Minding the Gap: Post-Lighting Savings Opportunities for Commercial DSM Programs

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E Source
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Project Overview

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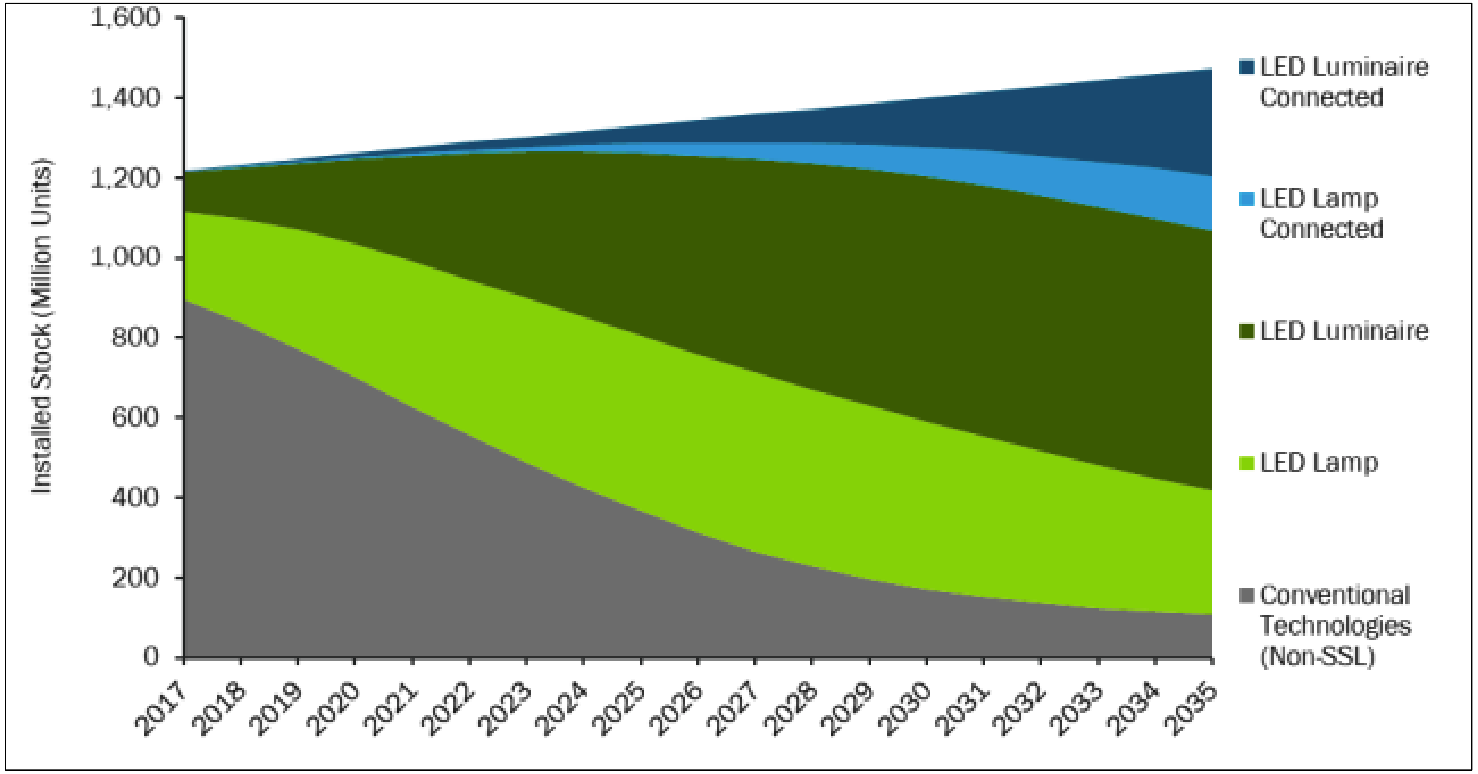
Mission accomplished: Lighting is mid-transformation

