



Northeast Energy Efficiency Partnerships

# **Next Generation Energy Efficiency: *Opportunities for Public Power in a Rapidly Changing Landscape***

Northeast Public Power Association  
Fall 2016 Public Utility Management Program

November 18, 2016

Brian Buckley

Northeast Energy Efficiency Partnerships

# NORTHEAST ENERGY EFFICIENCY PARTNERSHIPS



*“Accelerating and transforming markets for energy efficiency  
in the Northeast & Mid-Atlantic States”*

## Mission

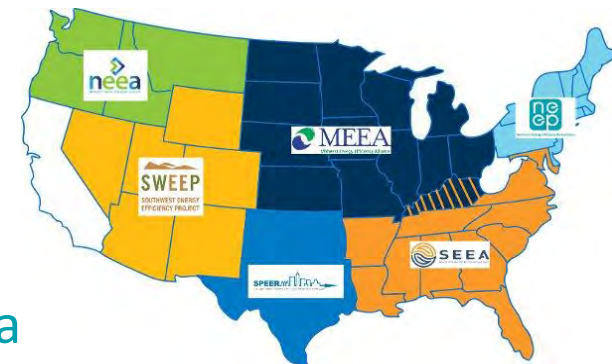
Accelerate energy efficiency as an essential part of demand-side solutions that enable a sustainable regional energy system

## Vision

Region embraces Next Generation Energy Efficiency as a core strategy to meet energy needs in a carbon-constrained world

## Approach

Overcome barriers and transform markets via  
Collaboration, Education and Enterprise



*One of six Regional Energy Efficiency organizations (REEOs) funded by the U.S. DOE to support state efficiency policies and programs. Does not lobby or litigate.*

# Today We'll be Covering...



## The Changing Energy Landscape

1. Unprecedented Embrace of Energy Efficiency
2. Photovoltaic Penetration
3. Transportation Electrification

## Next Generation Energy Efficiency

1. Grid Modernization
2. Geo-targeting
3. Strategic Electrification
4. Integrated Demand Side Management (EE+DR)
5. New Program Strategies- Segmentation, SEM,
6. Financing
7. EM&V 2.0

## Opportunities for Public Power

1. Lead By Example
2. Street Lighting
3. GRITs
4. Demand Reduction
5. Electrification
6. Energy Storage

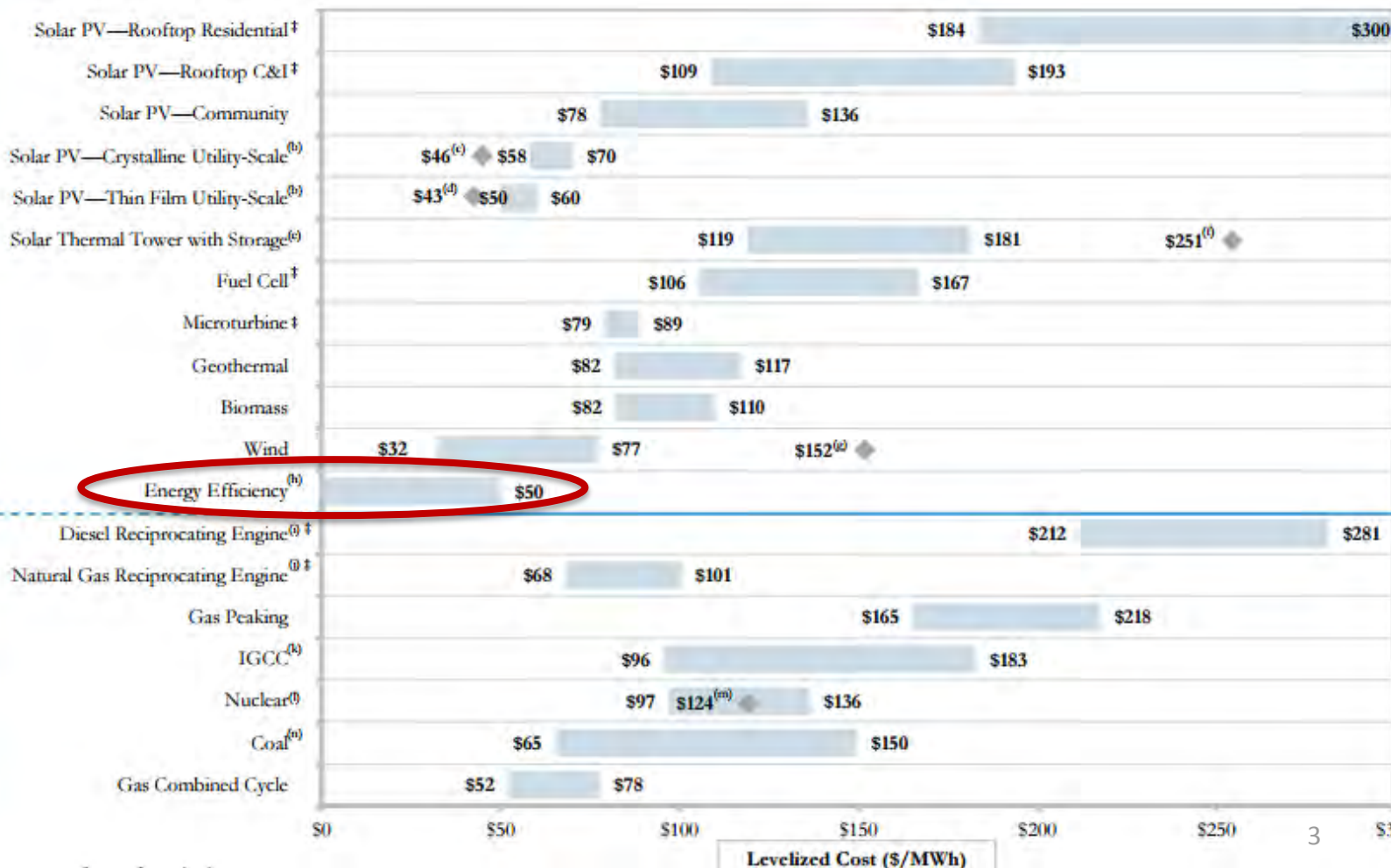


# The Changing Energy Landscape: Unprecedented Embrace of Energy Efficiency



With a lifecycle cost of between \$0 and \$50/MWh, investments in energy efficiency are more cost-effective than investments in *any* conventional energy generation resource.

