RPS Collaborative Webinar

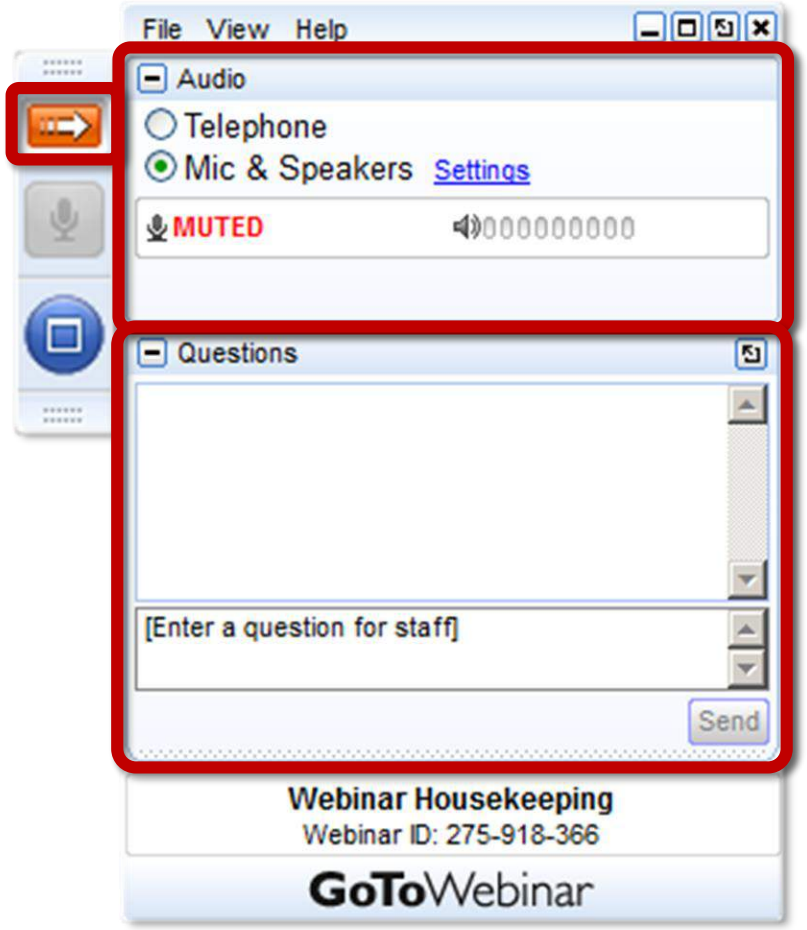
The Future of Electrification and What It Means for Clean Energy

Hosted by
Warren Leon, Executive Director, CESA

June 26, 2018

CleanEnergy States Alliance

Housekeeping



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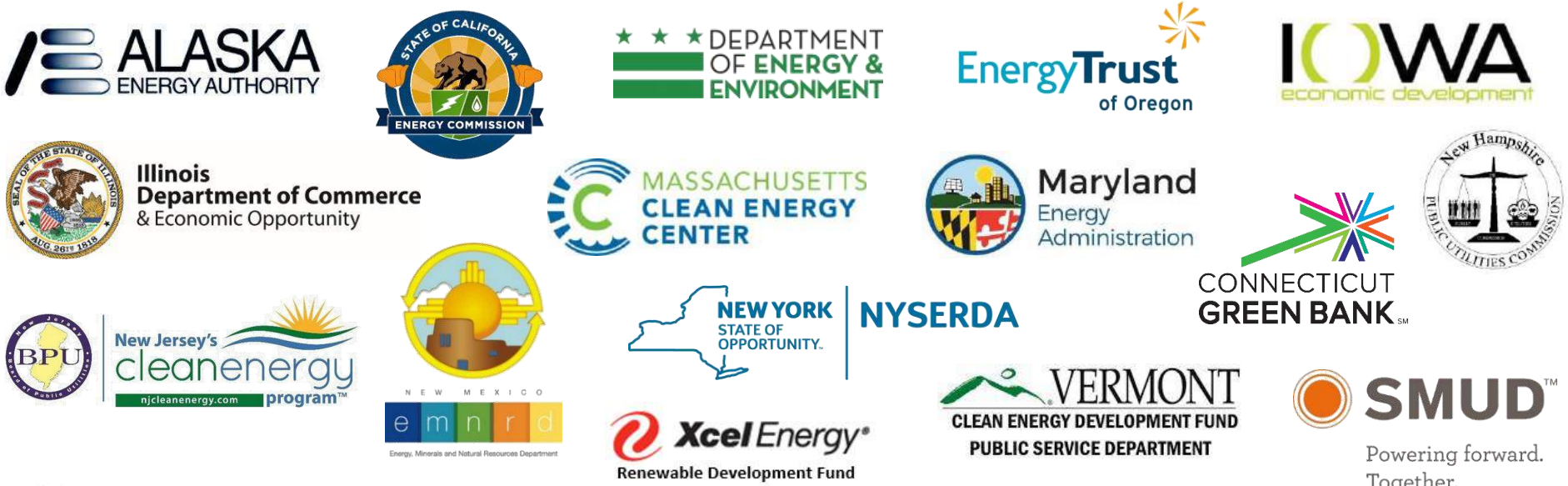

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RPS Collaborative

- With funding from the Energy Foundation and the U.S. Department of Energy, CESA facilitates the **Collaborative**.
- Includes **state RPS administrators**, **federal agency representatives**, and other stakeholders.
- Advances dialogue and learning about RPS programs by **examining the challenges and potential solutions** for successful implementation of state RPS programs, including **identification of best practices**.
- To sign up for the Collaborative listserv to get the **monthly newsletter** and announcements of **upcoming events**, see: www.cesa.org/projects/renewable-portfolio-standards

ENERGY FOUNDATION
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Upcoming Webinars

- **Resilient Power in Practice: Lessons Learned from the Field** (6/27)
- **State Programs for Clean Energy in Local Jurisdictions: Examples from New York and Oregon** (7/11)
- **Using Solar to Reduce Peak Loads: Evaluating Rhode Island's Distributed Solar Pilot** (7/12)
- **Blockchain Technology for RECs, Tracking Systems, and Other Energy Market Applications** (7/17)
- **Replacing Peaker Plants with Battery Storage** (7/19)
- **Simplifying Resilient Power Design with REopt Lite: A Look at New Features Added to NREL's Solar+Storage Tool** (7/25)
- **Expanding Solar PV Finance and Markets in Connecticut and Minnesota** (8/2)
- **Building Markets: Energy Storage in Massachusetts and Offshore Wind in Rhode Island** (8/9)

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The Future of Electrification and What It Means for Clean Energy

Webinar Speakers

Francisco de la Chesnaye

Senior Program Manager, Electric Power Research Institute

Warren Leon

Executive Director, Clean Energy States Alliance (moderator)

CleanEnergy States Alliance

U.S. National Electrification Assessment

Overview and Key Messages

Francisco de la Chesnaye, Ph.D.
Senior Program Manager,
Energy & Environmental Analysis

