Electricity Committee

Gas Committee

Committee on Consumers and the Public Interest

NARUC Summer Policy Summit

Another Outlet for Discussion:

The Effects of *Electrification* on
the Electric and Natural Gas Industries,
the Environment, and Consumers

NARUC Summer
Policy Summit

Moderator:

- Hon. Judy Jagdmann, Virginia

Panelists:

- Tom Wilson, EPRI
- Phil Jones, Alliance for Transportation Electrification
- Chris McGill, American Gas Association
- Elin Katz, Connecticut Consumer Counsel

NARUC Summer Policy Summit

EPRI's US National Electrification Assessment: Key Insights

Tom Wilson
Principal Technical Executive

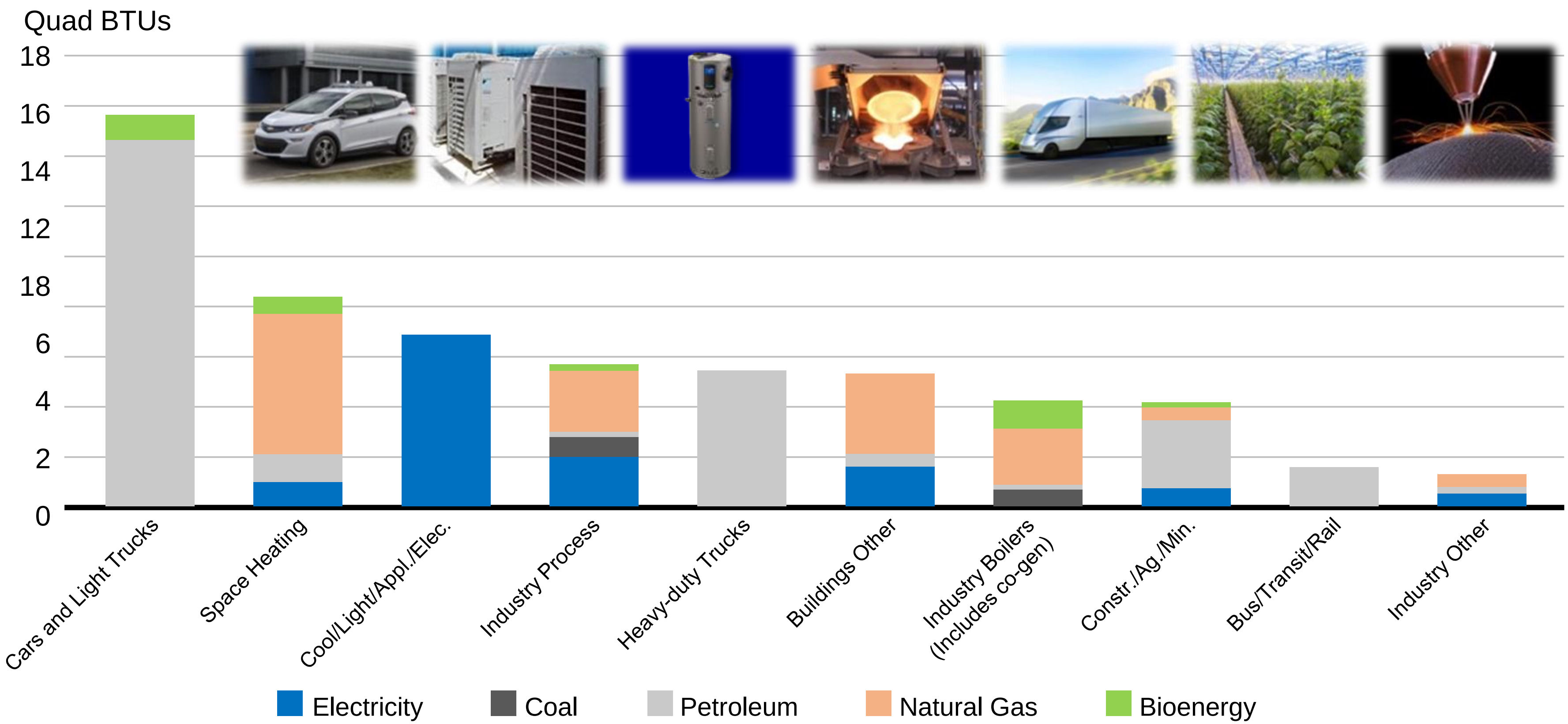
NARUC Session on the Effects of Electrification on the Electric and Natural Gas Industries, the Environment, and Consumers
July 16, 2018

U.S. National Electrification Assessment (USNEA)

- Economy-wide assessment:
  - Residential, commercial, industrial and transport
- Customers have broad technology choices and control
- Customer decisions integrated with detailed electricity supply model
- Just the beginning … kickoff to EPRI's Electrification Initiative

For more information on EPRI's Efficient Electrification Initiative:
https://www.epri.com/#/pages/sa/efficientelectrification