## ALTERNATIVE ENERGY<sup>(a)</sup>



## CONVENTIONAL

# The Changing Energy Landscape:

## Unprecedented Embrace of Energy Efficiency

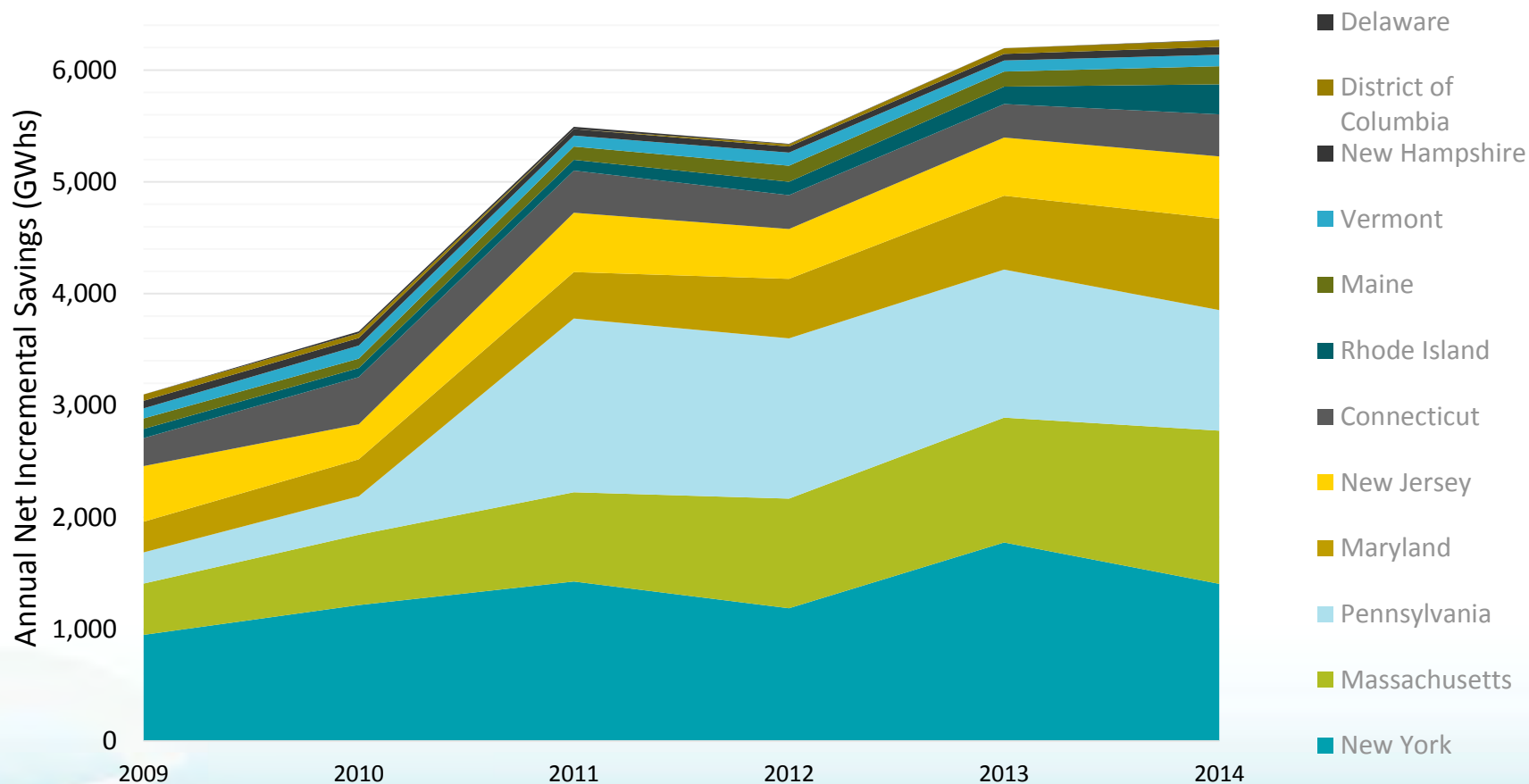


STATE	POLICY TYPE	PROGRAM ADMINISTRATOR	ENERGY SAVINGS GOALS
Connecticut	<u>All Cost-Effective Energy Efficiency</u>	Electric & Gas Utilities <u>2016-18 Plan</u>	<b>Electric:</b> 1.5% retail sales <b>Gas:</b> 0.6% retail sales (forecasted retail sales)
Maine	<u>All Cost-Effective Energy Efficiency</u>	Efficiency Maine Trust <u>2017-19 Plan (proposed)</u> <u>Budgets and Metrics</u>	<u>Proceeding Pending</u>
Massachusetts	<u>All Cost-Effective Energy Efficiency</u>	Electric & Gas Utilities + CLC <u>2016-18 Plan</u> <u>Term Sheet</u>	<b>Electric:</b> 2.93% retail sales <b>Gas:</b> 1.24% retail sales (forecasted retail sales)
New Hampshire	<u>All Cost-Effective Energy Efficiency</u>	Electric & Gas Utilities <u>2017 Plan</u>	<b>Electric:</b> 1.3% retail sales <b>Gas:</b> 0.8% retail sales (2014 retail sales)
Rhode Island	<u>All Cost-Effective Energy Efficiency</u>	Electric & Gas Utilities <u>2015-17 Plan</u>	<b>Electric:</b> 2.6% retail sales <b>Gas:</b> 1.1% retail sales (2012 retail sales)
Vermont	<u>All Cost-Effective Energy Efficiency</u>	Efficiency Vermont, BED, VGS <u>2015-17 Plan</u> <u>Demand Resource Proc.</u>	<b>Electric:</b> 2.1% retail sales <b>Gas:</b> 0.9% retail sales (forecasted retail sales)

# The Changing Energy Landscape: Unprecedented Embrace of Energy Efficiency



Annual verified electric savings have more than doubled in recent years, moving from ~3,100 GWh in 2009 to ~6,300 GWh in 2014. This is a direct result of regulatory policies and executive leadership in states supporting energy efficiency as a first order resource.



Sources: 2013-14 data is drawn from EIA form 861. 2011-12 data is drawn from NEEP's REED Database and ACEEE Scorecard/program administrator reports (D.C. Del., NJ. Pa.). 2009-10 data is drawn from ACEEE scorecards.

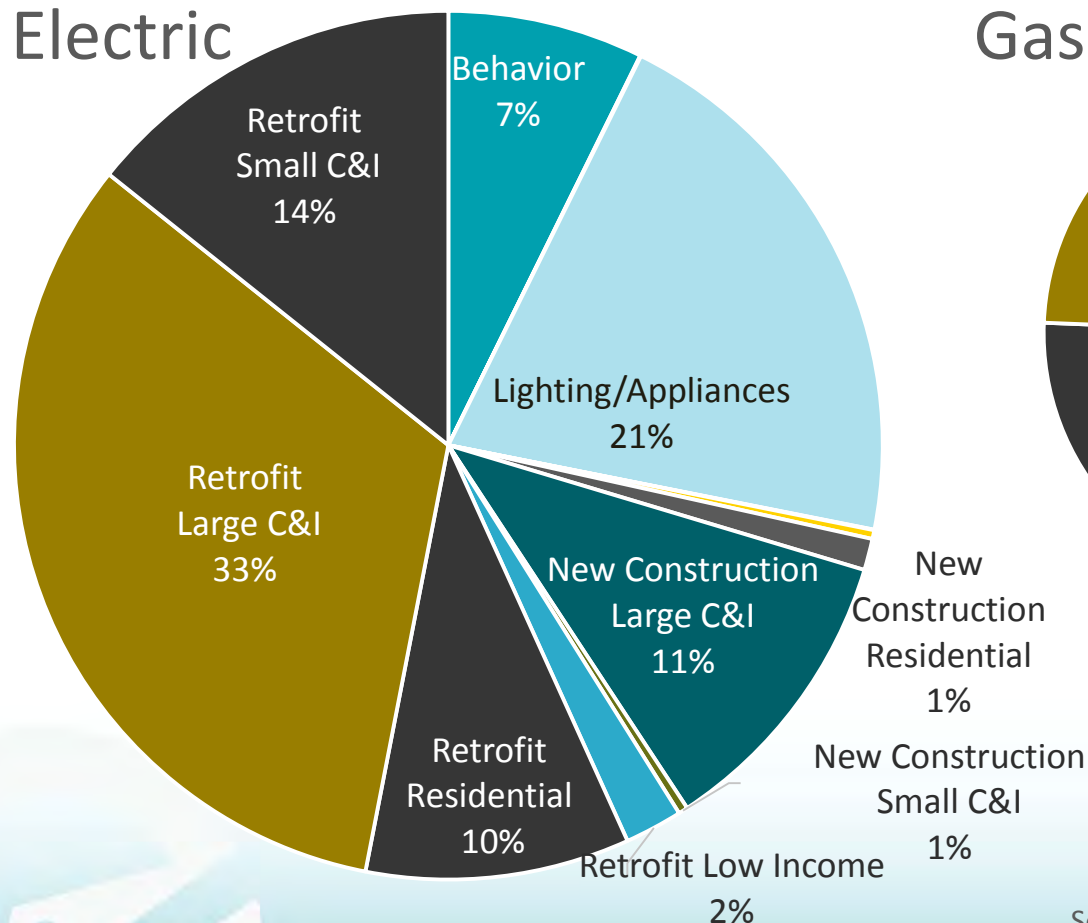
# The Changing Energy Landscape:

## Unprecedented Embrace of Energy Efficiency

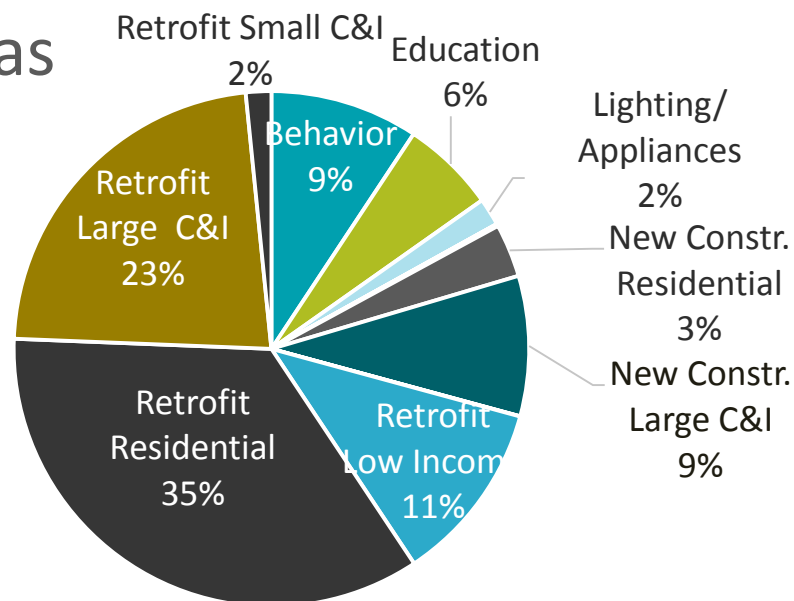


Electric programs mine the majority of their savings from lighting, appliances, and large commercial and industrial retrofits, while natural gas programs focus greater attention on low income and residential retrofit programs.