CESA Webinar: The Future of Electrification and What It Means for Clean Energy

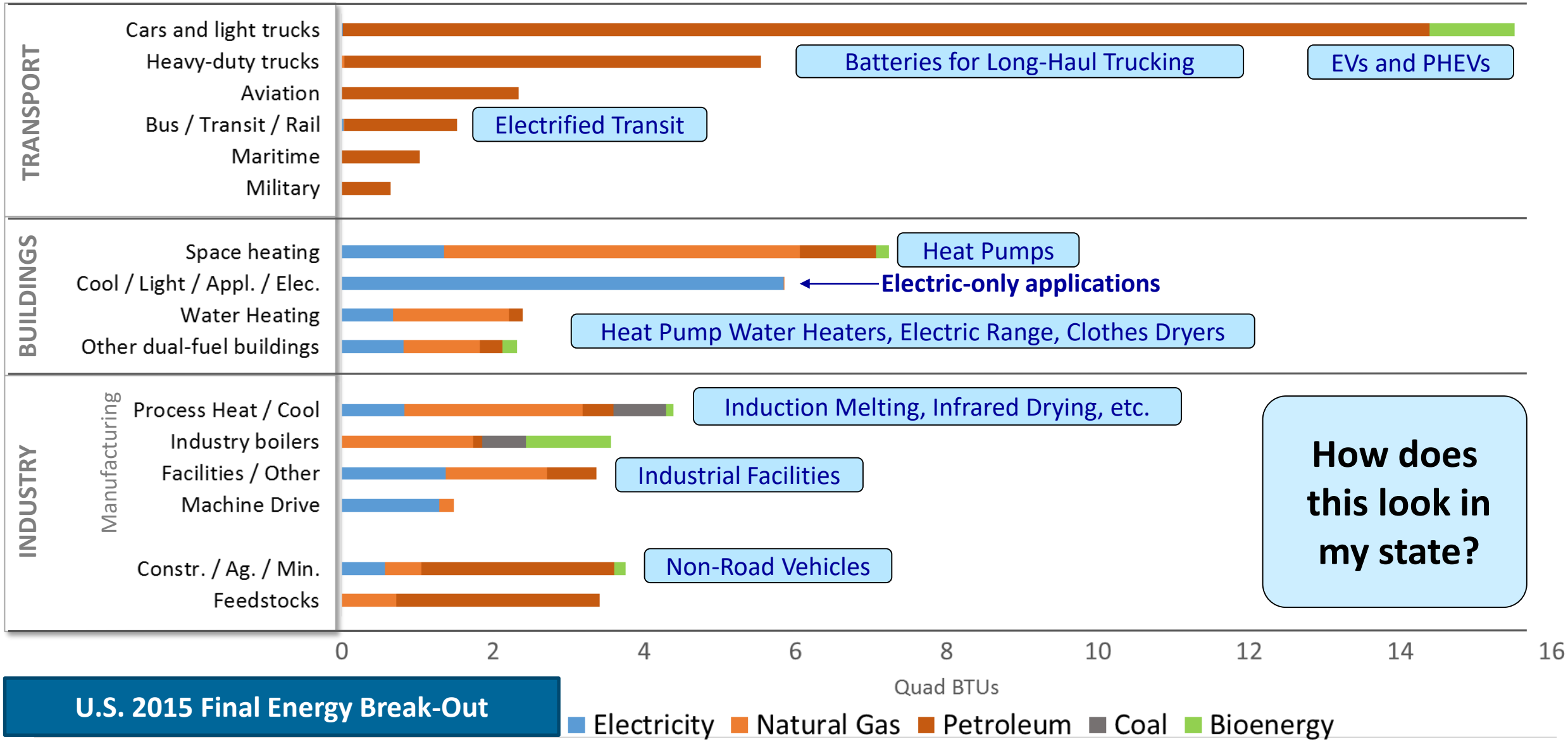
June 26, 2018

Agenda

National Electrification Assessment

State & Utility Electrification Assessment

Potential for Efficient Electrification Varies by End-Use Application



U.S. 2015 Final Energy Break-Out

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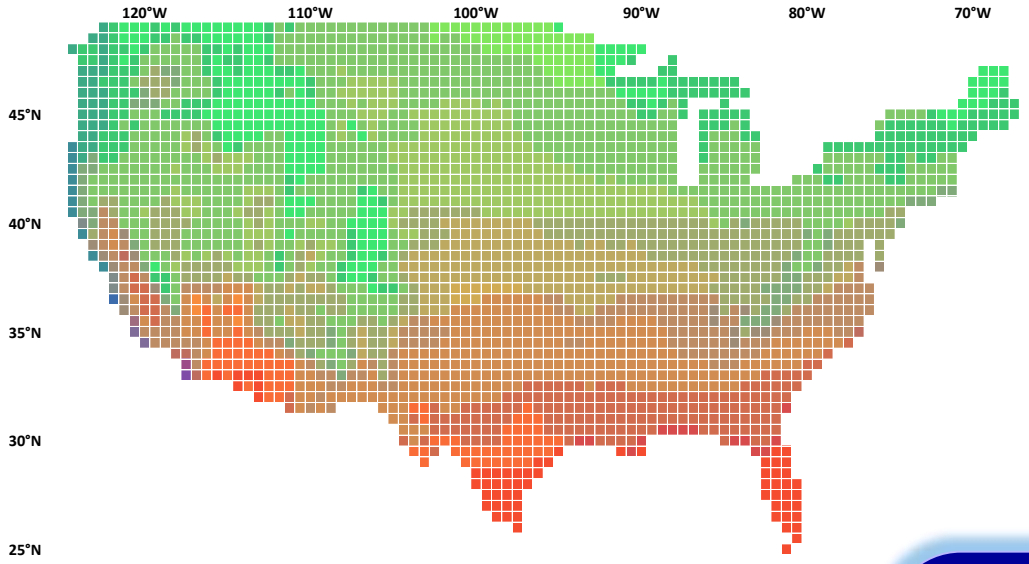
USNEA Modeling Approach: US-REGEN

Energy Use



- Climate zones
- Building types
- Household characteristics
- Industrial mix
- End-use technology detail

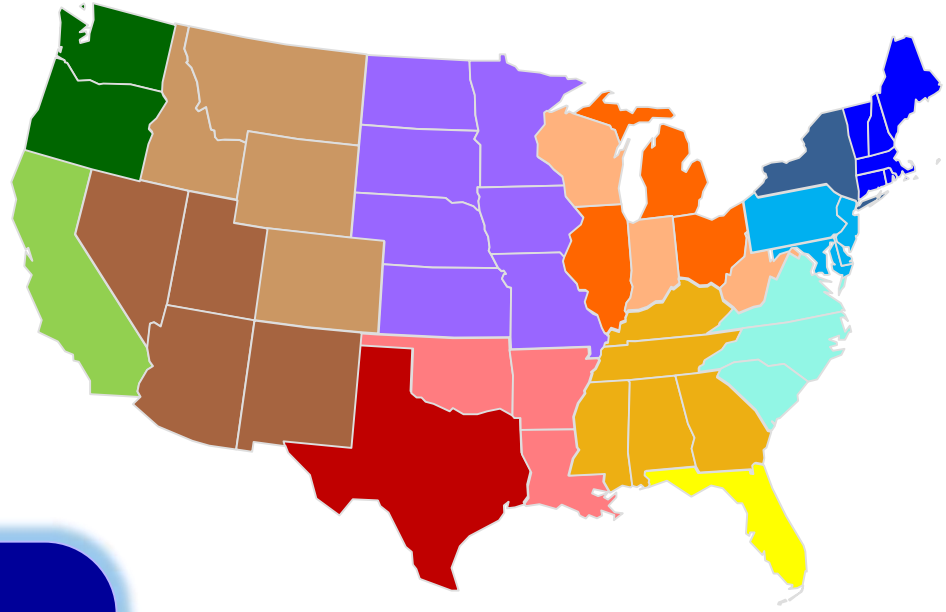
Synchronized Hourly Load, Renewables, and Prices

Model Outputs:

Generation, capacity, prices, and end-use mix

Emissions, air quality, and water

Electric Generation

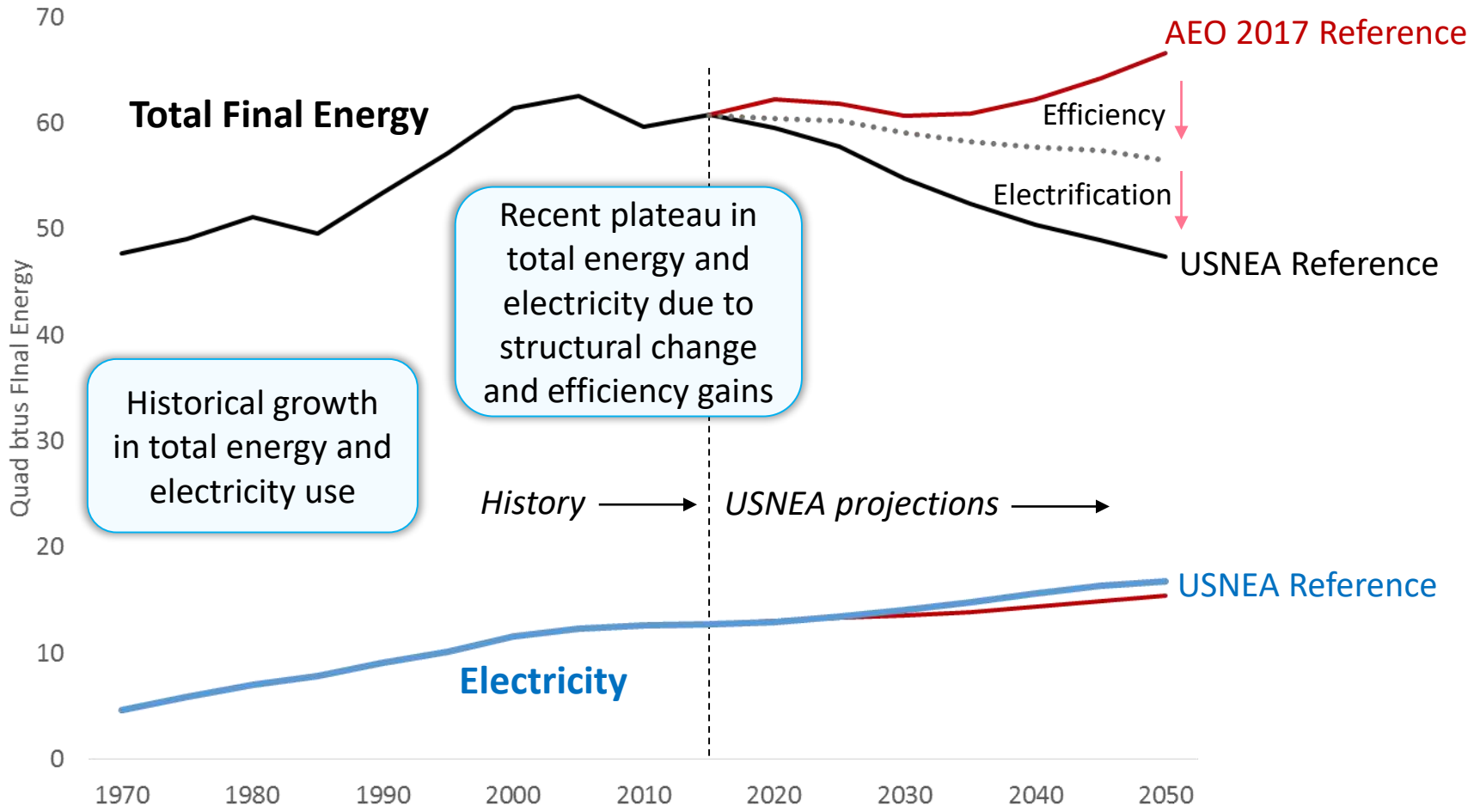


- Investment and dispatch
- Transmission
- Intermittent renewables
- Energy and capacity requirements
- State-level policies and constraints