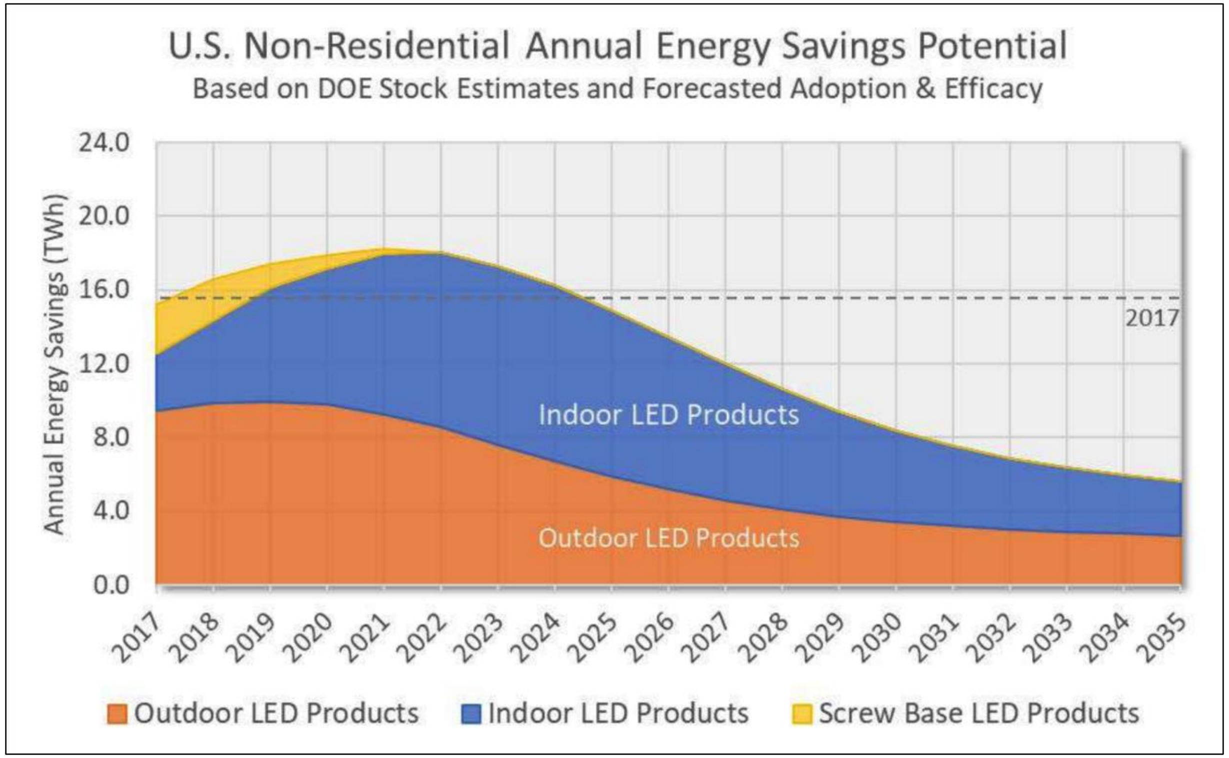
Installed commercial lighting base from 2017-2035



As recently as 2017, LEDs only had about 25 percent market share in the commercial sector; today it is about 2/3 and by the early 2030s, the market will be virtually transformed. Source: DOE.

LED measures are retiring. What will replace them?

Historical savings and future opportunities, with national lighting savings peaking in 2022



In 2024, technical potential savings will be on par with those achieved in 2017 when most portfolios already had comprehensive offerings…

…So, in jurisdictions where lighting is a viable efficiency opportunity, electric companies can still reap significant—albeit diminishing—savings for at least the next several years.

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We wanted to know what industry leaders thought the key post-lighting options are

- This work is based on interviews with 21 industry experts at 13 organizations across the US
  - The scope is commercial customers (with extra emphasis on SMBs) from now through 2035

- Most interviewees are EE senior staff at IOUs but also includes SMEs from:
  - National labs
  - Department of Energy
  - Regional Energy Offices (REOs)
  - Major implementation contractors (ICs)

