How Advanced is our Metering Infrastructure? Tales from the Northeast

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Moderator: Elizabeth Titus, NEEP

Webinar June 6, 2017

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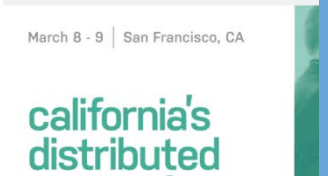

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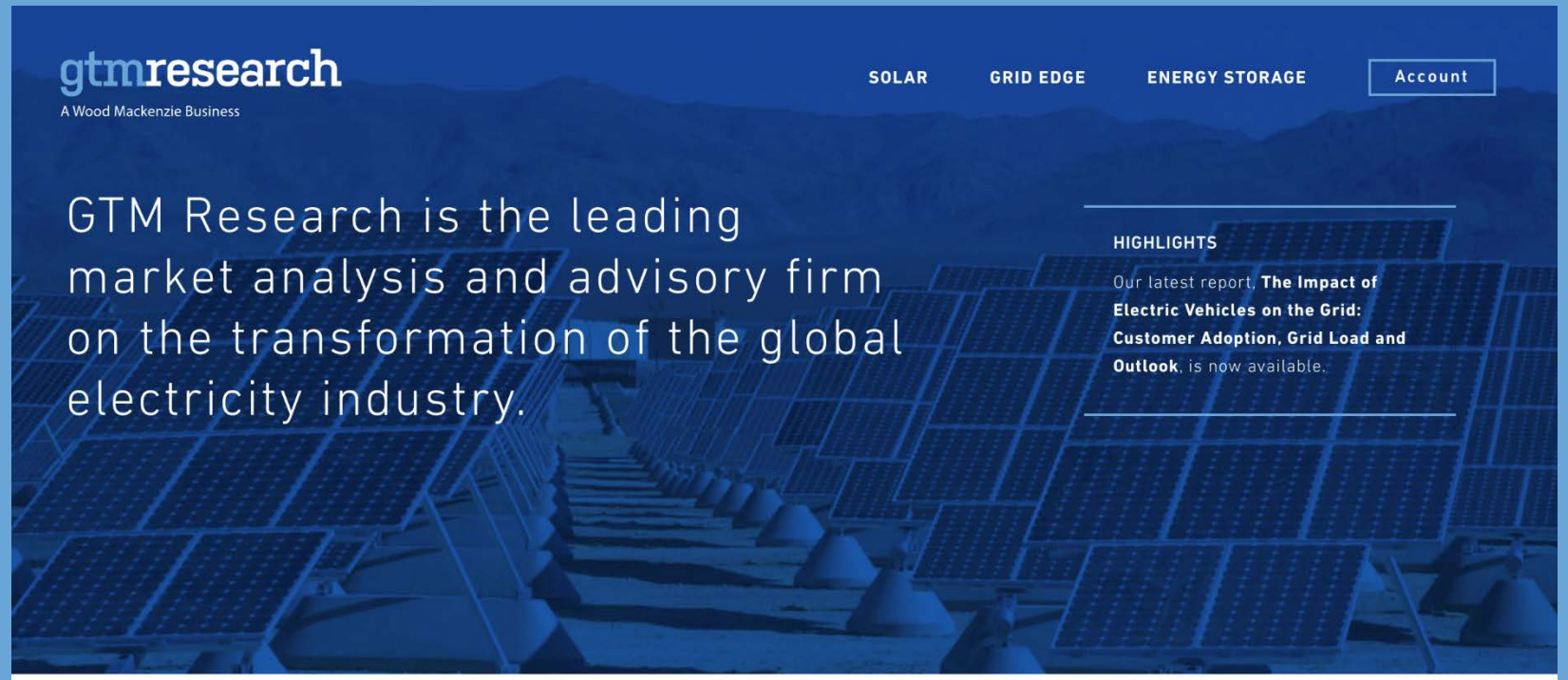

Recent Publications:

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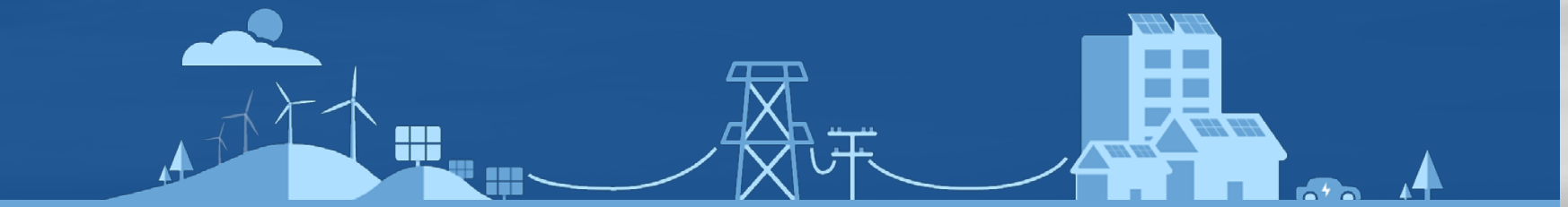
Grid Edge

Energy Storage

GTM Research is the premier market intelligence provider on the decarbonization and decentralization of energy



Clean Generation

Grid Modernization

Customer Evolution

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We guide companies leading the electricity transformation

Northeast Energy Efficiency Partnerships

"Assisting the Northeast & Mid-Atlantic Region in Reducing Total Carbon Emissions 80% by 2050"

