

Climate Action in Power Supply & Demand -- Energy efficiency & grid modernization

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Various theories about potential carbon reduction from efficiency

- NRDC - energy efficiency technologies and system-wide approaches could reduce US demand by 40% by 2050
- ACEEE - 10 particular EE paths could reduce US energy demand and carbon emissions by 33% by 2040
- IEA - EE can reduce worldwide GHG emissions by >25% by 2050
- Amory Lovins -- Integrated design & efficiency could halve building energy use and, across all sectors, reduce US 2050 fossil CO2 emissions by >80%.

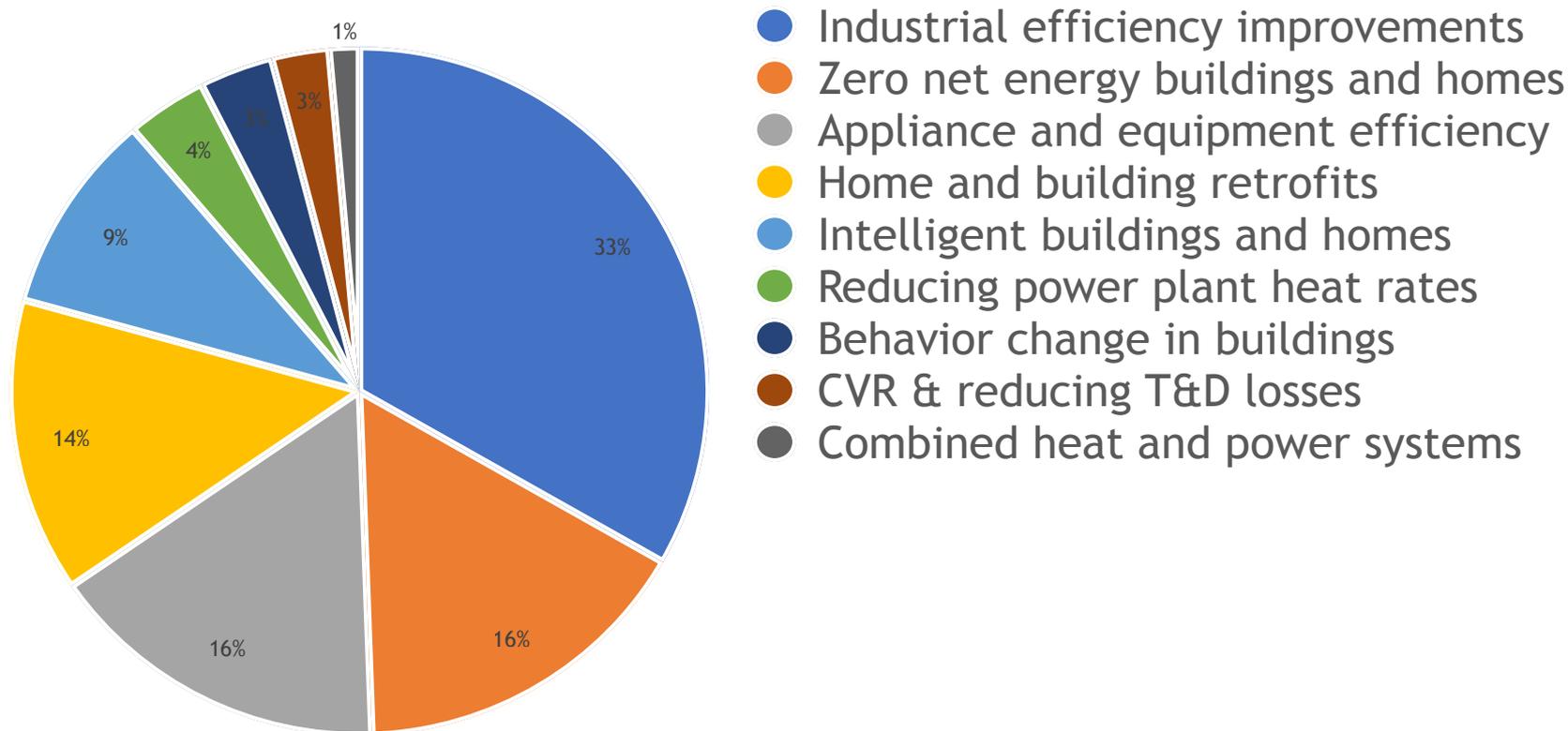
Context & definitions

Different approaches give different carbon impacts

- Energy efficiency - use less energy to deliver more services. Improve building shells, devices, controls, smarter uses, user behavior (ACEEE, DOE)