- Augmented by additional expertise and secondary research by IEI and E Source

Promising Technologies Through 2035

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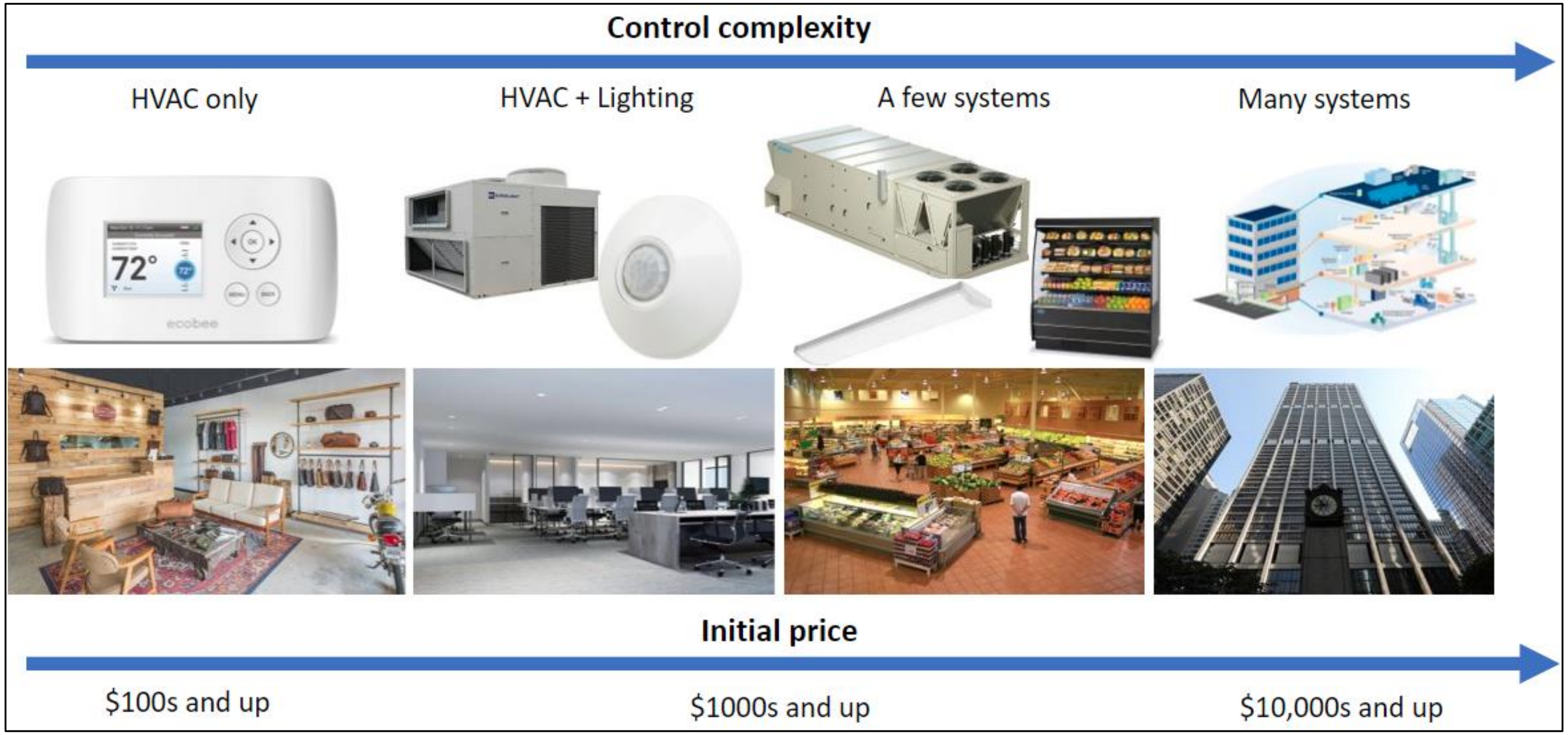
Post-lighting options vary in cost and maturity

Energy Efficiency Category	Segments	Examples / Technologies	Key Considerations
Advanced controls	SMB	• Smart thermostats • Networked lighting controls • HVAC controls based on lighting occupancy	• Relatively inexpensive and straightforward
	Midsized to larger	• Energy management systems (EMS)	• EMS now cost-effective in midsized buildings
Refrigeration	SMB	• Door gaskets • Night curtains • Adding doors • Tune-ups • Motor replacement • Smaller unit replacement	• Simple • Inexpensive • Approachable • But not all SMBs have refrigeration
	Larger	• Phase change materials in large refrigeration systems	• Non-efficiency perks: DR, outage resilience, temperature consistency
Air source heat pumps (HVAC)	All	• Rooftop units • Packaged terminal heat pumps (lodging) • Mini-splits and other small systems	• Cost-prohibitive for most SMBs • May require building shell upgrades • Technology still maturing