Mission

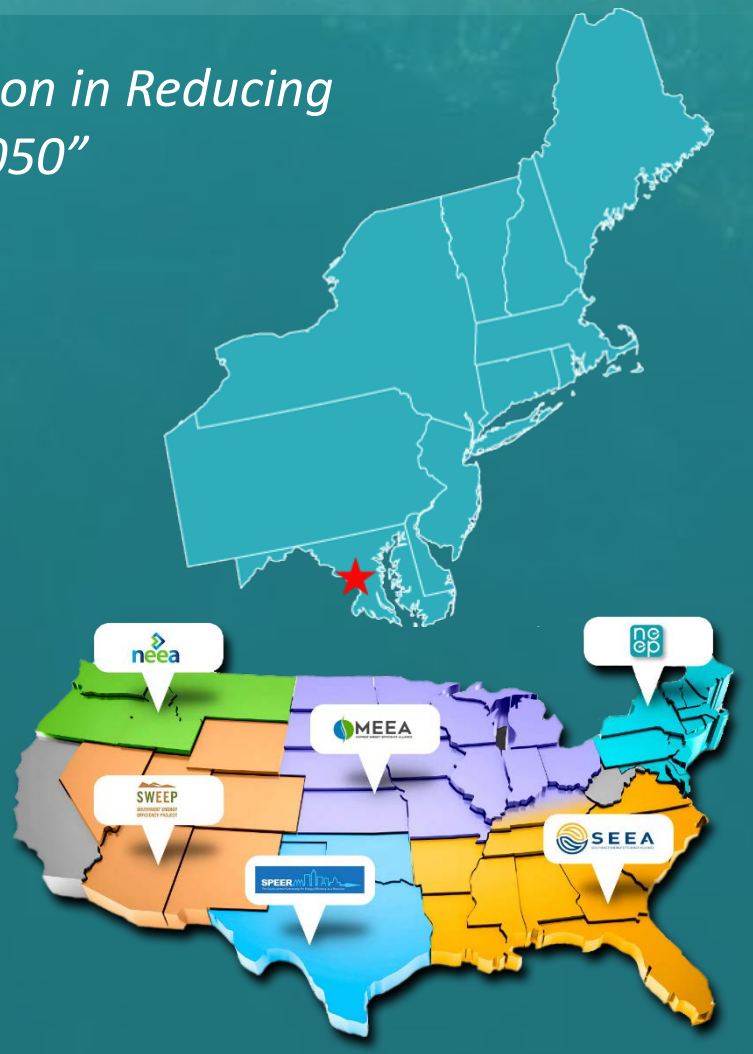
Accelerate energy efficiency as an essential part of demand-side solutions that enable a sustainable regional energy system

Vision

That the 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 through *Collaboration, Education, and Enterprise*



Resources Related to AMI from NEEP

HEMS: NEEP's work in Home Energy Management Systems includes Market Characterization reports, a Product List available on the NEEP website and a Working Group. Lack of consistent AMI penetration has been identified as a barrier for smart energy home adoption.

- Many smart devices could provide benefit if time of use rates were in place (but not without AMI)

M&V 2.0 and Evaluation Applications

- The Changing EM&V Paradigm, Dec 2015
  - Comprehensive report on the state of M&V 2.0
- Auto M&V Industry Brief: How Fast is the EM&V Paradigm Changing?, Dec 2016
  - Companion/update document, M&V 2.0 vendor table and case studies
  - 2017 Update to vendor table and brief forthcoming this summer

2017 Analyses of Changing Landscape

- Advanced Metering Infrastructure - Utility Trends and Cost-Benefit Analyses in the NEEP Region
- EM&V Forum and Policy Brief: State Leadership Driving Non-Wires Alternative Projects and Policies

Our Panelists

Paulina Tarrant is a Research Associate on the Grid Edge team at GTM Research. She is responsible for data collection and tracking of global grid edge deployments. She authors research on the global AMI market, and developed GTM Research's AMI installation forecast. She holds a B.A. in Environmental Studies from Brown University.

Samantha Caputo works in a cross-functional position to support NEEP's work in public policy, buildings and market strategies. Samantha helps advance energy efficiency through tracking and analyzing policy trends in the Northeast & Mid-Atlantic region, developing case studies on state and local programs, and advancing knowledge and best practices across sectors. Samantha completed an accelerated program at Clark University, graduating in 2015 with a B.A. in Global Environmental Studies and Spanish, and in 2016 with a M.S. in Environmental Science and Policy.

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gtmresearch

GTM AMI Coverage

Assets

GTM Data Hub

- Utility Information
- Deployment Information

EIA Data

Reports

Research Note on The State of US AMI Deployment

- Highlights from the release of the 2015 Form EIA-861 data files

AMI Global Forecast 2017-2021

Utility AMI Analytics at the Grid Edge.

Grid Edge Markets

AMI	Customer Energy Management	DER Services	Distribution Automation	Electric Vehicle Infrastructure
Energy Storage	Grid Edge Customer Analytics	Grid Edge Network Analytics	Utility Back Office	Utility Network Operations

AMI Project Progression

Representative AMI Project Analytics Maturity

- Allow remote readings to headend
- Allow remote connect/ disconnect
- Secure data communication
- Fraud prevention contingency plan

- Implementing the meter-to-cash system
- Provide customer access to energy usage data

- Demand management
- Mid- to long-term load forecasting
- Distribution O&M (metering and transformer assets)
- OMS/AMI integration for real-time outage management

- Segmentation and customer targeting
- Load disaggregation
- Enable DR and incorporate demand charge response