End Use (Final) Energy Use By Sector

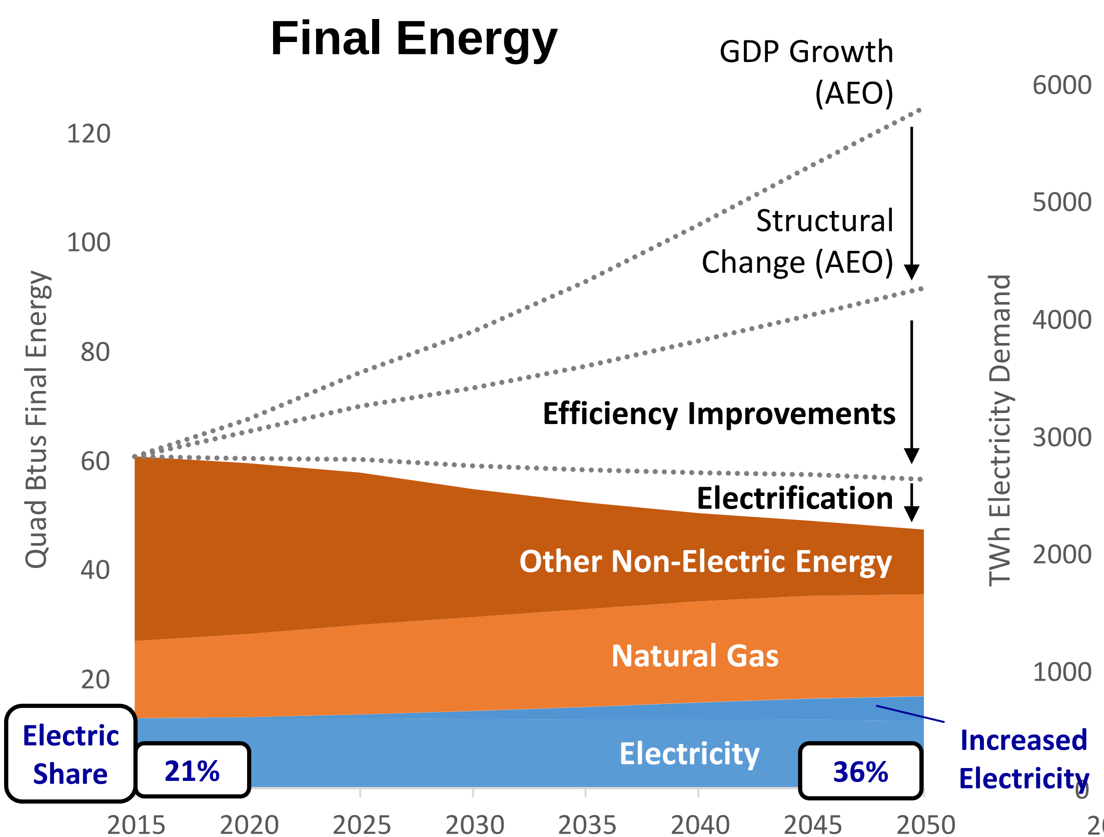


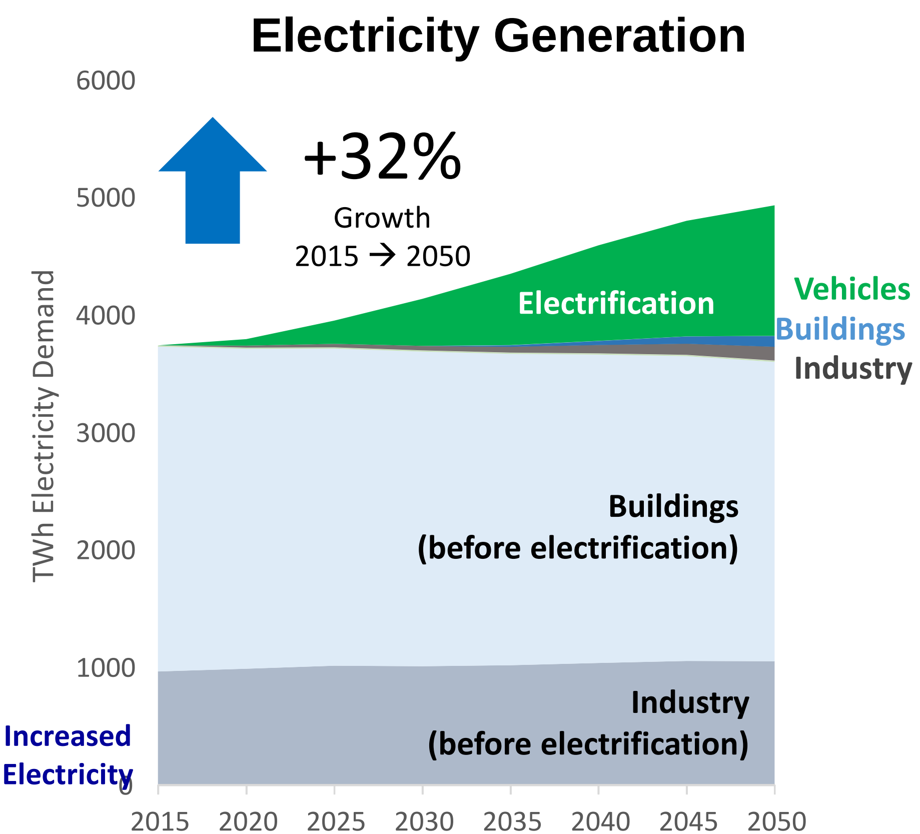
** Excludes upstream and midstream energy use, e.g., power generation, oil and gas extraction, refining, and pipelines*

EPRI's US National Electrification Assessment Scenarios

CONSERVATIVE	Slower Technology Change	• AEO 2017 growth path for GDP and service demands, and primary fuel prices • EPRI assumptions for cost and performance of technologies and energy efficiency over time • Existing state-level policies and targets
REFERENCE	Reference Technology	
PROGRESSIVE	Reference Technology + Moderate Carbon Price	
TRANSFORMATION	Reference Technology + Stringent Carbon Price	

