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Utility Customer-Funded Energy Efficiency 101

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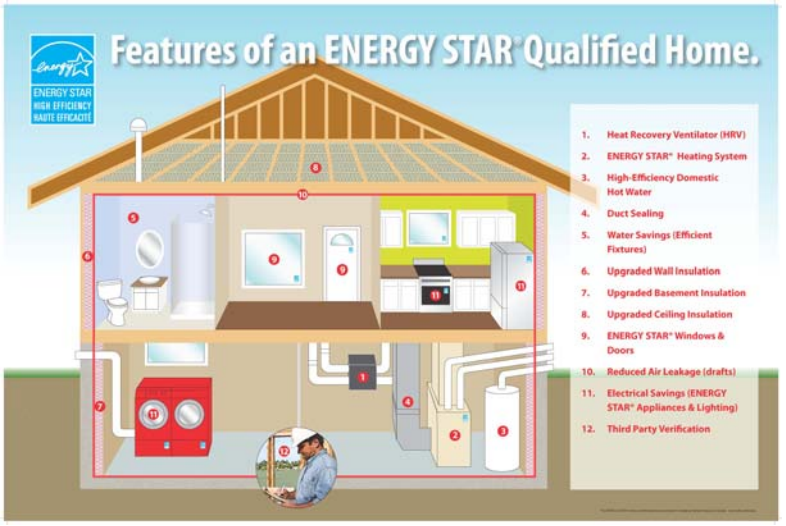
Presentation of Topics

- What is energy efficiency (EE)?
- Why do EE?
- What are the barriers to EE —why does it need interventions?
- What are the types of EE programs?
- What are the metrics for success?
- What is the size of utility customer-funded EE market?
- What are major EE policy/regulatory issues in the US?



What is Energy Efficiency?

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Efficiency versus Conservation

Energy Conservation:

Doing with less of a service in order to save energy

- Using less energy and probably getting less of a result
- Example: Turning down the thermostat to get less heating

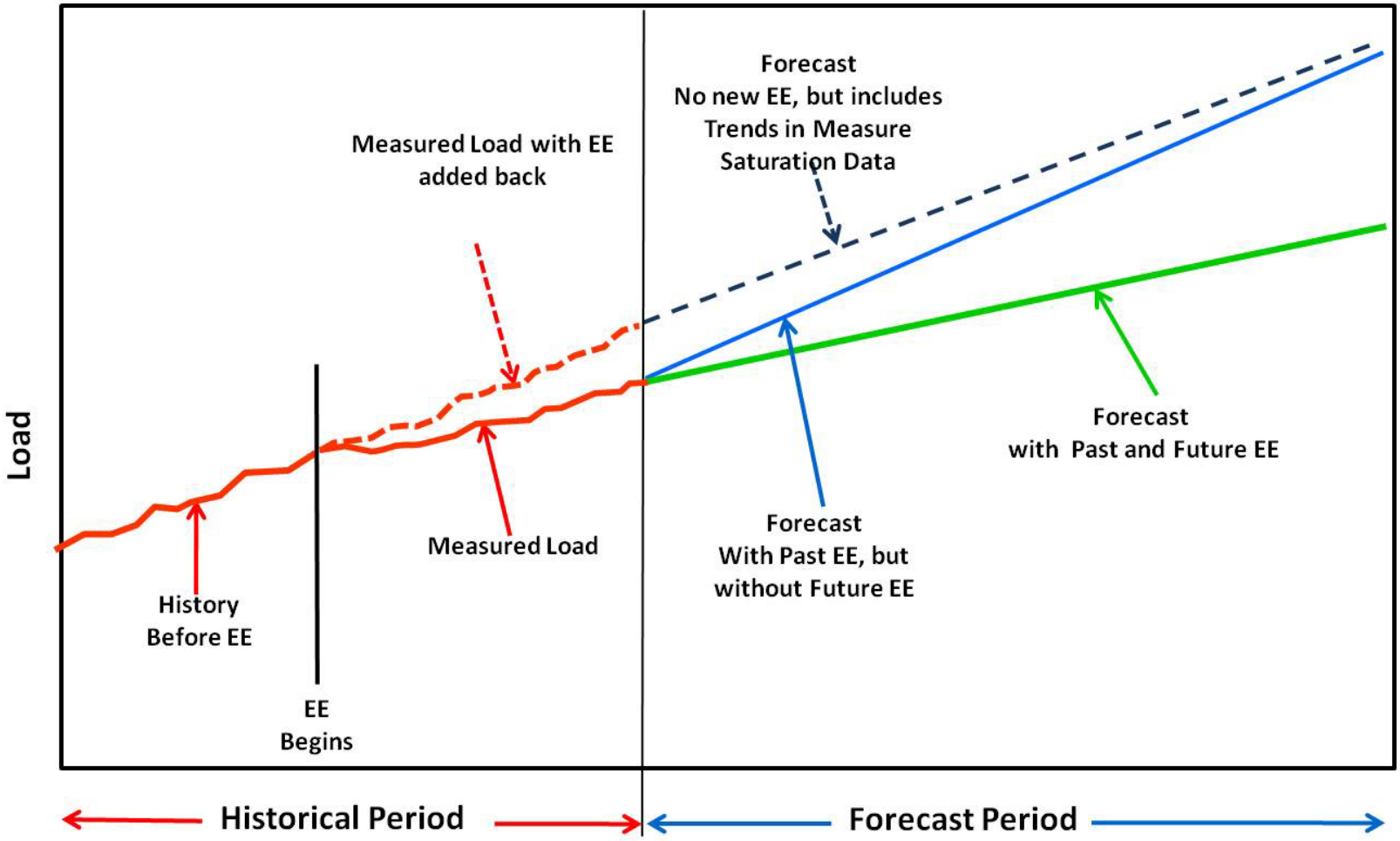
Energy Efficiency:

The use of less energy to provide the same or an improved level of service

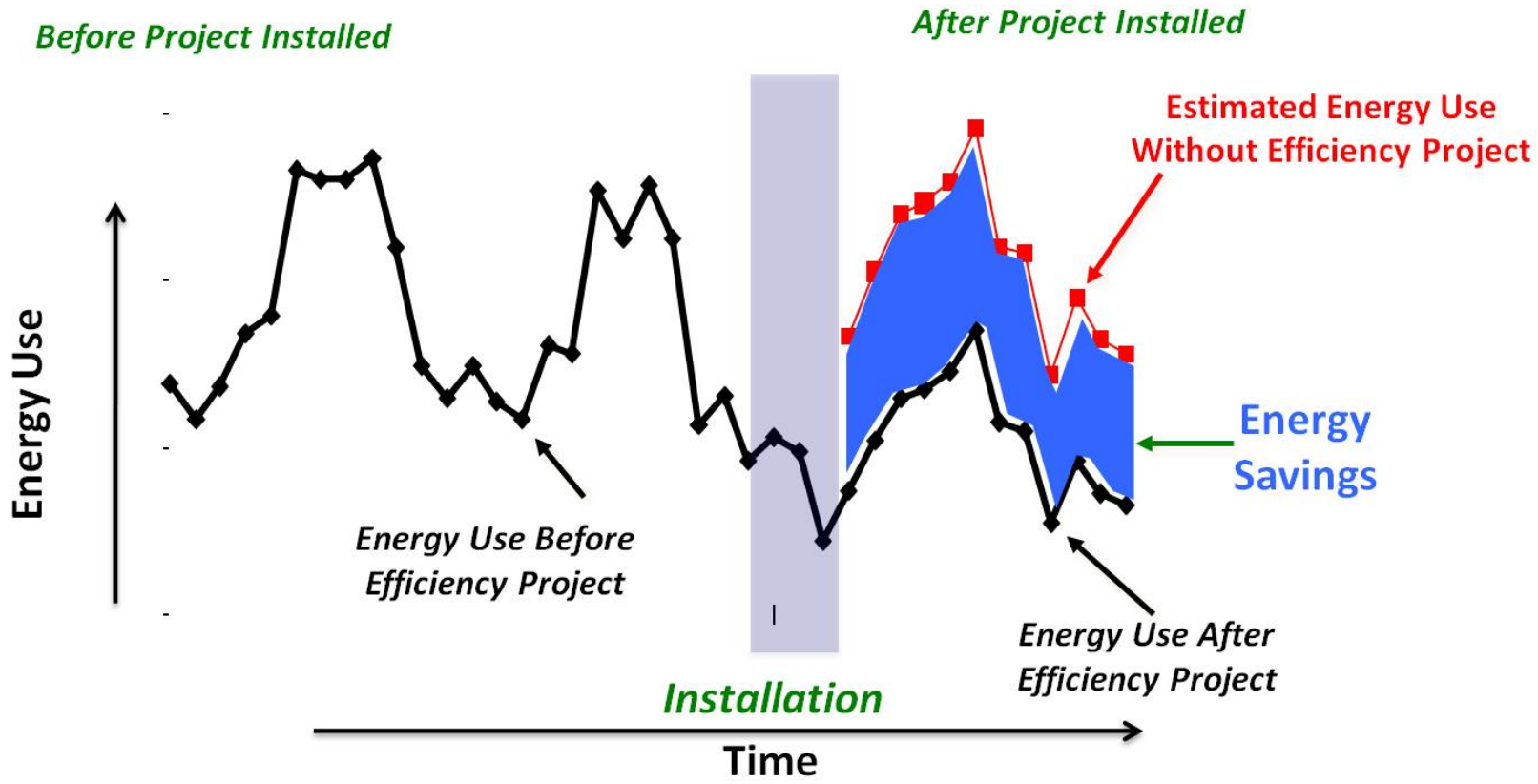
- Using less energy to perform the same function
- Example: A more efficient furnace

Example: Turning street lights off versus installing efficient streetlight lamps and controls

Energy Efficiency System Savings



Energy Efficiency Project Savings



Energy Consumption Before, During And After Project Is Installed

Documenting Energy Efficiency Savings

1. **Verify potential to generate savings**
2. **Determine lifetime savings**

Example: Lighting Retrofit

Potential to save:

Before: 60 Watts/fixture

After: 13 Watts/fixture

Savings:

Determined based on operating hours and lifetime of lamps

Example: New Car

Potential to save:

Before: 10 MPG

After: 50 MPG

Savings:

Determined based on how many miles driven and for how many years

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Why do Energy Efficiency?

Why do Energy Efficiency?

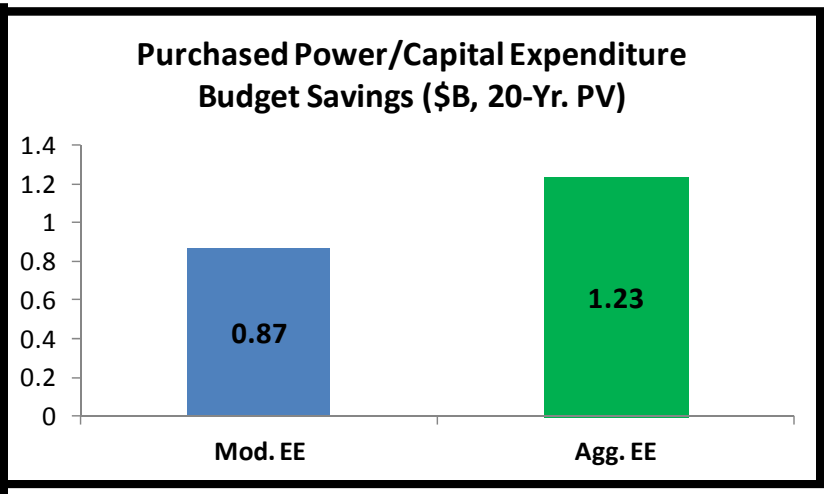
- Has already done a lot to reduce wasting of energy
- Is relatively cheap—reduces investment requirements for supply-side resources:
  - » Lower generation, transmission, distribution capitol costs
  - » Lower fuel and other operating costs
  - » Reduced risk and exposure to market volatility
- There are plenty of opportunities
- Not a limited resource—new technologies and strategies
- Can be quickly implemented
- Can be targeted, modular, manageable
- Diversifies resource portfolios/increases system reliability

EE Reduces a Utility's Cost to Serve

- EE avoids the need for new generation additions which reduces capital expenditures
- EE reduces total sales and peak demand which reduces energy production costs

Case	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
BAU	P			P	M	P	M		M				P		P
Mod. EE	P			P		P&M			M		M		P		P

P – Peaker M – Mid-Merit Red – Deferred Plant



Example of Rates, Bills, and Participants – illustrative example from New England Utility – presentation slide courtesy of Tim Woolf of Synapse