Key Assumptions for NEA Scenarios

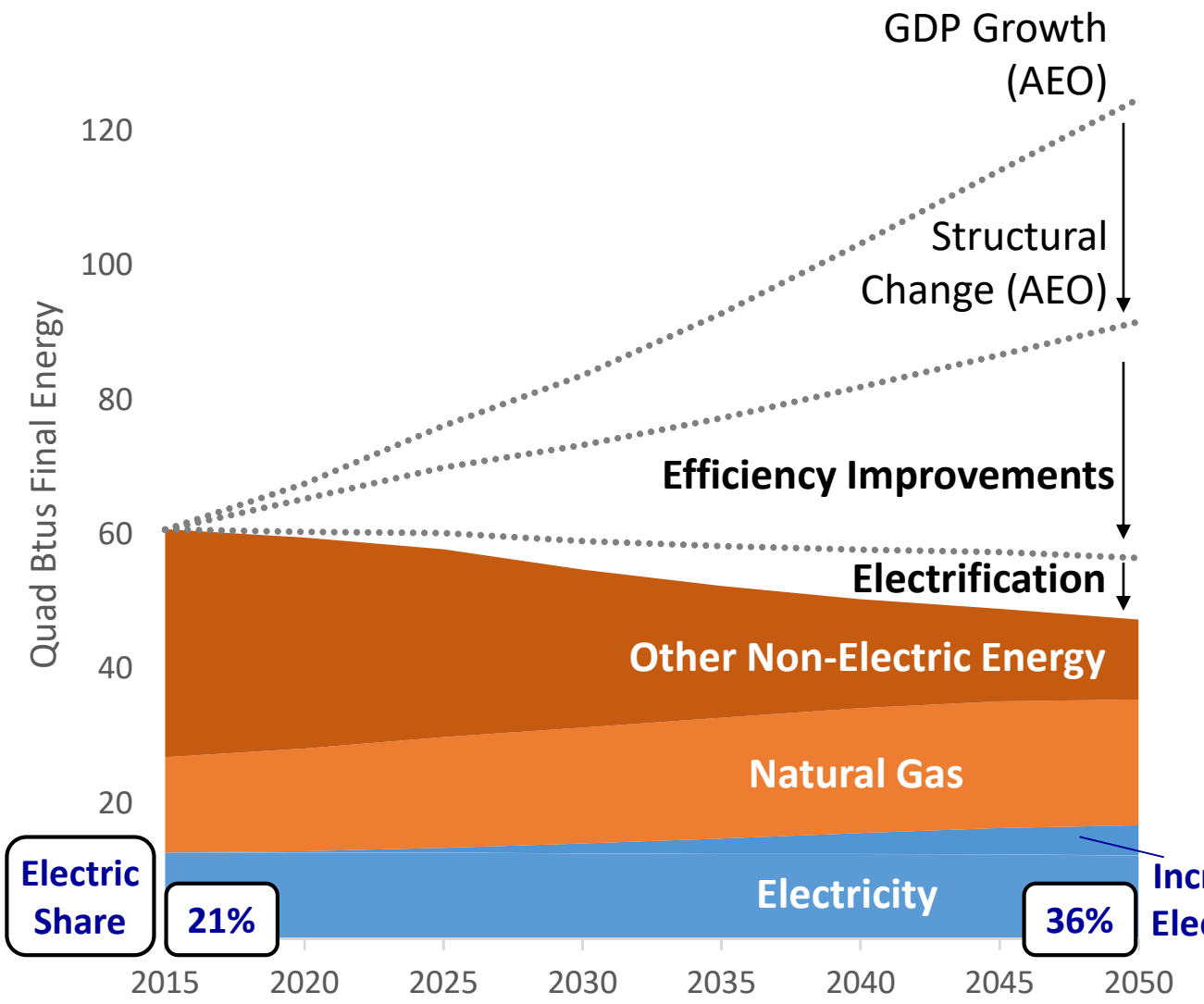
	CONSERVATIVE	REFERENCE	PROGRESSIVE	TRANSFORMATION
Light-Duty Vehicle Costs	**Slower decline in battery costs**	EPRI/ANL estimates	EPRI/ANL estimates	EPRI/ANL estimates
Other Technology Costs	EPRI estimates	EPRI estimates	EPRI estimates	EPRI estimates
Efficiency Improvements	EPRI estimates	EPRI estimates	EPRI estimates	EPRI estimates
Economic Growth / Service Demands	AEO 2017	AEO 2017	AEO 2017	AEO 2017
Primary Fuel Prices (Natural Gas, Oil)	AEO 2017 Low Price Case	AEO 2017 Low Price Case	AEO 2017 Low Price Case	AEO 2017 Low Price Case
Electric Sector Policies	State RPS only	State RPS only	**State RPS + \$15/tCO$_2$ in 2020, rising at 7%**	**State RPS + \$50/tCO$_2$ in 2020, rising at 7%**
End-Use Sector Policies	None	None	**\$15/tCO$_2$ in 2020, rising at 7%**	**\$50/tCO$_2$ in 2020, rising at 7%**

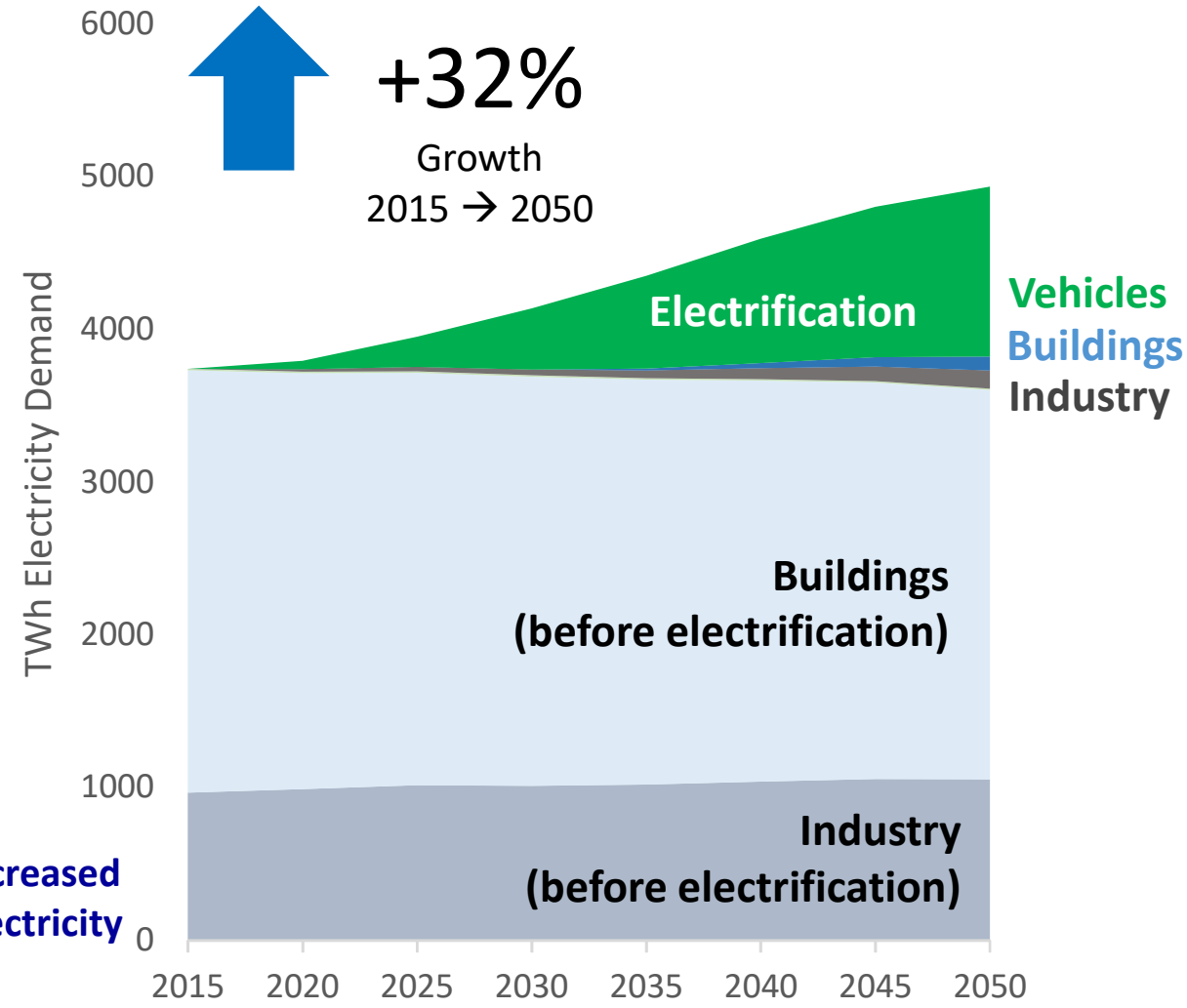
Total Final Energy Declines While Electricity Demand Increases



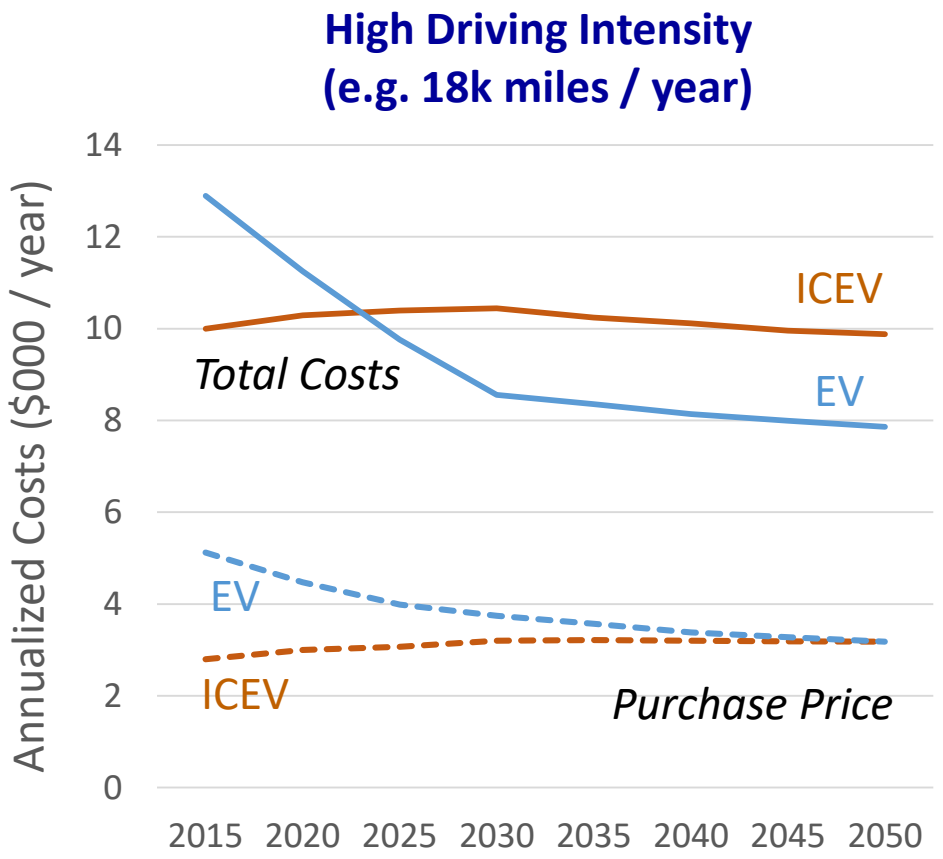
Compared with AEO, USNEA Reference projects **more efficiency gains and more electrification → declining total energy with rising electricity**

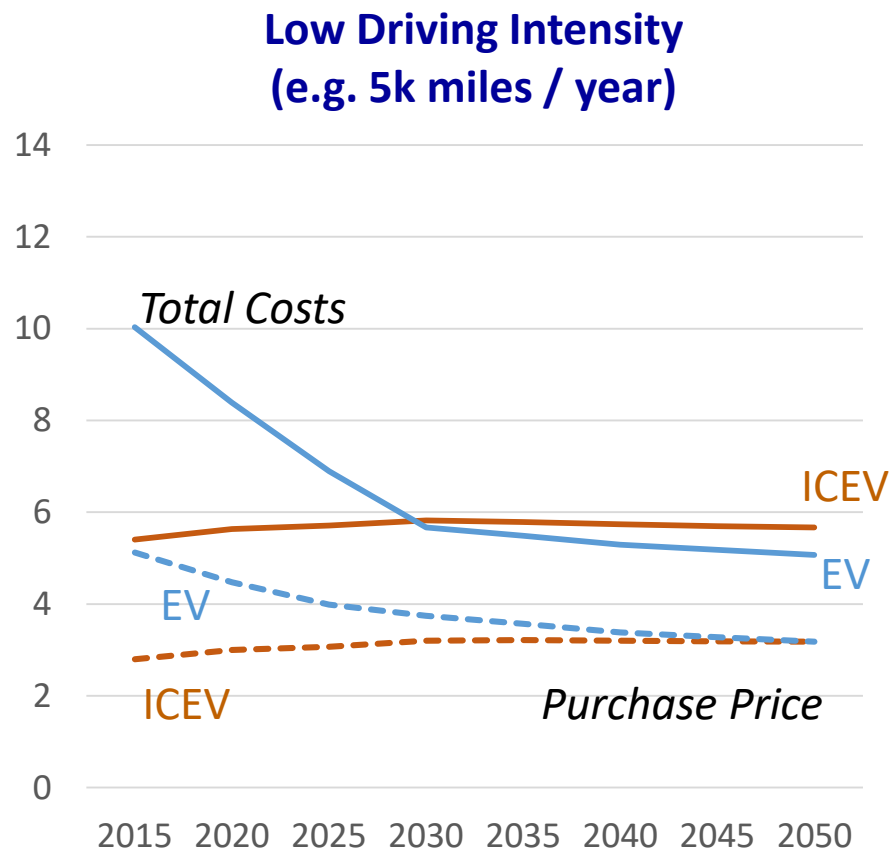
Efficient Electrification: Reference Scenario





