



U.S. National Electrification Assessment

The National Press Club
April 3, 2018

U.S. National Electrification Assessment

Welcome



Mike Howard, Ph.D.
President and CEO, EPRI
The National Press Club
April 3, 2018

U.S. National Electrification Assessment



Integrated Energy Network



A Pathway for Action

Ensuring Safe, Reliable, Affordable and Cleaner Energy Resources

U.S. National Electrification Assessment



U.S. National Electrification Assessment

National Electrification Assessment Review

- Analysis and Results
- Energy End Use Perspective



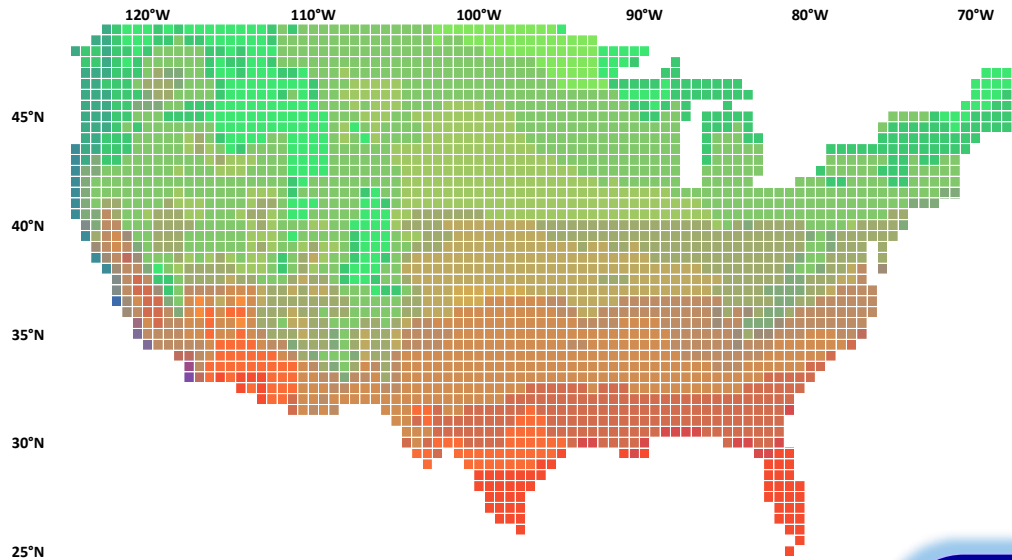
Geoff Blanford, Ph.D.
Technical Executive,
Energy and Environment, EPRI



Allen Dennis
Senior Program Manager,
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USNEA Modeling Approach: US-REGEN

Energy Use

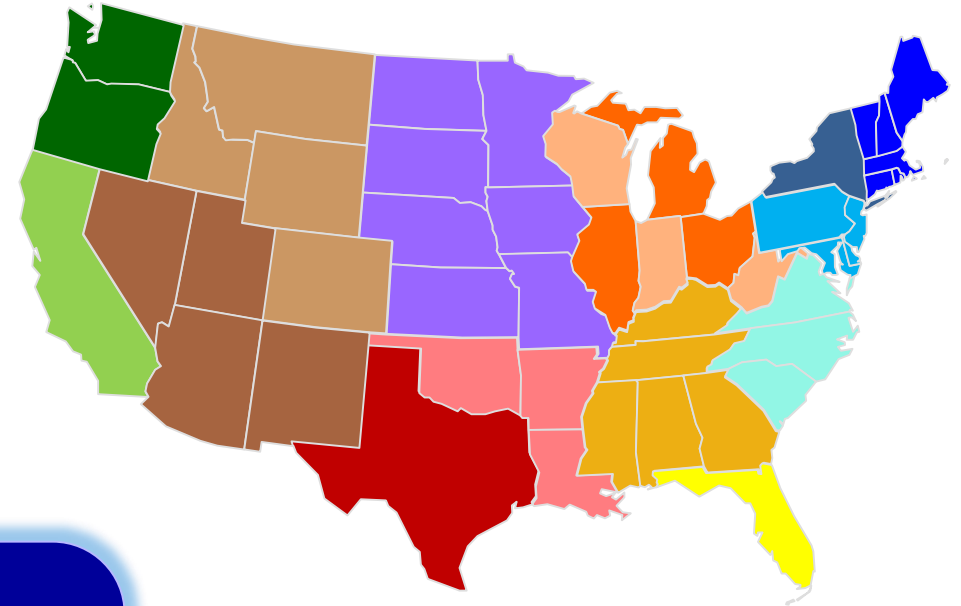


- Climate zones
- Building types
- Household characteristics
- Industrial mix
- End-use technology detail



Synchronized
Hourly Load,
Renewables,
and Prices

Electric Generation



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

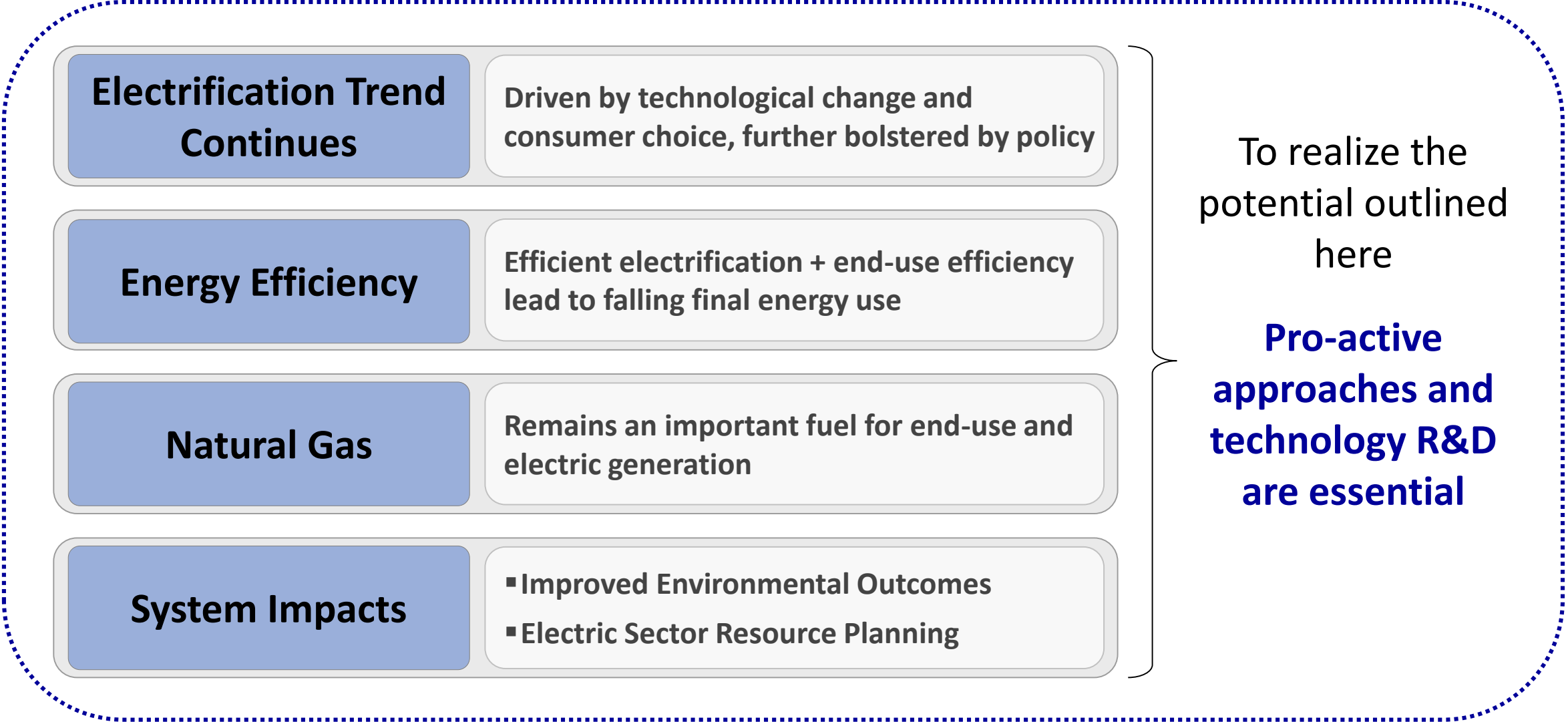
Model Outputs:

Generation, capacity,
prices, and end-use mix
Emissions, air quality,
and water

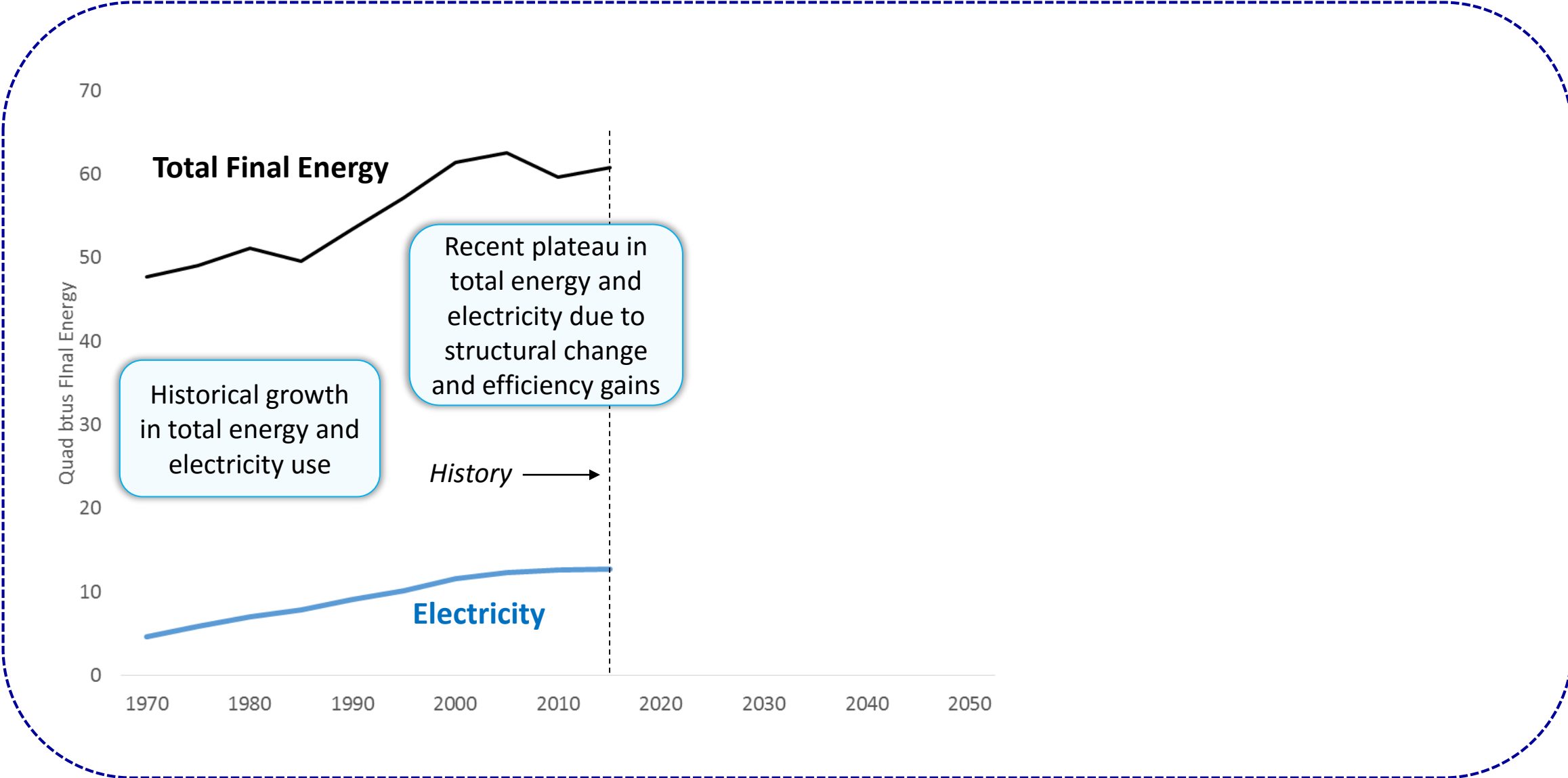
USNEA Scenarios

CONSERVATIVE	Slower Technology Change	<ul style="list-style-type: none">• 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	

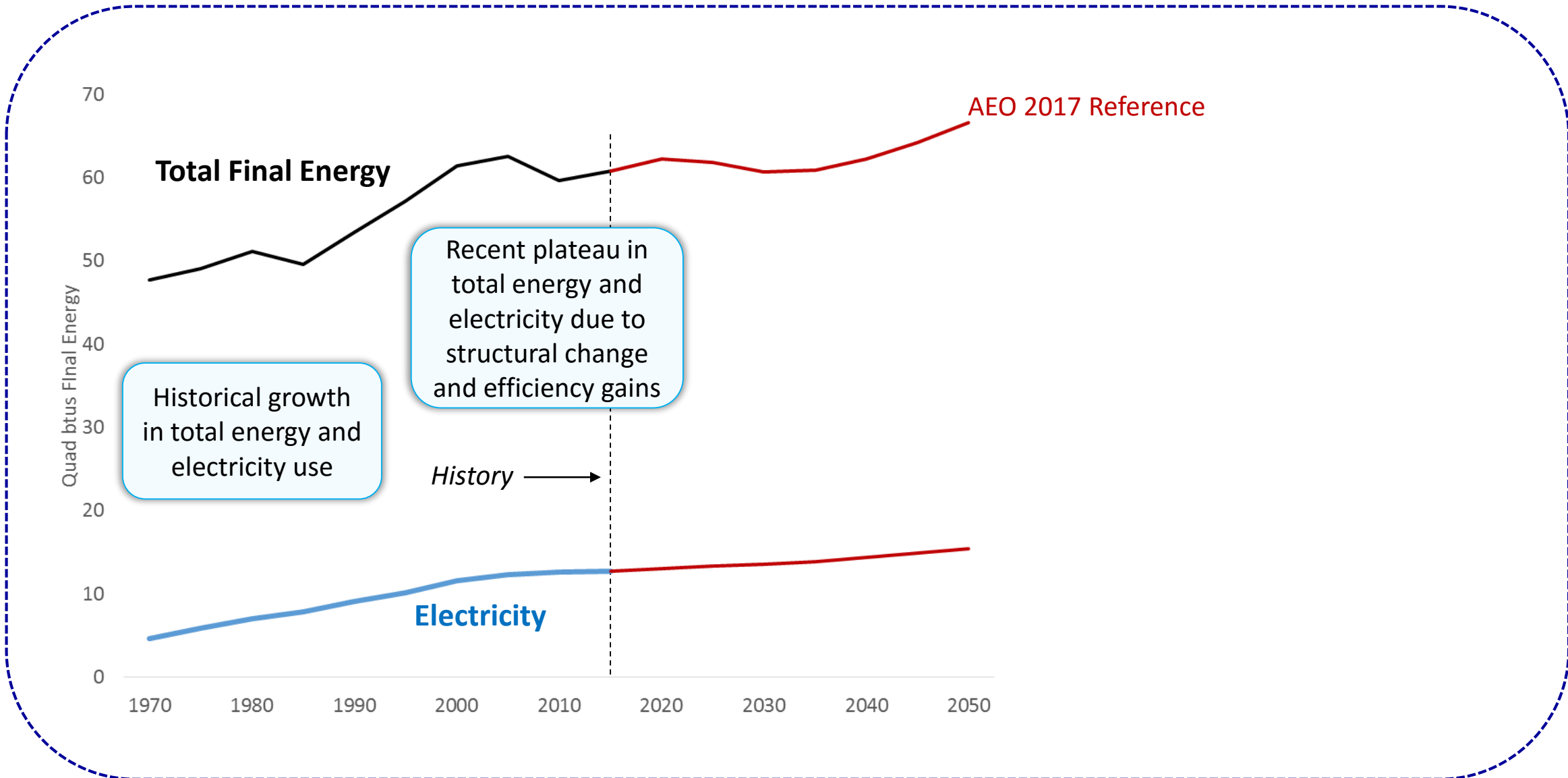
Key Messages from National Electrification Assessment