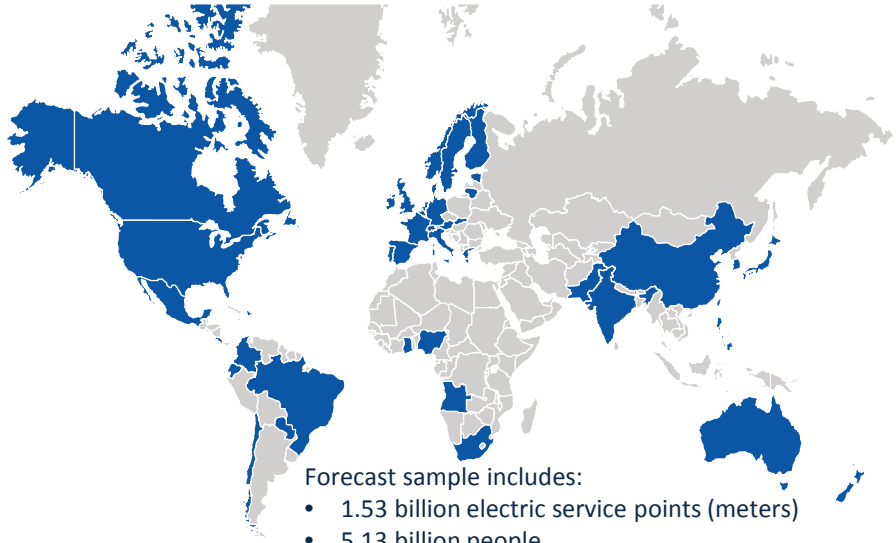
- Provide power quality and network data to internal utility planning groups
- Centralized or substation-based volt/VAR control
- Predictive outage management/ reliability

- Support behind-the-meter DER and storage

Source: GTM Research

Global Installed Base of AMI is Expected to Reach 922 Million Meters by 2021

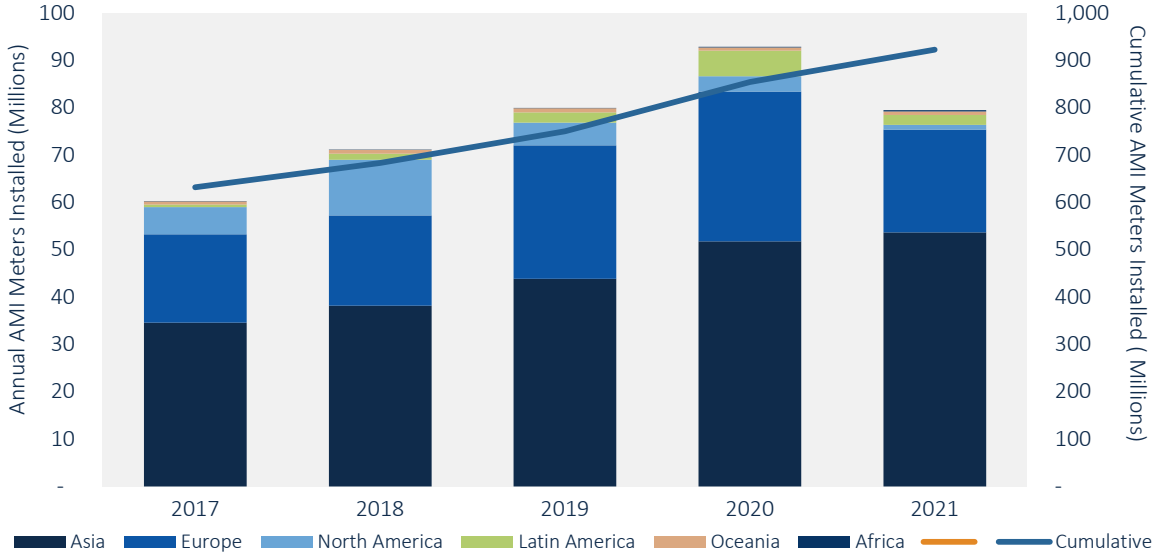
AMI Meters Installed, 2017E-2021E



Forecast sample includes:

- 1.53 billion electric service points (meters)
- 5.13 billion people

AMI Meters Installed, 2017E-2021E



Source: GTM Research

Annual advanced metering infrastructure (AMI) spending is forecasted to grow an average of 16% a year through 2020, but then decline drastically by 32% in 2021. Growth in global AMI installations is dominated by Asia, which has plans to roll out large deployments of AMI by 2025. In the U.S., many large utilities have announced or have begun full-scale deployments. Growth in Latin America is largely spurred by deployments in Mexico, demonstration projects in Brazil, and rollout plans in Colombia. In Europe, countries are ramping up AMI installations to reach 2020 EU-wide targets. The sharp drop in annual installations is largely due to slowdown in Europe once AMI targets are reached. This is reflected in a 31% decline in annual AMI installations in the EU in 2021.

Both PPL in the U.S. and Enel in Italy are deploying a second generation of AMI meters. These AMI retrofits are not included in the cumulative AMI installations, but are instead shown in the annual amount of AMI installed.

Overview of Market Drivers and Barriers for AMI and AMI Analytics

Grid Edge Market Drivers for AMI and AMI Analytics

Market Driver	AMI	AMI Analytics
National and State-Level Mandates	●	○
New Utility Services and Revenue Opportunities	●	●
Utility Operations & Maintenance Cost Avoidance	●	◑
Grid Integration of Distributed Energy Resources	○	◑
Distribution System and Customer-Site Power Quality & Efficiency	○	◑
Utility Transmission and Distribution Investment Deferral	○	◑
End-Customer Energy Bill Savings	○	●
End-Customer and 3rd-Party Grid Services Revenue Opportunities	○	◑
Grid Distribution Reliability and Resiliency	○	◑

Grid Edge Market Barriers for AMI and AMI Analytics

Market Barrier	AMI	AMI Analytics
Capital Cost and Financing Hurdles	●	◑
Systems Integration/Implementation Complexity	◑	◑
Split Incentives (regulated/unregulated utility, landlord/tenant)	◑	○
Traditional Utility Business Practices (software licensing, grid planning and procurement paradigms, etc.)	○	●
Emerging Technology Risks	○	◑
Staffing and Resource Limitations	○	◑