Most promising technology: advanced controls

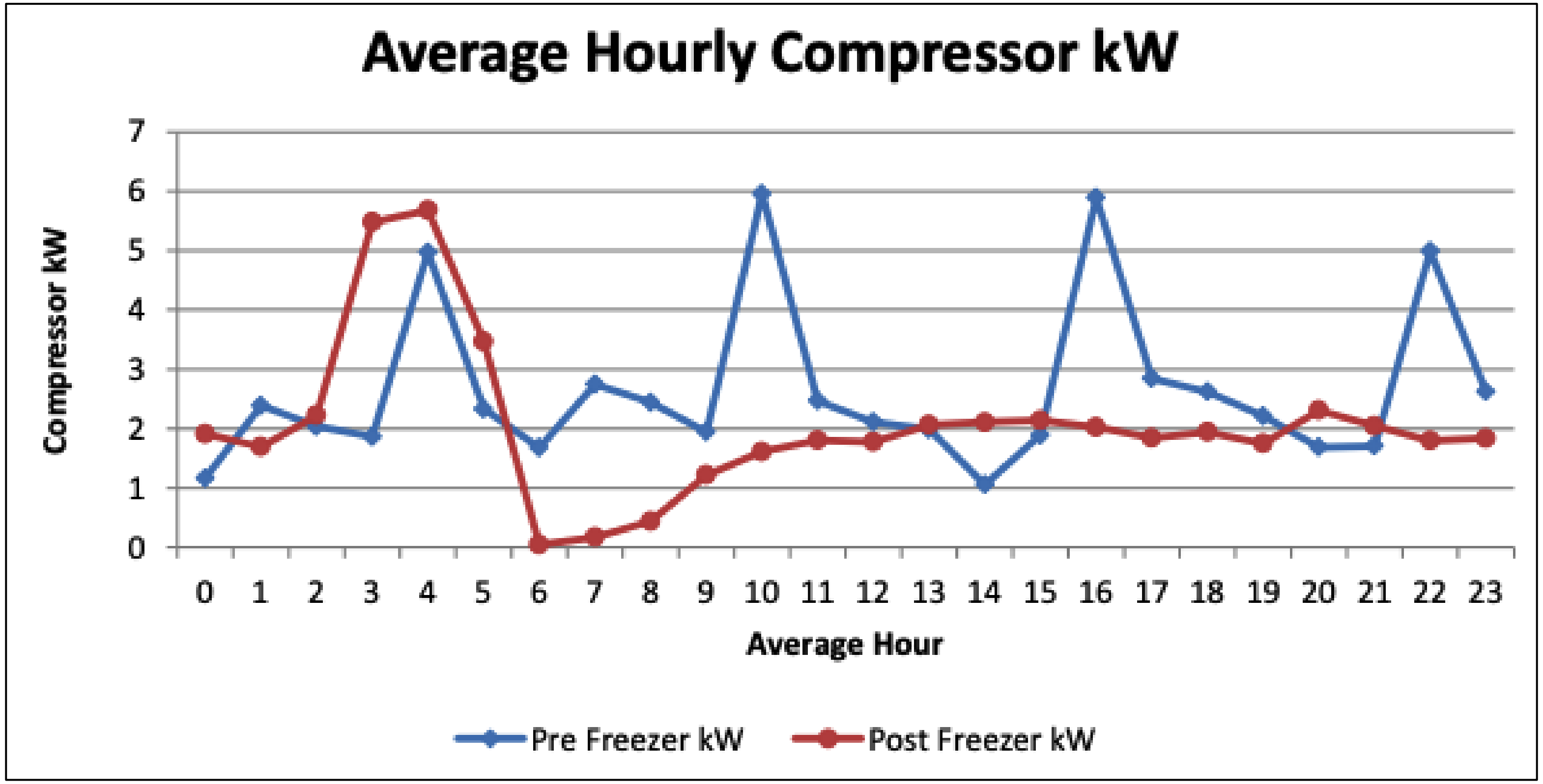
While nearly all customers can benefit from controls, the type and complexity will vary



The simplest solutions may save a SMB customer 10 percent on utility bills for an investment of just a few hundred dollars, while multi-system controls in large businesses are increasingly sophisticated but also offer greater savings than ever before.