Example – **Low** Investment Efficiency Scenario

	Rates Impacts	Bill Impacts	Participation
	(% of Total Rate)	(% of Total Bill)	(% of Customers)
New Construction	0.4%	-16.2%	0.5%
HVAC	0.4%	-4.7%	0.3%
Retrofit	0.4%	-10.5%	2.0%
Lighting	0.4%	-1.6%	23.5%
Products	0.4%	-2.5%	3.2%
Non-Participants	0.4%	0.4%	majority

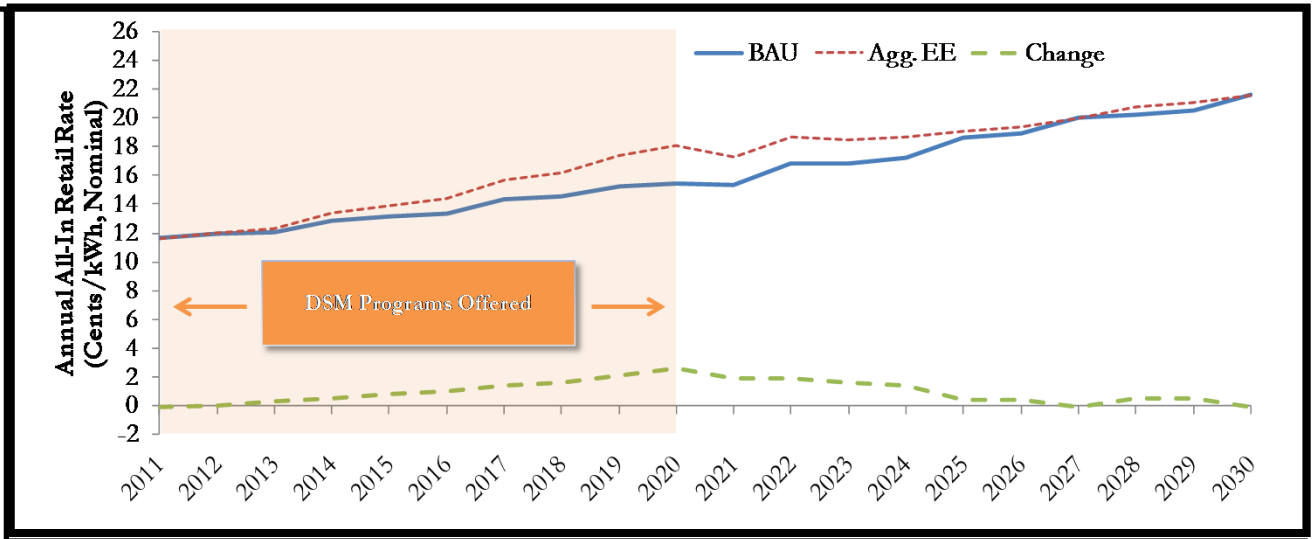
Example – **High** Investment Efficiency Scenario

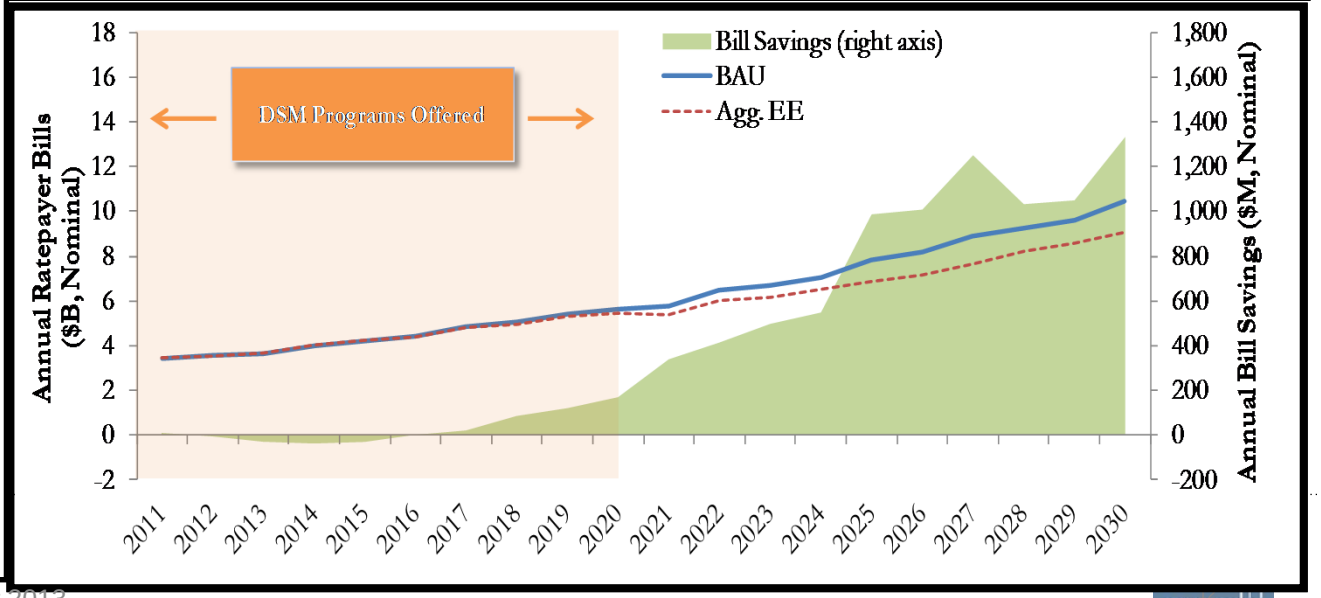
	Rates Impacts	Bill Impacts	Participation
	(% of Total Rate)	(% of Total Bill)	(% of Customers)
New Construction	1.6%	-15.6%	1.9%
HVAC	1.6%	-4.1%	1.0%
Retrofit	1.6%	-9.9%	7.9%
Lighting	1.6%	-1.0%	94.0%
Products	1.6%	-1.8%	12.7%
Non-Participants	1.6%	1.6%	minority

Takes Time for Financial Benefits from EE to Reach Ratepayers (and Utility Shareholders)

Costs are incurred first-year but effects of programs are felt over the entire lifetime of the measures (~4-20 years)

Timing and scale of benefits will depend on utility-specific conditions (e.g., cost structure, historic test year, regulatory structure and rate case timing, underlying cost growth)





Two Comments on Financial Impacts

- Impact on Non-Participants:
  - Rates, at least in short to medium term, probably go up
  - Program participation rates are a key aspect of this customer equity issue – bigger programs and more inclusive program designs result in more participants – fewer non-participants
- Impact on Utilities: Since EE defers the need to build more power plants, fewer capital dollars are spent and with lower sales:
  - Utility revenues between rate cases can be lower than anticipated
  - Potentially reducing utility profits and shareholder returns
- Quantifying the participant, non-participant and utility impacts requires South Dakota specific analyses