### Electric

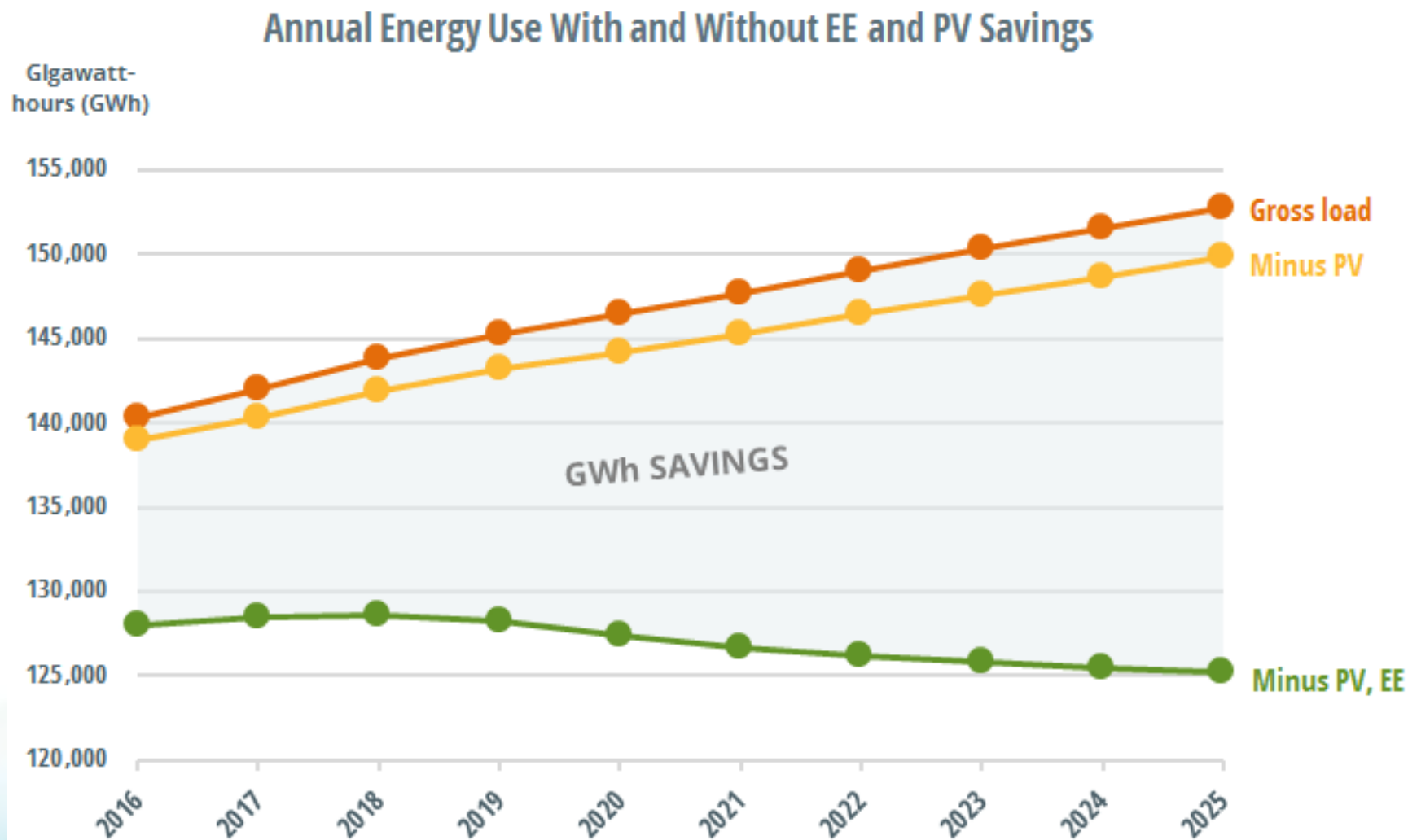


### Gas



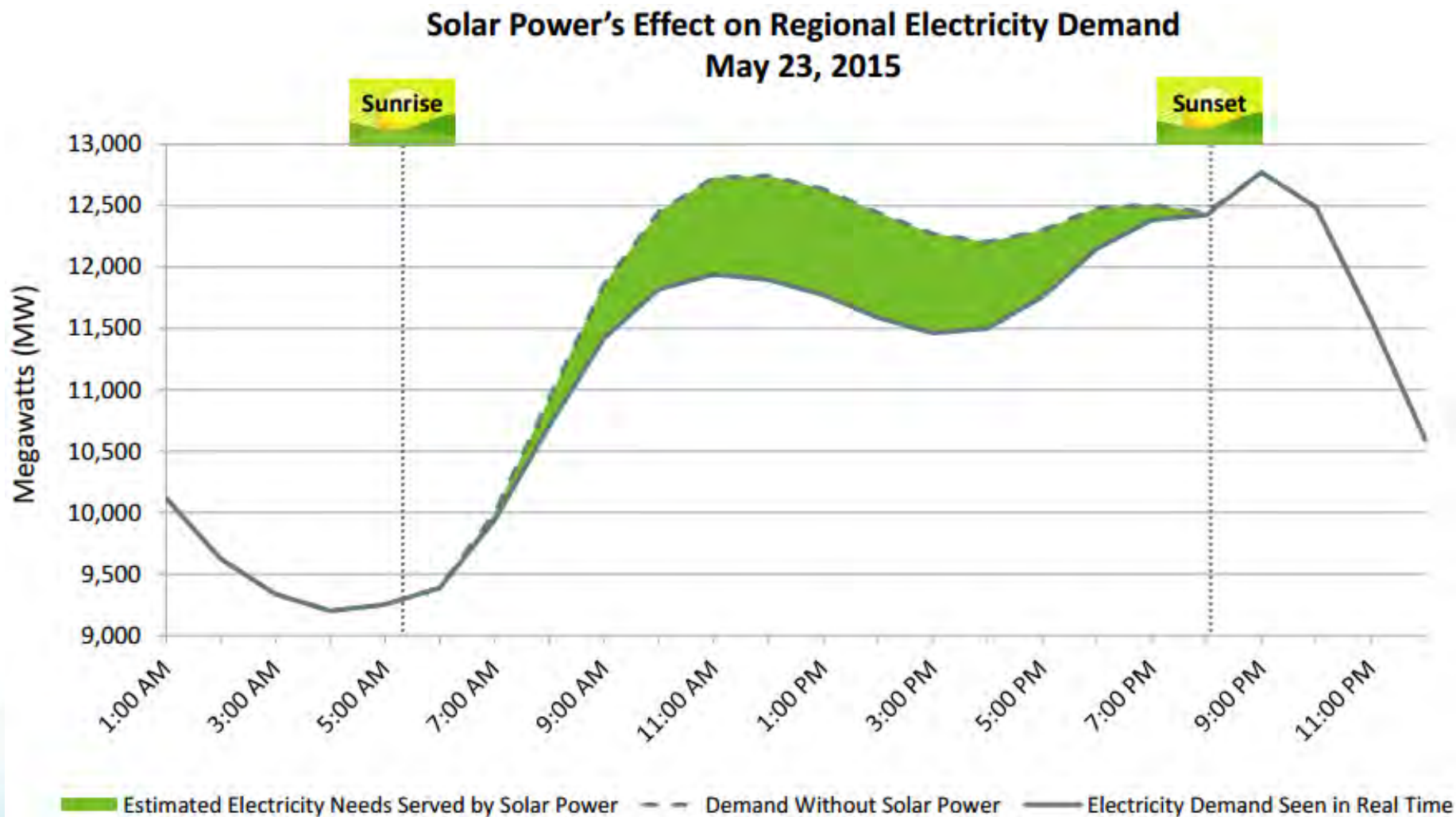


# The Changing Energy Landscape: Unprecedented Embrace of Energy Efficiency





# The Changing Energy Landscape: Growing Photovoltaic Penetration



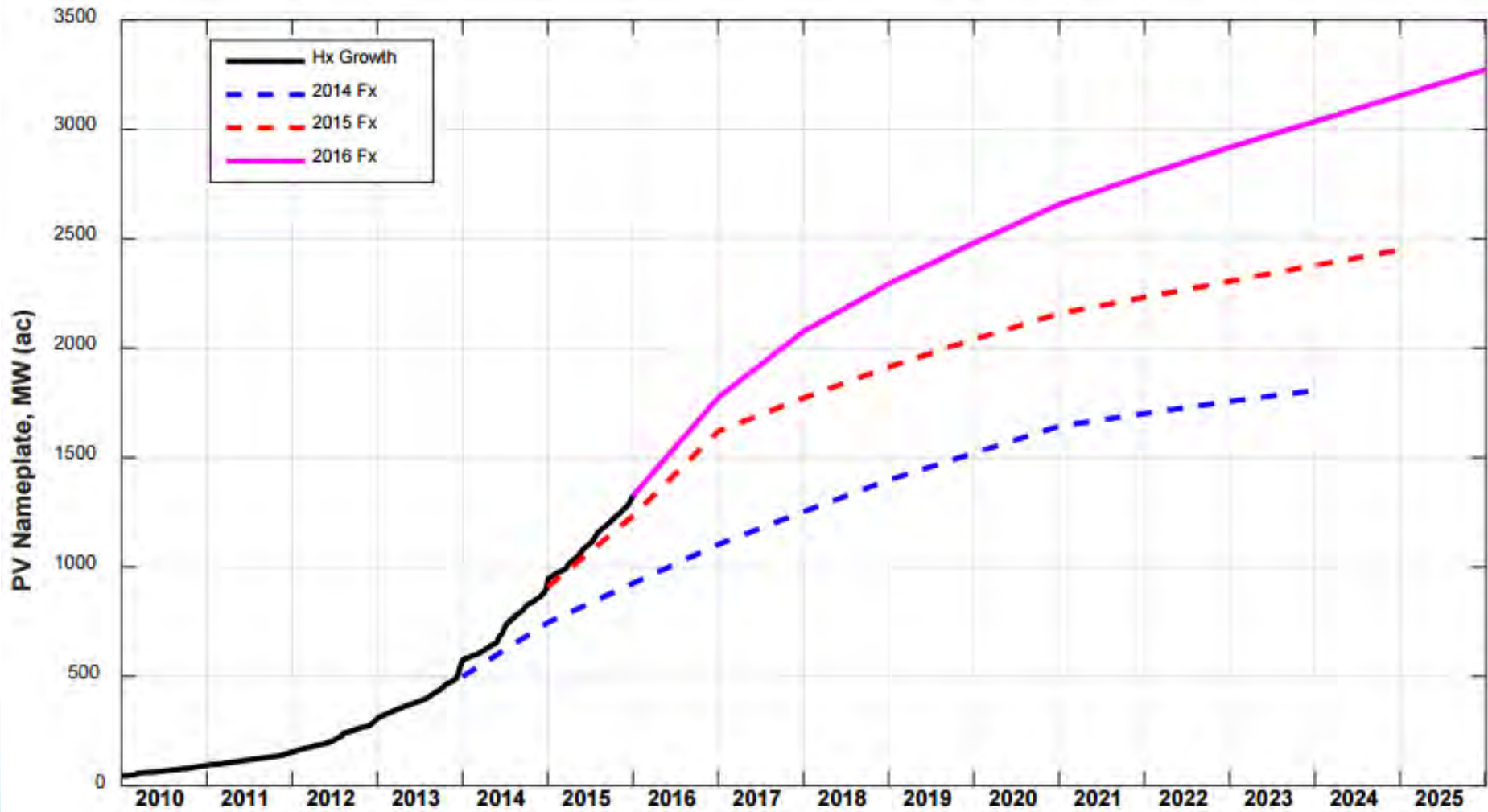
Source: ISO-NE

# The Changing Energy Landscape: Growing Photovoltaic Penetration



State	Nameplate PV Capacity	Net Peak Demand	PV as Percent of Peak Capacity