- “Beneficial electrification” -- convert non-electric energy uses to electricity to use more zero-carbon, low-cost generation (EPRI, DOE, NREL)
- Grid modernization - a platform of grid technology, communications, sensors & analytics to operate and leverage the grid and distributed and customer assets effectively.

Carbon reductions from classic energy efficiency sources

1,225 MMT of carbon reduction by 2040 from non-transportation EE measures

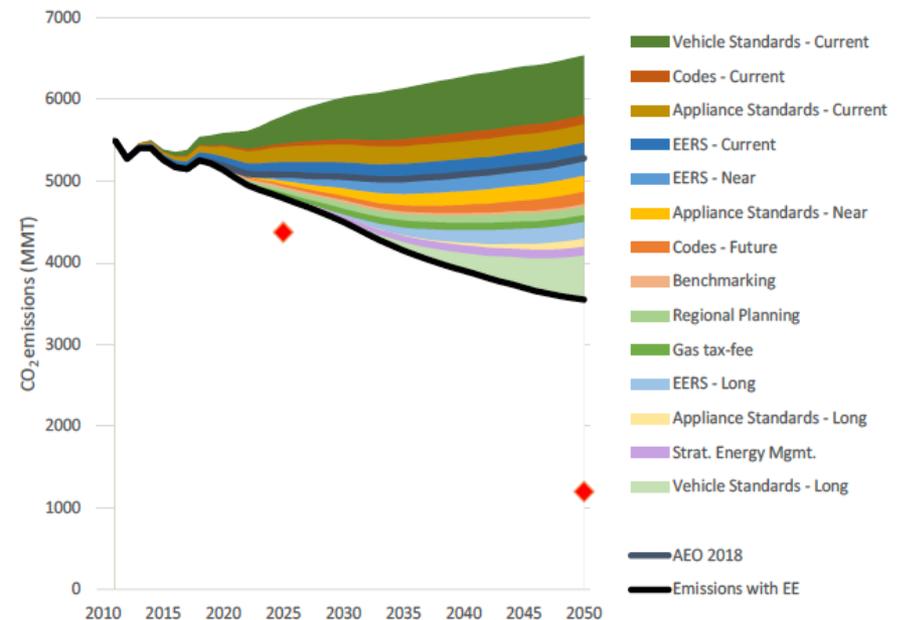


Source: ACEEE, Steve Nadel, "Pathways to Cutting Energy Use and Carbon Emissions in Half," 12/16

Classic energy efficiency policies

- Energy efficiency requirements for electric & gas utilities
- Appliance standards (federal & state)
- Building energy codes including Zero Net Energy
- Energy benchmarking
- Industrial energy efficiency
- Regional transportation & land use planning
- Education & labeling
- Rebates
- Intelligent efficiency