Source: GTM Research

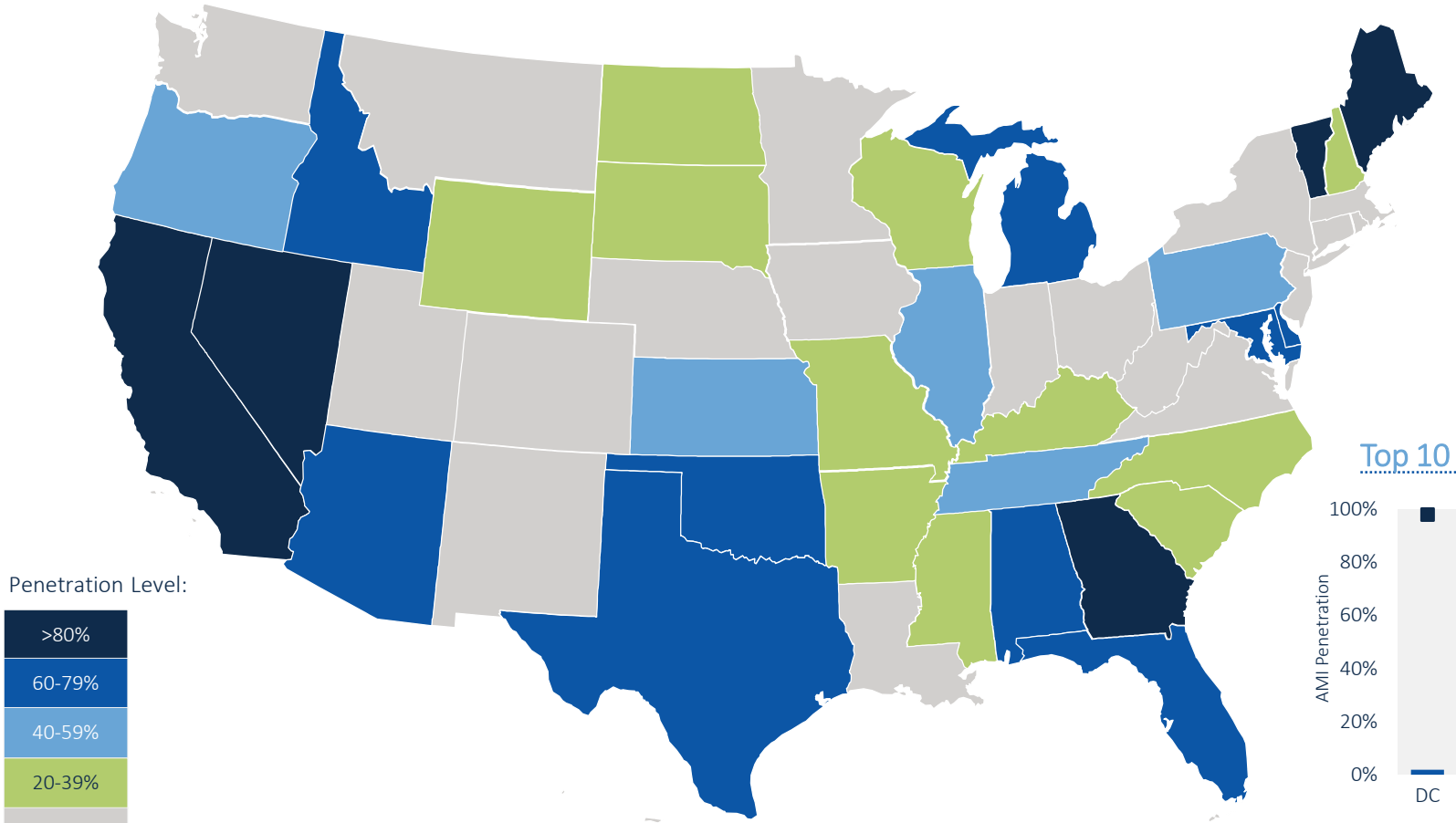
● Strong Factor: The driver is of primary importance and applies broadly to the market

◑ Weak Factor: The driver is of secondary importance and/or only applies to a limited segment of the overall market

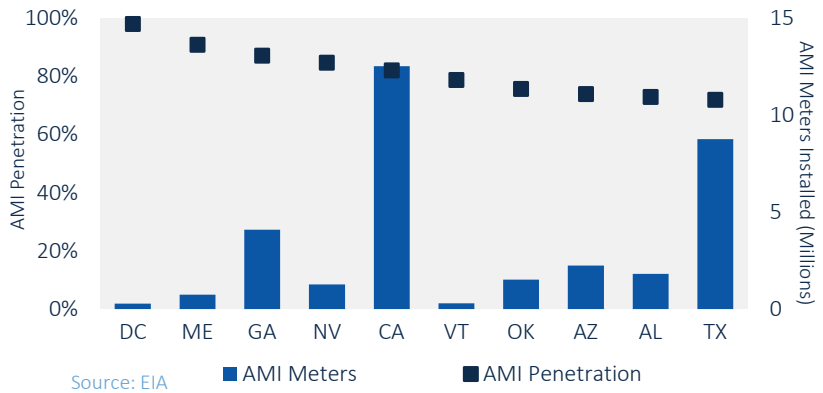
Source: GTM Research

USA AMI Penetration Levels

AMI Penetration in the U.S. as of December 2015



Top 10 States by AMI Penetration



Source: EIA

Southern California Edison's AMI Analytics Focus

Overview

- Utility serves over 5 million customers
- AMI contract announced in 2007, full deployment began in 2011 as part of the Edison SmartConnect program
- The 20-year cumulative benefits were estimated to reach $7.4 billion
- Deployed the SAP platform in 2011 to build network analytics applications, deployment upgrades including transition to SAP HANA

Vendor Selection

Role	Vendor
Metering Hardware and AMI Network	Itron
Meter Data Management System	Itron
Data Integration	SAP
Network Analytics	sas, Sentient Energy, Itron
Customer Engagement	FIRSTFUEL, OPOWER, ENERGYSAVVY