CT	188.01	7,683	2.5%
ME	15.34	2,127	.7%
MA	947.11	13,317	7.1%
NH	26.36	2,728	1.0%
RI	23.59	2,070	1.1%
VT	124.57	995	12.5%
Total	1,325.00	28,920	4.6%

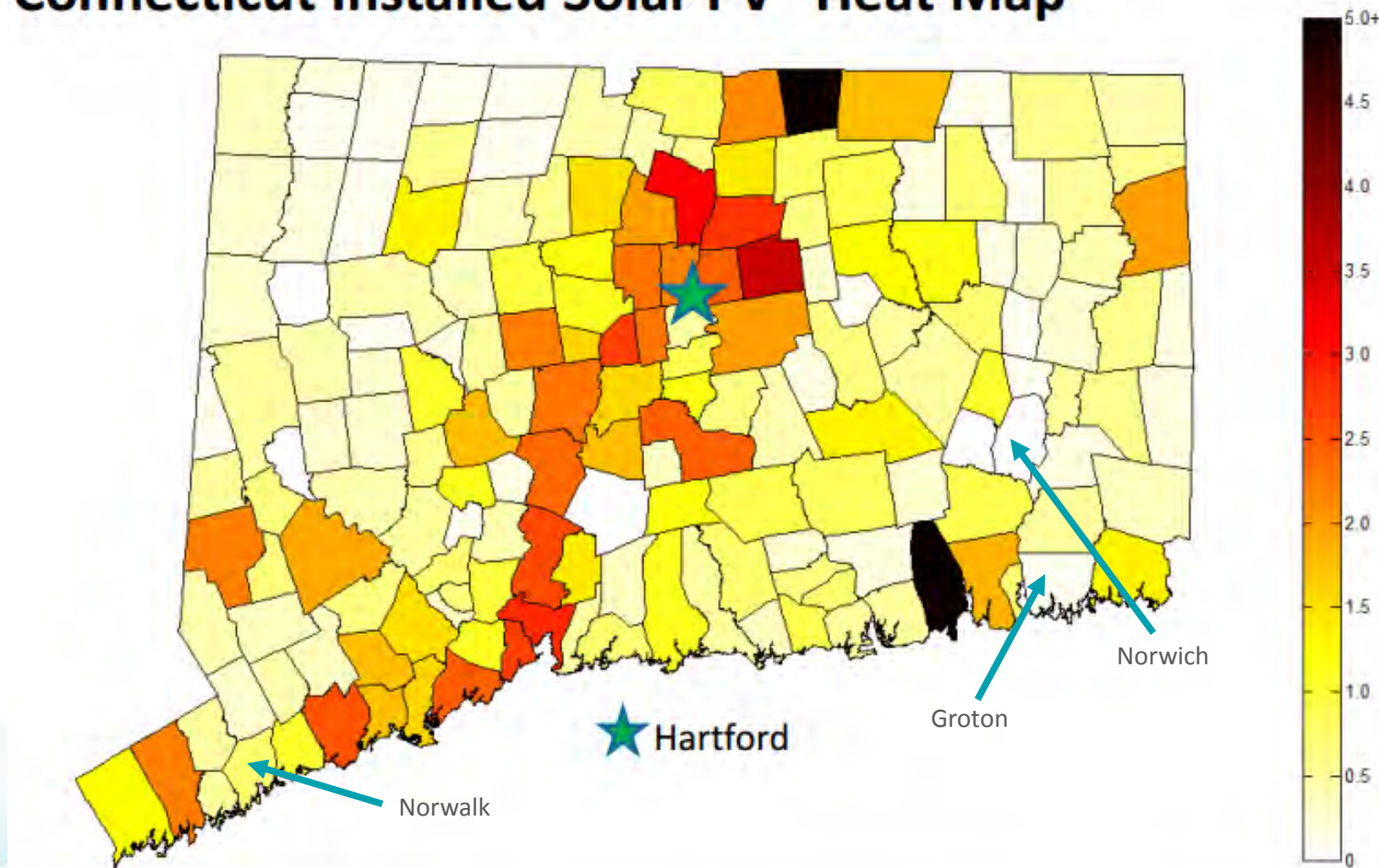
# The Changing Energy Landscape: Growing Photovoltaic Penetration



Source: ISO-NE

# The Changing Energy Landscape: Growing Photovoltaic Penetration

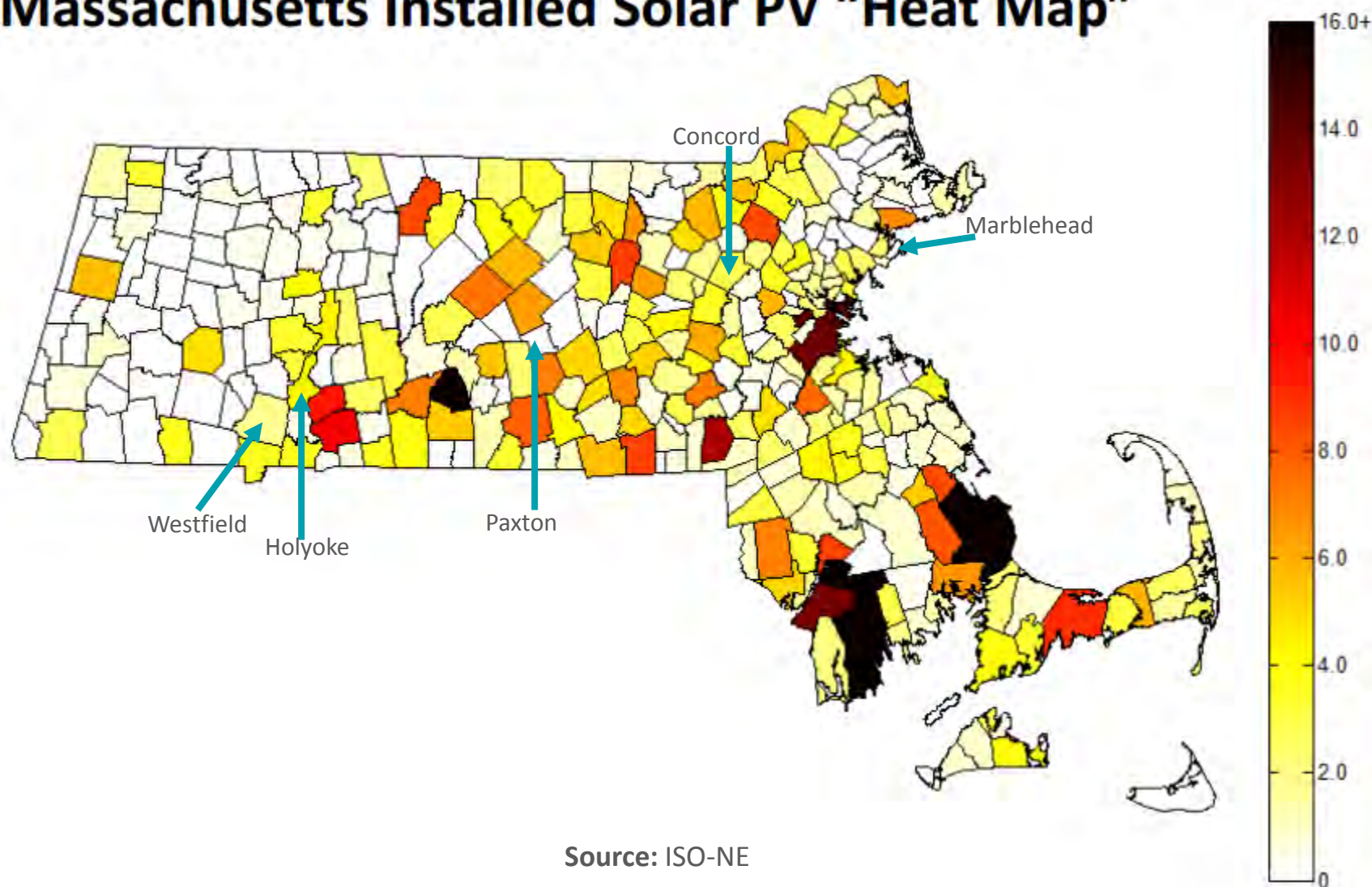
## Connecticut Installed Solar PV “Heat Map”