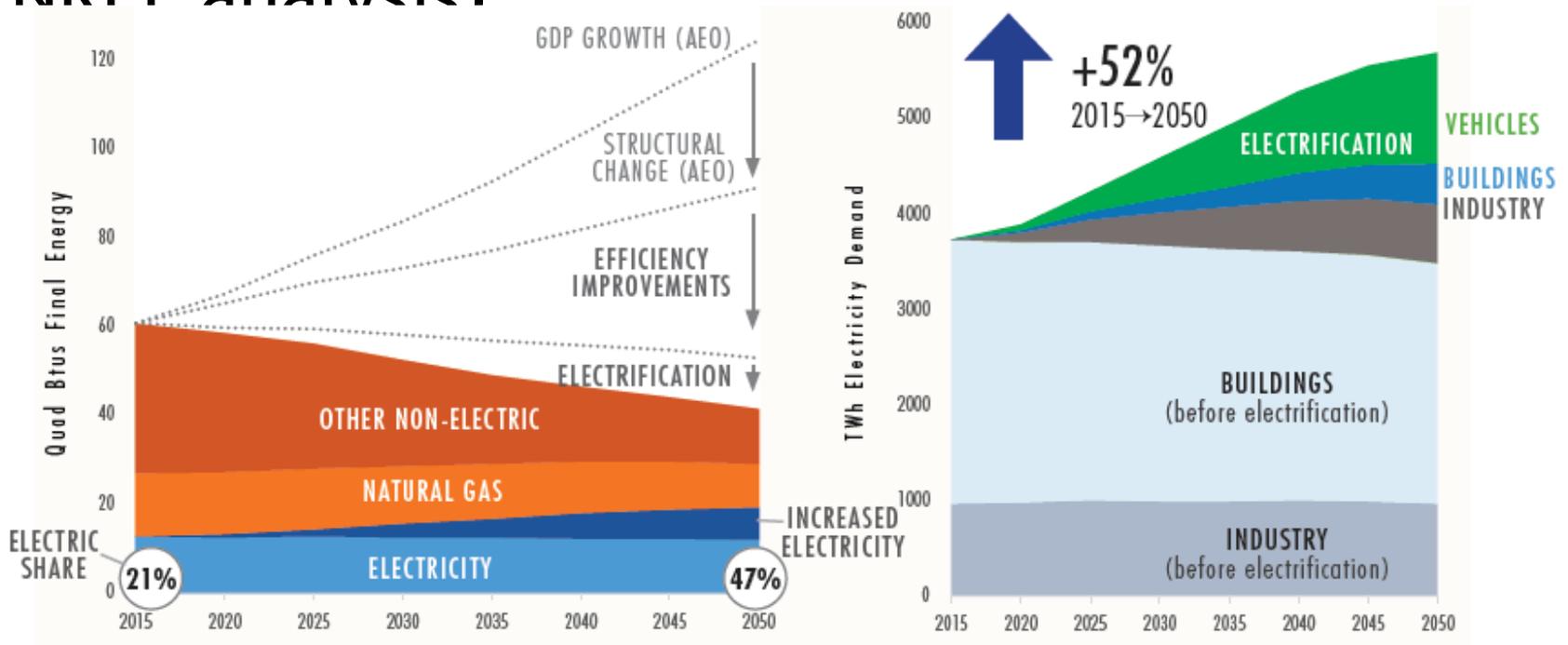
Impact of EE policies on projected carbon emissions



Lowell Ungar, ACEEE, "Doing our part: the contribution of energy efficiency policies to meeting US climate goals," ACEEE 2018 Summer Study, 8/18

Electrification + efficiency

With high electrification, EPRI projects total final energy falls, electricity load rises 52%, CO2 emissions fall 67%, and clean energy replaces much fossil generation. (lower in NREI analysis)



Source: EPRI, US National Electrification Assessment, 9/18

Grid modernization

- "Smart grid" investments in better sensors, communications, automation, two-way flows, smart meters, for the grid won't deliver much efficiency on their own -- maybe 3% throughput efficiency improvement?
- But a modern grid is the essential platform for electrification, distributed generation, renewables integration, demand response, and many types of energy efficiency to deliver carbon reductions.

Essential policies to achieve these carbon reductions

- Continually updating building and appliance efficiency standards
- Continuing RD&D for energy efficiency, renewables integration, energy end use electrification and reliable grid operation
- Huge amounts of clean energy production
- Coordinated economy-wide policies
- Extensive financing, subsidies, and market transformation efforts to accelerate waves of equipment replacement and support infrastructure
- New rationales and analytical methods that value accelerated decarbonization (carbon price?)
- Mandatory deep EE retrofit before PV installation