Non-Energy Benefits of Energy Efficiency

- Virtually all energy efficiency programs have objectives associated with reducing energy use and costs
- However, there is a wide range of other non-energy benefits (NEB) that come from energy efficiency activities—these can negative or positive
- NEBs can be categorized as those accruing to:
  - Utilities (energy providers)
  - Society as a whole
  - Individual participants
- For consumers, these NEBs may actually drive their interest in efficiency investments

Non-Energy Benefits: Utility & Societal

Value	Impact
Hedge value	Reduction of consumer exposure to volatility in electricity/gas commodity costs
Reduced commodity prices resulting from reduced demand	Reduction in aggregate demand puts downward pressure on wholesale market electric and gas commodity prices
Easing electricity/gas distribution/transmission capacity constraints and enhancement of reliability	(localized) Reduced line losses, voltage support (reliability), and power quality improvements Reduces the likelihood of gas curtailments, and may eliminate or delays the need for local capital intensive system upgrades
Avoided transmission and distribution capital and operating costs	(localized) Particularly valuable in areas with high energy use, high demand growth, and/or constrained distribution systems
Environmental benefits	Production and consumption of electricity/gas has environmental impacts.
Customer bill collection and service-related savings	Avoiding shut-off notices, shutoffs/reconnects, and carrying costs on arrearages
Can provide access to energy savings opportunities for all markets	Virtually all consumers can participate in energy efficiency programs
Economic development	EE programs can support greater net job growth than electricity/ gas supply and delivery

Non-Energy Benefits: Jobs

- **Direct.** Jobs are in firms that are actually receiving the efficiency program dollars and doing the energy efficiency work
- **Indirect.** Jobs in firms supplying goods and services to energy efficiency firms
- **Induced.** Those created by the demand generated by wage and business income from energy efficiency investments and by energy bill savings.

Non-Energy Benefits: Participant Benefits

- Indoor air quality improvements, improved comfort (e.g., quality of light, less noise, fewer drafts, better building temperature control), higher productivity and lower rates of absenteeism through better-performing energy using systems (e.g., ventilation, building shell, lighting)
- Reduced equipment operations and maintenance (O&M) costs because of more efficient, robust systems (although more complex systems could require more maintenance)
- Water and wastewater savings
- Positive personal perceptions (e.g., “green,” environmental consciousness) and for commercial businesses and public entities, improved public perceptions and the ability to market products and tenant leases
- Avoided capital cost for equipment or building component replacements whose capital costs can be paid from savings

What are the Barriers to Energy Efficiency?

Barriers to Energy Efficiency

Efficiency's Version of the Tragedy of the Commons

Efficiency is a great cost-effective mechanism for society to save energy and other NEBs, but…there is a paradox ….

It is not necessarily the choice that individual energy users make because of various market barriers

Barriers to Energy Efficiency

- Front-end investment requirements
- Principal agent problem (property owner/tenant)
- Lack of information and understanding of benefits (and risks)
- Transaction costs
- Lack of knowledgeable contractors, suppliers, etc.
- Uncertainty in documenting benefits

Barriers to Energy Efficiency

Examples of issues in different markets

Institutional/Public Sector Buildings

- Large backlog of deferred capital investments
- Lack of financial resources
- Lack of people resources

Commercial Businesses

- Split incentive problem
- Lack of interest even in long tenancy situations since energy costs represent small percentage of business costs

Residential

- Poor: not able to make investments
- Middle class: lack financing
- Well-off: energy costs represent a small portion of disposable income so not that interested
- Split incentive problem
  - Tenants pay energy bills
  - No incentive for owner improvements

Industrial

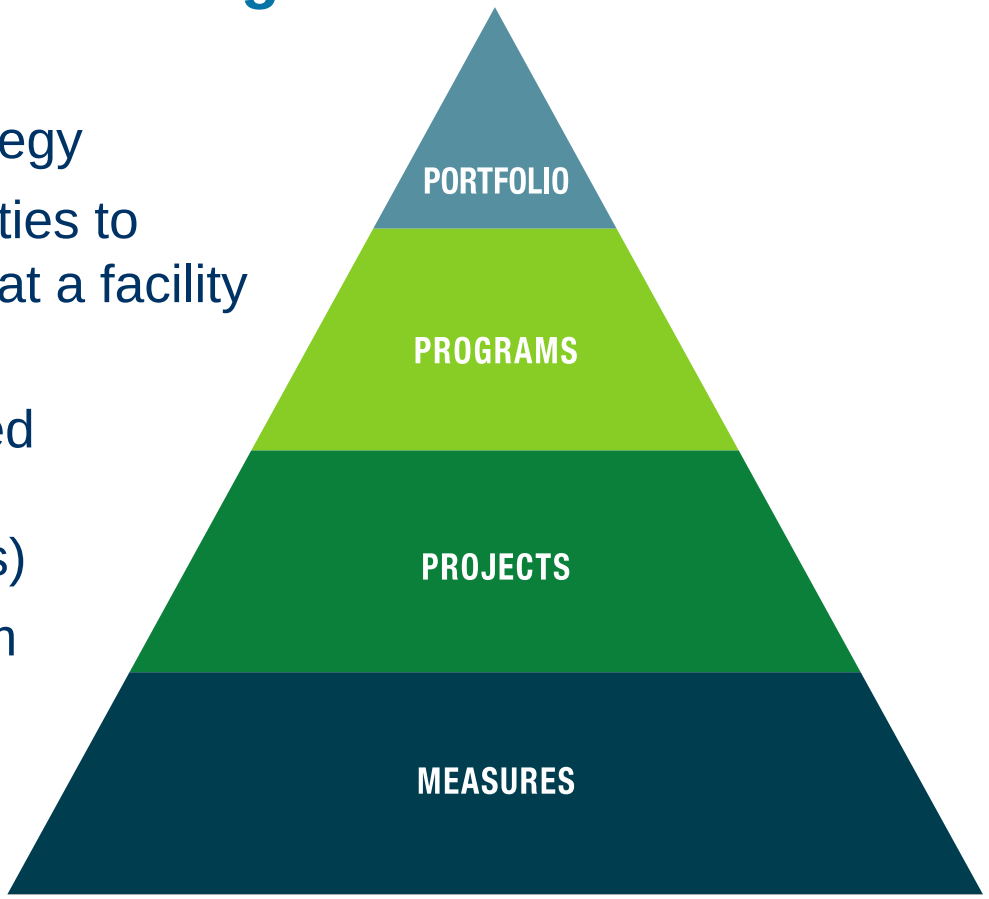
- Short investment horizon (1-3 year paybacks sought)
- Energy costs can represent small percentage of business costs

What are the Types of Energy Efficiency Programs?

