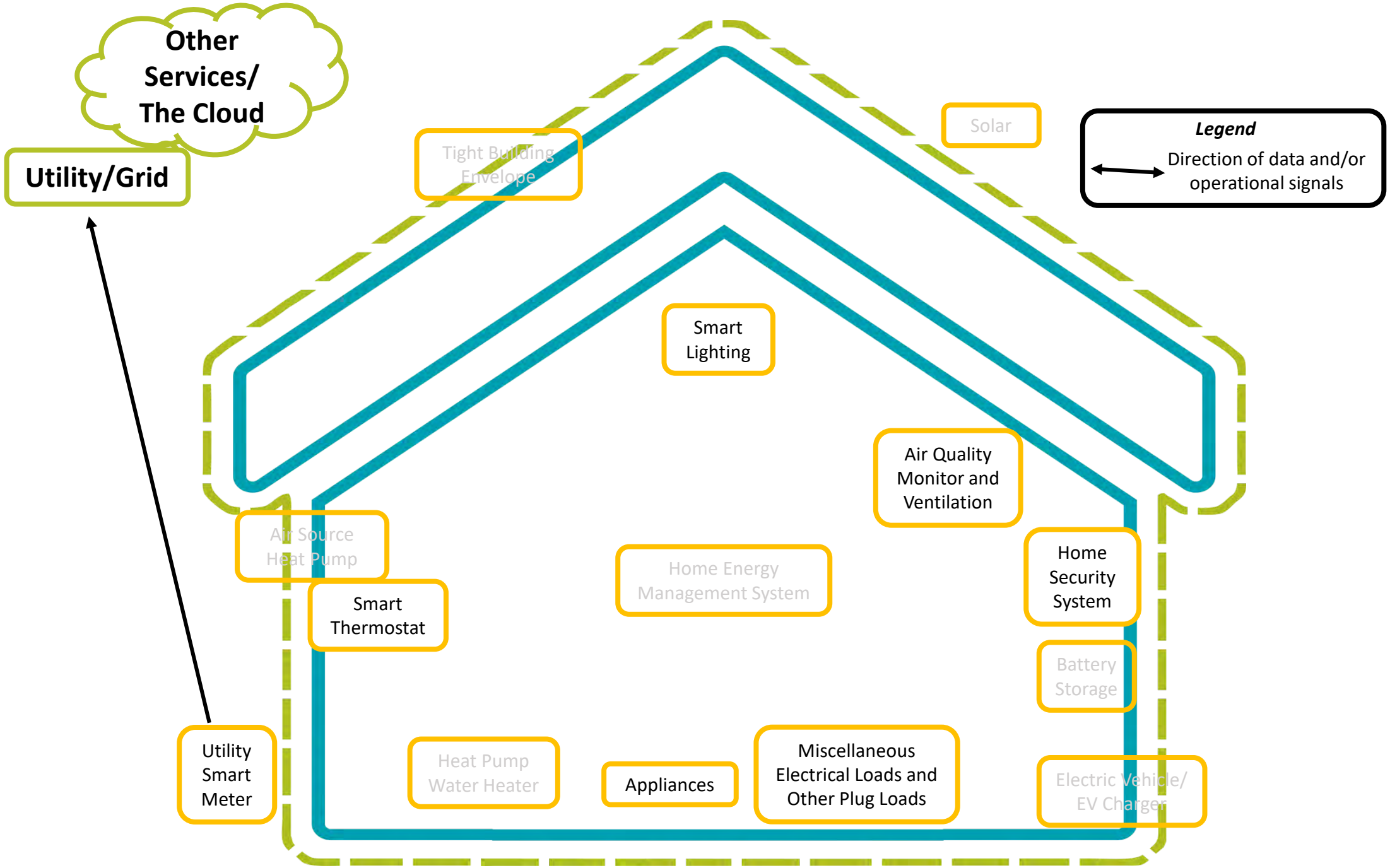
4.2 Quadrillion BTUs per year of direct fossil fuel use