Current State of Outage Management and Intelligent Distribution Transformer

Analytics being worked on by Itron and Cyient

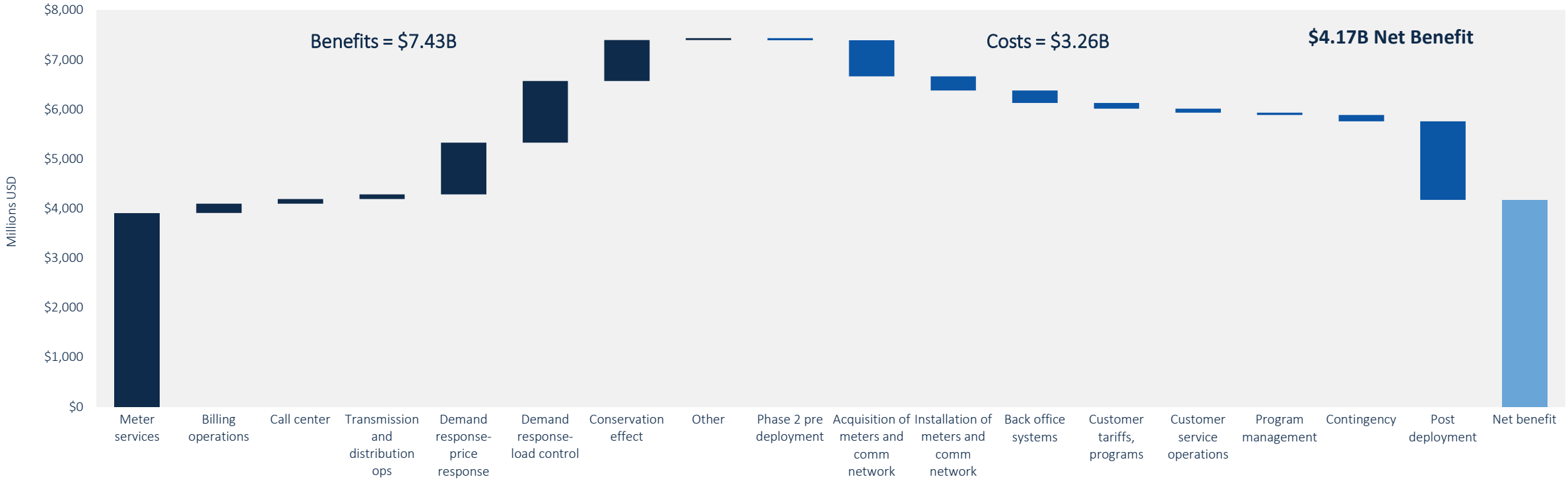
- Overlaying GIS with SCE's grid topology for situational awareness
- Leveraging Itron-provided weather data

Use cases

- Transformer loading : Evaluating peak load, loss of life and service voltage
- Transformer overloads: Viewing area-wide heat maps of asset loading and at-risk transformers
- Load aggregation: Generating load profiles by circuit or at any system node
- Voltage management: Viewing system voltage fluctuations and identifying assets outside of voltage limits

Southern California Edison's Cost-Benefit Analysis Summary

Estimated Benefit and Cost Breakdown Reported (Nominal)

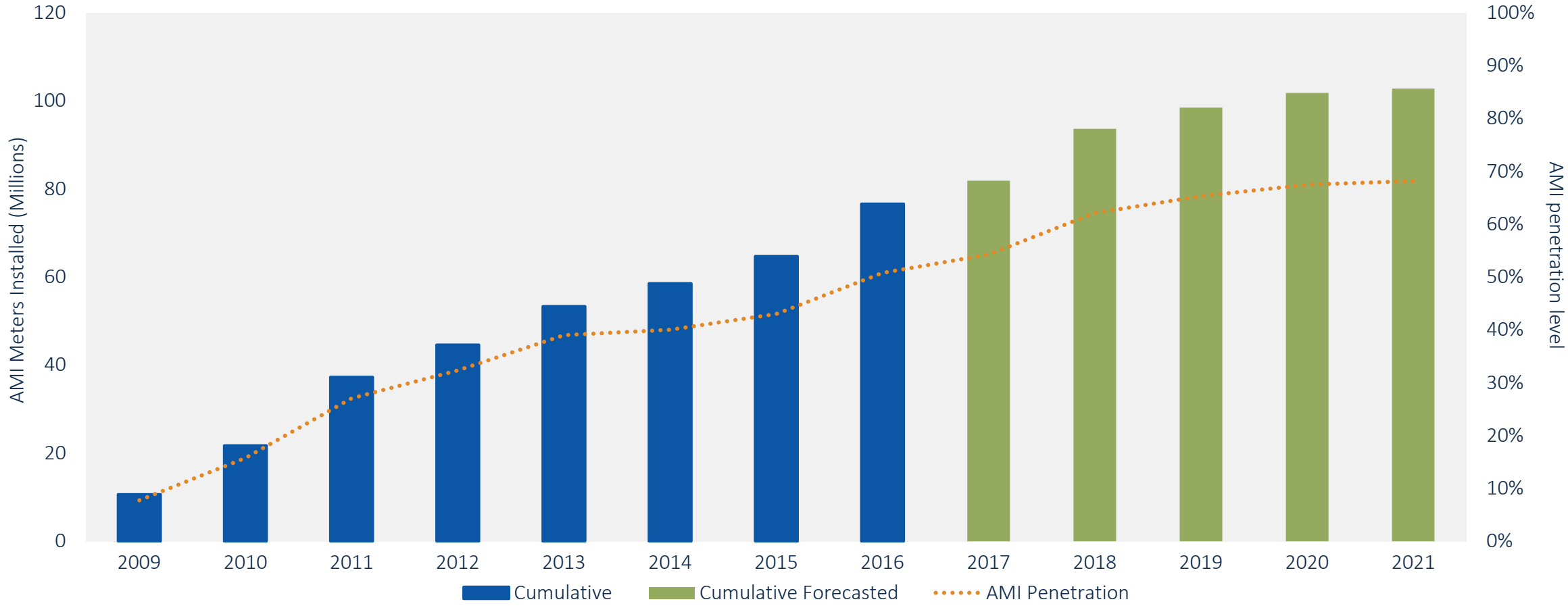


Source: SCE rate filing

Key value drivers: Avoided labor costs (meter reading, field services), recovered cost due to demand response (price and load control), and avoided cost due to energy savings (conservation effect)