Energy Efficiency Programs

Savings Hierarchy for Most EE Programs

- Fundamental savings unit are **measures**—equipment or strategy
- **Projects** are coordinated activities to install one ore more measures at a facility
- **Programs** are collections of similar projects that are intended for a specific market (a describable group of customers)
- **Portfolios** are multiple program initiatives in specific market sectors



Energy Efficiency Programs

Public Mechanisms and Regulatory Approaches—Voluntary and Mandatory

- **Voluntary Programs**
  - Down-market: customer rebates
  - Mid-market and up-market: contractor and manufacturer incentives
  - Education, technical assistance and training programs
- **Mandatory Programs**
  - Building codes
  - Appliance standards
  - Energy efficiency resource standards

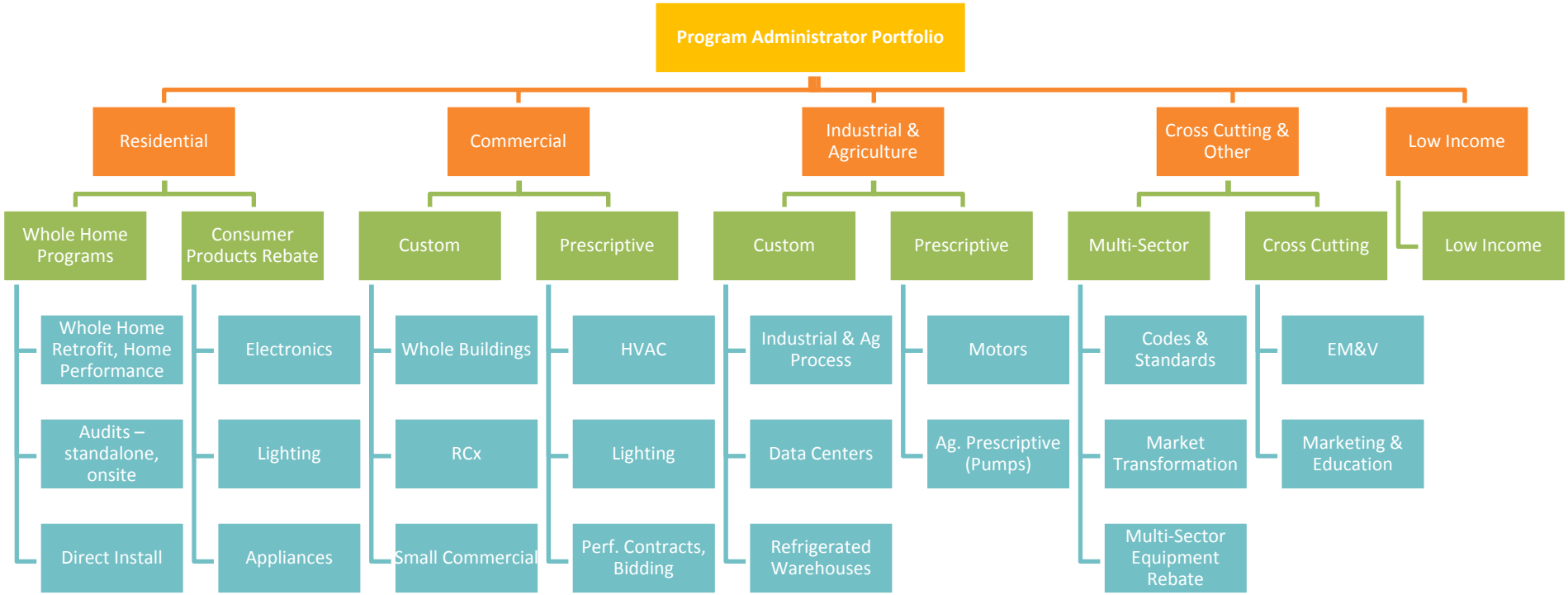
New Construction and Retrofits

- **New Construction** – more efficient than what would have been built

- **Retrofits** - two kinds of measures:
  - Replace on burnout = replace equipment when existing equipment fails
  - Early replacement = replace equipment before the end of the useful life of existing equipment

Energy Efficiency Programs

Examples of common program types (and support activities)



What are the Metrics for Success?

Metrics for EE Programs

Typical Metrics and Goals

Energy Benefits

- Total savings for a project, program, or portfolio
- Total savings for a State
- Energy use indices—e.g., energy consumption per capita or per gross state product
- Annual and lifetime

Cost Effectiveness

- Net Economic Benefits
- Costs per unit of saved energy—administrator costs

Consumer Benefits

- Bill reductions/increases
- Rate reductions/increases

Other Benefits

- Stability of energy markets, national security, etc.
- Avoided T&D or generation investments
- Creation of private sector market of energy efficiency services and products—job creation

Metrics for EE Programs

Conceptual example:

Administrator cost of saved energy over economic lifetime of measures

values based on 2006 and 2007 data—findings not verified by presenter

	$/lifetime kWh
California	0.03-0.05
Massachusetts	0.032-0.038
New Jersey	0.024-0.05
New York	0.009-0.018
Oregon	0.013-0.016
Connecticut	0.032-0.045
Vermont	0.024-0.035
Iowa	0.036-0.044
Mean (of broader set)	0.031

Source: "Measuring and Tracking State Energy Efficiency Program Progress: The Use and Importance of Data." *Dan York, Ph.D., Utilities Program Director. American Council for an Energy-Efficient Economy*, 2011

Metrics for EE Programs

Consumer Benefits—Bill Savings

Electricity Bills

Rates

	Cents/kWh	Average kWh per month
California	$0.15	590
Florida	$0.12	1,176
Texas	$0.13	1,161
Hawaii (2010)	$0.338	628

Source: Next10 (2010)

Why Evaluate?

- **Document impacts.** Document the energy savings of projects and programs in order to determine how well they have met their goals; e.g., has there been a good use of the invested money and time? Provide PROOF of the effectiveness of energy management.
- **Resource Planning.** To support energy resource planning by understanding the historical and future resource contributions of energy efficiency as compared to other energy resources. Provide data to support efficiency as a reliable resource.
- **Understand why the effects occurred.** Identify ways to improve current and future projects and programs as well as select future projects. “You can’t manage what you don’t measure” and “Things that are measured tend to improve.”