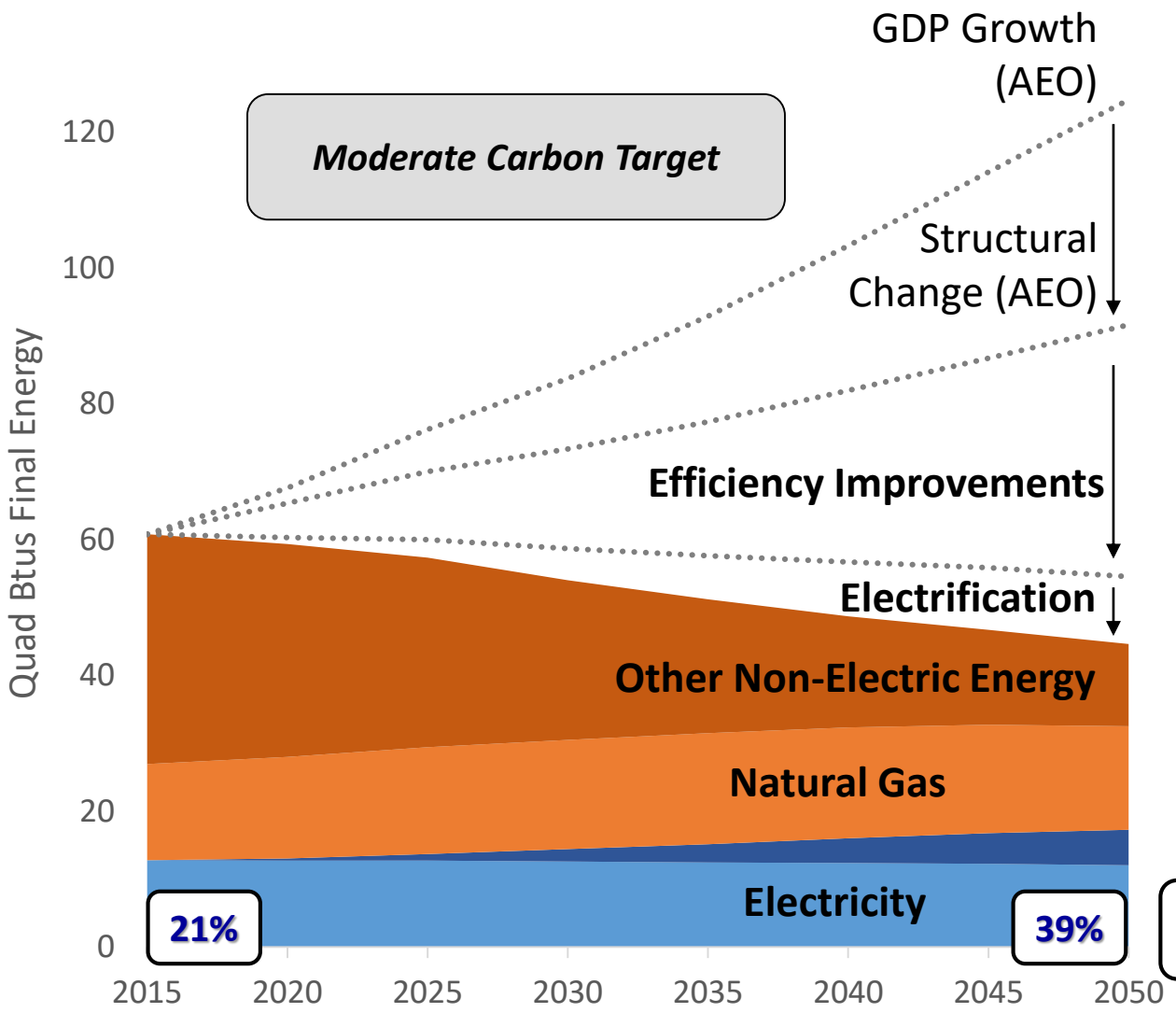
Passenger Vehicle Cost Assumptions for Representative Household