Efficient Electrification: Reference Scenario





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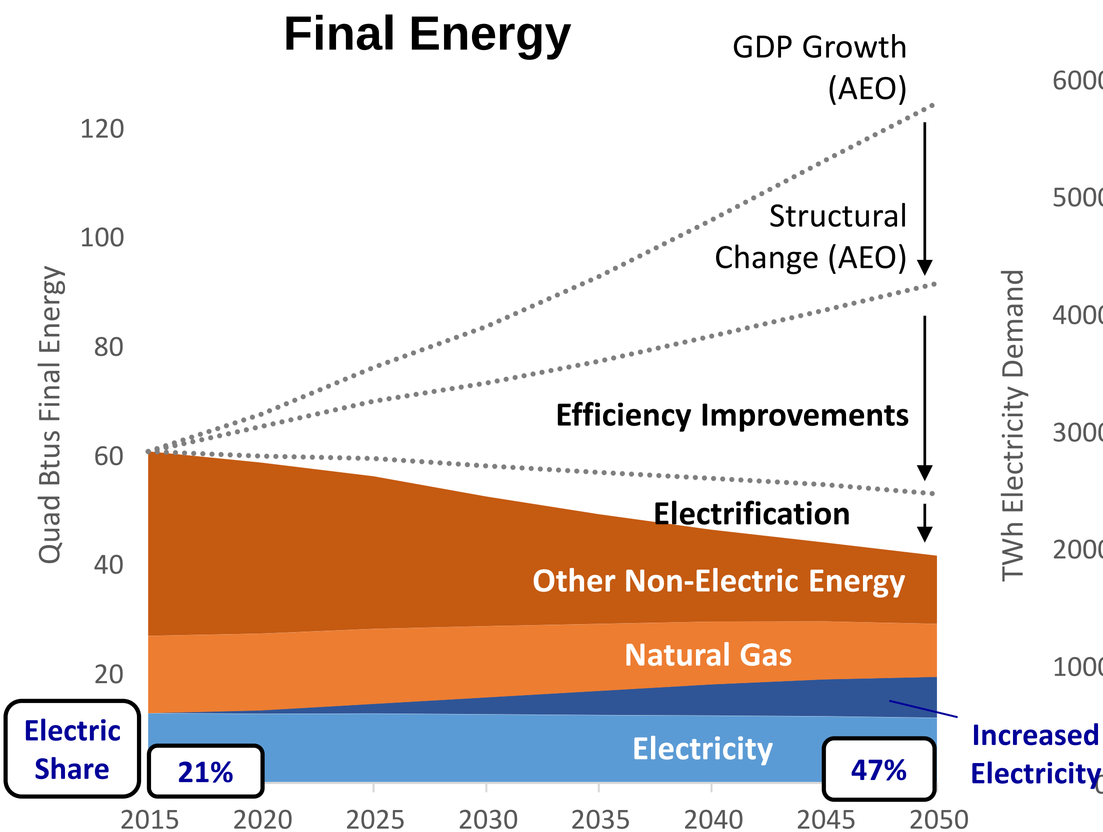
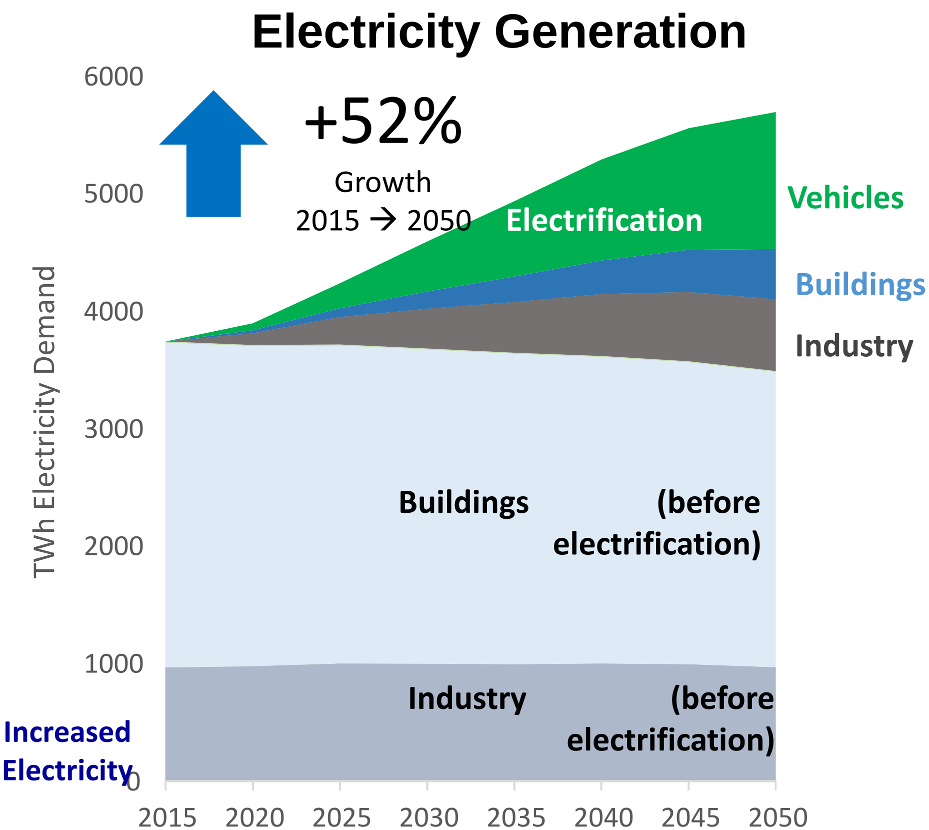
Efficient Electrification: Transformation (tight carbon target)





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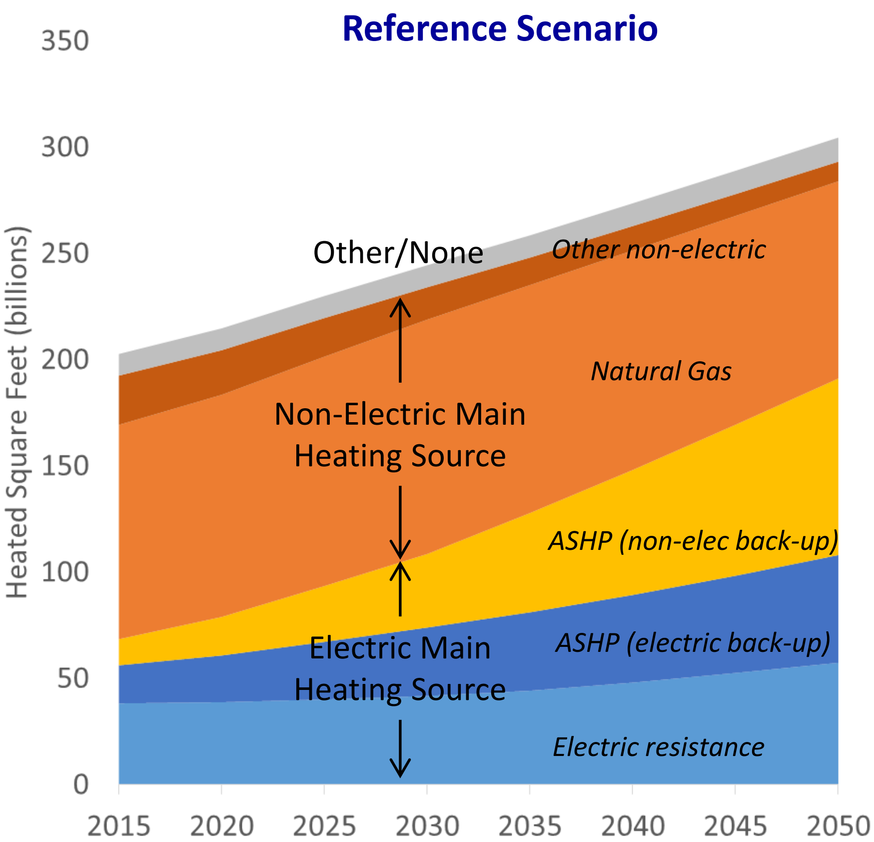
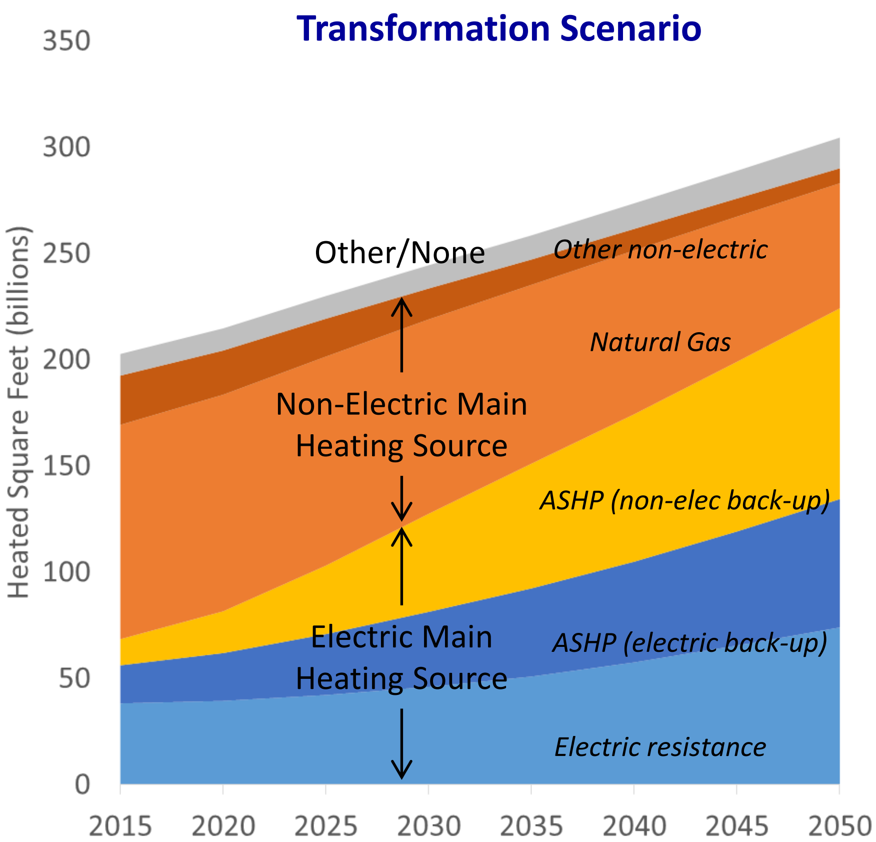
Projections for US Residential Space Heating Services