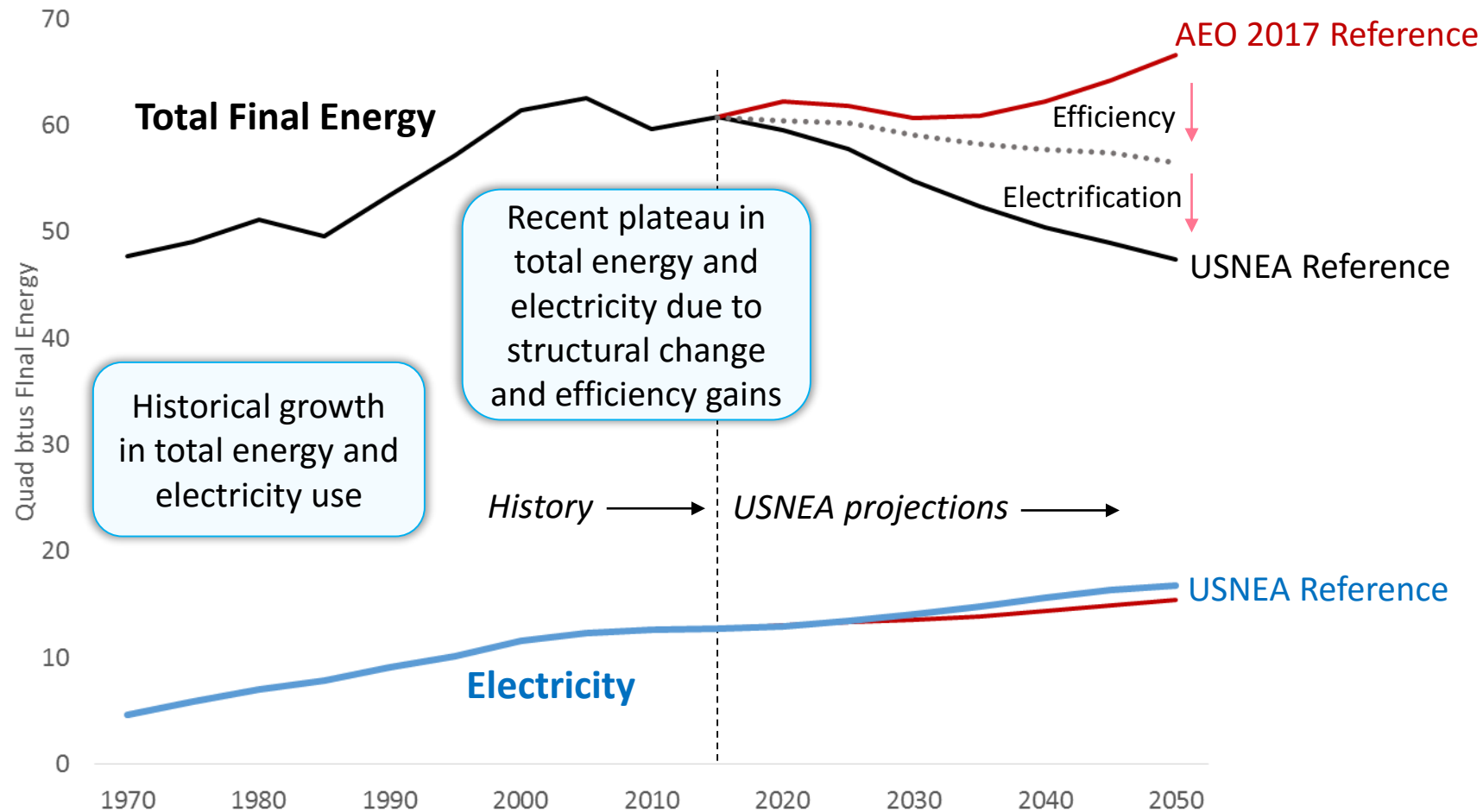
Historical Growth in Total Energy and Electricity Use