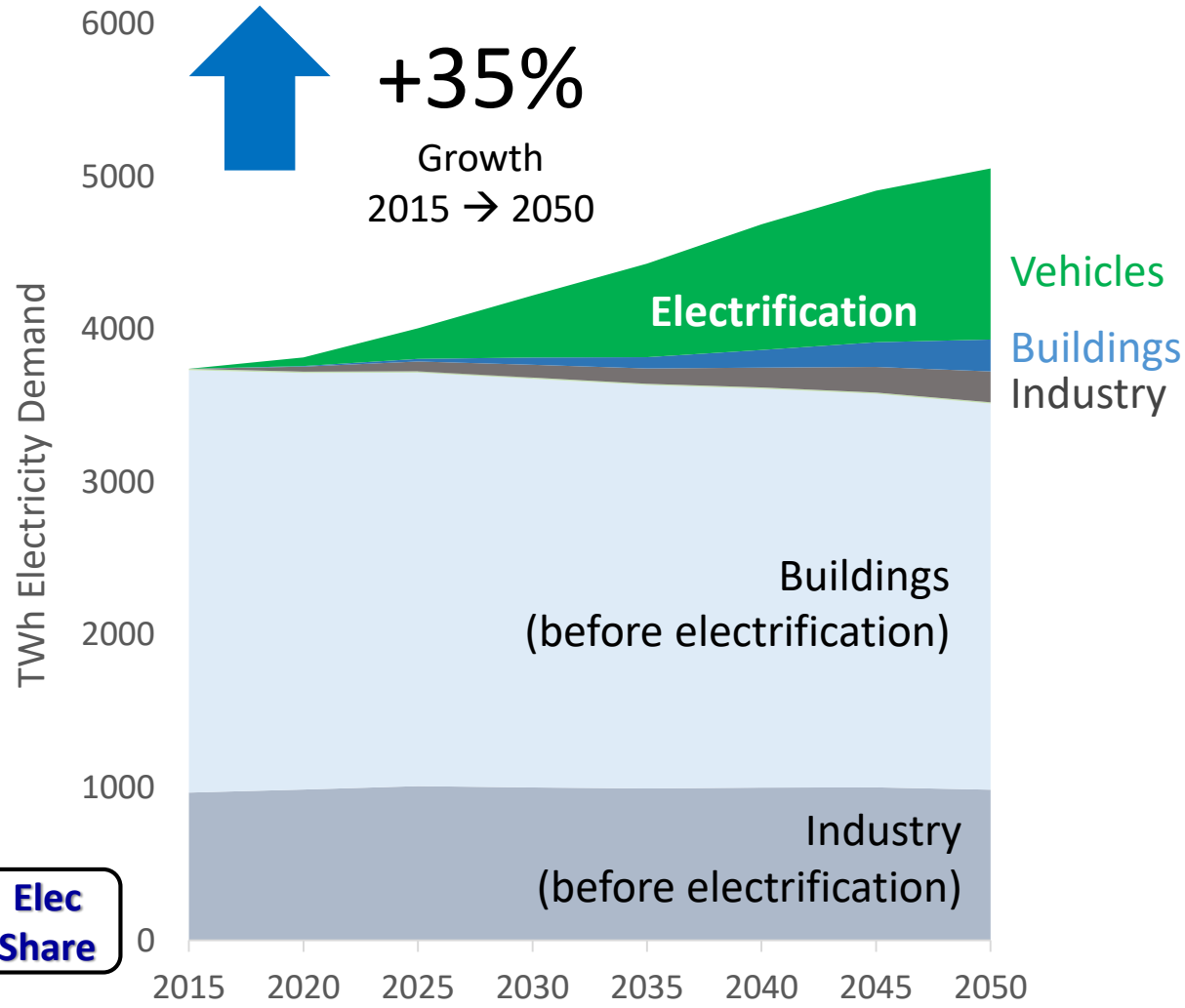




Based on suburban household in NE-Central model region

Efficient Electrification: Progressive





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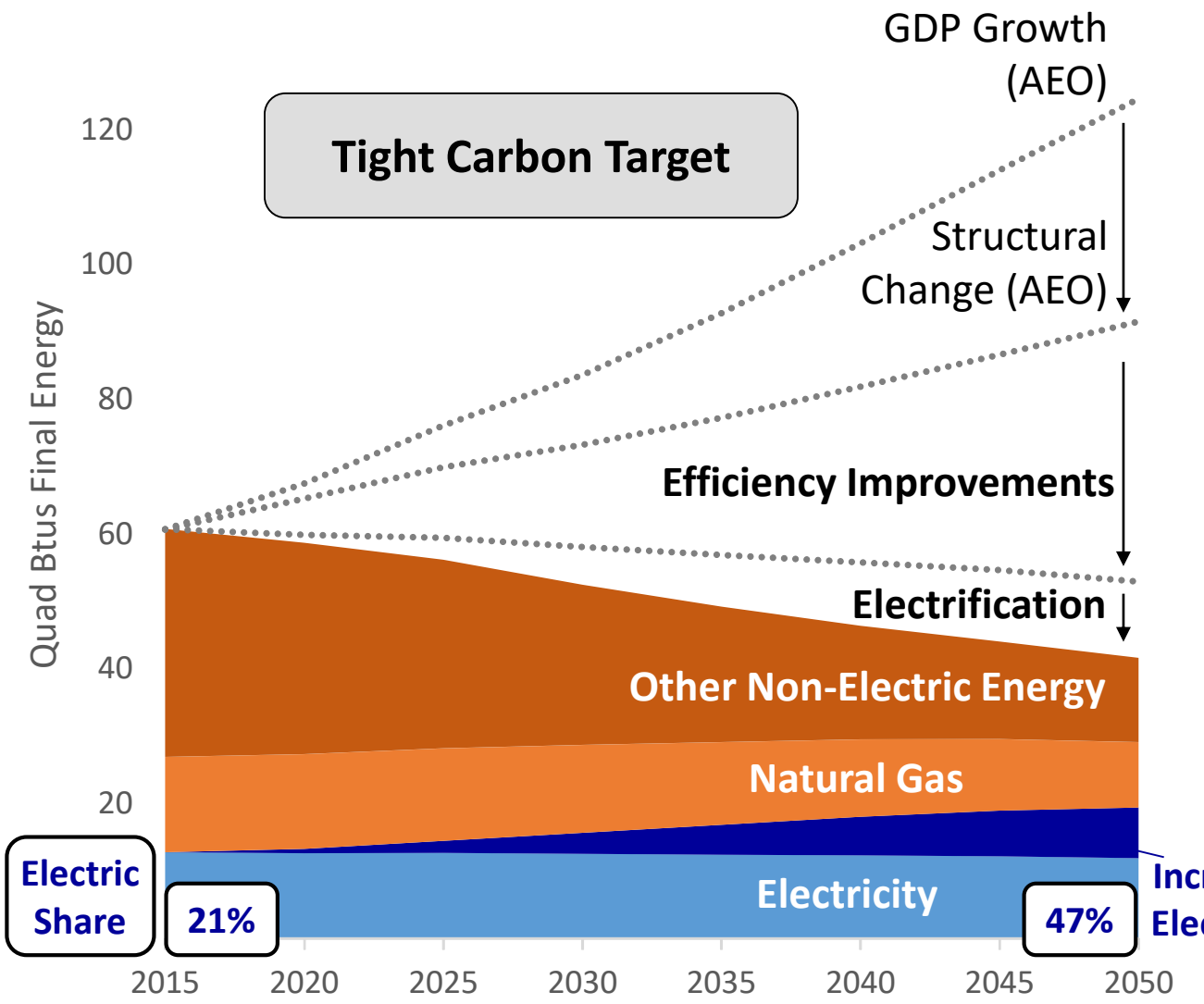
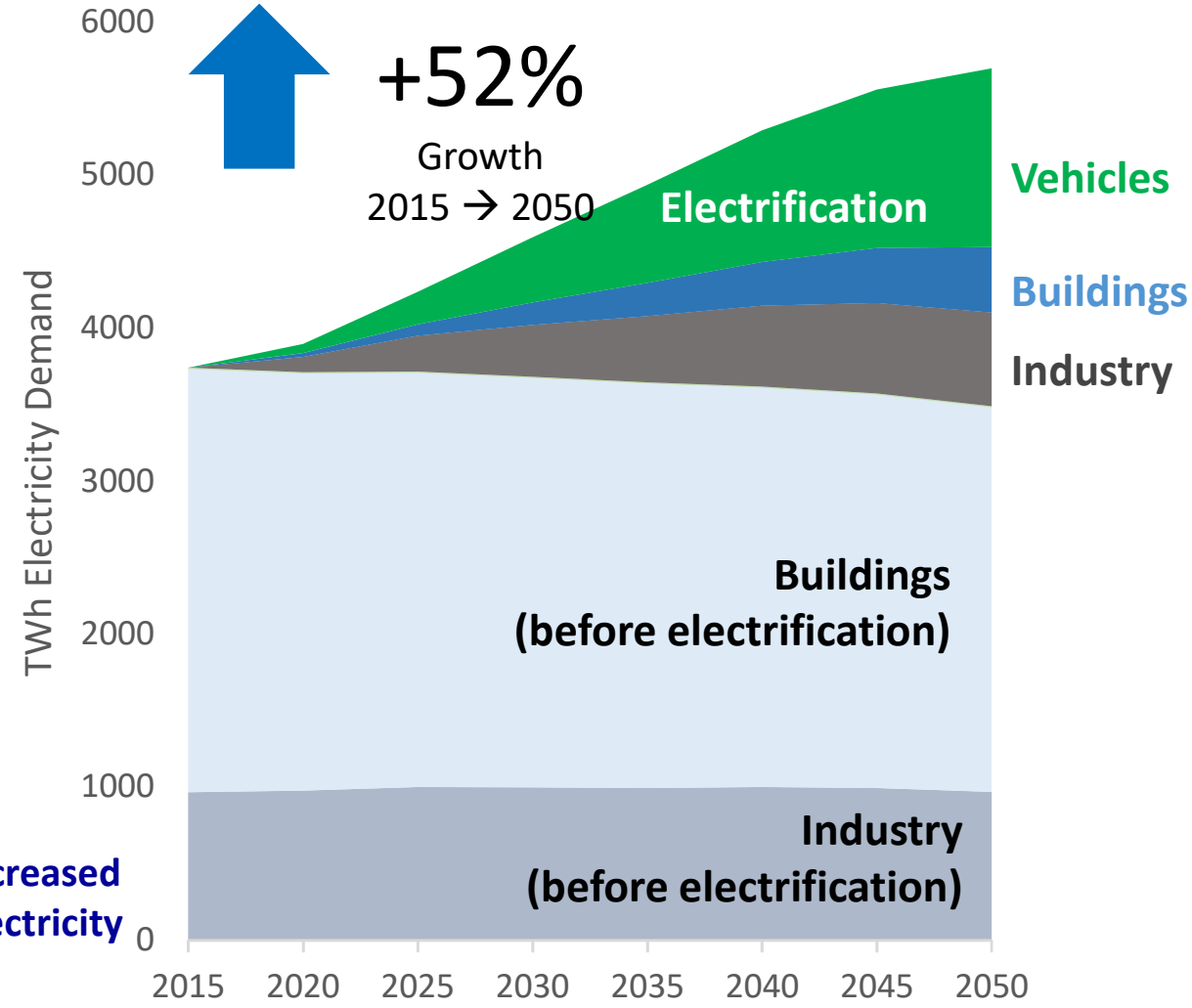
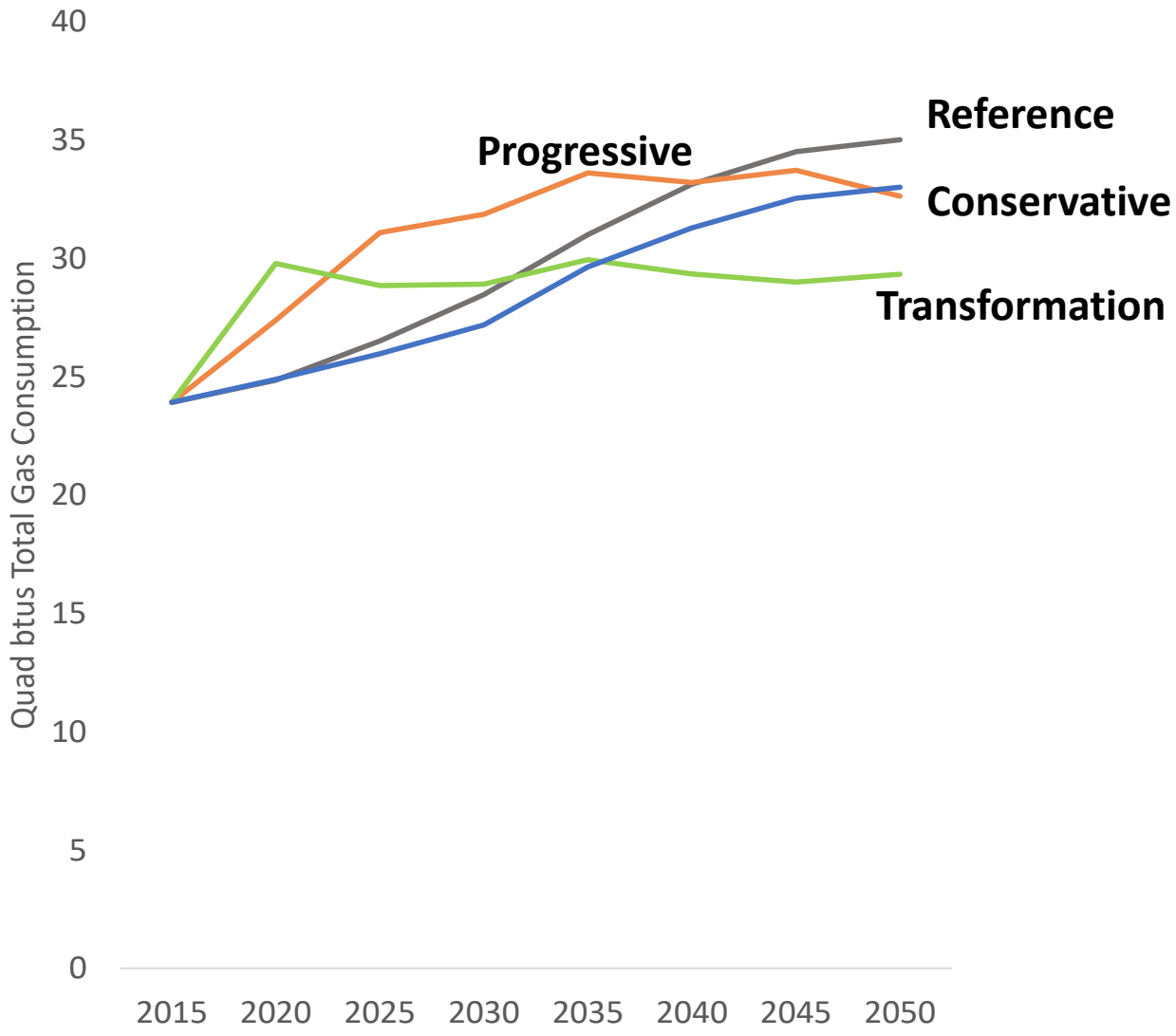
Efficient Electrification: Transformation