U.S. National Electrification Assessment (USNEA) - Results

SCENARIO (Electricity Portion of Final Energy in 2015 & 2050)	Total Final Energy	Electric Load	Natural Gas	Economy Wide
CONSERVATIVE (21% & 32%)	20%	24%	33%	19%
REFERENCE (21% & 36%)	22%	32%	40%	20%
PROGRESSIVE (21% & 39%)	27%	35%	31%	57%
TRANSFORMATION (21% & 47%)	32%	52%	18%	67%

Key Take Away Messages from National Electrification Assessment

Electrification Trend Continues	Driven by technological change and consumer choice, further bolstered by policy
Efficiency Increases Emissions Decrease	Efficient electrification + end-use efficiency lead to falling final energy use
Natural Gas Use Grows	Remains a key fuel for end-use and electric generation
System Impacts	Changing load shapes and new flexible loads create challenges and opportunities

BUT…

The full potential may not be realized without deliberate and integrated decisions

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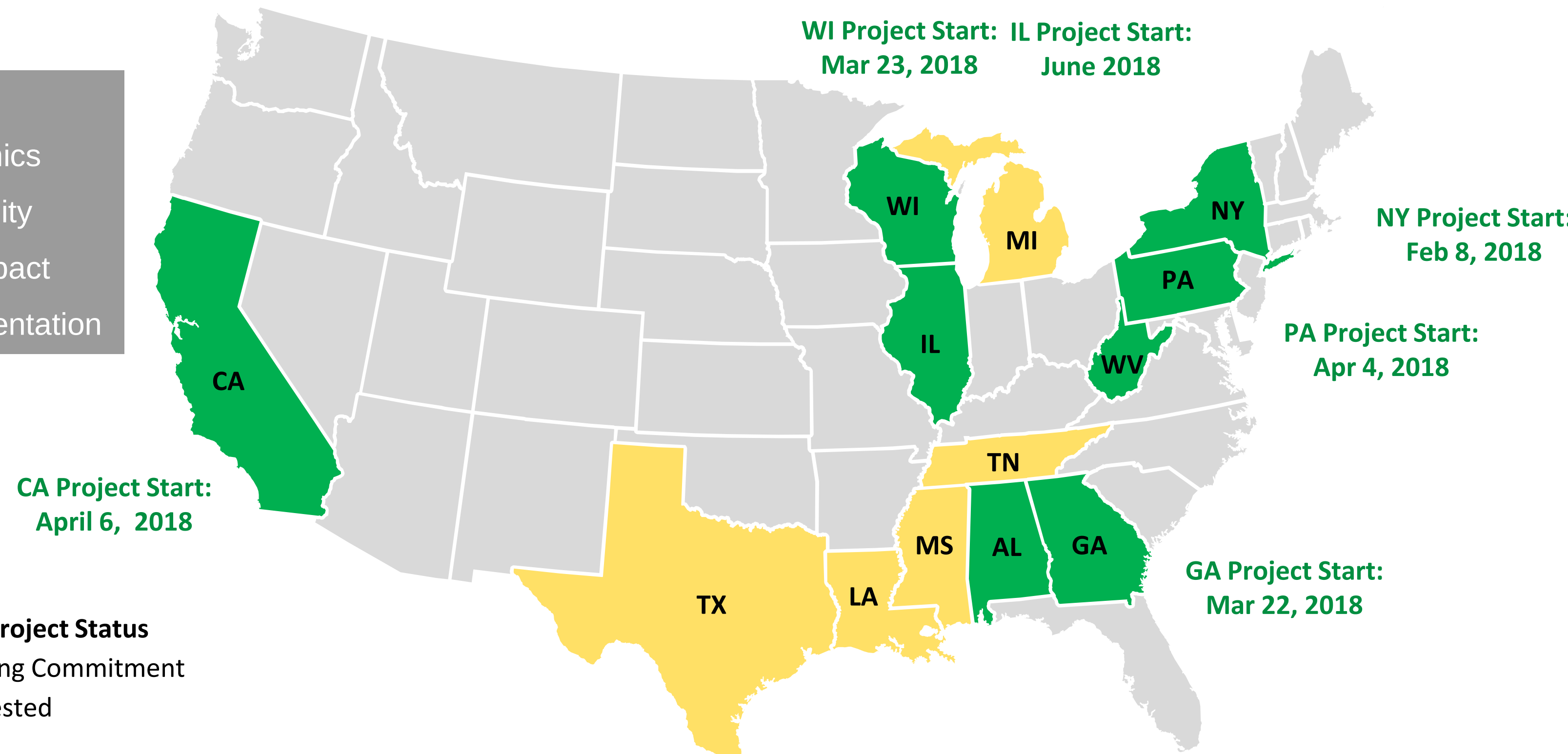
State and Utility Electrification Projects in Development

FOCUS:

- Economics
- Air Quality
- Grid Impact
- Implementation



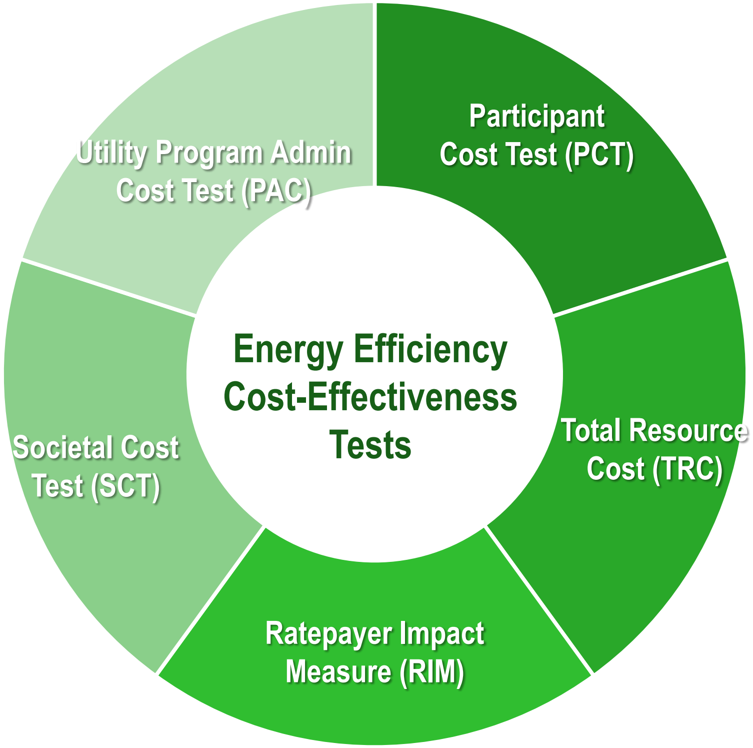
Key – State Project Status

- Funding Commitment
- Interested

State-wide level of Electrification Assessment

June 30, 2018

Efficient Electrification Benefits/Cost Framework…
Leveraging Efficiency Cost-Effectiveness Tests...



KEY QUESTIONS

- IS THE PARTICIPANT BETTER OFF? (PCT)
- IS RESOURCE EFFICIENCY IMPROVED? (TRC)
- ARE RATES LOWERED (RIM)
- ARE SOCIETAL COSTS LOWER? (SCT)
- ARE REVENUE REQUIREMENTS LOWERED? (PAC)

LEVERAGE EFFICIENCY COST EFFECTIVENESS TESTS…FOCUS ON REGULATORY SUPPORT

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ELECTRIFICATION 2018

INTERNATIONAL CONFERENCE & EXPOSITION

www.electrification2018.com

SAVE THE DATE

AUGUST 20-23, 2018 LONG BEACH, CALIFORNIA

- To gain an understanding of the quantifiable customer and environmental benefits of efficient electrification
- To learn about best practices for implementing efficient electrification programs to maximize customer benefit
- To experience the latest electrification-related technologies in action
- To collaborate with industry, government, and academic leaders

For more information, contact Info@Electrification2018.com

Scan here for the latest EPRI Efficient Electrification newsletter

Together…Shaping the Future of Electricity

Thoughtful Pathways

Examining Natural Gas and the Cost Implications of Policy Driven-Residential Electrification

Chris McGill
VP Energy Markets, Analysis and Standards
NARUC, July 2018

Progress in technology and market developments for all energy sources need to be understood and acknowledged but what problem is *policy-driven* electrification of the natural gas residential space and water heating sector trying to solve?

Main Questions the Study Addresses

AGA Study

- Will residential electrification actually reduce emissions?
- How will residential electrification impact natural gas utility customers?
- What are the impacts on the Power Sector and Transmission infrastructure?
- What is the overall cost of residential electrification?
- https://www.aga.org/research/reports/implications-of-policy-driven-residential-electrification/

Initial Findings from Study

1. **Natural gas is a critical residential energy source: Residential natural gas demand in January is more than twice electricity demand in July**

2. **Total GHG reduction potential from policy-driven residential electrification is small: Ranging from 1.0 to 1.5 % of U.S. GHG emission in 2035.**

3. **Policy-Driven Electrification will be burdensome to customers: average residential household energy costs (utility bills and equipment/renovation costs) increase by 38 to 46 %.**

Implications of Policy-Driven Electrification of Residential Gas Use, AGA, July 2018.

Initial Findings from Study

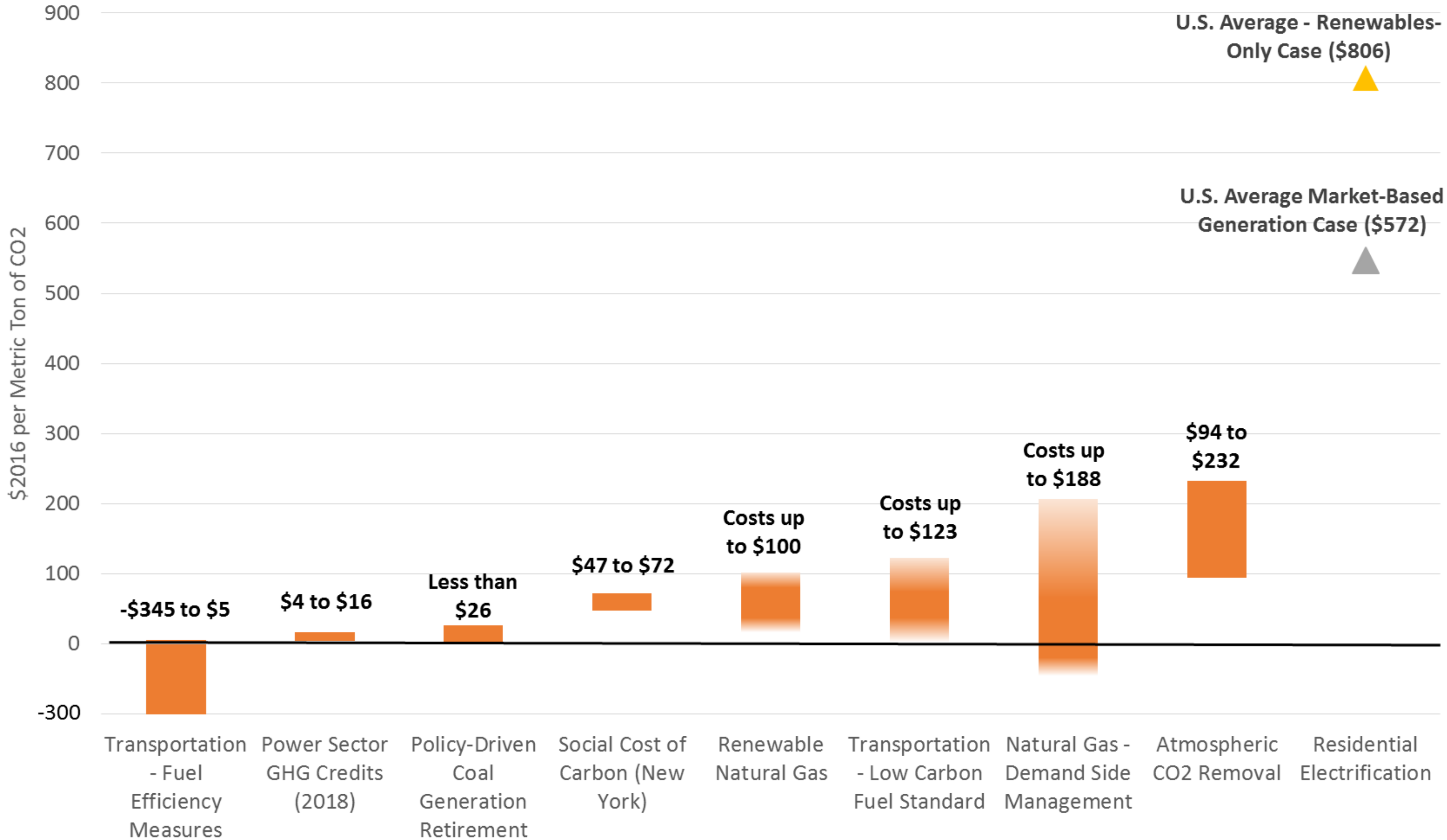
4. A policy-driven residential space and water heating strategy is expensive to the economy - \$590 Billion to \$1.2 Trillion in total incremental energy costs.