# The Changing Energy Landscape: Growing Photovoltaic Penetration

## Massachusetts Installed Solar PV “Heat Map”



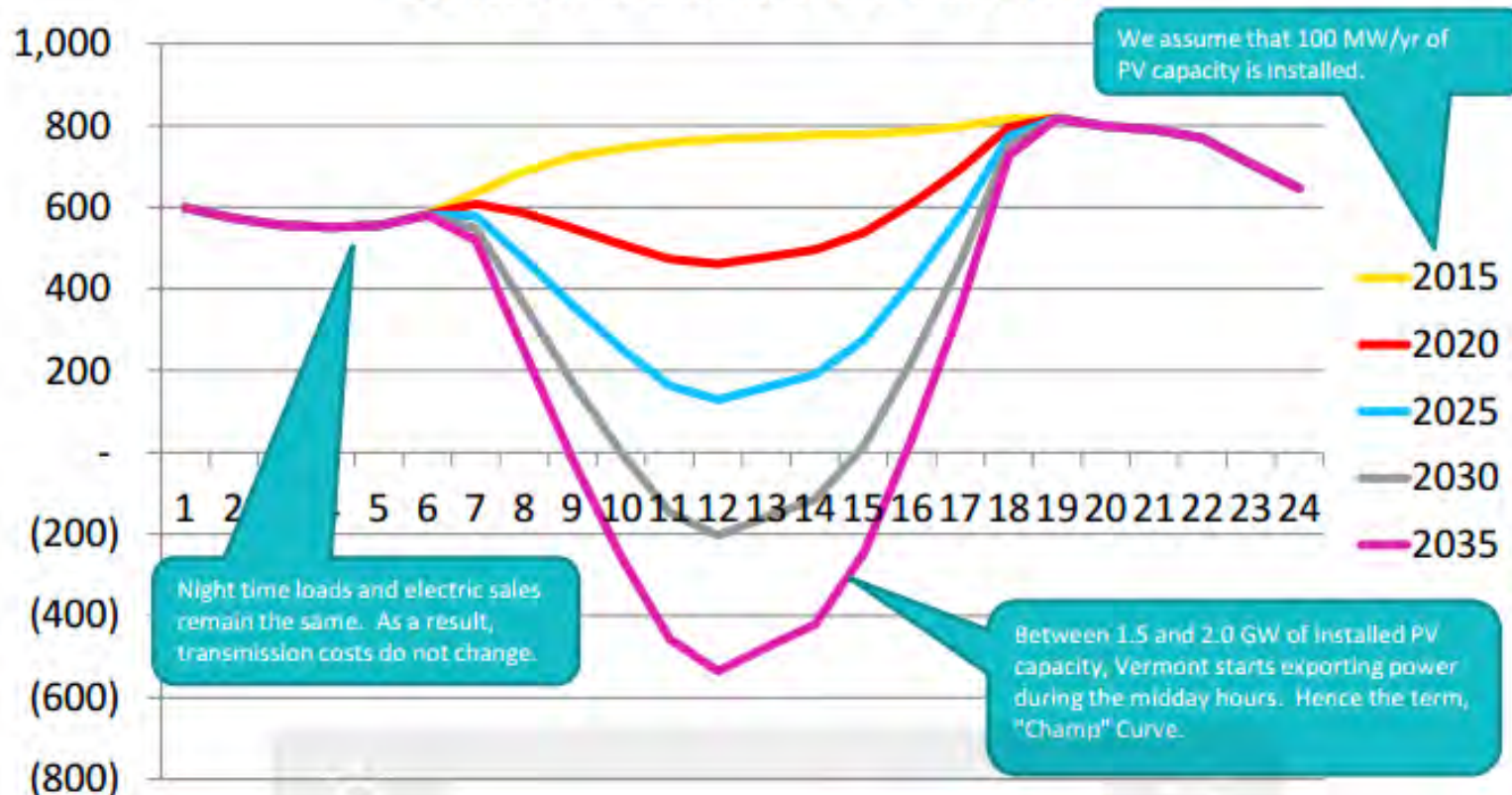
# The Changing Energy Landscape: Growing Photovoltaic Penetration



## Vermont's July-average "Champ Curve"

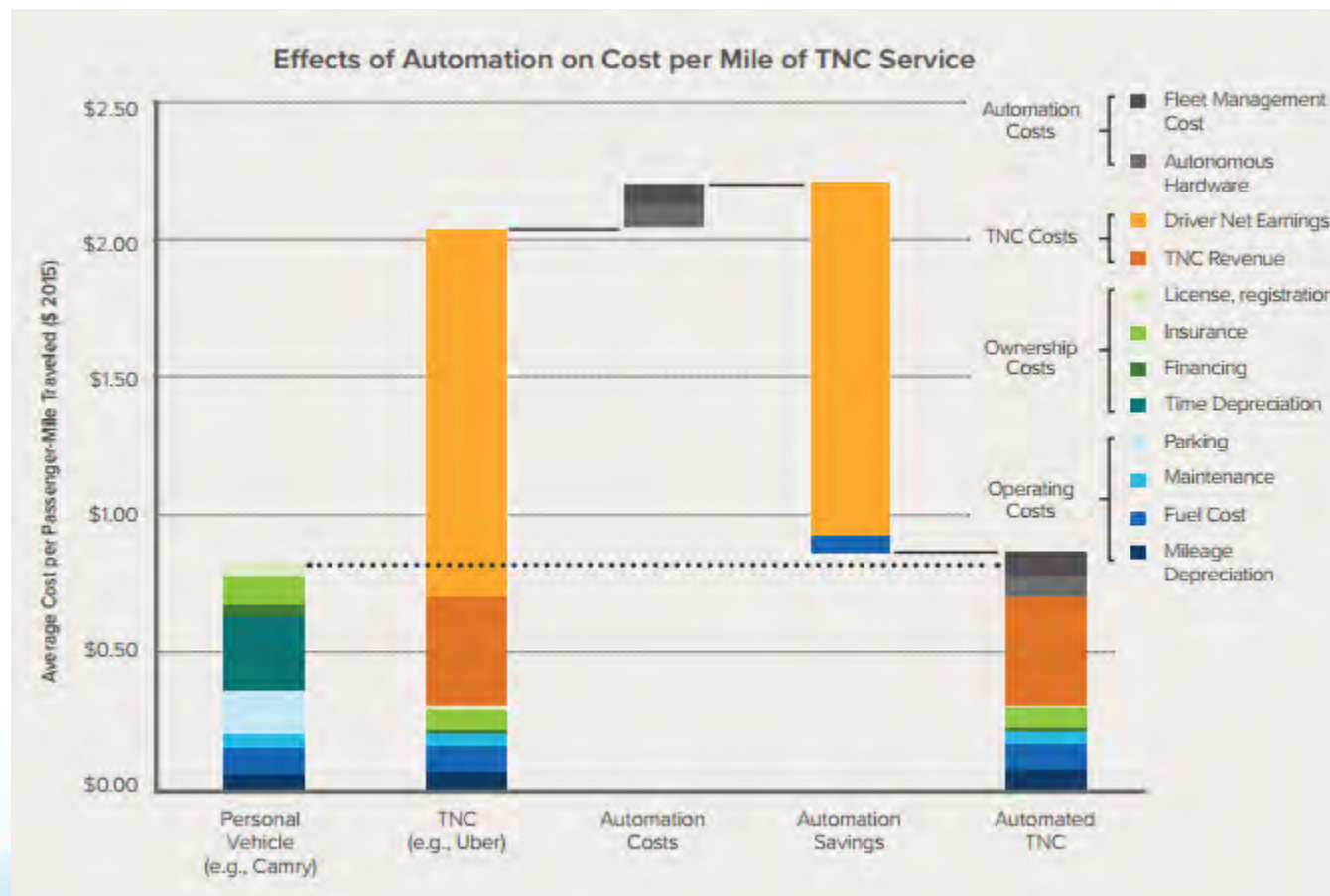
**1 GW of net-metered PV in 2025**

**2 GW of net-metered PV in 2035**



# The Changing Energy Landscape: Transportation Electrification

“People tend to underestimate the change that will occur in the next two years and underestimate the amount of change in the next ten.”