Refrigeration: An option spanning many segments

Performance of a PCM refrigeration system



In this chart, pre-PCM consumption (blue) has numerous large peaks. Post-installation (red), there is still a single large peak when the PCM liquid was refrozen overnight, but critical daytime peaks are eliminated. Because the PCMs are refrozen with a compressor operating in the cool of the night, overall energy use (corresponding to the total area under each of the lines) was significantly lower with PCMs. Source: Southern California Edison.

Interviewees are both hot and cold on heat pumps

- ASHPs for HVAC are universally applicable and can offer savings, but interviewees are ambivalent because:
  - Expensive with long payback
  - Renters have little incentive to adopt
  - Building owners may prioritize less-expensive upgrades
  - Might require building shell upgrades
  - Might require electric infrastructure upgrades
  - Commercial adoption lags behind residential
  - Still more expensive to operate in some areas than legacy heating systems
  - Contractors aren't as familiar with ASHPs and some believe they cannot perform in cold weather, hindering adoption
  - Can be subject to fuel-switching bans in some jurisdictions

- Despite these limitations, most interviewees still believe ASHPs will be a valuable technology, just not a panacea

Honorable mentions: 7 more possible silver BBs

Though interviewees cited these technologies less often than the “Big 3” of controls, refrigeration, and heat pumps, they still may provide significant savings by 2035

Technologically mature

- Replacing first-generation LEDs with ultra-high efficiency products (best fit for SMBs)
- Indoor agriculture lighting, HVAC, and controls systems
- Lighting design
- Building shell upgrades
- Heat pump water heaters

Technologically immature

- DC lighting
- Non-compressor HVAC and refrigeration

Shifting Away from Prescriptive Downstream Programs

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EE portfolios are shifting more to midstream

Savings reported by efficiency programs active in midstream programs

Program	Actual savings (MWh)
Duquesne Light Co. (lighting)	228,940.00
ComEd (mixed measures)	155,126.00
DTE (HVAC)	131,192.00
Pepco (mixed measures)	93,532.00
DTE (light)	71,700.00
BGE (mixed measures)	48,954.00
Delmarva (mixed measures)	38,604.00
PECO (mixed measures)	34,977.00
Pepco (lighting)	29,070.00
OGE (lighting)	23,919.87
Xcel Energy (lighting)	19,763.69
SMECO (mixed measures)	10,094.00
Oncor (HVAC)	2,027.25
DTE (food service)	1,400.00
Delmarva (HVAC)	969.00
Southwestern Electric Power Co. (lighting)	750.76
California midstream commercial water heating	130.00
SDG&E (water heating)	59.62
Delmarva (lighting)	9.87

© E Source (DSMdat). **Note:** MWh = megawatt-hour.

- Most of the electric companies interviewed are planning to transition at least some of their current retail offerings to midstream.

- Most common areas of interest:
  - HVAC (especially ASHPs)
  - Small refrigeration replacement
  - Water heating

Market Transformation is of keen interest…
…But approaches vary

- Most electric companies signaled an intention to expand MT efforts
- There is no industry established “correct” way to approach MT
- There are successful past examples of MT efforts

TOGETHER We Are Transforming the Northwest

Electric Companies Are Set to Broaden Their Approaches

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Additional strategies can help fill the lighting void

- Bundling holistic solutions
  - Bundling lighting with other measures may help keep lighting in portfolios longer
  - May be easier said than done in territories where lighting has often been used to carry other less cost-effective measures

- Expanded Strategic Energy Management (SEM)
  - Has worked well for industrial customers
  - Expanding to midsized commercial customers may yield new savings opportunities (though probably not a good fit for small businesses)

- Explore innovative financing mechanisms
  - Can help overcome the higher price-tag of many post-lighting products, like heat pumps and advanced controls
  - Examples include: on-bill financing, landlord-tenant split incentives, hybrid pay-for-performance, and helping customers to secure ancillary funding like Federal grants or enrolling EE purchases in DR programs