5. Such a policy may require infrastructure investments of \$150 to \$425 Billion for generation capacity and transmission.

6. Policy-driven electrification of the residential sector is an expensive tool for greenhouse gas emissions reductions - \$572 to \$806 per ton CO_2.

Implications of Policy-Driven Electrification of Residential Gas Use, AGA, July 2018.

Emissions Reductions Costs for Alternative Approaches to Reducing CO2 Emissions



Source: Implications of Policy-Driven Electrification of Residential Gas Use, AGA, July 2018.

Emerging gas technologies can make substantial and cost-effective contributions to GHG reduction goals

~100

Innovative Gas Technologies for Residential / Small Commercial identified in our global search

25-40%

GHG reduction potential on a customer basis by integration of these technologies and other efficiency practices

60-80%

GHG reduction – sufficient to meet COP 21 goals – with inclusion of future CHP technologies and Renewable Gas

- Policy goals for sustainable energy can be achieved at significantly lower consumer cost through integrating innovative gas solutions into long-term resource planning, while offering customers more choice and improved affordability, reliability and comfort.
- Gas technologies can enhance energy system reliability (system-wide and as a local backup) and efficiency, while reducing the need for new electric generation and T&D infrastructure and preserving the future value of gas infrastructure.
- Electric technologies will also improve, and are supported by incentives, but their GHG impacts depend on the generation fuel mix. In some regions electrification may increase GHG emissions through the 2030s.

Enovation Partners, May 2018.

Innovative technologies were assessed, prioritized and aligned with relevant end use pathways

High priority technologies by major end use, Enovation Partners, May 2018

- Low-cost residential gas absorption heat pump (GAHP) combination
- Condensing furnace
- Transport Membrane Humidifier (TMH)

- Tankless water heater - Maintenance-free approaches for tankless water heaters
- Solar-assisted heating - PV assisted domestic hot water heater (potable)
- Unplugged power burners - Two-Phase Thermo-Syphoning (TPTS) technology
- Combined Space and Water Heating Systems*

- Ozone and cold water washing

- High production fryers
- Boilerless steamer - Multistacked convention steamer for high volume cooking
- Combination steam and heat oven

- IoT thermostats (i.e. Nest, Honeywell)
- Building envelope (insulation, windows, building materials)
- Demand controls for HW systems
- Thermostatically controlled low flow shower head

- Solid oxide fuel cells*
- Micro CHP – gas recip, sterling engine*

- Fuel cell electric vehicles (hydrogen)
- Commercial CNG vehicles

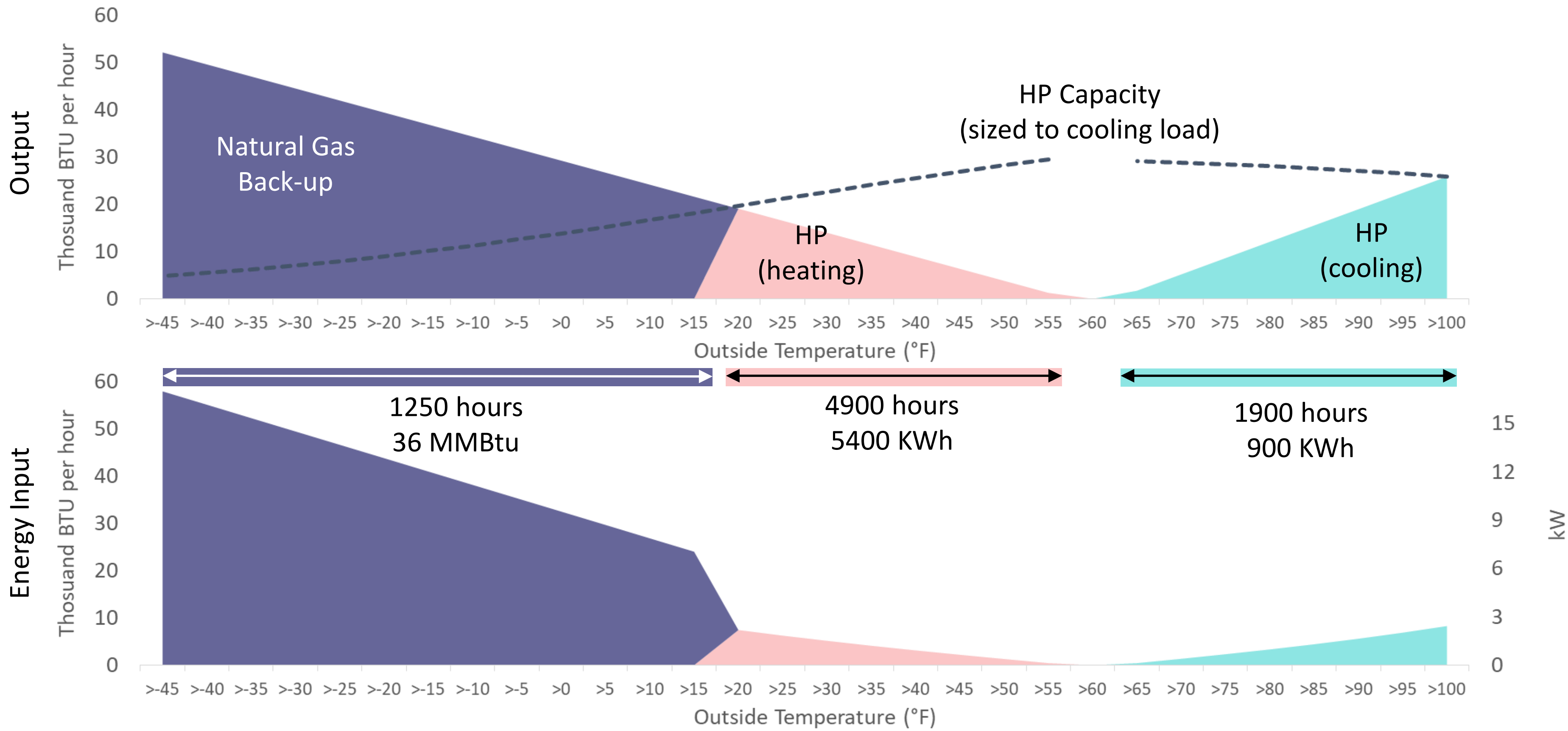
Note: All technologies were independently evaluated and scored by several SMEs; evaluation criteria primarily considered GHG impact and time to market; aggregated scores were consistent among experts and robust against multiple weightings; * designates technology with multiple end-uses, but listed only once