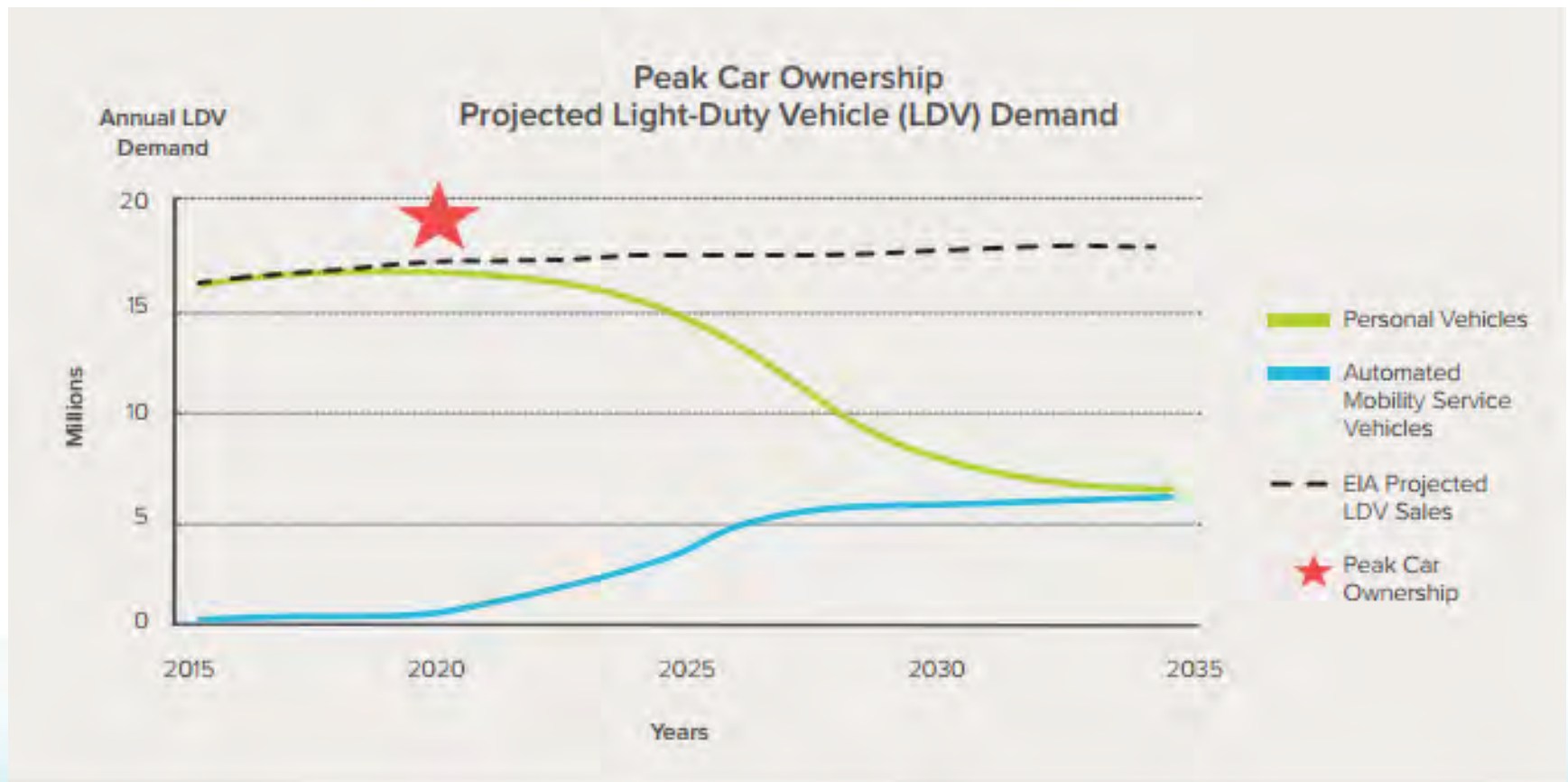




# The Changing Energy Landscape: Transportation Electrification



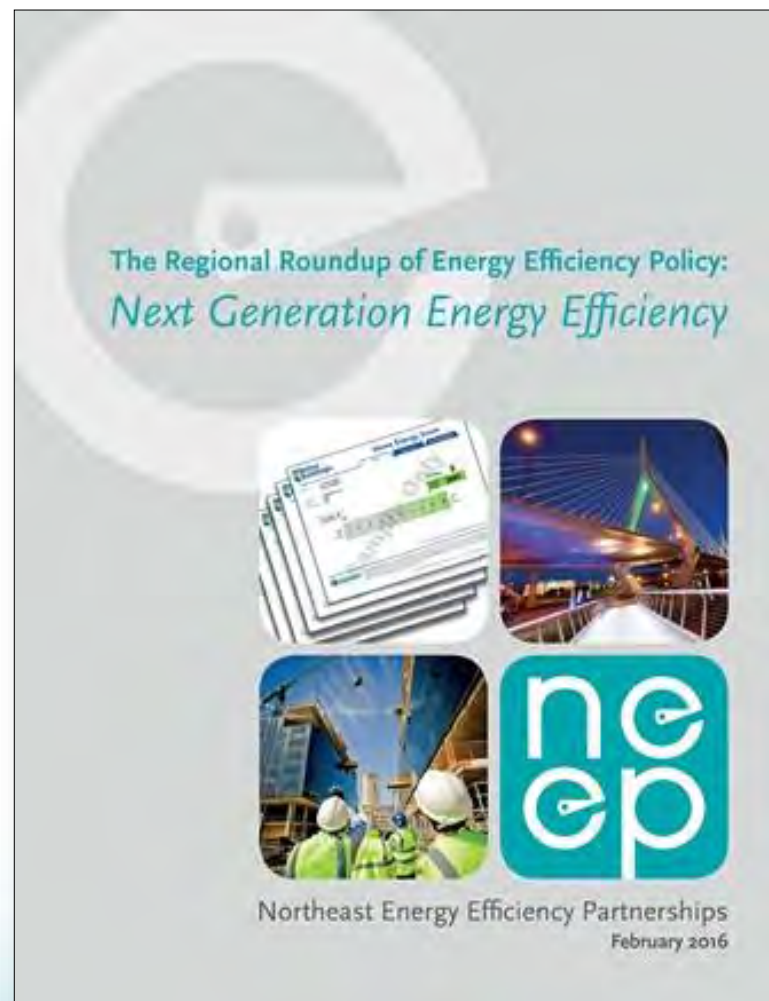
“People tend to underestimate the change that will occur in the next two years and underestimate the amount of change in the next ten.” –Bill Gates



# CHARTING A COURSE: Next Generation Energy Efficiency



- Grid Modernization
- Geo-targeting
- Strategic Electrification
- Integration with other distributed energy resources
- Deep savings for all fuels
- Controls & data analytics
- Advanced building design & operation
- Engaging private markets



# NEXT GENERATION ENERGY EFFICIENCY



TREND	NEXT GENERATION POLICY	STATES
<b>Grid Modernization</b>	Examining new utility frameworks responsive to <b>emerging technologies/societal</b> challenges and anticipating proliferation of <b>multi-directional power flows</b> , while also emphasizing <b>greater customer engagement</b> .	MA, NY, CT, RI, DC, NH
<b>Strategic Electrification and Geo-targeting</b>	Planning to procure savings from energy systems as a whole — <b>across all fuels</b> — with an emphasis on <b>targeting distributed energy resources</b> and their capabilities to <b>defer</b> or limit the need for further investments in <b>distribution and transmission</b> system <b>assets</b> .	VT, RI, NY, MA, ME
<b>Advanced Building Policies</b>	Shifting toward a whole-building approach to efficiency emphasizing advanced building energy codes, code compliance mechanisms, and <b>building energy rating and labeling</b> practices that drive <b>toward “zero energy.”</b>	RI, MA, CT, VT, DC, NY, DE
<b>New Program Strategies</b>	Harnessing new technology and policy innovations, enhance customer understanding around energy usage through expanded <b>energy data access</b> , <b>information communication technologies</b> , and <b>strategic energy management strategies</b> .	MA, VT, CT, NY
<b>Integrating EE and Demand Response</b>	Pairing <b>energy efficiency program planning</b> with opportunities for <b>demand response</b> in a manner that <b>enhances cost-effectiveness</b> and reduces <b>peak load</b> growth.	MD, CT, RI, MA, PA.
<b>Evolution of Financing Tools</b>	<b>Leveraging private capital investments</b> to increase funding available for energy efficiency programs through the use of Green Banks and related credit facilities, while also <b>preserving proven program structures</b> .	NY, CT, PA., NJ
<b>EM&amp;V 2.0</b>	Coupling <b>new data collection technologies</b> and <b>software-as-a-service analytic tools</b> with traditional EM&V for <b>real-time feedback</b> of efficiency program impacts that is <b>less costly</b> and sufficiently accurate.	Many states exploring, none fully implementing

# Grid Modernization



New utility frameworks responsive to emerging technologies and societal challenges and anticipating proliferation of multi-directional power flows, while also emphasizing greater customer engagement.