AEO 2017 Projects Rising Total Energy and Electricity Use

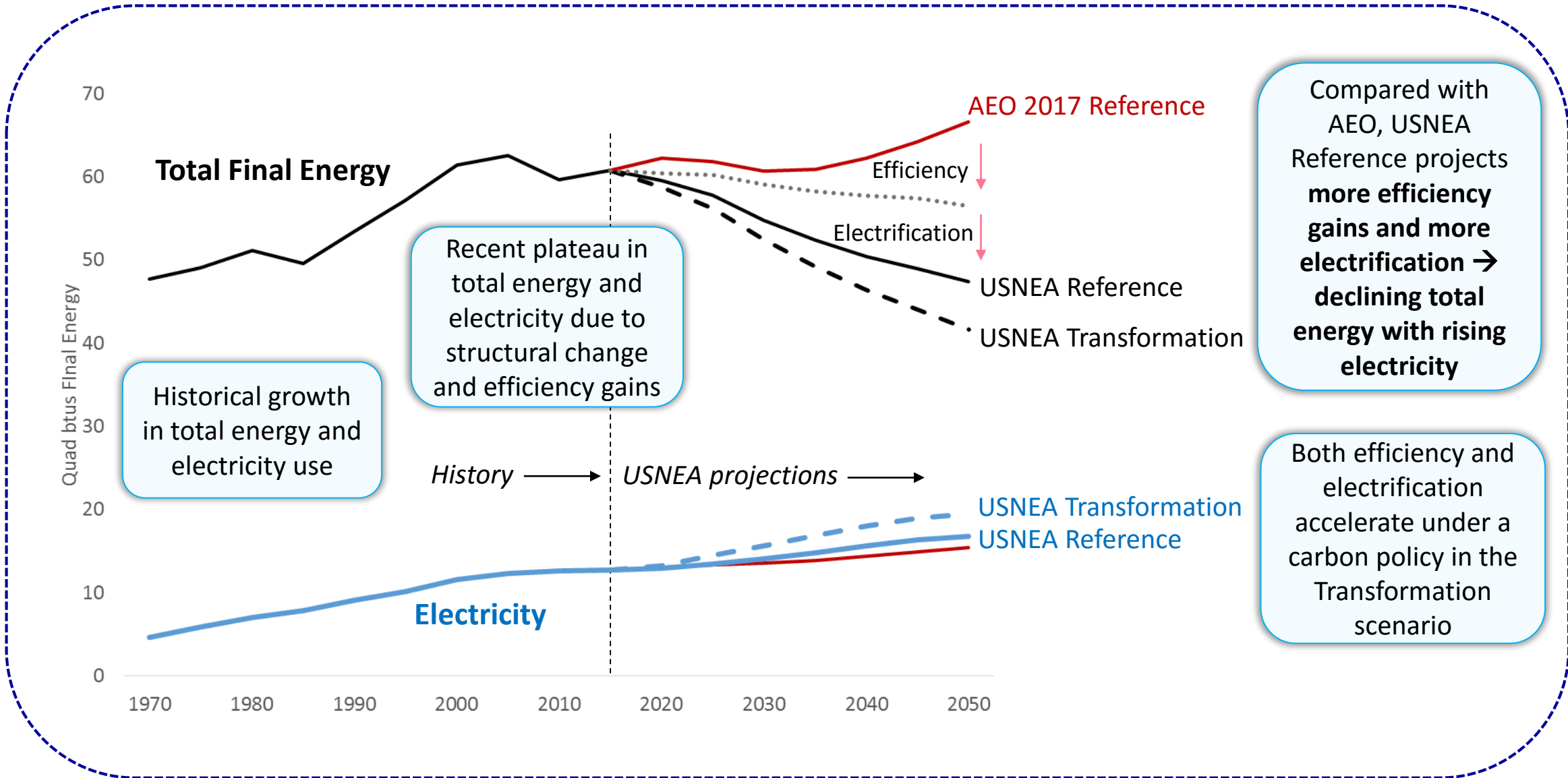


Total Final Energy Declines While Electricity Demand Increases

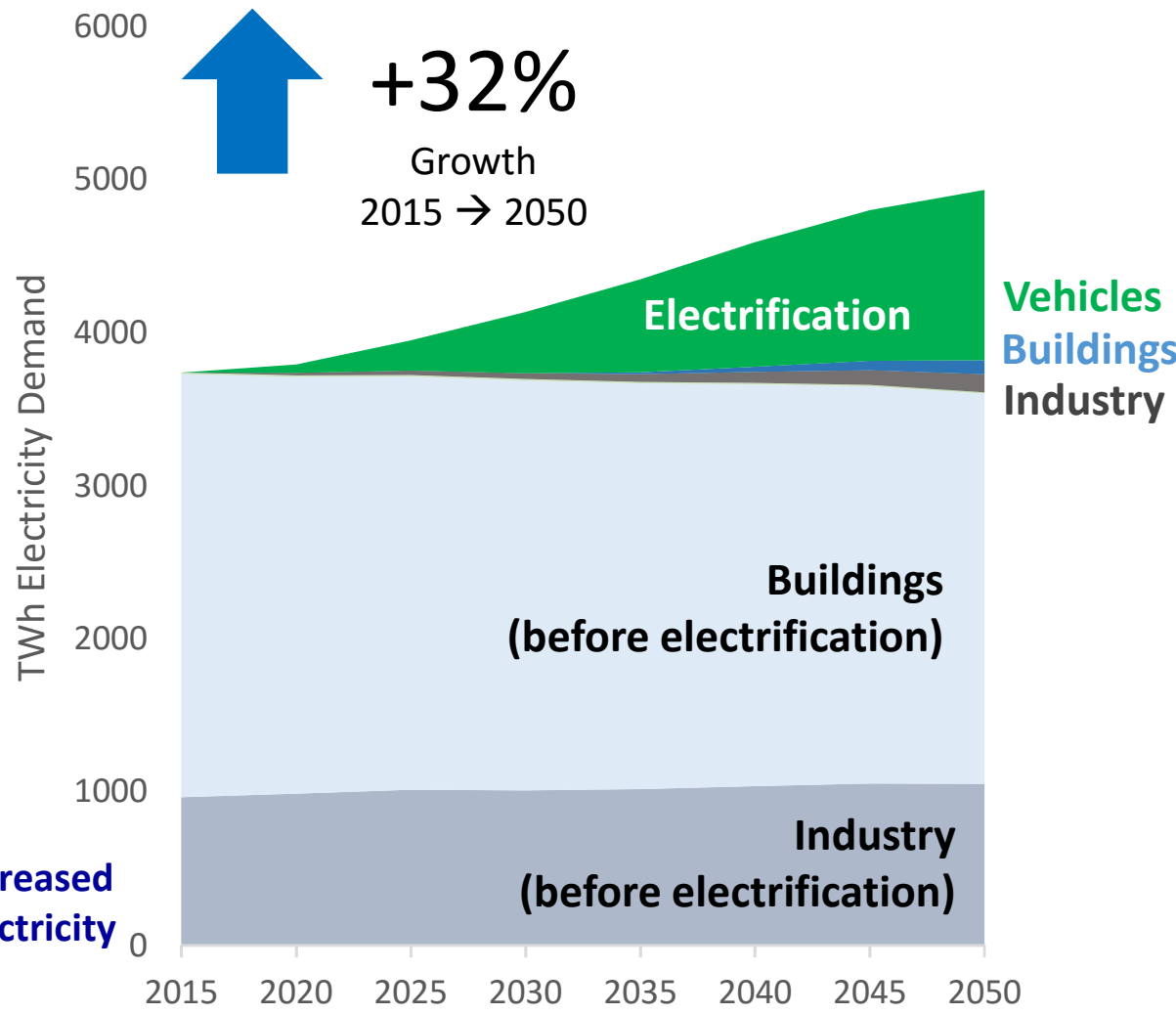
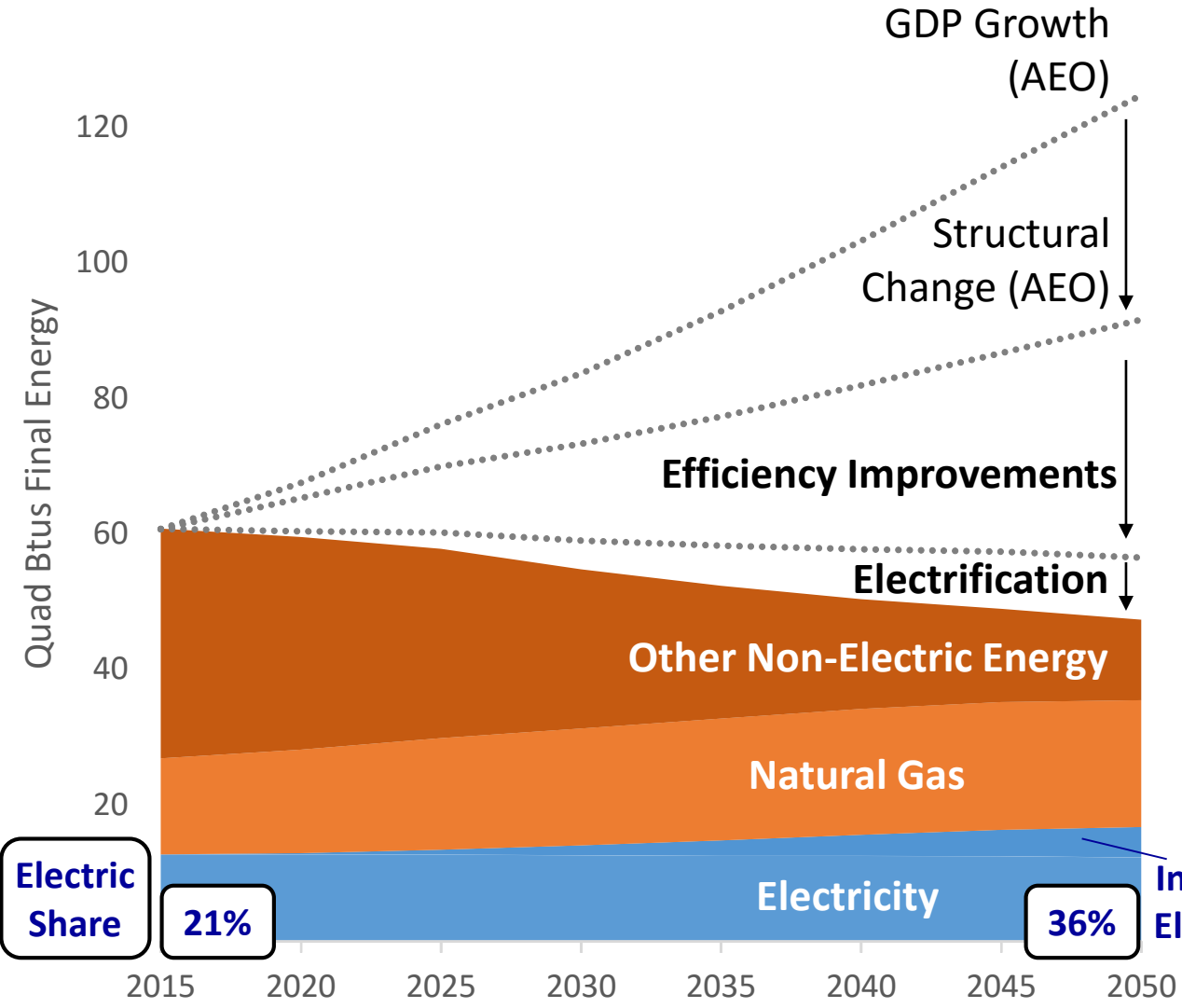


Compared with AEO, USNEA Reference projects **more efficiency gains and more electrification** → **declining total energy with rising electricity**