Questions?

Chris McGill
VP Energy Markets, Analysis and Standards
American Gas Association
cmcgill@aga.org

EPRI Backup Slides

Hybrid Gas-Electric Heat Pump System Potentially Attractive (e.g., Northern Wisconsin)



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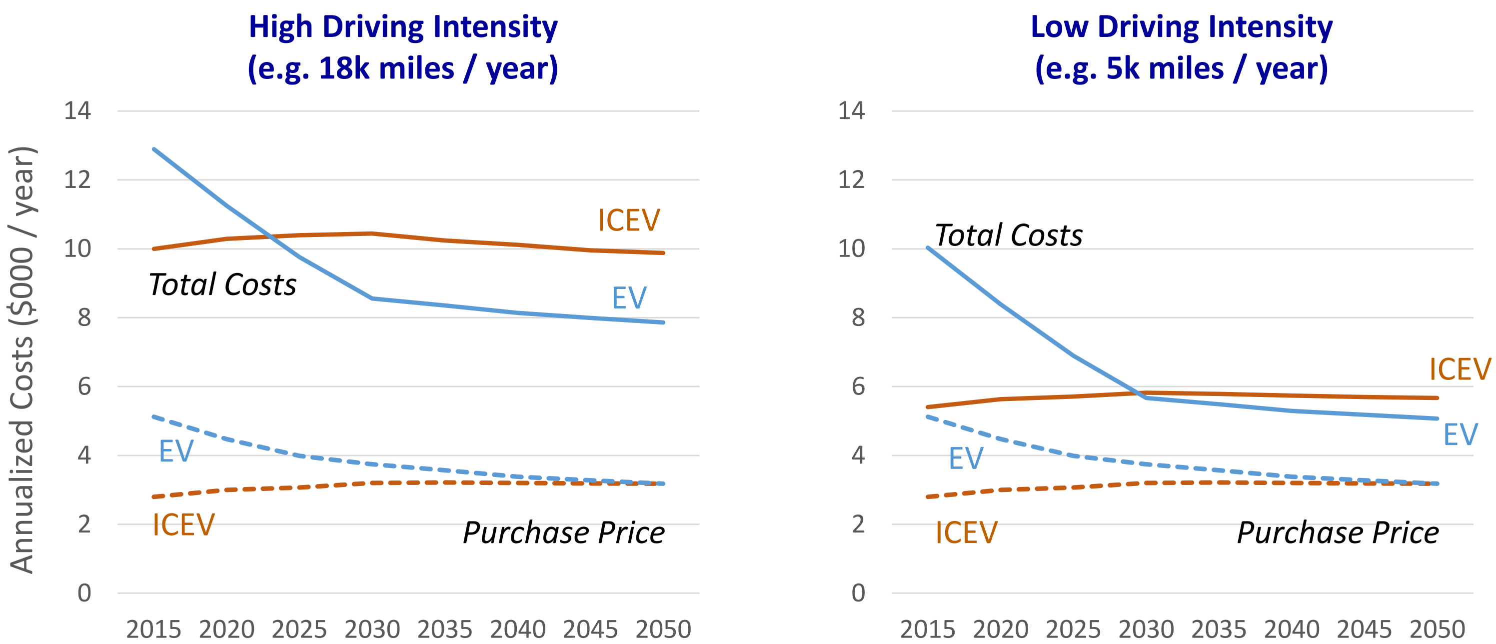
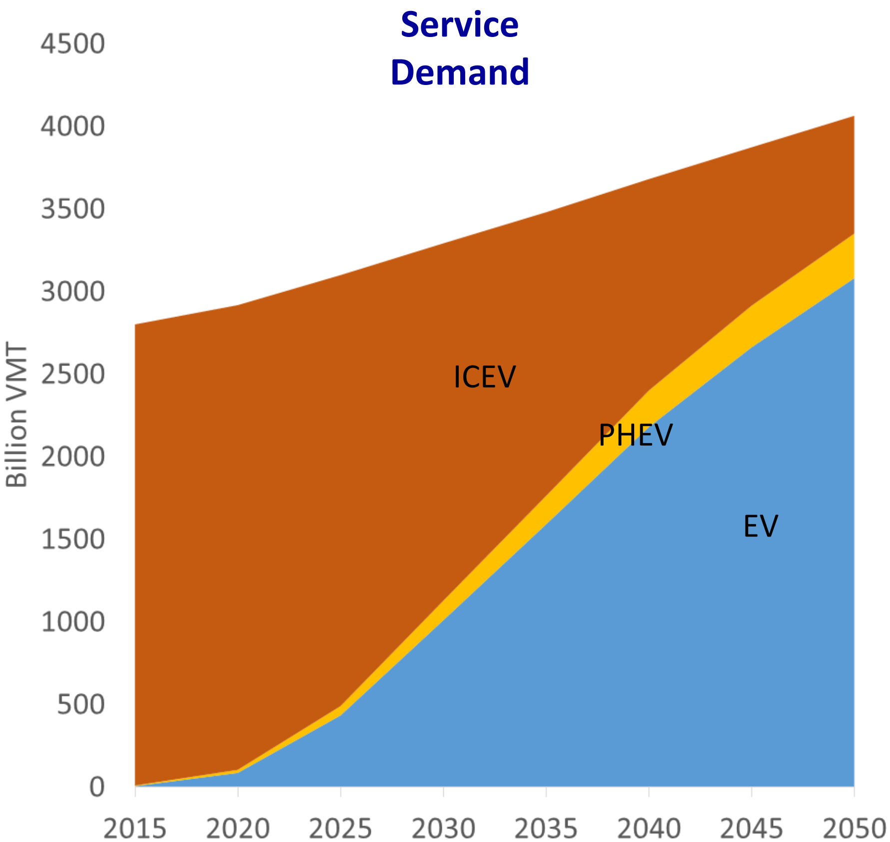
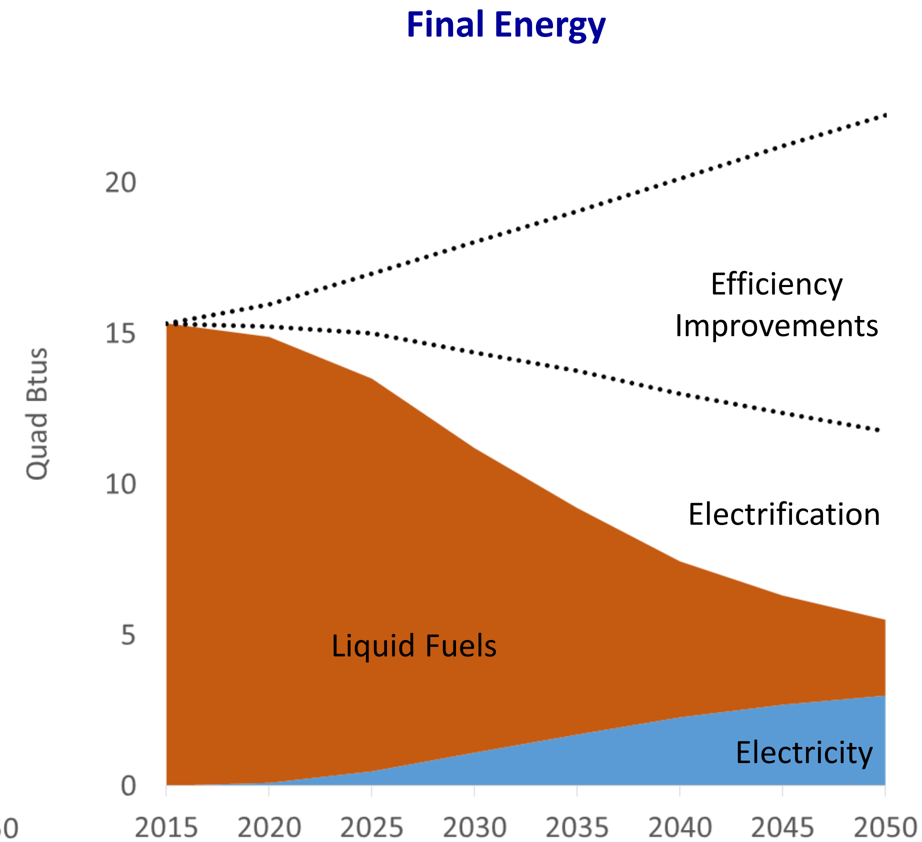
Passenger Vehicle Cost Assumptions for Representative Household