Total Natural Gas Demand Rises in All Scenarios



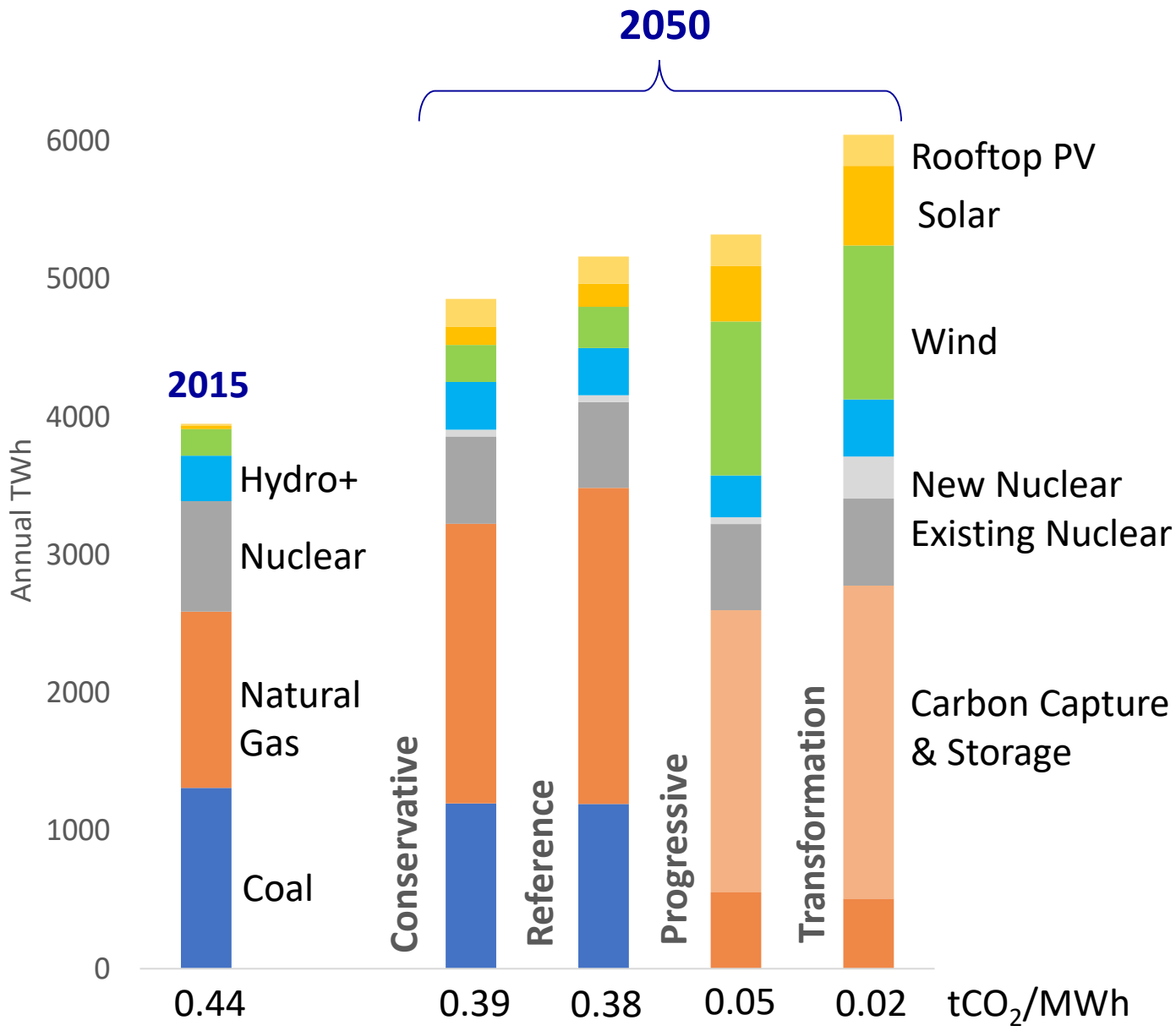
Drivers for Gas Demand:

Electric Generation	▪ Expanded NGCC use (+ CCS with carbon price)
Buildings	▪ Retains role in both primary heating and heat pump back-up
Industry	▪ Oil to gas fuel switching
Carbon Price Impacts	▪ Decreased use in buildings and industry is offset by generation with CCS

Electric Generation Mix

Electric Generation 2015 and 2050:

- **Diversified Generation**
- **Potential for CCS with Natural Gas**
- **Decarbonized Electric Power Sector**
- **One of Many Generation Mixes**



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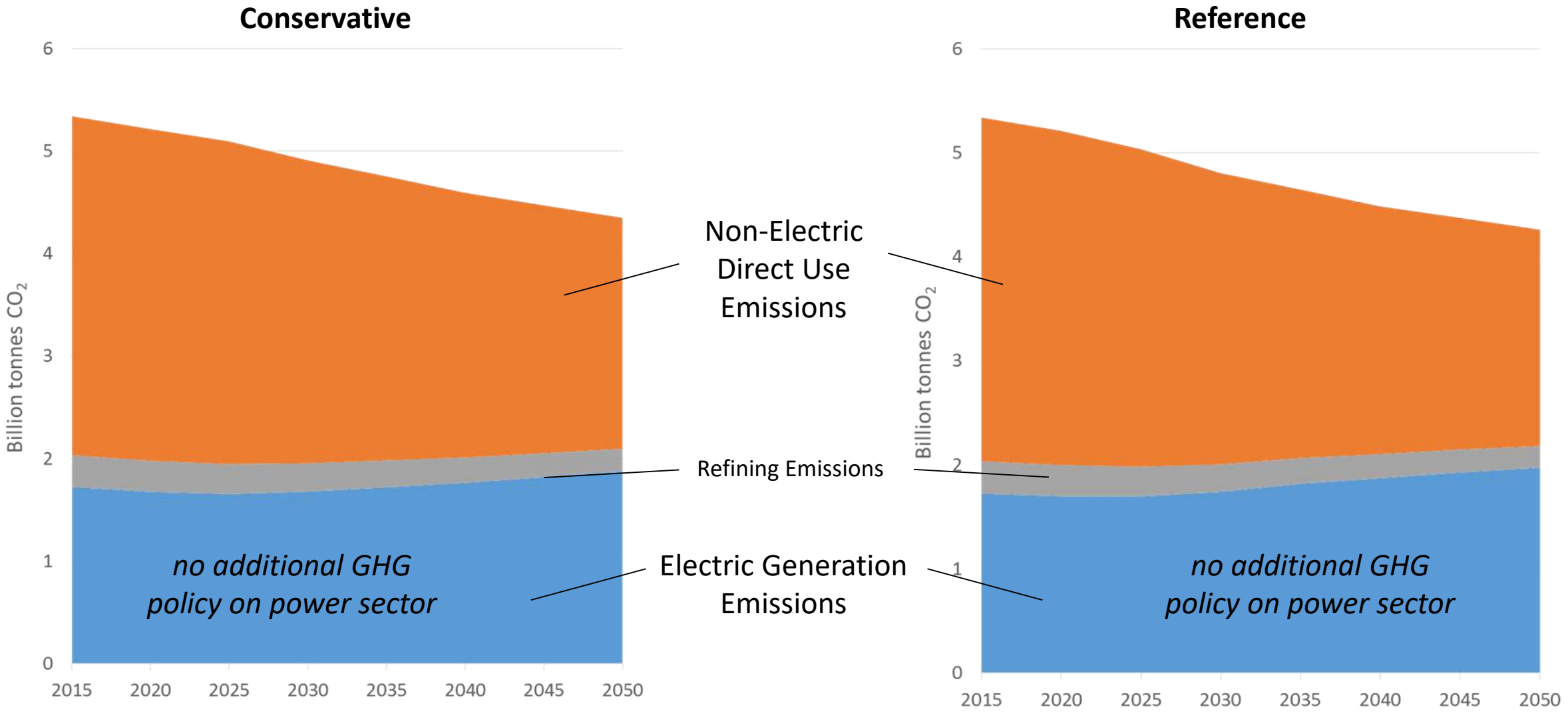
U.S. Economy-Wide CO_2 Emissions 2020 to 2050



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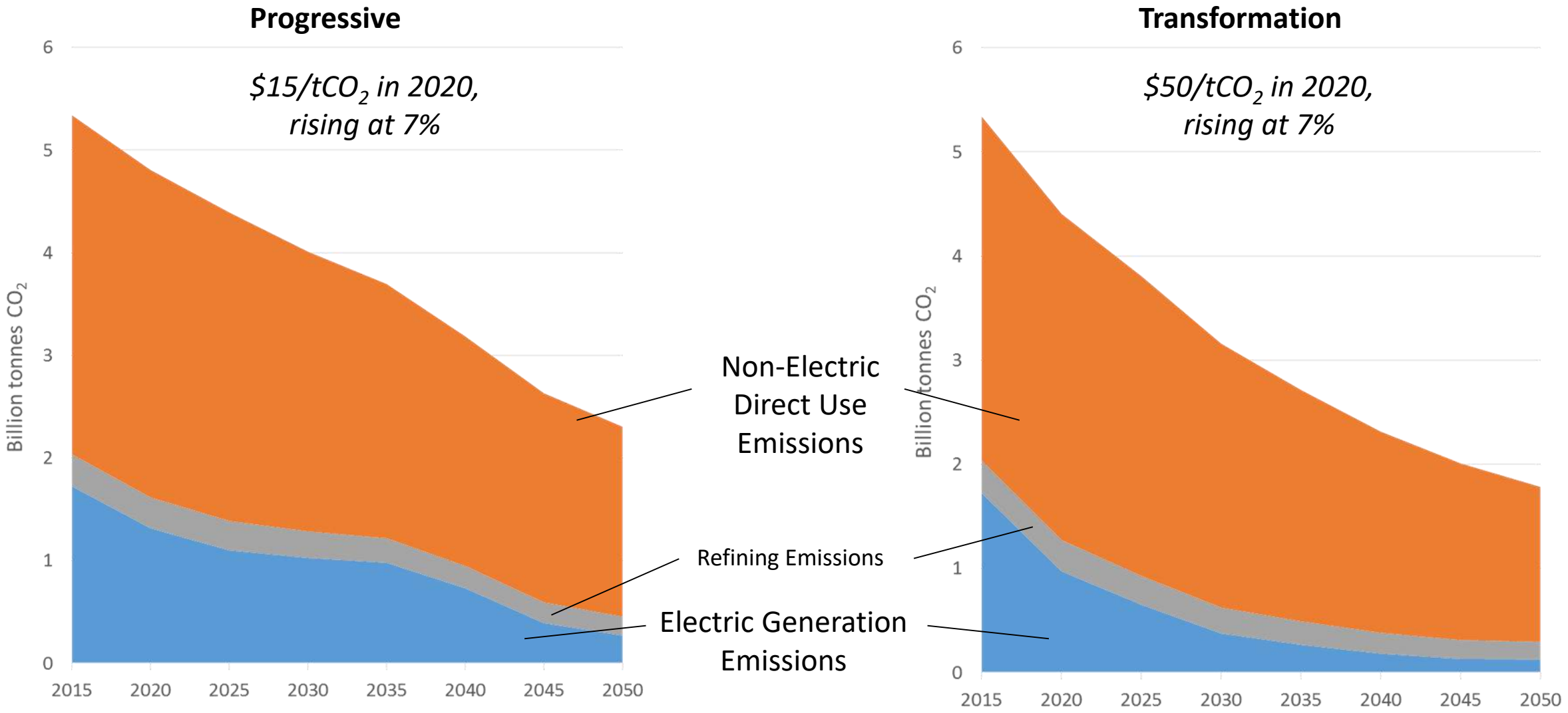