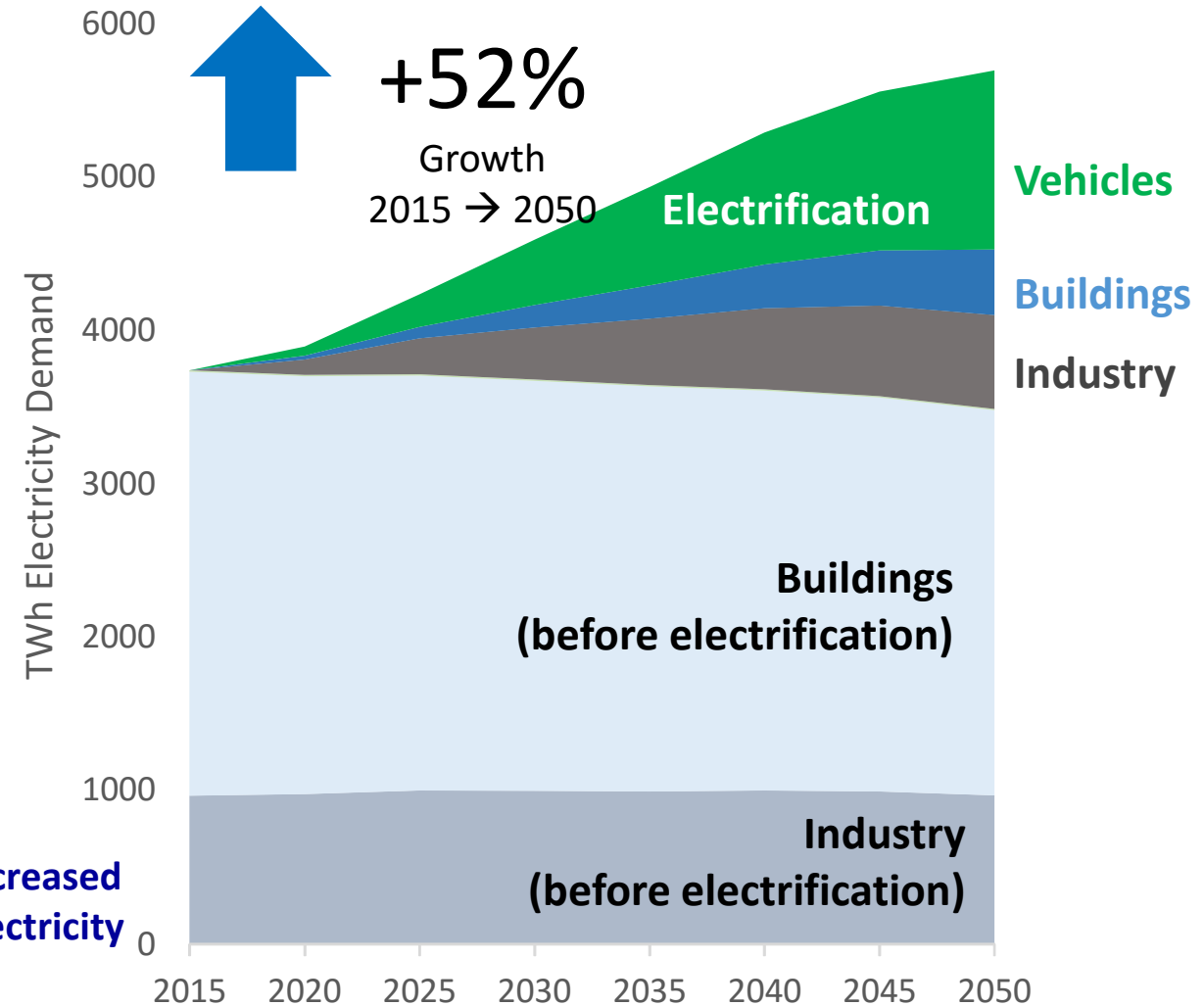
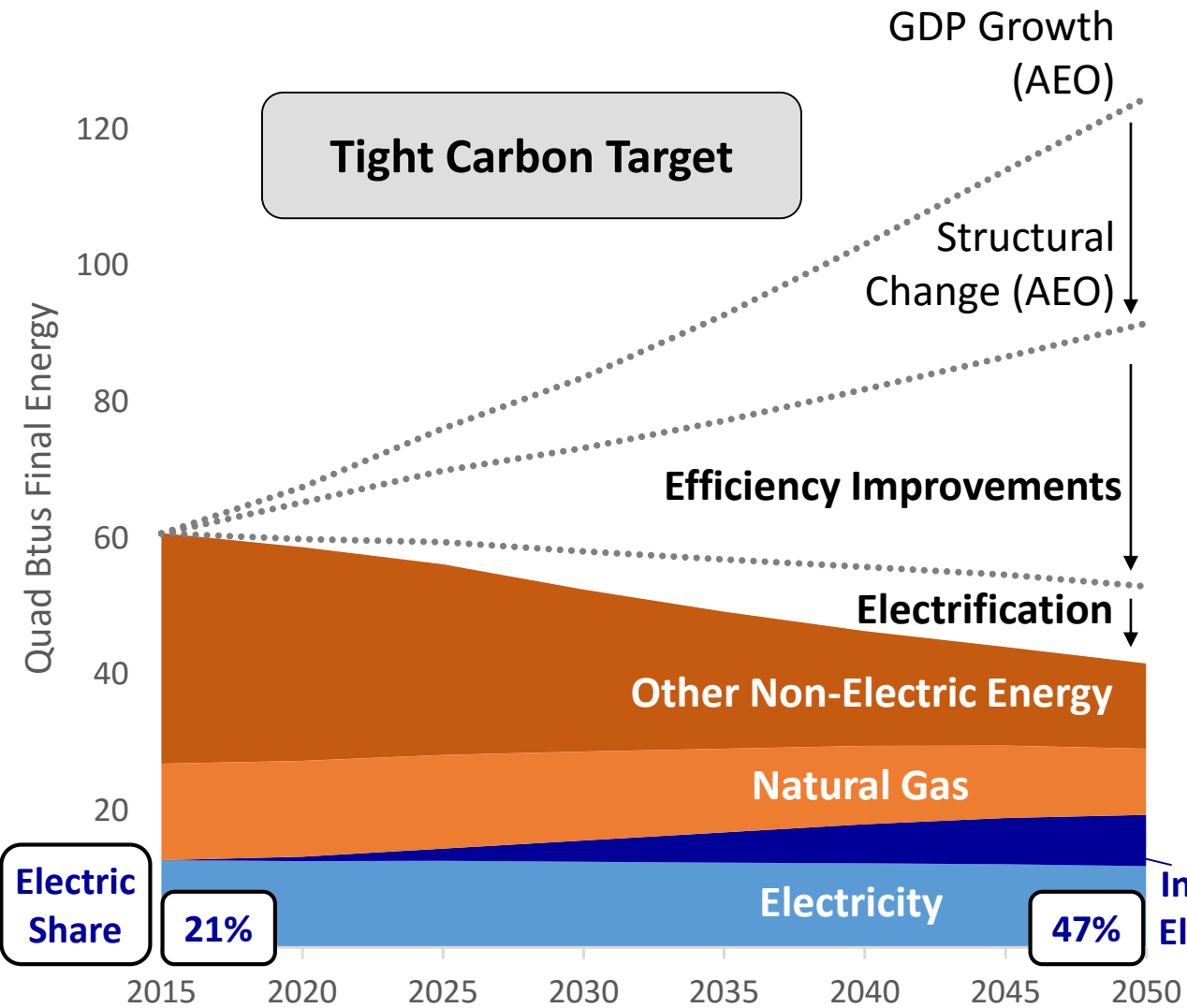
Total Final Energy Declines While Electricity Demand Increases



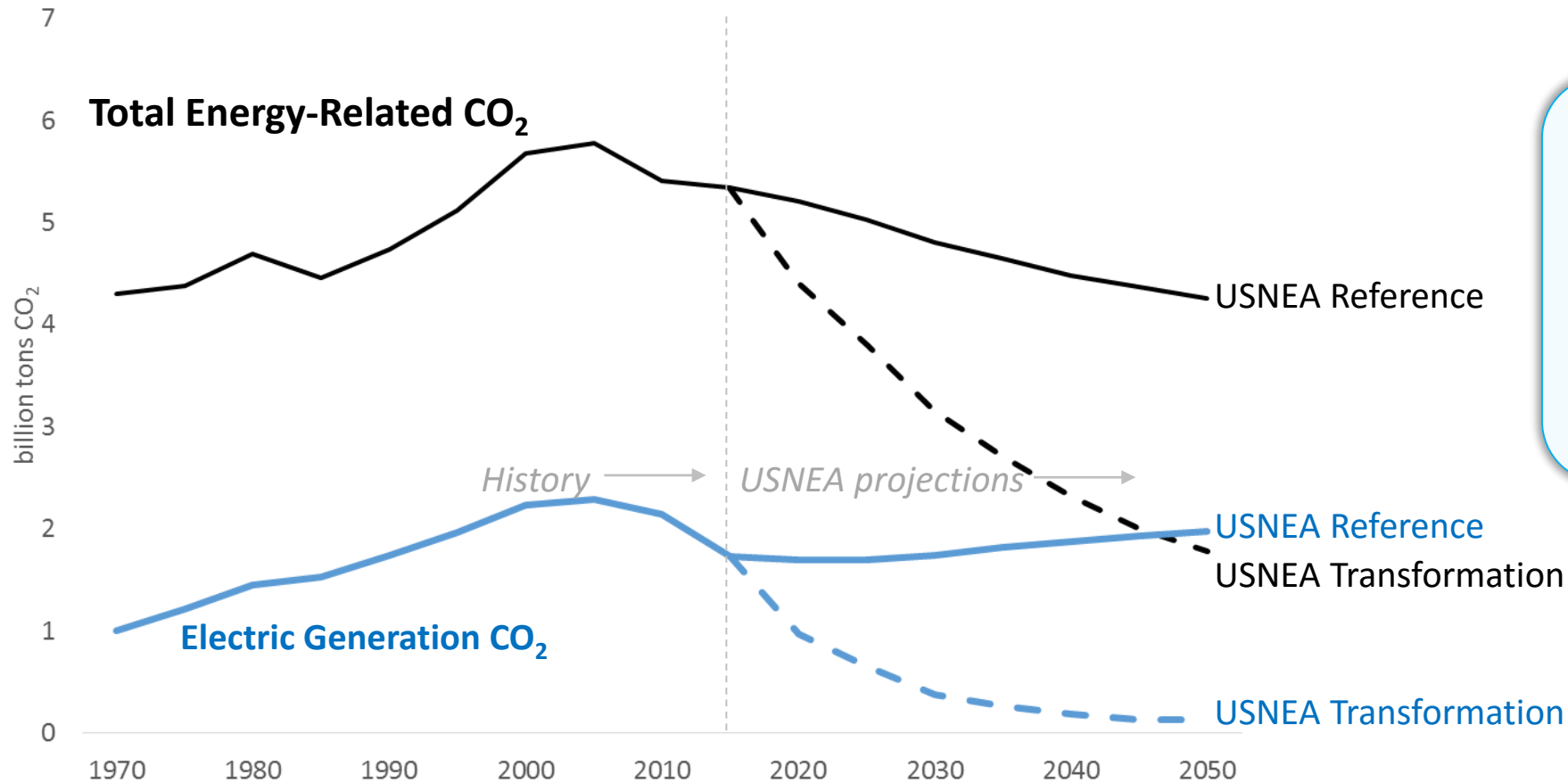
Efficient Electrification: Reference Scenario