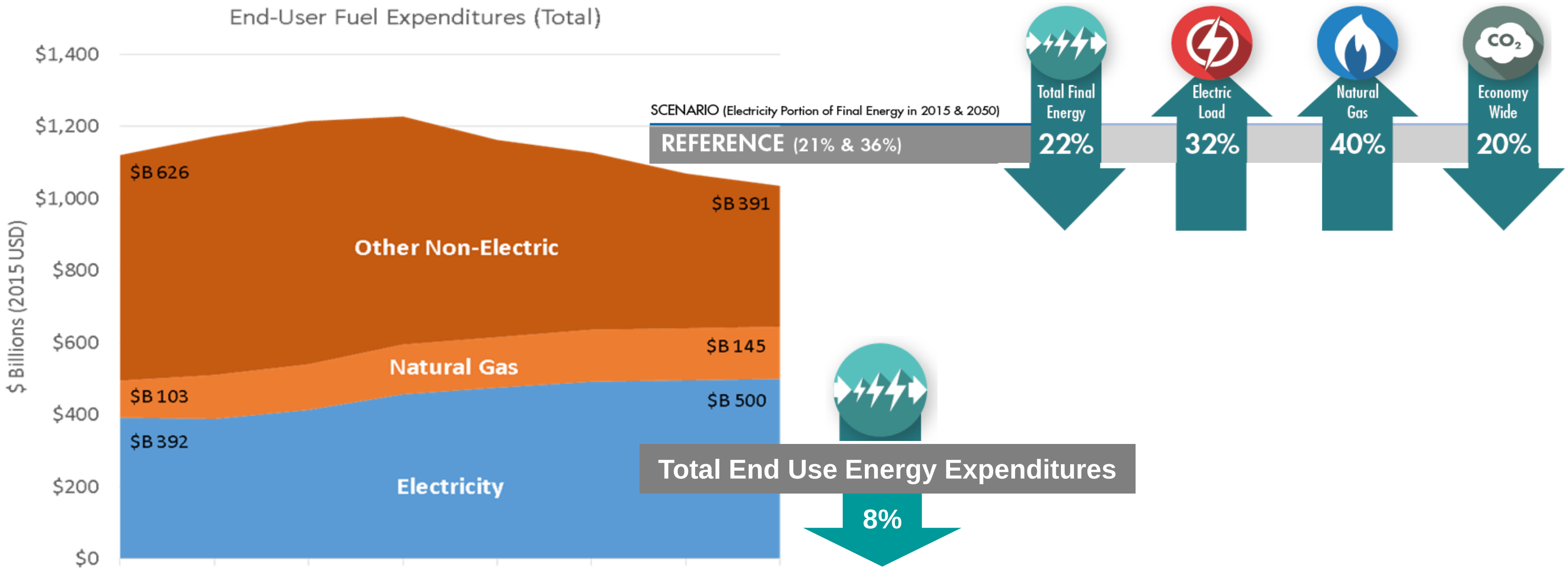
Based on suburban household in NE-Central model region

Reference Projections for US Light-Duty Vehicles





End-User Fuel Expenditures – Reference Case



Total Energy Expenditures Decline