# Geo-Targeting

- Geographic focusing of distributed energy resources and their capabilities to defer or limit the need for further investments in distribution and transmission system assets.
- Often include a combination of targeted energy efficiency, demand response and photovoltaics.
- Leading states: VT, NY, RI, MA, CT, ME



Northeast Energy Efficiency Partnerships



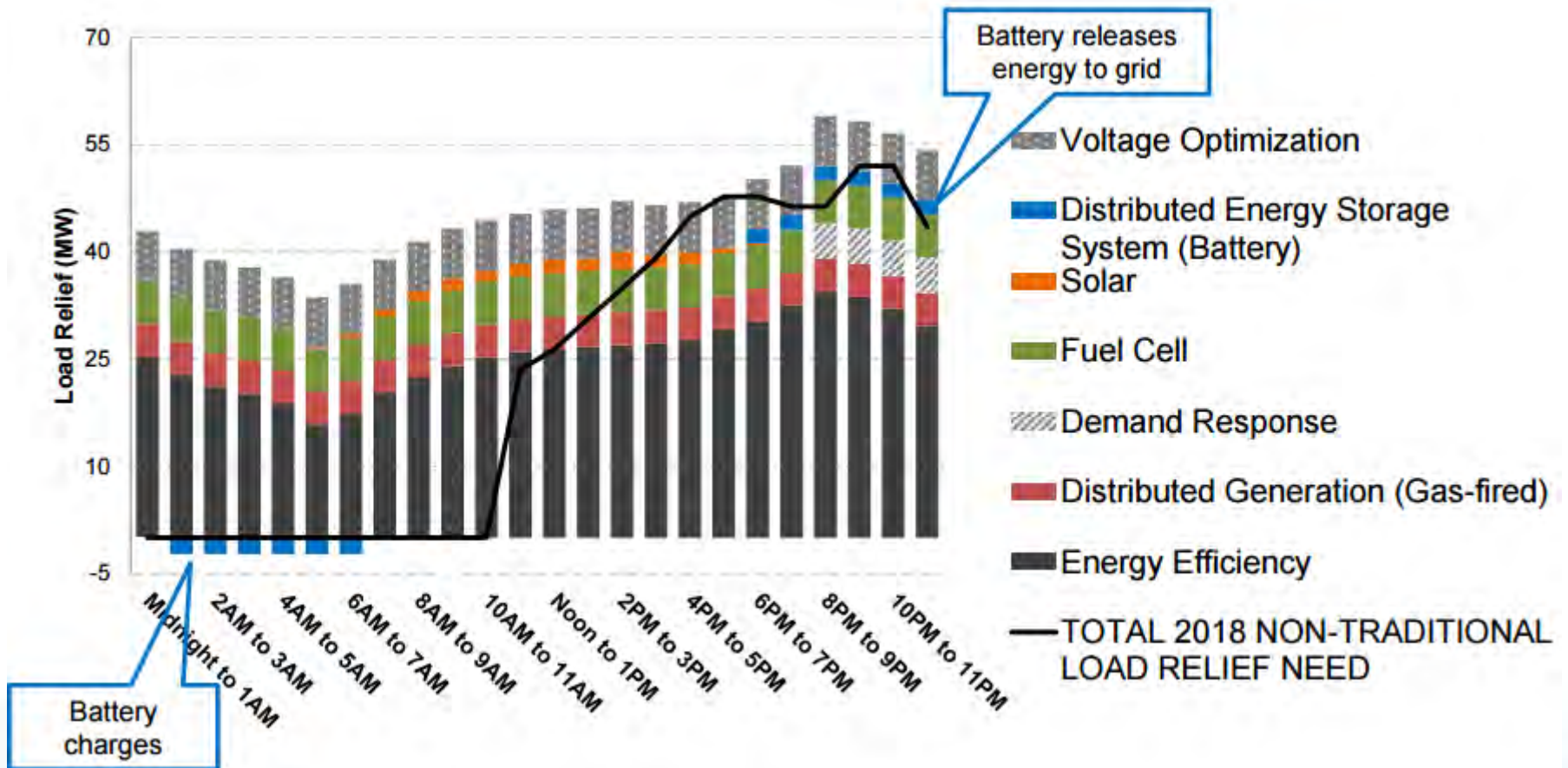
### Energy Efficiency as a T&D Resource: Lessons from Recent U.S. Efforts to Use Geographically Targeted Efficiency Programs to Defer T&D Investments

January 9, 2015

Chris Neme & Jim Grevatt, Energy Futures Group



# Geo-Targeting



Source: Con Edison BQDM Proposal

## NEXT GENERATION TRENDS

# Strategic Electrification

Planning to procure savings from energy systems as a whole, across all fuels, with emphasis on transforming the heating and transportation sectors to achieve system-wide carbon reduction goals.

Leading states backing up climate goals with policy action:  
VT, NY, RI, CT

***State leadership and planning are key!***





# Strategic Electrification

Tier III Measure	2017			2018		
	No. of Units	MWh Credits	Total Budget	No. of Units	MWh Credits	Total Budget
Electric Bus	2	2,428	\$ 145,680	3	3,642	\$ 222,890
Electric Vehicle	40	1,518	\$ 91,080	50	1,898	\$ 116,158
Electric Vehicle Supply Equipment	12	414	\$ 24,840	19	656	\$ 40,147
High Performance Heat Pumps	40	2,830	\$ 169,800	49	3,467	\$ 212,180
PassivHouse	0	-	\$ -	0		\$ -
<b>Total</b>		<b>7,190</b>	<b>\$ 431,400</b>		<b>9,663</b>	<b>\$ 591,376</b>
Tier III Measure	2019			2020		
	No. of Units	MWh Credits	Total Budget	No. of Units	MWh Credits	Total Budget
Electric Bus	2	3,642	\$ 227,348	4	4,856	\$ 309,194
Electric Vehicle	72	2,733	\$ 170,605	80	3,037	\$ 193,373
Electric Vehicle Supply Equipment	25	863	\$ 53,872	15	518	\$ 32,982
High Performance Heat Pumps	70	4,952	\$ 309,124	76	5,377	\$ 342,367
PassivHouse			\$ -	2	755	\$ 48,073
<b>Total</b>		<b>12,190</b>	<b>\$ 760,949</b>		<b>14,543</b>	<b>\$ 925,989</b>

# Integrating Efficiency and Demand Response



Energy Efficiency is Slowing Peak Demand Growth and Flattening Energy Use

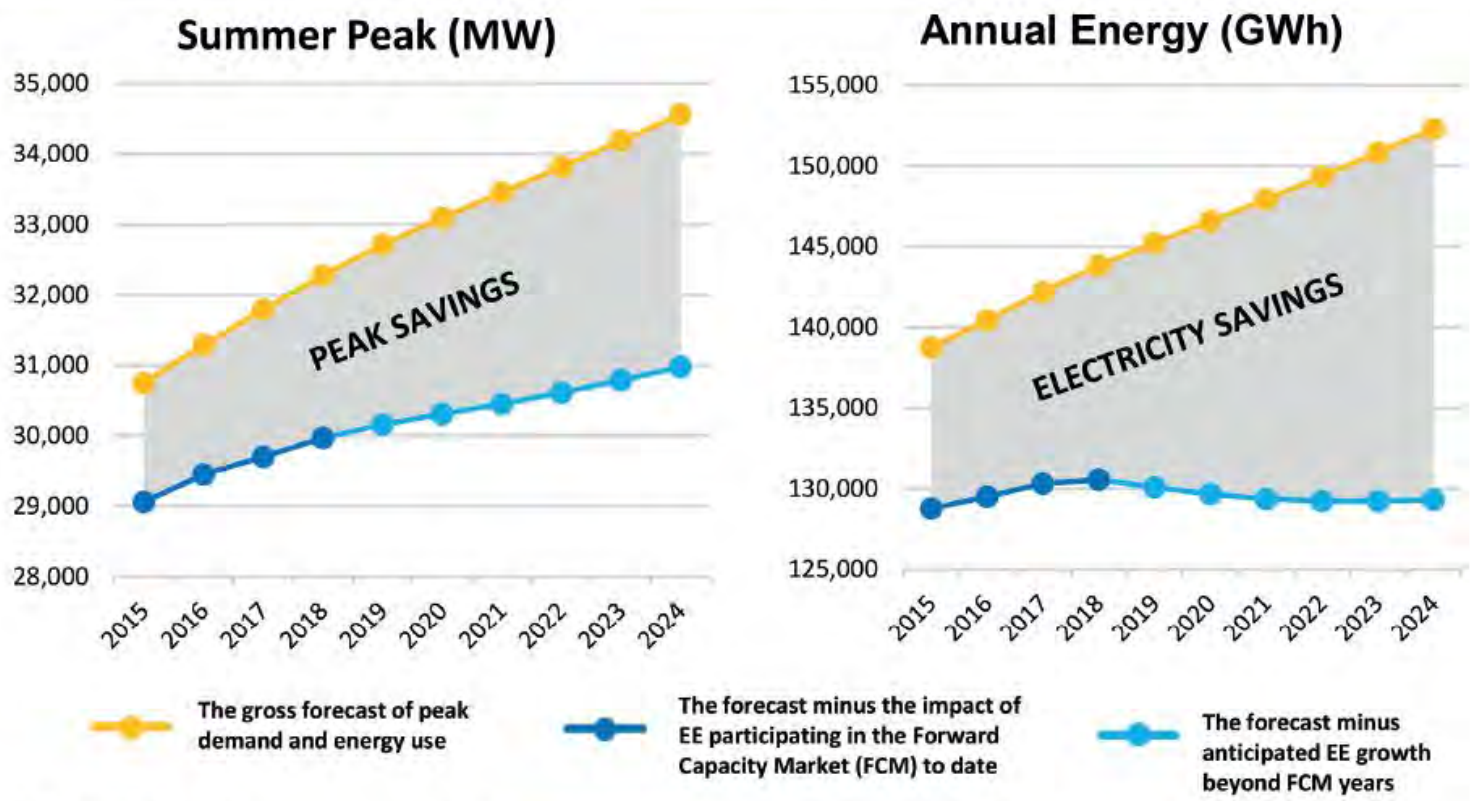


Chart Courtesy of ISO-New England

Source: [Final ISO New England EE Forecast for 2019-2024](#) (April 2015)