Efficient Electrification: Transformation

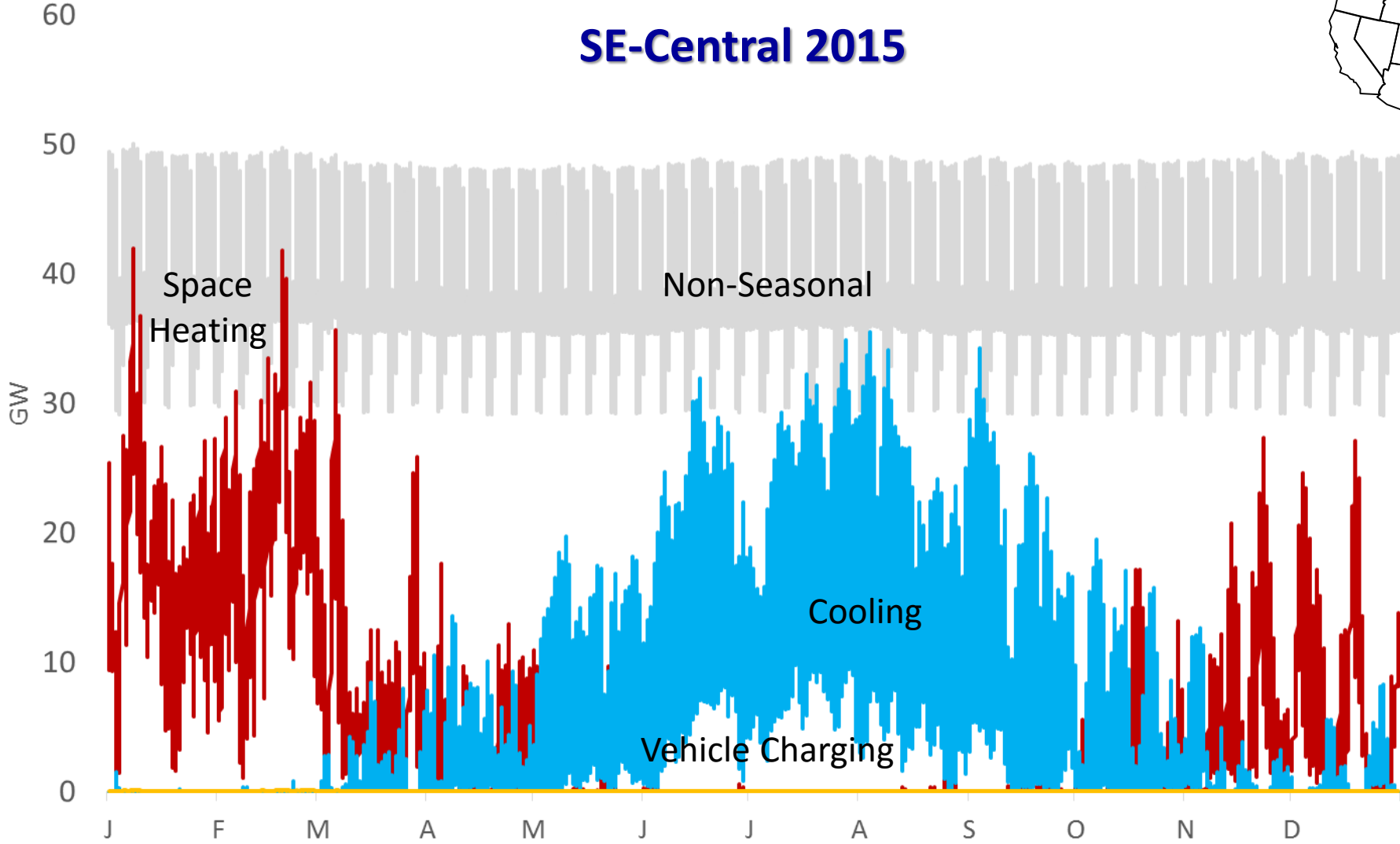


Total and Electric Generation CO₂ Emissions



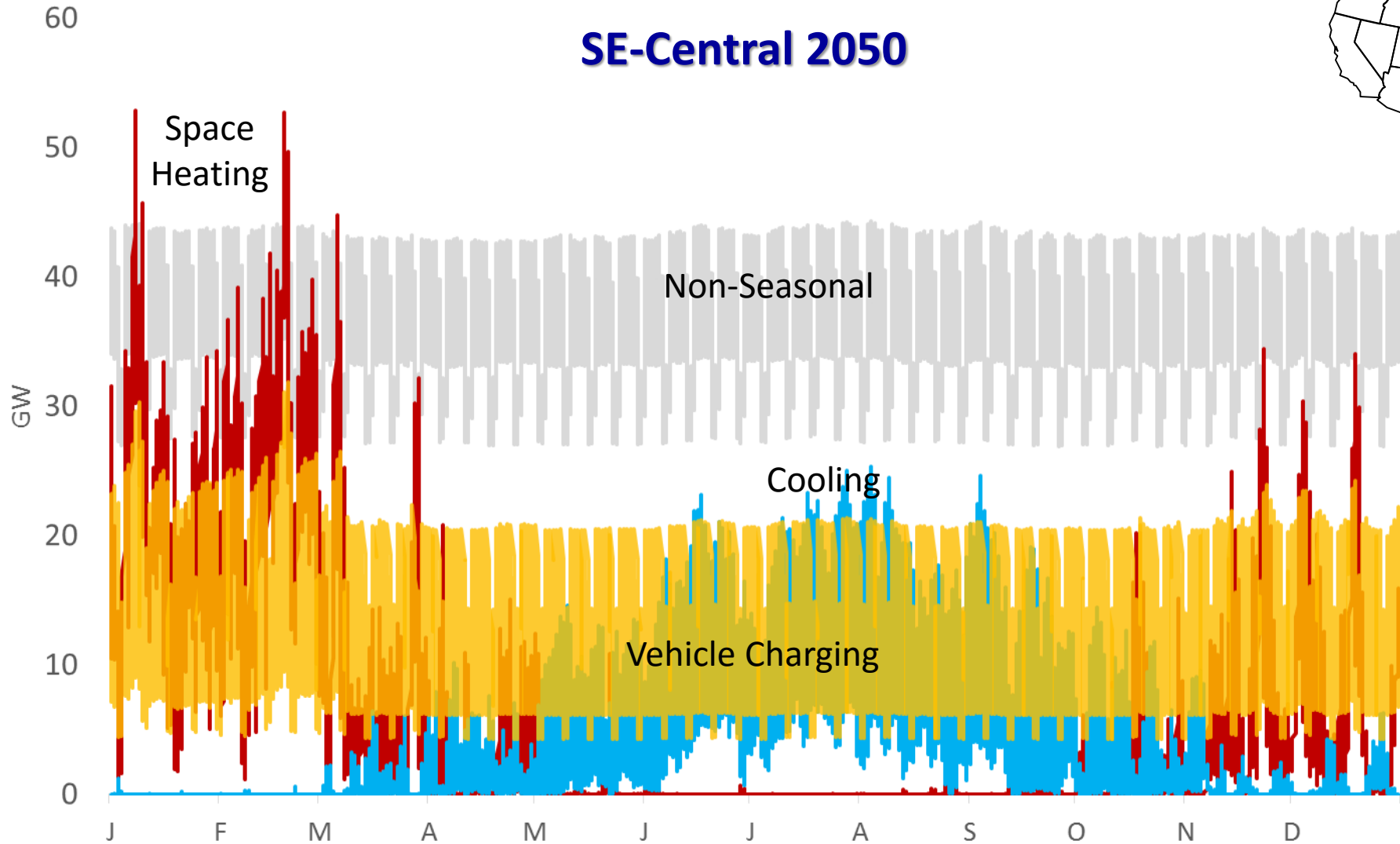
Increasing electrification leads to lower overall CO₂ emissions, even as emissions from electric generation increase in the USNEA Reference