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Key Messages from National Electrification Assessment

Electrification Trend Continues	Driven by technological change and consumer choice, further bolstered by policy
Energy Efficiency	Efficient electrification + end-use efficiency lead to falling final energy use
Natural Gas	Remains an important fuel for end-use and electric generation
System Impacts	▪ Improved Environmental Outcomes ▪ Electric Sector Resource Planning

To realize the potential outlined here

Pro-active approaches and technology R&D are essential

Next step: State and Utility Electrification Assessments

Task 1:
Energy System Assessment Supply & Demand of Electricity (2020 to 2050)

Task 2:
Environmental Assessment GHG Emissions and Air Quality (2020 to 2050)

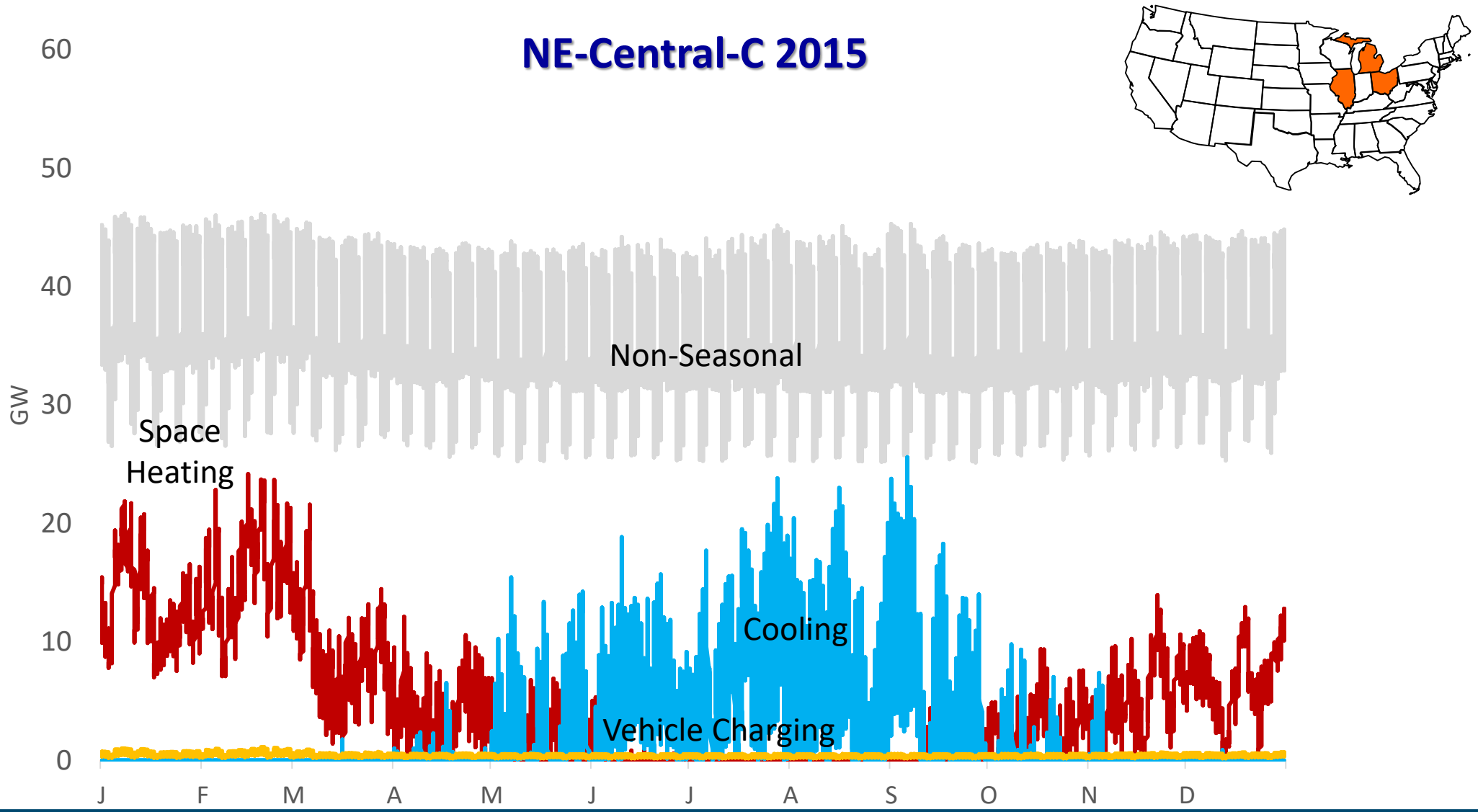
Task 3:
High-level Transmission Assessment (Selected Years)

Task 4:
Utility-level Electrification Assessment & Implementation Plan (Selected Years)

State-Level Assessment

Utility-Level Assessment

Load Shape Changes from Electrification and Efficiency



How Will Sectoral Loads Change Over Time?

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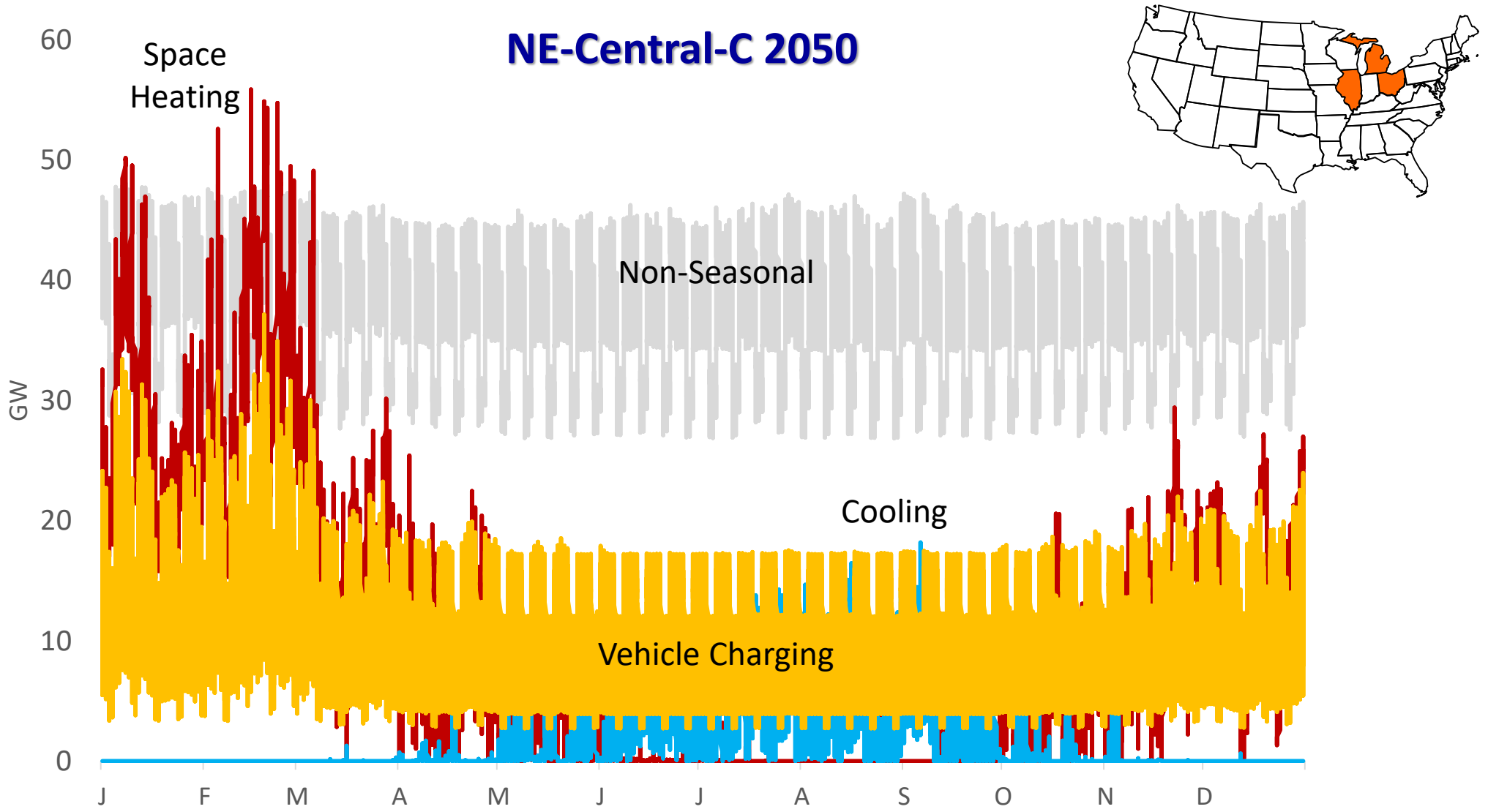
Load Shape Changes…How Will This Impact Supply Mix/Grid Assets?



