

# 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%.

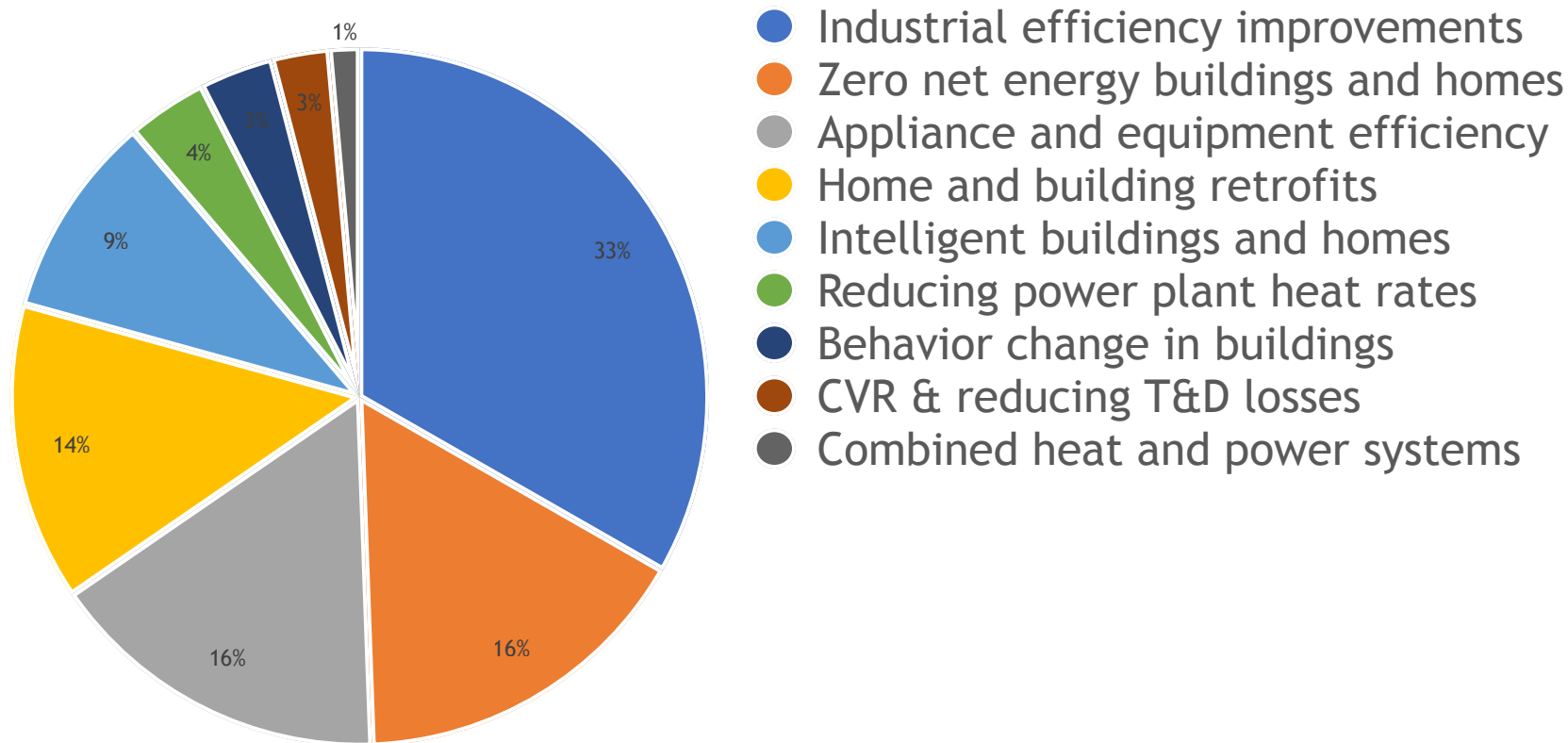
# Context & definitions

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**

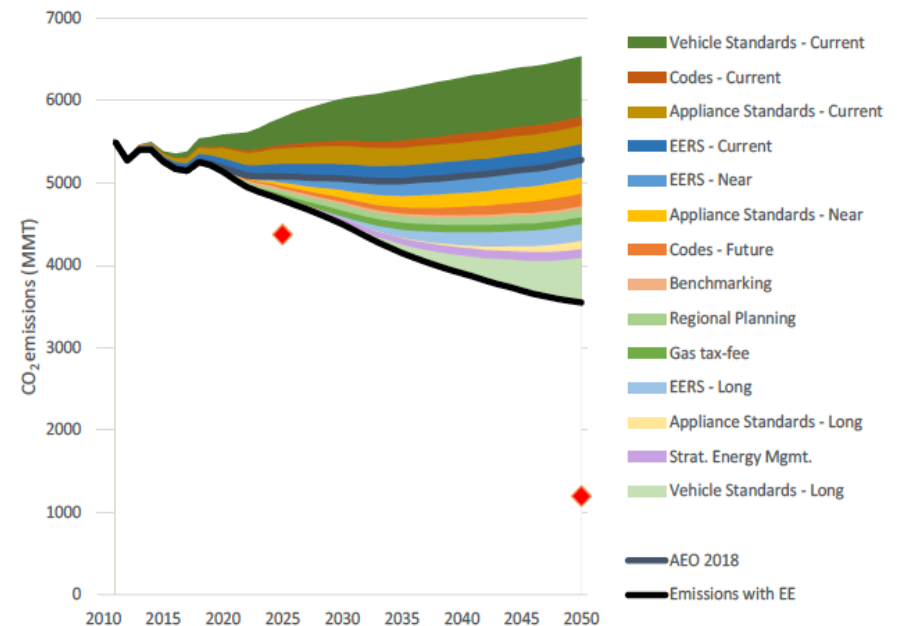