Regulatory and Legislative Factors

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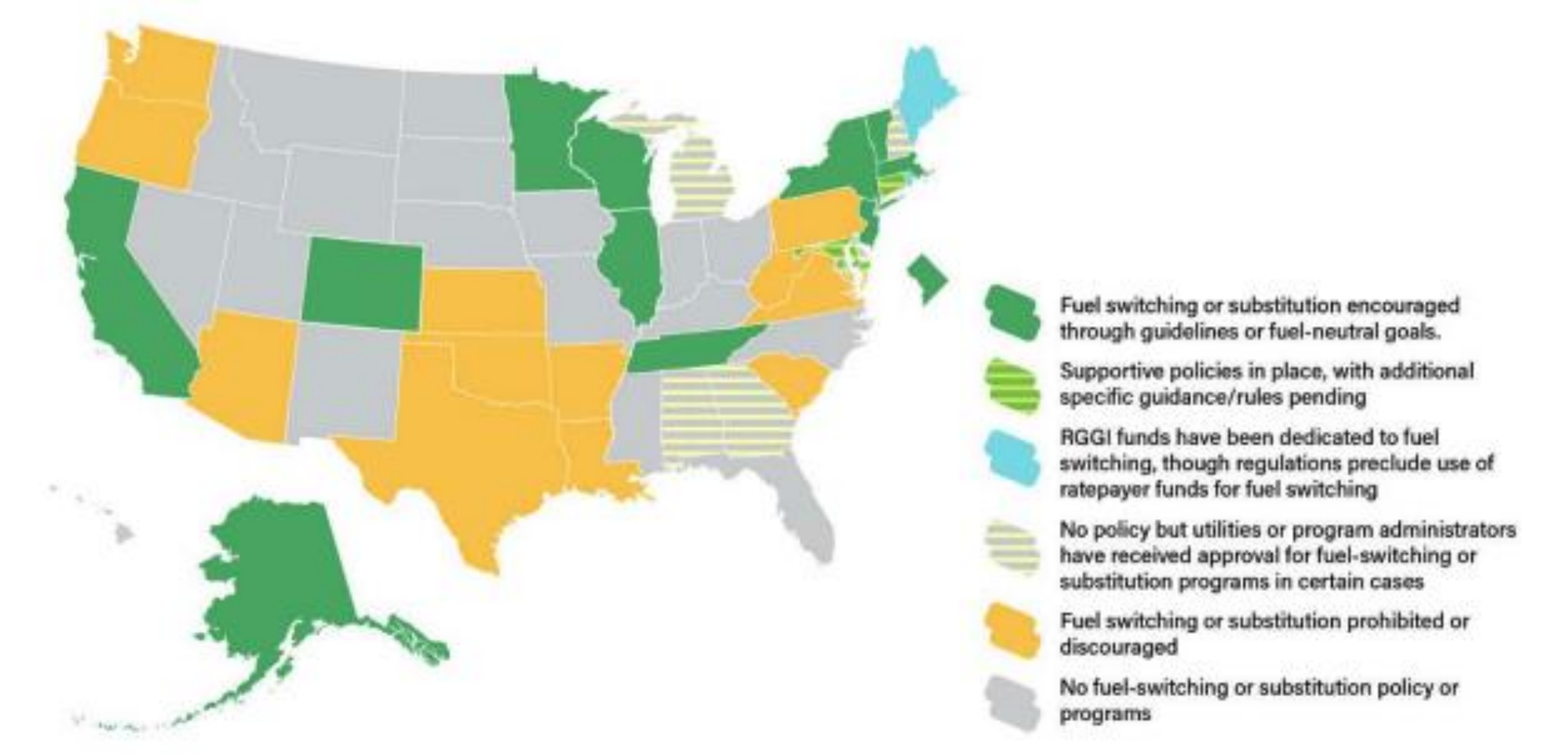
Electrification may have a big impact… in some areas

State policies regarding BE vary widely



Some jurisdictions have policies favoring beneficial electrification, while others disallow it entirely. The degree to which BE efforts are allowed in a specific area will have a significant influence on post-lighting portfolios. Source: ACEEE.

Total System Benefit: Is California the future?

- *TSB unites EE and DR and may expand the number and scope of measures in portfolios*

- *As California goes, often the industry goes; if successful in California, TSB could become the norm and may radically transform what post-lighting portfolios look like*

- But TSB has an Achilles' Heel: complexity

$$TotalSystemBenefit = (ElecBen + GasBen + Qty * (NTGRkWh + @MEBens) * RefrigBens + Qty * (NTGRkWh + @MEBens) * GasInfraBens) - (ElecSupplyCost + GasSupplyCost + Qty * (NTGRkWh + @MECost) * UnitRefrigCosts)$$

This is the TSB equation, which is much more complex than traditional cost-effectiveness tests. Further complicating TSB calculations, many of these variables can have constituent equations or vary depending on time of day, season, or climate.