Significant Shift in Pattern and Size of Load

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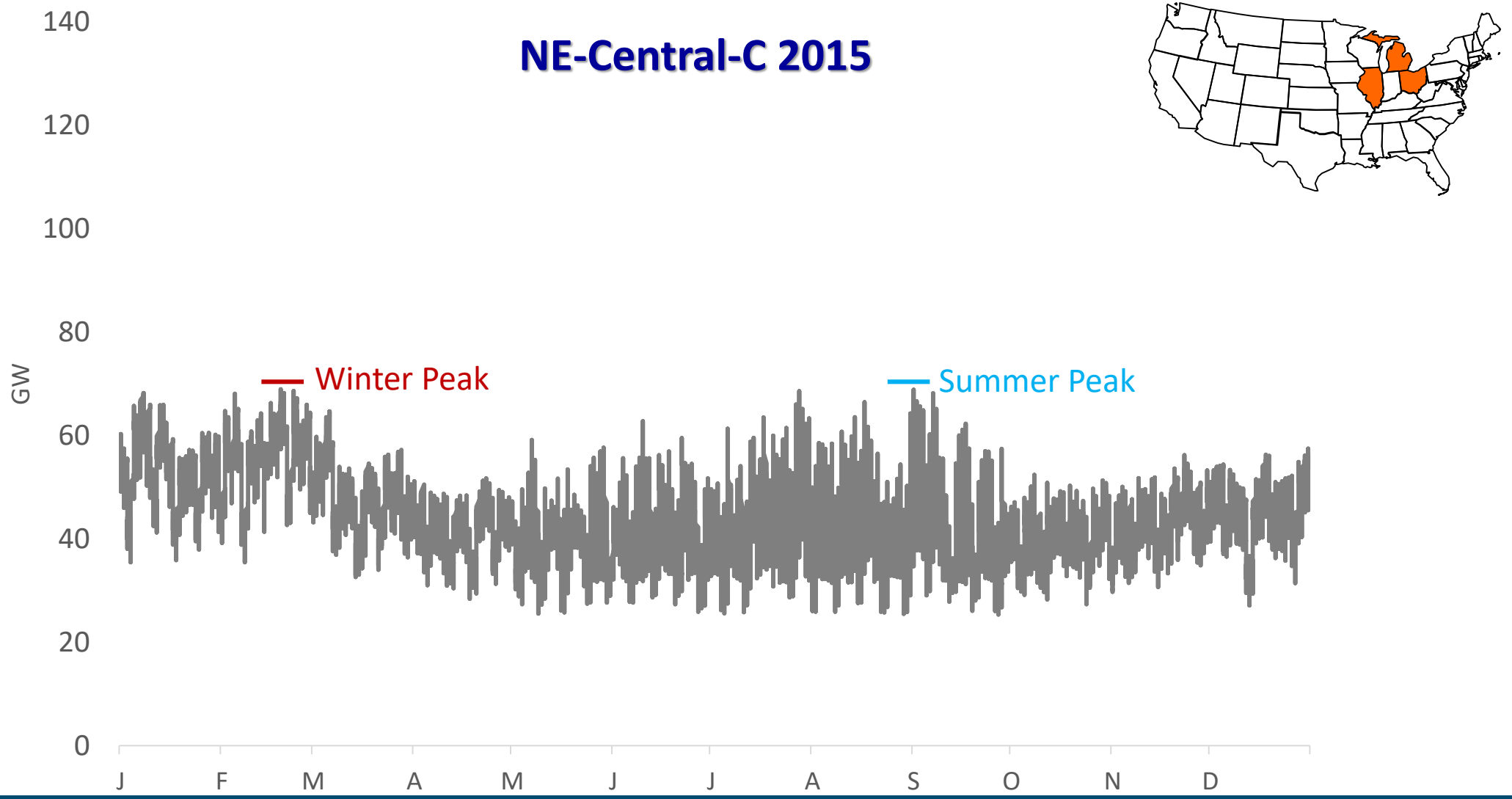
Aggregate Load Shape Changes from Electrification and Efficiency



How Stable Are These System Dynamics?

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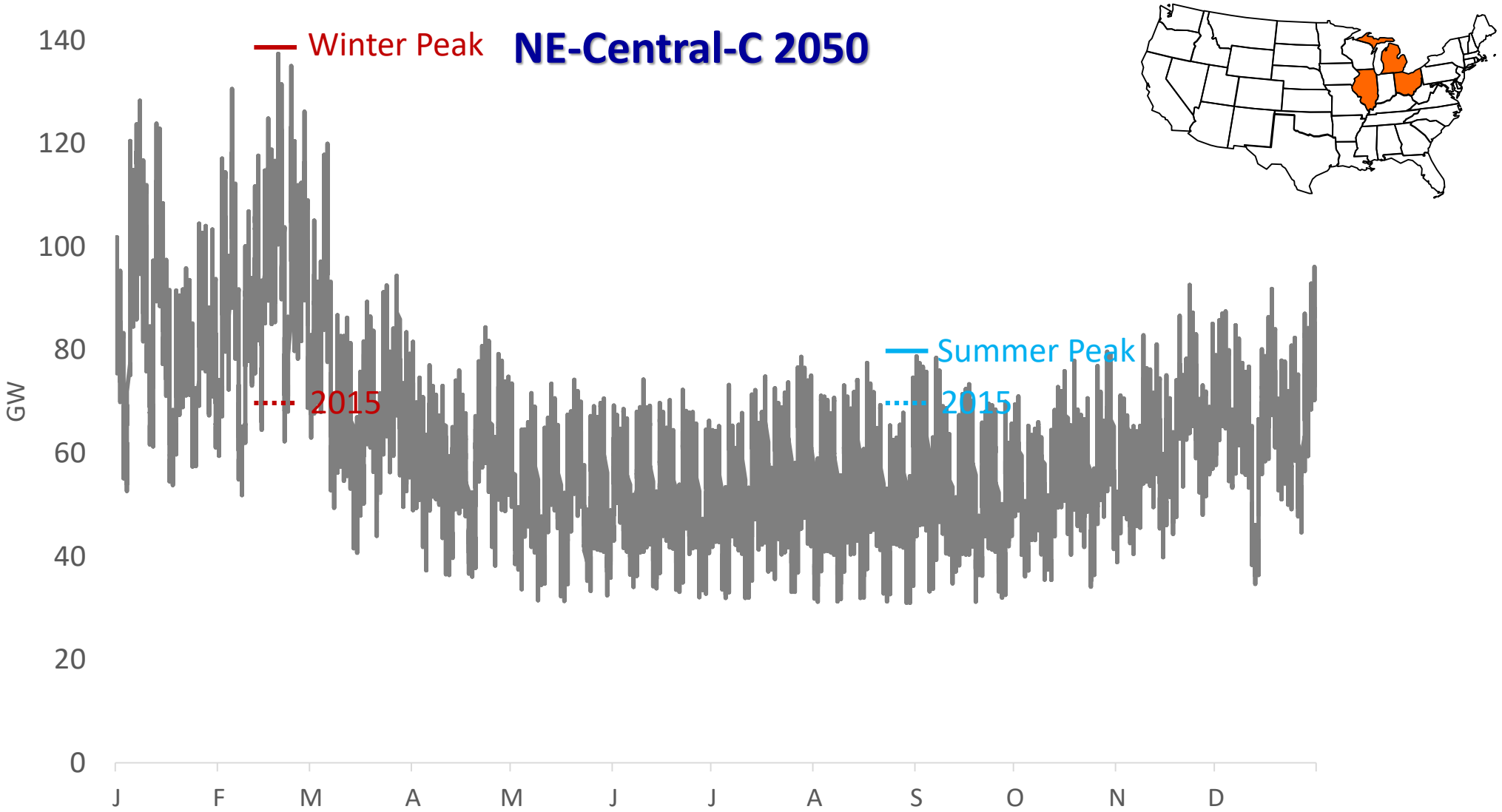
Aggregate Load Shape Changes from Electrification and Efficiency



Electrification Will Impact Electric Sector Resource Planning

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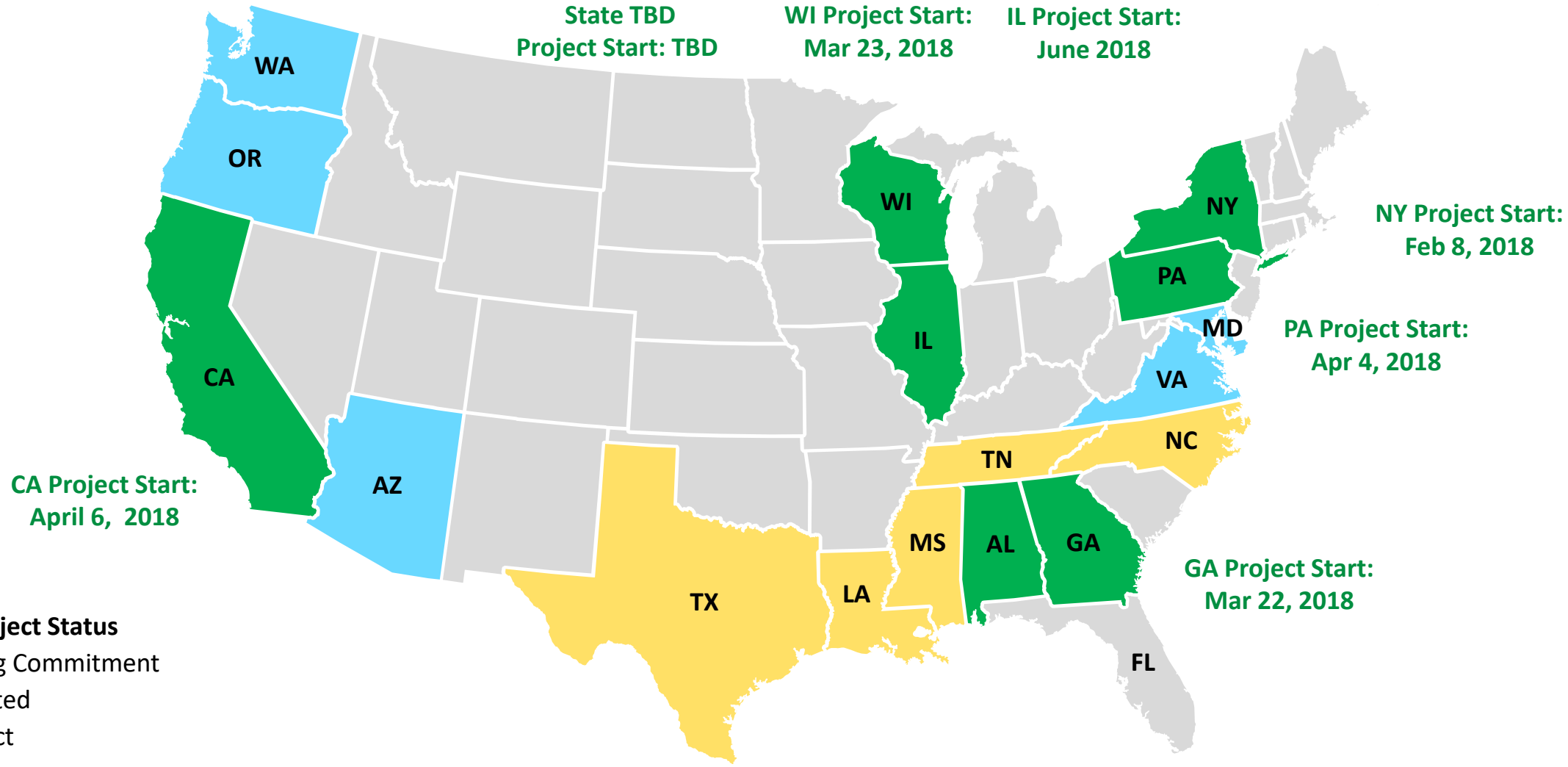
U.S. State and Utility Electrification Projects in Development



Goal: 10 State Projects | Current Participation: 8 States with 11 Members

Update: June 18, 2018

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U.S. National Electrification Assessment

Direct URL

https://www.epri.com/#/pages/product/3002013582/

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Together…Shaping the Future of Electricity

Thank you for attending our webinar

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