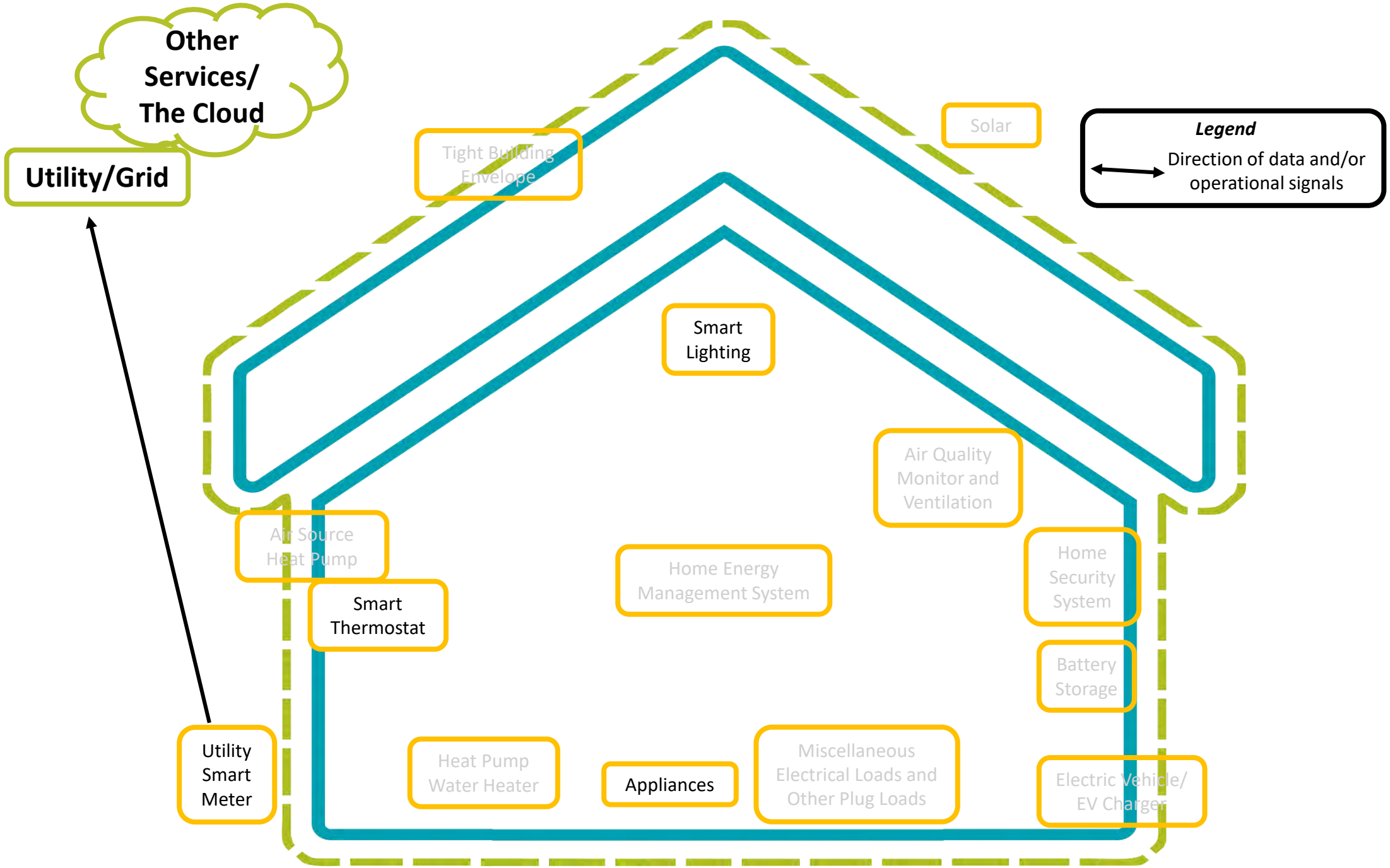
Residential sector uses ~1/4 of fossil fuel




Other Services/ The Cloud
Utility/Grid
Tight Building Envelope
Solar
Legend
Direction of data and/or operational signals
Smart Lighting
Air Quality Monitor and Ventilation
Air Source Heat Pump
Home Energy Management System
Home Security System
Smart Thermostat
Battery Storage
Utility Smart Meter
Heat Pump Water Heater
Appliances
Miscellaneous Electrical Loads and Other Plug Loads
Electric Vehicle/ EV Charger


Other Services/ The Cloud
Utility/Grid
Tight Building Envelope
Solar
Legend
Direction of data and/or operational signals
Smart Lighting
Air Quality Monitor and Ventilation
Air Source Heat Pump
Smart Thermostat
Home Energy Management System
Home Security System
Battery Storage
Utility Smart Meter
Heat Pump Water Heater
Appliances
Miscellaneous Electrical Loads and Other Plug Loads
Electric Vehicle/ EV Charger


Other Services/ The Cloud
Utility/Grid
Tight Building Envelope
Solar
Legend
Direction of data and/or operational signals
Smart Lighting
Air Quality Monitor and Ventilation
Air Source Heat Pump
Smart Thermostat
Home Energy Management System
Home Security System
Battery Storage
Utility Smart Meter
Heat Pump Water Heater
Appliances
Miscellaneous Electrical Loads and Other Plug Loads
Electric Vehicle/ EV Charger


Other Services/ The Cloud
Utility/Grid
Tight Building Envelope
Solar
Legend
Direction of data and/or operational signals
Smart Lighting
Air Quality Monitor and Ventilation
Air Source Heat Pump
Smart Thermostat
Home Energy Management System
Home Security System
Battery Storage
Utility Smart Meter
Heat Pump Water Heater
Appliances
Miscellaneous Electrical Loads and Other Plug Loads
Electric Vehicle/ EV Charger