Metrics for EE Programs

Getting to Metrics: Evaluation Types

Evaluation Type	Description	Example Uses
Impact Evaluation	Quantifies direct and indirect changes associated with the subject program(s)	Determines the amount of energy and demand saved
Process Evaluation	Indicates how the procedures associated with program design and implementation are performing from both the administrator's and the participants' perspectives	Identifies how program designs and processes can be improved
Market Effects Evaluation	Analyzes how the overall supply chain and market for energy efficiency products have been affected by the program.	Characterizes changes that have occurred in efficiency markets and whether they are attributable to and sustainable with or without the program
Cost-Effectiveness Evaluation	Quantifies the costs of program implementation and compares them with program benefits	Determines whether an energy efficiency program is a cost-effective investment compared with other programs and energy supply resources

What is the Size of the Utility Customer-Funded EE Market?

The Customer-Funded EE Market

Size of Utility Customer-Funded EE Market—Context

- Policies supporting customer-funded EE programs have proliferated over the past 5-10 years, leading to substantial growth in program activity
- LBNL conducted an analysis in 2009 to project spending and savings from customer-funded EE programs to 2020
- In 2012 that study was updated to extend that earlier analysis to 2025 with “low”, “medium” and “high” case scenarios

The Customer-Funded EE Market

Current EE spending at an all-time high, but concentrated in a handful of states

2010 Customer-Funded EE Program Spending ($M)

Rank	State	Electric	Gas	Total
1	CA	938	201	1,139
2	NY	482	39	521
3	NJ	191	126	317
4	MA	245	72	317
5	WA	218	29	247
6	FL	165	11	176
7	OR	135	23	158
8	MN	107	36	144
9	CT	108	12	119
10	MI	75	41	116
All Other States		1,284	247	1,531
U.S. Total		3,948	838	4,786

- Total Electric and gas EE program spending more than doubled over latter half of decade (from $2B in 2006 to $4.8B in 2010)
- Roughly 80%/20% split between electric and gas program spending
- Two thirds of total U.S. spending concentrated in 10 states

Source: CEE (2012), excludes load management

The Customer-Funded EE Market

Key policy drivers for EE program spending and savings projections

Key Policy Drivers for Energy Efficiency Spending and Savings	Applicable to Electric Efficiency Programs	Applicable to Natural Gas Efficiency Programs
Energy Efficiency Resource Standard (EERS)	AZ, CA, CO, HI, IL, IN, MD, MI, MN, MO, NM, NY, OH, PA, TX	CA, CO, MI, MN, NY, IL
Energy efficiency eligibility under state RPS	HI, MI, NC, OH, NV	
Statutory requirement that utilities acquire all cost-effective energy efficiency	CA, CT, MA, RI, VT, WA	CA, CT, MA, RI, VT, WA
Systems benefit charges	CA, CT, DC, MA, ME, MT, NH, NJ, NY, OH, OR, RI, VT, WI	CA, DC, ME, MT, NJ, NY, RI,WI
Integrated resource planning	34 States (primarily in the West and Southeast) and TVA	17 States (primarily in the West and Northeast)
Demand Side Management plan or energy efficiency budget	28 States	21 States (primarily in the Northeast and Midwest)

The Customer-Funded EE Market

Total U.S. Electric Program Spending Increases across multiple scenarios

Scenario	Projected Spending ($B, nominal)			Projected Spending (% of Revenues)			Average Annual Spending Growth		
	2015	2020	2025	2015	2020	2025	2010-2015	2015-2020	2020-2025
Low	4.8	5.2	5.5	1.2%	1.2%	1.1%	4%	2%	1%
Medium	6.5	7.4	8.1	1.7%	1.8%	1.7%	11%	3%	2%
High	8.3	10.8	12.2	2.2%	2.6%	2.7%	16%	5%	3%

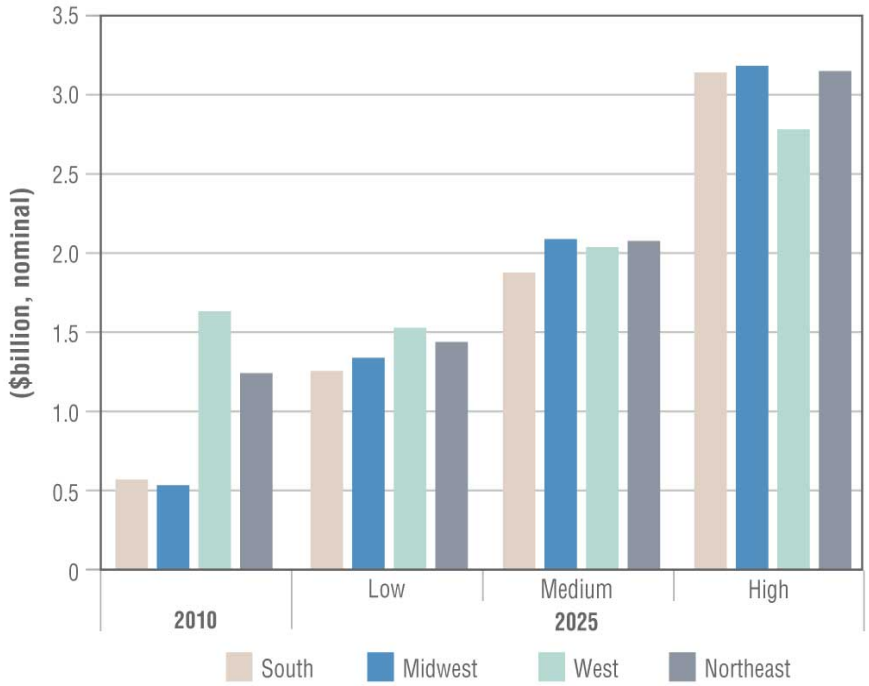
Projected Electric Energy Efficiency Program Spending

- Across all three scenarios, electric EE program spending grows in nominal dollars to 2010 ($3.9 billion)
- Electric program spending as a percentage of electric utility revenues grows in the medium and high cases, but remains flat at 2010 level (1.1% of revenues) in the low case
- In 2010, total incremental annual savings from electric EE programs was 18.4 TWh or 0.5% of U.S. retail electric sales (ACEEE)
- Projected annual incremental savings rise to 28.8 TWh in 2025 in medium case, about a 55% increase from 2010