Source: ACEEE, Steve Nadel, "Pathways to Cutting Energy Use and Carbon Emissions in Half," 12/16

# 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

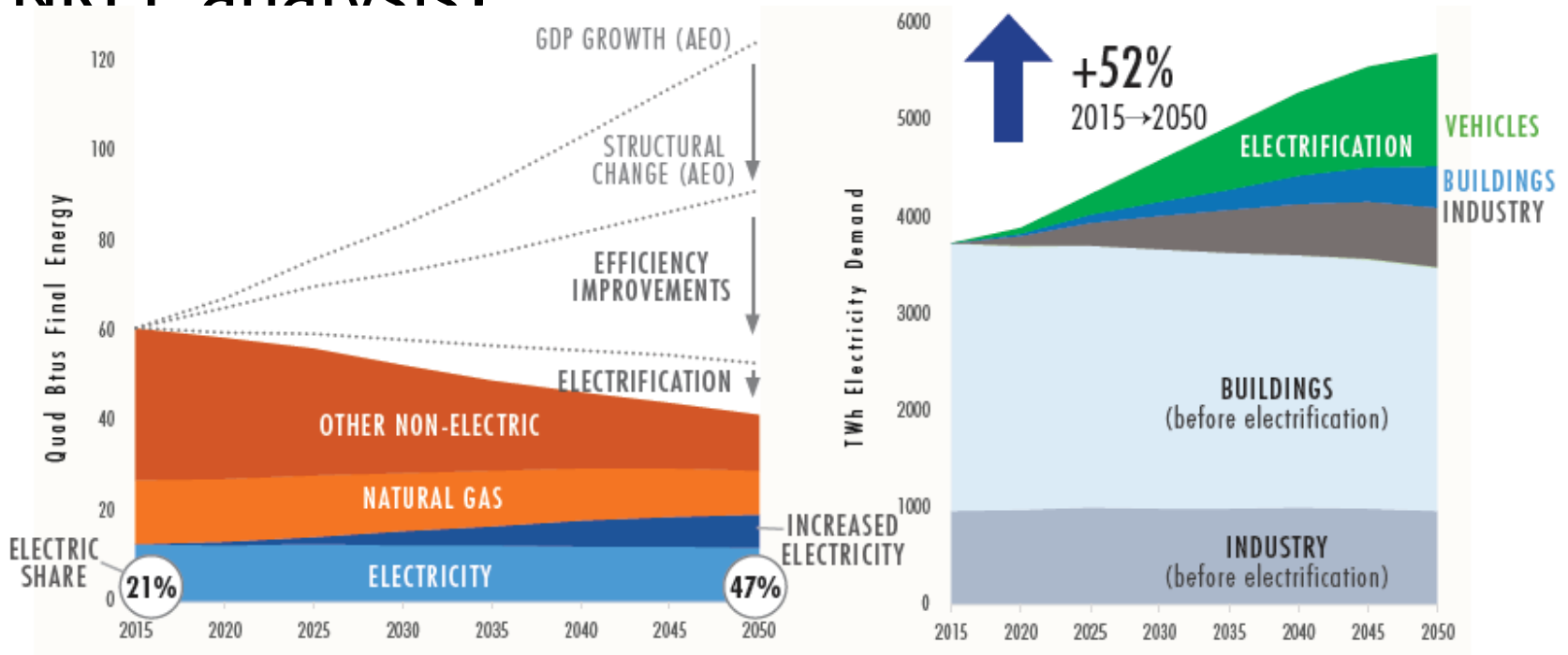
## Impact of EE policies on projected carbon emissions



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