64.7 Million AMI Meters Installed in the U.S. by 2015, 102 Million Meters by 2021

AMI Meters Installed in the U.S.



Source: GTM Research and EIA

Tales from the Northeast

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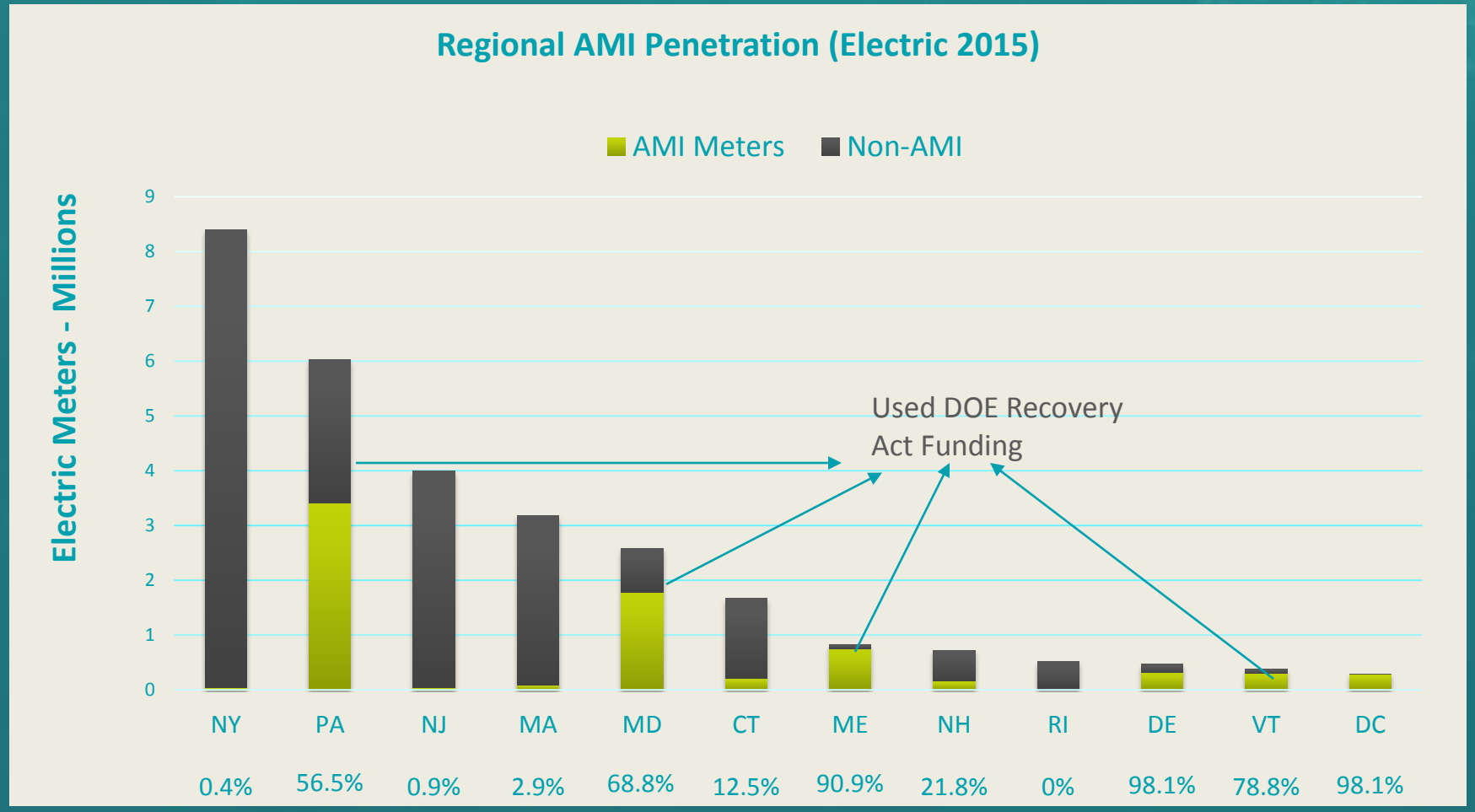
Current Situation