Base Year Load Shape Reflects Current Technology Stock



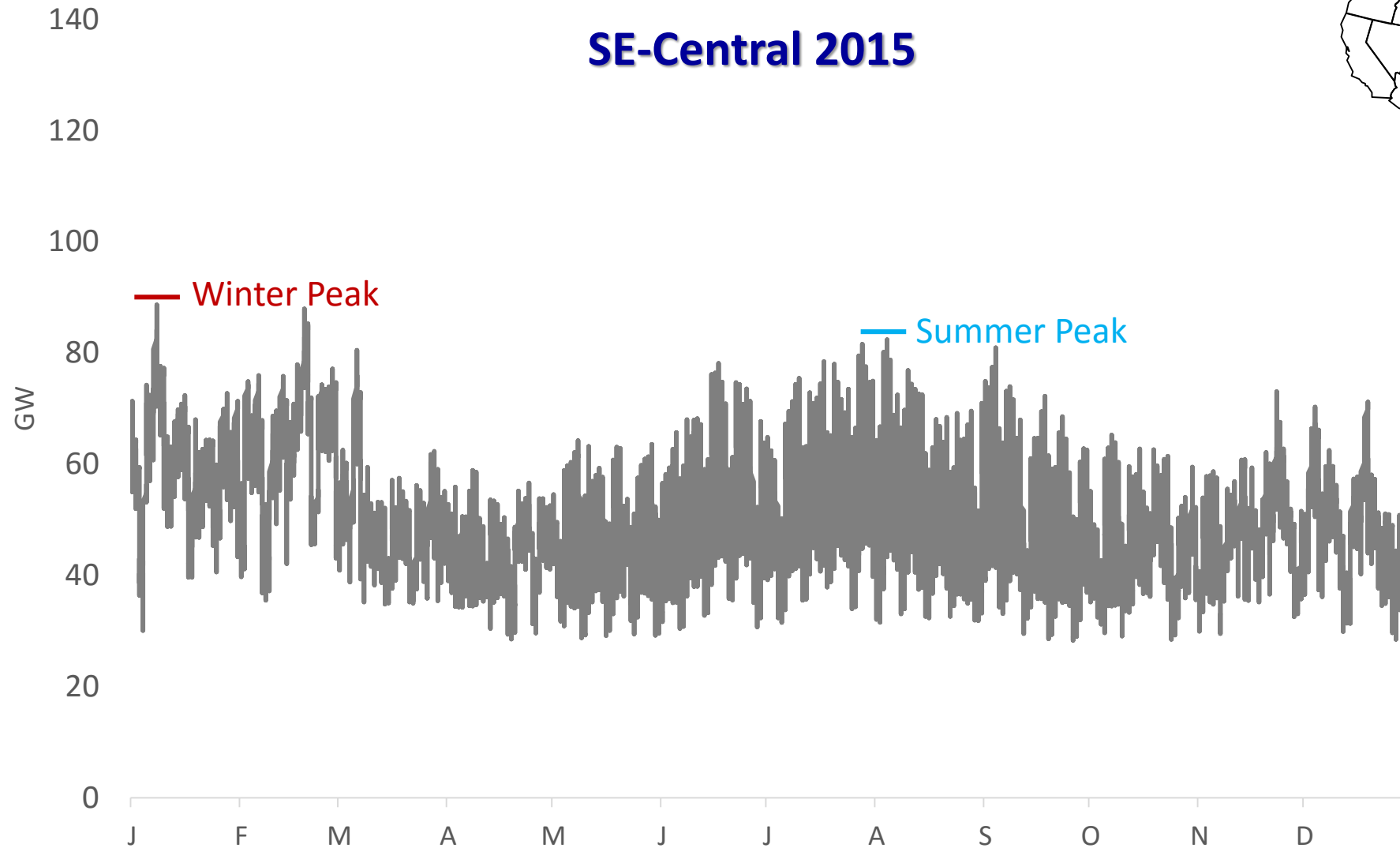
How Will Sectoral Loads Change Over Time?

Reference Projections Reflect Electrification / Efficiency



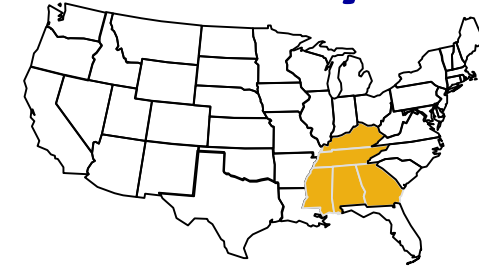
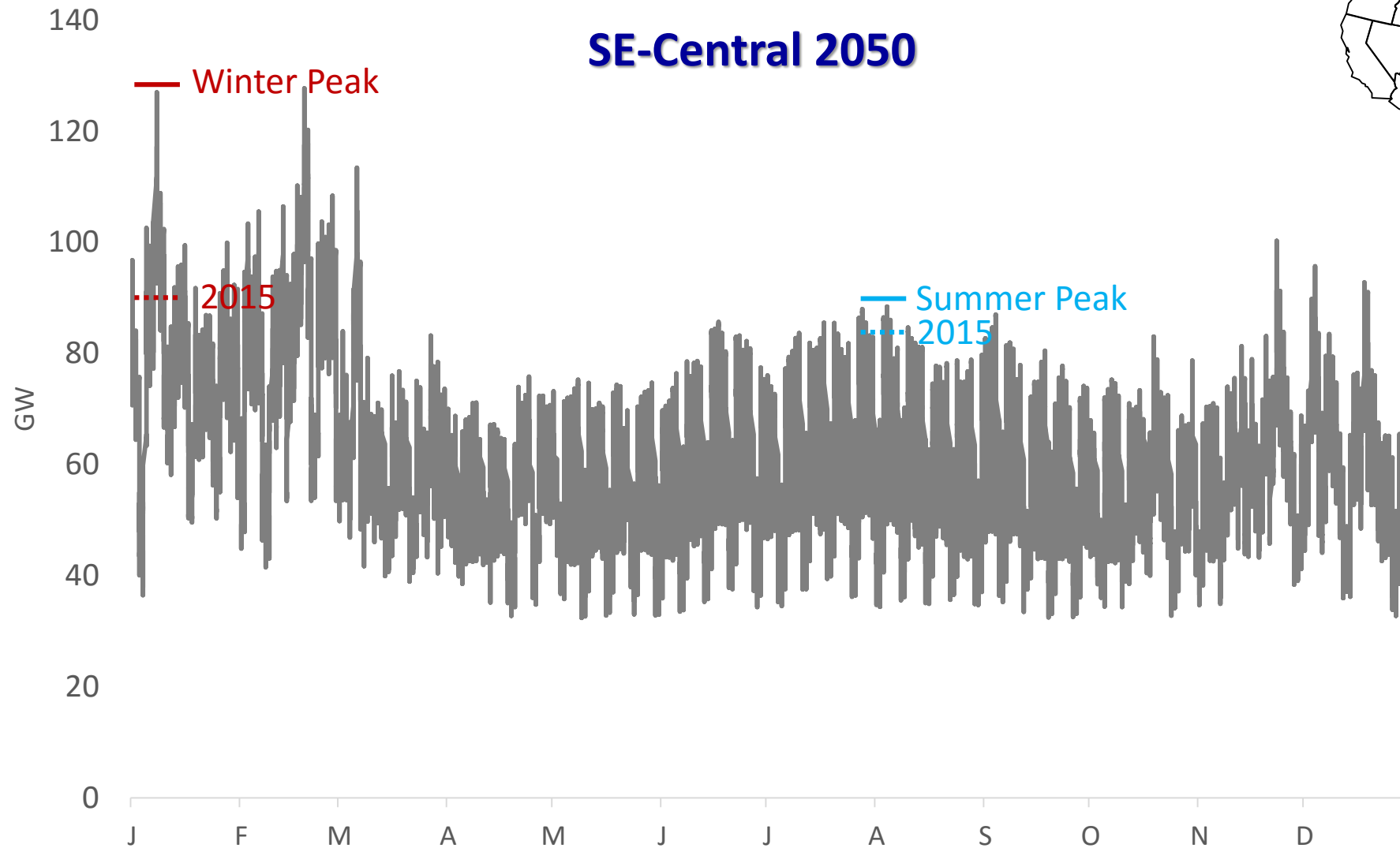
Significant Shift in Pattern and Size of Load