The Customer-Funded EE Market

Electric EE spending growth driven by Midwest & South

- Populous Midwest states with aggressive EERS are ramping up (IL, IN, MI, OH)
- Spending growth in South driven by several larger states with modest EERS policies and/or nascent IRP/DSM planning processes (FL, TX, NC, MD, KY)
- In Northeast and West, which historically have dominated the EE program landscape, spending also increases in the medium case, but more slowly than the other two regions

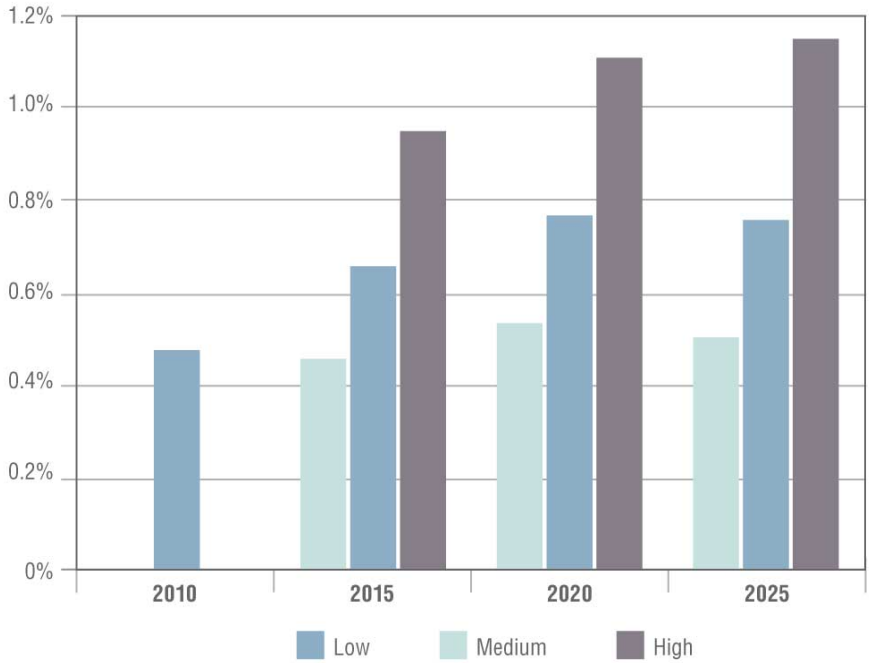


Projected Electric EE Program Spending by Census Region (2025)

The Customer-Funded EE Market

Electric savings could offset a large portion of projected load growth

- Projected annual incremental savings rise to 0.76% by 2025 in medium case
- EIA's 2012 reference case projects that U.S. electric retail sales will grow by 0.58% annually through 2025
- Projected EE savings in the medium case would largely offset forecasted electric load growth



Projected Incremental Annual Electric EE Savings from Customer-Funded Programs (Percent of Retail Sales)

What are Major Efficiency Policy/Regulatory Issues in the US?

EE Policy/Regulatory Issues

Broad policy and market context issues:

- A persistent economic downturn may impact the ability of EE administrators to meet savings targets as well as the political feasibility of increasing ratepayer funding for EE programs
- Low natural gas prices reduce the avoided energy forecast and the headroom for cost-effective EE, as well as participant interest
- The effect of new Federal appliance and lighting efficiency standards on the remaining market potential for voluntary EE programs
- EE programs can be part of the compliance solution for retiring coal-fired units—how much reliance on EE vs. supply-side options?

EE Policy/Regulatory Issues

EE Program funding and regulatory oversight issues:

- Funding levels and short-term rate impacts associated with large-scale energy efficiency implementation
- Innovative program designs to reach deeper and broader savings in order to achieve goals significantly beyond current achievement – *increase customer participation*
- Sustainable EE business models to motivate utilities to participate in a positive manner - utilities' earnings capabilities not hindered by customer efficiency with opportunities to receive additional earnings for excellent performance
- Efficiency is treated and analyzed as an actual resource
- Near-term, shortage of trained personnel in the energy efficiency services sector

EE Policy/Regulatory Issues

EE Program focus and design issues:

- Who pays vs. program spending (equity objectives)
- Maximize cost-effectiveness vs. opportunities for all customers to participate
- Targeted to under-served markets & utility customers
- Program administration costs vs. other costs (e.g., incentives)
- Types of programs
    - Retrofit vs. “lost opportunity”
    - Information/education vs. “subsidies” (incentives)
- *Natural gas and electricity efficiency interactions*
- *Role of utility versus private sector service and product providers*
- *Balance activities with near and long-term impacts*

Natural Gas and Electricity Efficiency – Partners or Adversaries?

Good:

- Packaging electricity and natural gas efficiency measures can be beneficial for consumers – residential, commercial and industrial
- With low natural costs (and the difficulty of showing cost-effectiveness of natural gas measures), evaluating cost-effectiveness at the Electricity/natural gas portfolio level can help justify natural gas measures

Bad?:

- Competition and potential for fuel switching between natural gas and electric only utilities can create unintended consequences

Opportunity:

Coordinated, joint delivery of services can:

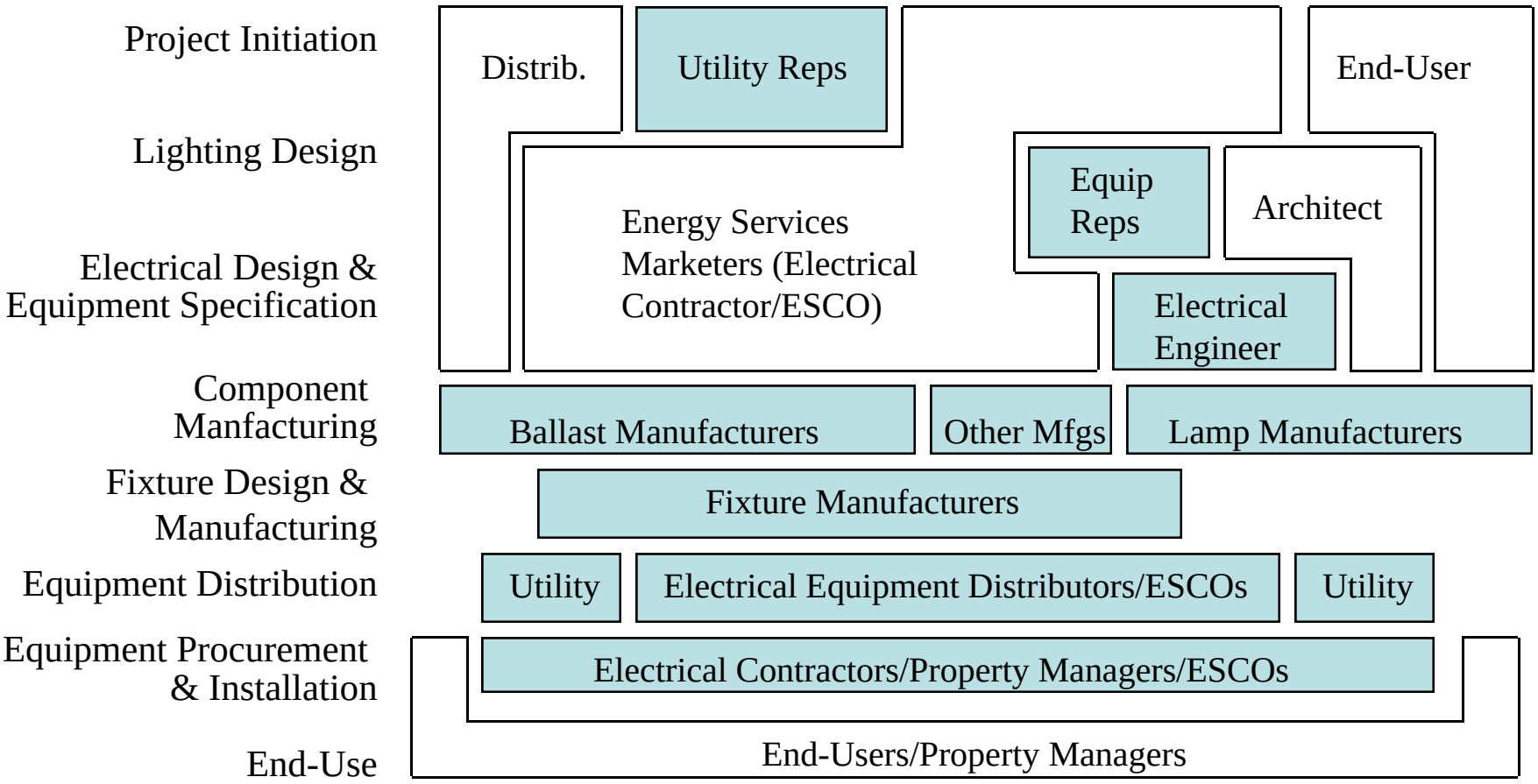
- Reduce usage for both electricity and gas
- Is more cost-effective with reduced transaction costs

Role of Program Administrator and Other Market Participants

Creating vibrant energy efficiency services industry involves regulator defining roles of administrator and implementers

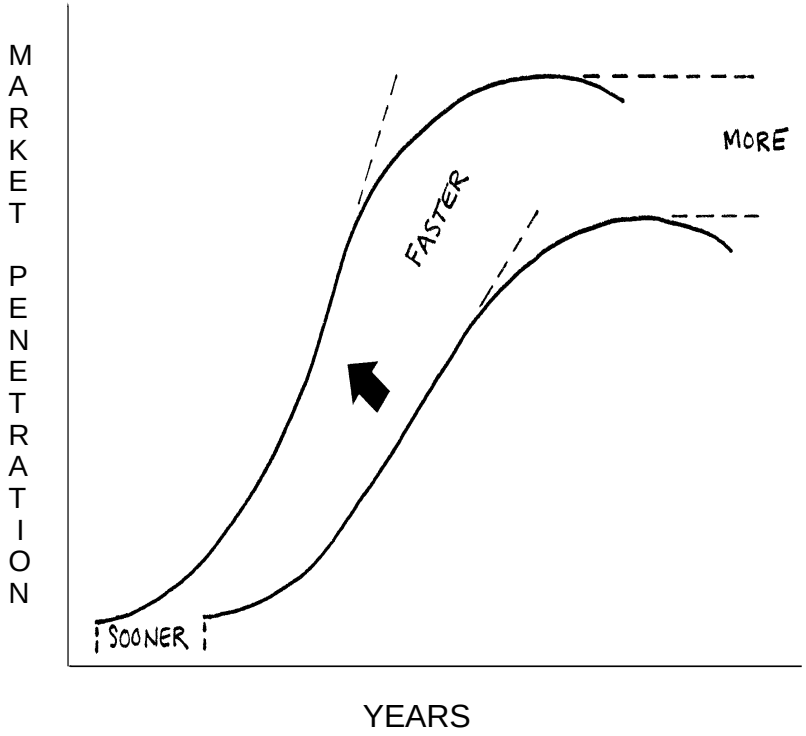
- Distribution utilities are in unique position to influence efficiency activities
  - Substantial customer reach—field representatives
  - Customer perception as trusted advisor: objective
  - Access to customer bills—financing, credit-worthiness
  - Information on customer energy usage patterns
- Private sector energy efficiency services industry may be inhibited if utilities provide one-stop source of information, financing, technical advice, program delivery & implementation
  - As relationships between efficiency service providers and customers strengthen, customer/utility bond shifts to a market driven by private sector
  - Regulators can critically review utility role as primary program implementers

Example Utility/Private Sector Roles: Commercial Sector Lighting Retrofits



Program focus: near-term savings vs. long-term market impacts

- Resource acquisition. The primary objective of this program category is to directly achieve energy and/or demand savings, and possibly avoid emissions, through specific actions.
- Market transformation (MT). The primary objective of this program category is to change the way in which energy efficiency markets operate (e.g., how manufacturers, distributors, retailers, consumers, and others sell and buy energy- related products and services), which tends to result in more indirect energy and demand savings.
- Multiple objectives. Programs can include some or all of the above-listed objectives.



Final Notes - key elements for program design and the efficiency market

- **These programs are strategic efforts to intervene in a market**
  - Begin with the market in mind
  - Focus on market barriers and opportunities
  - Listen to consumer and trade allies
  - Use utility channels and brands
  - Keep participation simple
  - Have a program theory—"why will this program work?"
- **Leverage private sector expertise and funding**
- **Start with demonstrated program models**—build for future infrastructure
- **Ensure efficiency investments deliver results**—impact, process and market evaluation

Goals:

- Beneficial changes in the structure or function of the market or the behavior of market participants,
- Increase in the adoption of energy efficient products, services, and/or practices
- Maximize participation of consumers
- Lasting or sustained change - the targeted market changes last beyond the program

Thank You

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