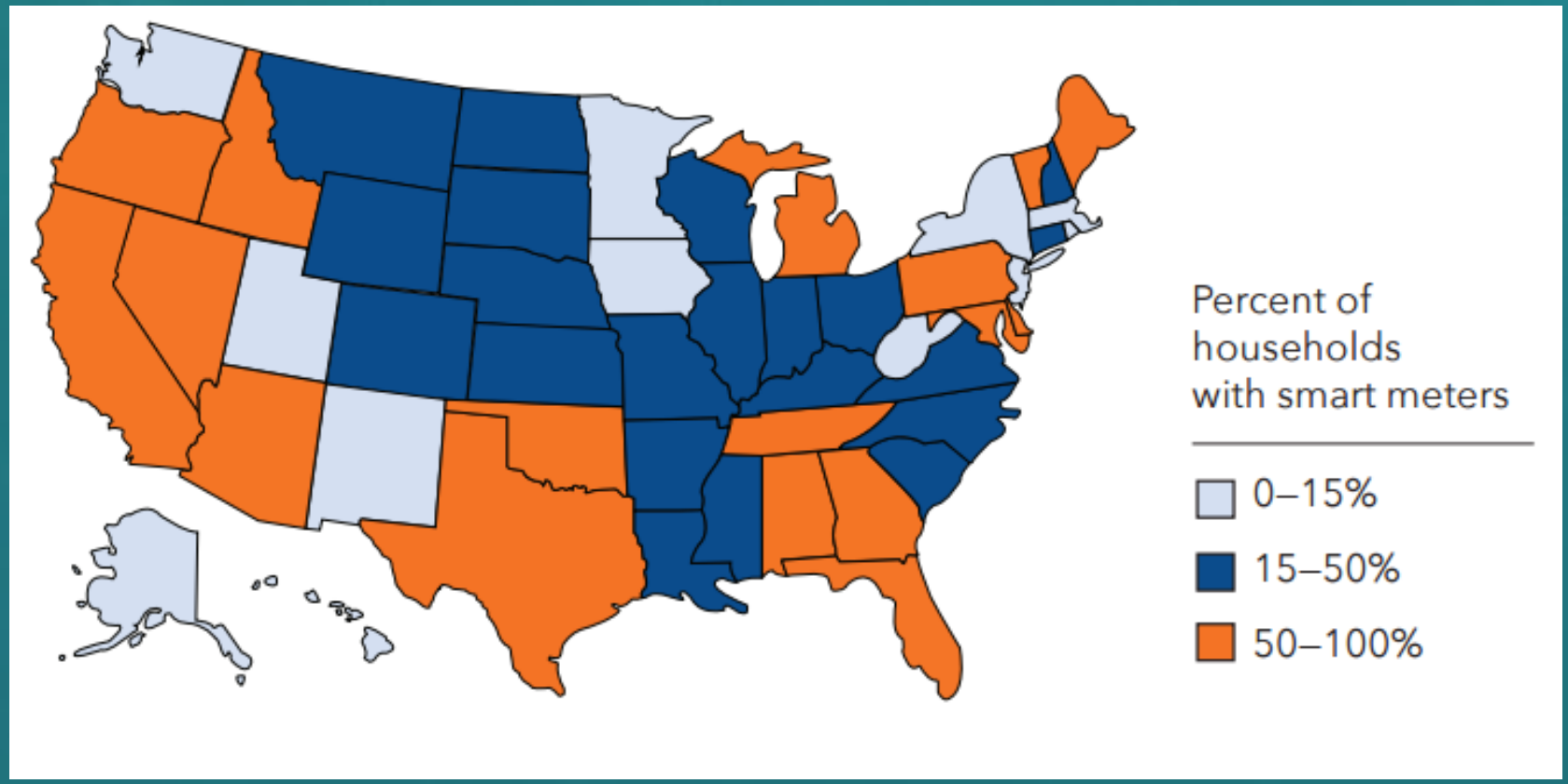


Data for this table was taken from the EIA 861 form, available at :
https://www.eia.gov/electricity/data/eia861/

The Numbers, 2015

State	AMI Meters	Total Meters	Percent of AMI
DC	277,998	283,502	**98.06%**
ME	746,599	821,200	**90.92%**
VT	297,116	377,060	**78.80%**
MD	1,780,499	2,586,788	68.83%
DE	308,685	465,429	66.32%
PA	3,412,095	6,038,194	56.51%
NH	158,377	725,807	21.82%
CT	209,922	1,673,452	12.54%
MA	86,544	3,205,736	2.70%
NJ	36,800	4,001,517	0.92%
NY	32,091	8,400,874	0.38%
RI	249	516,073	0.05%

Current Situation in Perspective, 2015



Edison Foundation, October 2016

New NEEP Resource

- Insight into utility trends regarding AMI deployment costs and benefits within the Northeast and Mid-Atlantic

- The report reviews the costs and benefits evaluated in both retrospective and prospective AMI deployment proposals, highlighting any outlying factors included in each proposal.

Available here:
http://www.neep.org/advanced-metering-infrastructure-utility-trends-and-cost-benefit-analyses-neep-region

What are the Benefits?

Economic

- Reliability
- Avoided T&D
- Reduction in meter reading & operations
- Engineering & field service operations
- Peak Load Reduction
- Reduced GHG emissions
- Energy Conservation

Qualitative

- Risk reduction
  - Improved compliance with safety standards
  - Data privacy
  - Theft reduction
- System efficiency & resiliency
  - System planning
  - Crew productivity
- Customer
  - Customer satisfaction
  - Customer convenience
  - Demand Response
- Environmental
  - Conservation Voltage Reduction
  - Priority pollutant reduction
  - Energy Conservation

What are the Costs?