Aggregate Load Shape Already Has Winter Peak in Some Regions



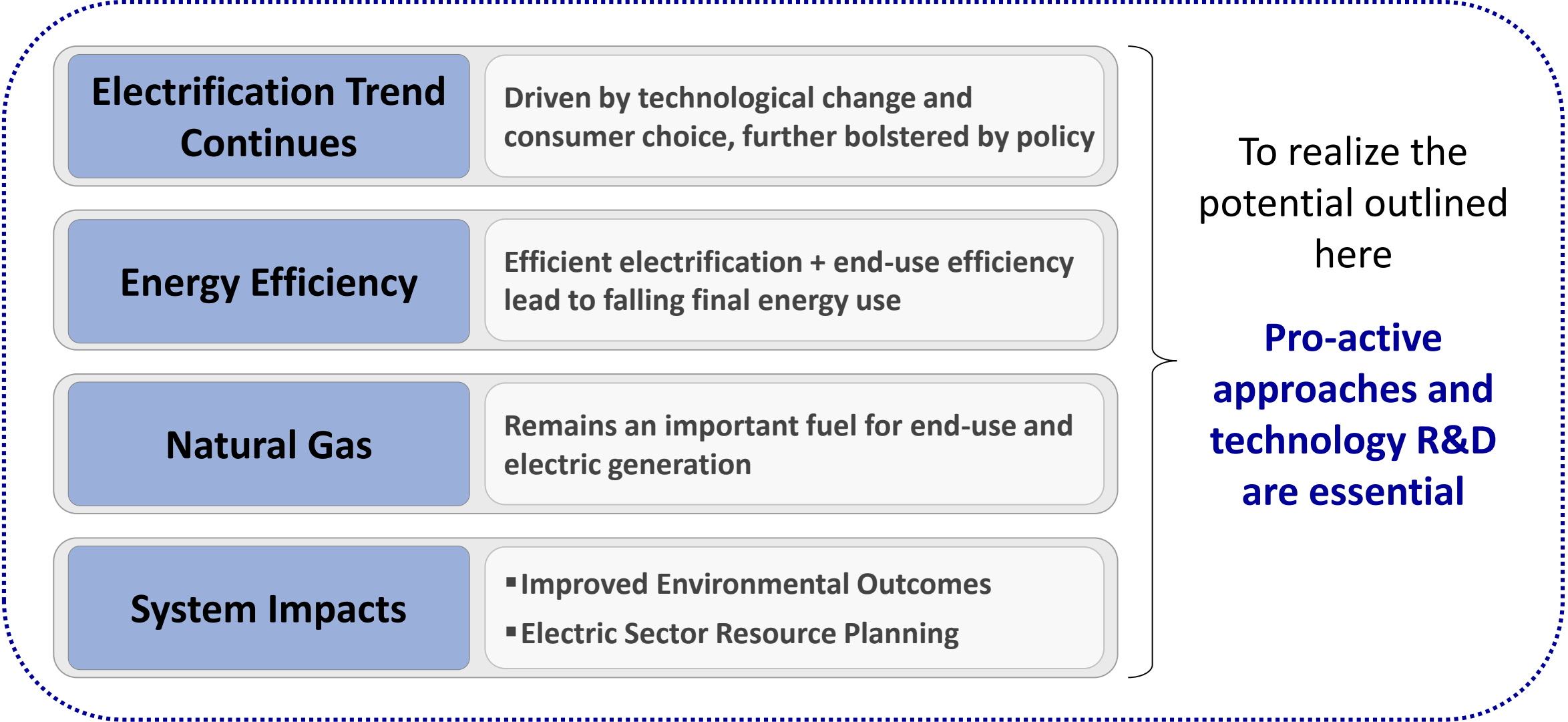
How Stable Are These System Dynamics?

Aggregate Load Shape Changes from Electrification and Efficiency



Electrification Will Impact Electric Sector Resource Planning

Key Messages from National Electrification Assessment





Together...Shaping the Future of Electricity

U.S. National Electrification Assessment

Overview and Key Messages



Allen Dennis
Senior Program Manager, Power Delivery and
Utilization

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The Integrated Energy Network – **Efficient** Electrification

Using Cleaner Energy Through Efficiency and Electrification

Producing Cleaner Energy

Integrating Energy Resources



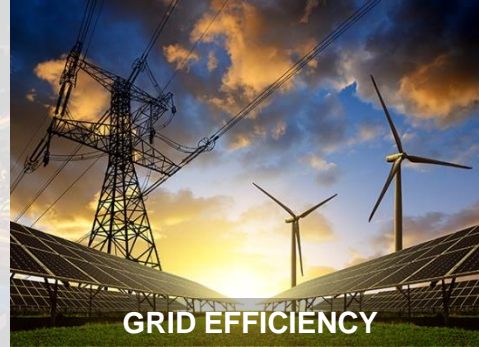
PRODUCTIVITY EFFICIENCY



HEALTH & SAFETY



ENERGY EFFICIENCY



GRID EFFICIENCY



EMISSIONS EFFICIENCY



WATER EFFICIENCY

Economic and environmental factors will increasingly reward and drive the application of electric technologies to **boost energy efficiency** and **grid flexibility**, **increase productivity** and **improve product quality** while **supporting emissions reduction**, **water savings** and **safety**.

Targeted Electrification Technologies

RESIDENTIAL

Air-source and ground-source heat pumps
Variable-capacity ducted heat pumps

COMMERCIAL

Variable refrigerant flow heat pumps
Variable-capacity rooftop heat pumps
Rooftop air-source heat pumps
Heat pump water heaters
Heat pump pool dehumidification
Forklifts (comm & ind applications)
Truck stop electrification
Commercial food service equipment
Water ozonation/ Wastewater treatment

INDUSTRIAL

Infrared curing and drying
UV curing
Induction surface treatment
Induction furnaces
Pipeline compression
C&I heat recovery chiller
Agricultural equipment
Pumps (single- to three-phase)

TRANSPORTATION

Light duty passenger vehicles
Transit/School buses
Heavy duty trucks

Identification of Opportunities to Increase Productivity

Food Processing Customer Case Study

PROJECT OBJECTIVE

Identify opportunities for:

- Energy optimization
- Electrification
- Energy related EHS (environment, health and safety)
- Water savings applications

CUSTOMER ISSUES

Increase productivity to maintain market share in competitive market

Water regulations related to process utilization and discharge

RESULTS

INCREASED RELIABILITY

UV system completely disinfects water and has no downtime

INCREASED EMPLOYEE SAFETY

No need to transport, store and handle chlorine for water disinfection

INFRARED FOOD PROCESSING

Less expensive to operate and faster (**80%** less time)

ACOUSTIC HEATING, DRYING AND COOLING

50-75% reduction in energy

Line speeds **4** times faster

Can be used for rapid cooling before food is frozen into packaged containers

EV Demand Management / Smart Charging Pilot

Real-world example at a Mid-Atlantic utility

PROJECT OBJECTIVE

Measure and evaluate real world:

EV charging behavior

Costs

Grid impact

CUSTOMER ISSUES

Education

Options

Charging station installation

RESULTS

EV CHARGING BEHAVIOR

Most customers followed TOU timelines as well as responded positively to demand response signals (many were not plugged in during peak demand)

COSTS TO CUSTOMER

Lower cost. TOU rates saved EV customers money.

COST TO UTILITY

Customer behavior coupled with TOU rates encouraged off-peak charging behavior, and hence lowered costs to all ratepayers

IMPACT ON GRID

Little impact on local circuits as measured on transformer loading from substation to neighborhood.

Further analysis and integration into grid operations and planning

EPRI's Focus – Going Forward



ANALYTICS

Establish Industry Stakeholder Group

Conduct National, Regional, and Service Territory Assessments



TECHNOLOGY PIPELINE

Identify Early Stage Efficient Electrification Technologies

Accelerate Adoption Through Expanded EPRI Lab Capabilities and Field Demonstrations



R&D COLLABORATION

Develop Electrification Roadmap

Convene Efficient Electrification National Conference

Lead Development of Virtual Centers of Excellence



INFORM INDUSTRY STAKEHOLDERS, POLICYMAKERS, REGULATORS AND CUSTOMERS

In Summary

- Many electric technologies are cost effective and offer excellent solutions to solve customer issues
- Electric technology non-energy benefits typically are the deciding factors to install the electric technology
- Technology advancements will continue “at a lightning pace”



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How are Electrification and the National Assessment Important to Electric Utilities?



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Senior Vice President,
External Relations and
Technical Resources, EPRI



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President and CEO Ontario
Power Generation, Inc.;
EPRI Board Member



Pat Vincent-Collawn
Chairman, President, and
CEO, PNM Resources, Inc.;
EPRI Board Member



Sheryl Carter
Director, Power Sector, Natural
Resources Defense Council;
EPRI Board Member

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