Source:  
MA DOER

**Top 1% of Hours accounts for 8% of MA Spend on Electricity**  
**Top 10% of Hours accounts for 40% of Electricity Spend**

# Integrating Efficiency and Demand Response

Program	Sector	Details
Manual Curtailment	C&I	<ul style="list-style-type: none"> <li>Based upon contractual commitments</li> <li>50-100kW usage reductions</li> <li>Reservation v. voluntary enrollment</li> <li>Opportunity for bonus payments</li> </ul>
Direct Load Control (DLC)	Res./ Small C&I	<ul style="list-style-type: none"> <li>Based upon direct communication between a program administrator</li> <li>Smaller usage reductions (~1kW)</li> </ul>
Legacy DLC	Res./ Small C&I	<ul style="list-style-type: none"> <li>Switch based, one way signal</li> <li>Cycling an A/C condensing unit, heat pump, pool pump, or hot water heater</li> <li>Minimum verification required</li> </ul>
Two-Way DLC	Res./ Small C&I	<ul style="list-style-type: none"> <li>Behind the meter information and communication technologies (ICT) transit data over HAN/Broadband</li> </ul>
Behavioral Demand Response	Res.	<ul style="list-style-type: none"> <li>Based upon customer engagement</li> <li>Can provide incentive or use behavioral triggers</li> <li>AMI Required</li> </ul>

# **Integrating Efficiency and Demand Response**

## **Moving beyond switches, toward a proliferation of connected devices**

- Smart Phones, T-Stats, Hot Water Heaters, Heat Pumps, EMS, ARTUs, CALCs, PEVs, energy storage, etc.

## **Program Administrators Offering Demand Response**

- NWA projects throughout the country
- Mass. 2016-18 Plan
- Conn. 2016-18 C&LM Plan
- Pennsylvania Act 129 Phase III
- NHEC Go Beyond the Peak
- Maryland BGE Smart Energy Rewards
- NY Dynamic Load Management Plans, Smart Home Rate in REV Track II Order



## **Why should utilities should get in the game? Survey Says...**

- Those who are enthusiastic about smart tech identify as enthusiastic about EE; 52 percent, v. 27 percent of the general population
- Customers value connectivity almost as much as cost savings
- NGA report outlining opportunities

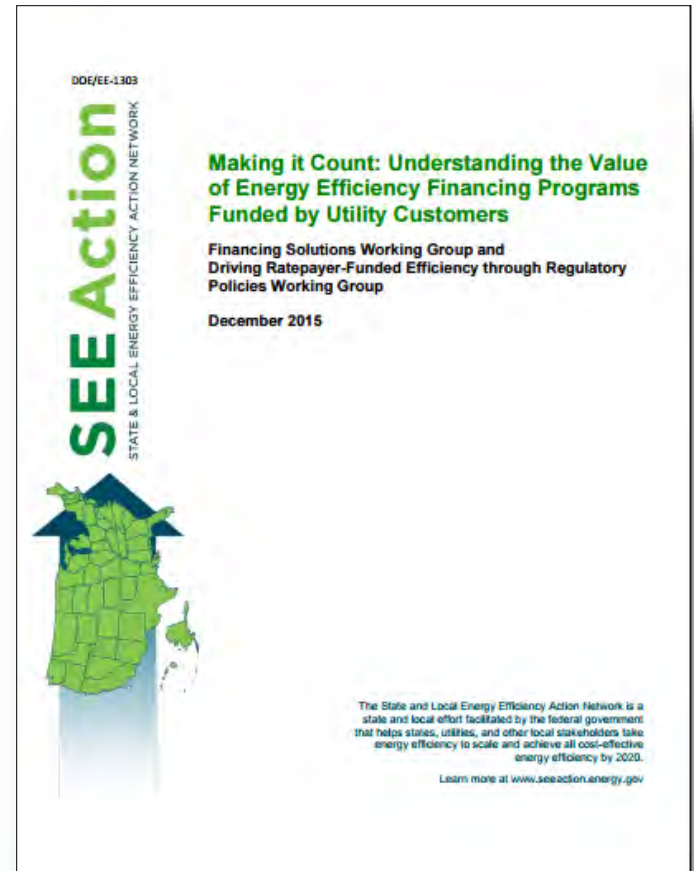


# Private Finance as a Supplement to EE Programs

Building on past work in on-bill financing and revolving loan funds, many states are beginning to leverage private capital investments to increase funding available for energy efficiency programs through the use of Green Banks and related credit facilities, while also preserving proven program structures.

*Leading states: Ct, NY, Penn*

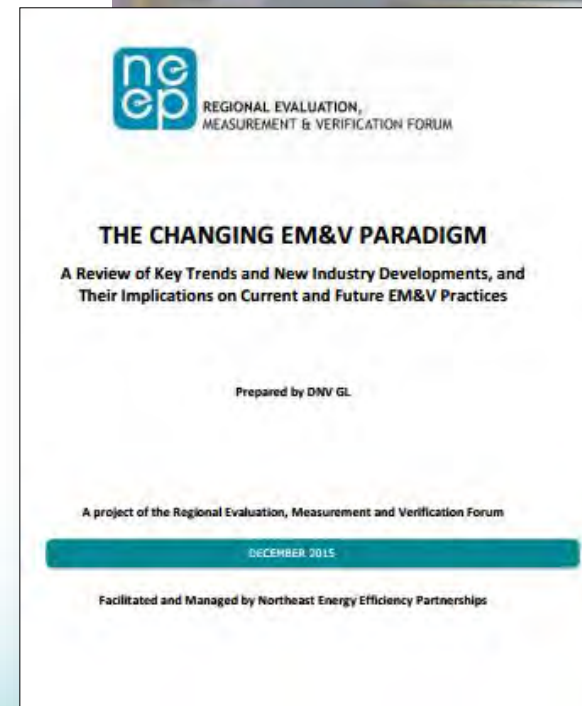
Another increasing trend is private market investment as part of their portfolio.



# Evaluation, Measurement & Verification 2.0



- Utilizing quick cycle feedback and non-intrusive load monitoring to identify opportunities for energy savings and verify savings
- Complements “tried & true” EM&V methods
- Opens the door for operational savings that were harder to verify under the measure/incentive approach



# Next Generation Efficiency: Opportunities for Public Power



## Leading By Example

- Municipal Facilities are good targets for energy efficiency upgrades due to high **saliency**, extended **lifetime**, and in some cases **grants** from state government

## Green Revolving Investment Tracking System (GRITS) for APPA

- Web-based project management tool that allows users to track and analyze energy, financial, and carbon savings data
- Can recapture operational savings to create green revolving fund
- Free for APPA members

## Street Lighting

- LED Street lighting is a proven technology with opportunities to **save 50-80% of energy costs**, and virtually all maintenance costs
- Muni's can be more agile than regulated utilities, whose **tariff revisions** can take years





# Next Generation Efficiency: Opportunities for Public Power

## Demand Reduction

- Large utilities are piloting large DR programs to reduce ICAP tags, **shifting capacity costs** to those who are not
- If AMI Penetration, then think about **Time Varying Rates** and **Peak Time Rebates** to reduce ICAP Tag. If not, consider **Direct Load Control** technologies.

## Electrification

- Muni's can be more agile than regulated utilities, whose regulatory paradigm does not allow for **fuel switching**
- Electrification and associated increase in **load factor** can **lower overall costs**, spreading MW costs over more MWhs



# Next Generation Efficiency: Opportunities for Public Power



Use Case		Estimated Share of 1766 MW Recommendation		Millions \$		Benefit/Cost Ratio
		%	MW	Combined Benefits (Market Revenue + System Benefits)	Cost	
Investor Owned Utility (IOU) Grid Mod Asset: Distributed Storage at Utility Substations		40%	707	1301	387	3.36
Municipal Light Plant (MLP) Asset		10%	177	446	97	4.60
Load Serving Entity (LSE)/Competitive Electricity Supplier Portfolio Optimization		8%	141	158	77	2.05
Behind the Meter	C&I Solar + Storage	6%	106	103	58	1.78
	Residential Storage	4%	71	19	53	0.49
	Residential Storage Dispatched by Utility	5.5%	96	129	39	2.43
Merchant	Alternative Technology Regulation Resource	1.5%	28	45	15	3.00
	Storage + Solar	10.5%	185	373	102	3.66
	Stand-alone Storage or Co-Located with Traditional Generation Plant	9.5%	168	405	92	4.40
Resiliency/Microgrid		5%	87	133	48	2.77

Source: MA DOER/CEC “State of Charge” Potential Study on cost-effectiveness of energy storage

# Next Generation Efficiency: Opportunities for Public Power



## Energy Storage

- Can provide resiliency, as well as revenue streams for from wholesale markets
- \$20 million MA DOER grant funding opportunity pending, CT support dependent upon CES
- CESA released “Energy Storage Procurement Guidance Document for Municipalities” includes RFP template for utility scale storage

**Request for Proposals Template: Utility Scale**

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[Title and Solicitation Number]

(Organization)  
for The Town of (municipality),  
Community Clean Energy Resiliency Initiative  
Request for Proposals

Release Date: \_\_\_\_\_, 2016  
Due Date: \_\_\_\_\_, 2016

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Northeast Energy Efficiency Partnerships

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## **NORTHEAST ENERGY EFFICIENCY PARTNERSHIPS**

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