Capital Expenses

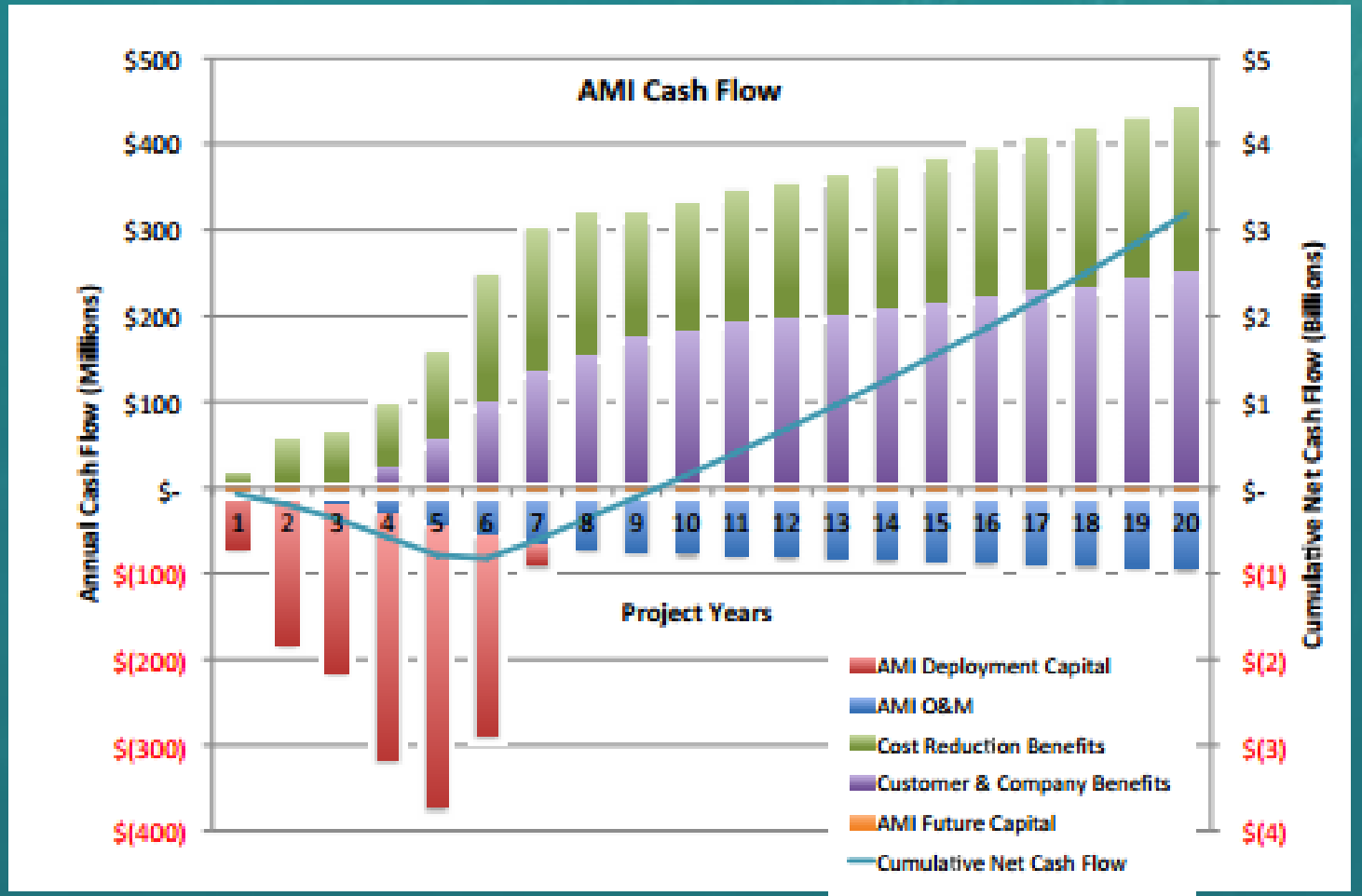
- Metering equipment
- Network & communications infrastructure
- Stranded Costs

Operations & Maintenance

- Infrastructure procurement
- Project management
- Information Technology systems
- Field services
- Revenue reduction

Customer Education

- Marketing
- Customer education



Source: ConEdison Capital Investment and Ongoing Cost-Benefit Comparison

Overview of Cost-Benefit Analyses

Utility	Year Proposed	Meters	Time-Varying Rates	Conservation Voltage Reduction	Stranded Costs	Customer Education	
						Benefit	Cost
CL&P (CT)	2007	3,000 (Deployed)				$	
CMP (ME)	2007	622,000 (Deployed)			$		
BG&E (MD)	2010	1.23M (Deployed)		$		✓	✓
Con Edison (NY)	2010	3.6M (Approved)	✓	$			
GMP (VT)	2010	260,600 (Deployed)		✓	$		
Eversource (MA)	2015	5 percent (Proposed)	$	$	$	✓	$
National Grid (MA)	2015	1.3M (Proposed)	$	$		✓	
Unitil (MA)	2015	103,000 (Deployed, to be upgraded)	✓	✓	✓		✓

AMI as a part of a bigger picture

National Grid, MA

National Grid Overall Benefits and Costs in NPV ($ in millions)			
Scenario	Benefits	Costs	Benefit Cost Ratio
Balanced Plan	$956.45	$1,066.49	.9
AMI-Focused Plan	$801.16	$784.27	1.02
Grid-Focused Plan	$463.33	$811.73	.57
Opt-in Focused Plan	$228.78	$408.76	.56

Important factors:

- Total Resource Cost Test
- GHG emissions benefit quantified
- Did not monetize customer benefits
- T&D capacity benefits considered QUALITATIVELY

How Have Utilities Addressed Cost-Benefit Analyses?

Connecticut Light & Power
A Northeast Utilities Company

- Proposed in 2007
- Monetized environmental and peak reduction benefits
- Attorney General considered benefits unknown and too reliant on customer education
- Postponed until the existing mechanical meters require replacement
- Evaluated a base (1.17), best (2.75), and worst case (.33) scenario

BGE

- Proposed in 2009, approved in 2010
- Energy price mitigation & energy conservation were quantified, but not avoided emissions
- Did not include time-varying rates or stranded costs
- Included customer education plan
- 1.26 B/C ratio

Summary of Findings

- If a benefit is not monetizing, that does not mean the benefit has no monetary value
- The business case
  - Depends on goals of the project, scale and dimension, and technological features
- The type of test used: UTC, TRC, or SCT
- Variance in the inclusion of stranded cost, time-varying-rates, conservation voltage reduction, customer education
- Impact of not using DOE Recovery Act of 2009 funds

Q&A Session

Please type your question on the chat box or raise your “virtual hand” to get unmuted