EPRI ELECTRIC POWER RESEARCH INSTITUTE

Electrification – Challenges and Opportunities

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IGNITING Technology – California Electrification

November 29, 2018

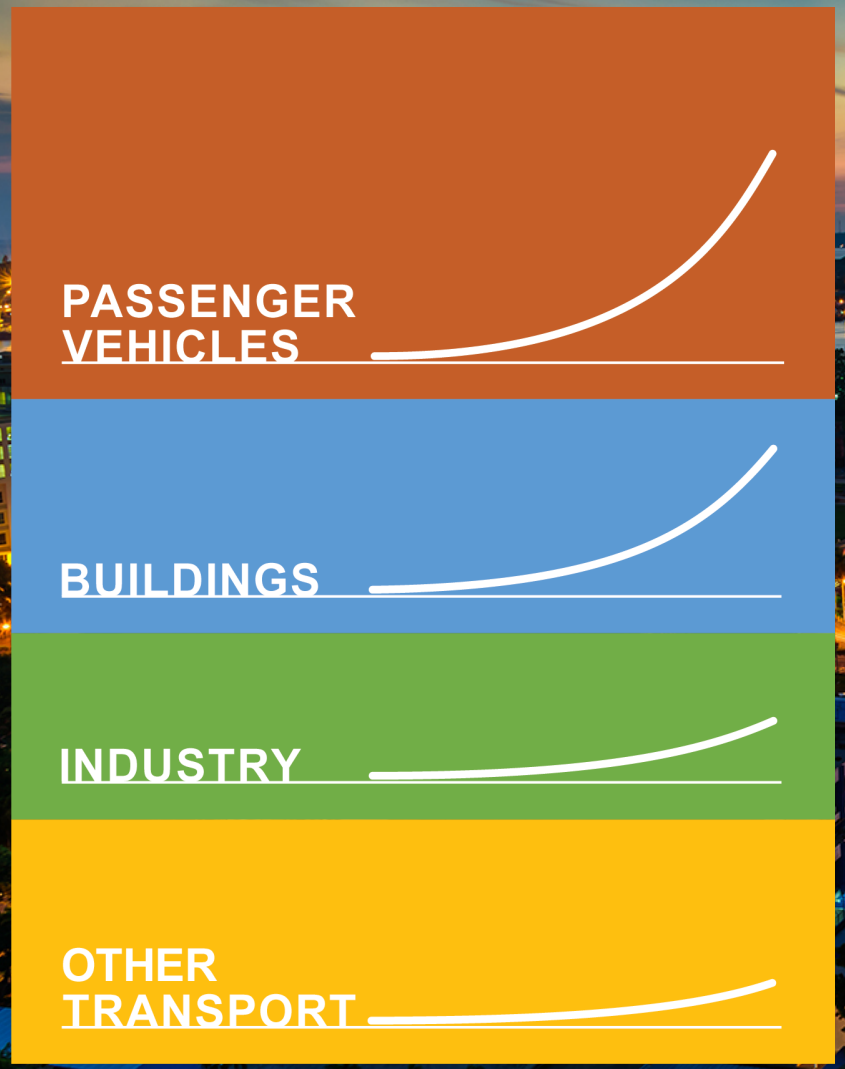
Benefits of Efficient Electrification

Energy Efficiency

Economic

Environmental

Electrification Impacts – What If…?



INCREASES ELECTRIC TO

45%

OF OVERALL ENERGY MIX (CURRENTLY 18%)

REDUCES CO_2 EMISSIONS

70%

FROM 5100 Mt TO 1600 Mt

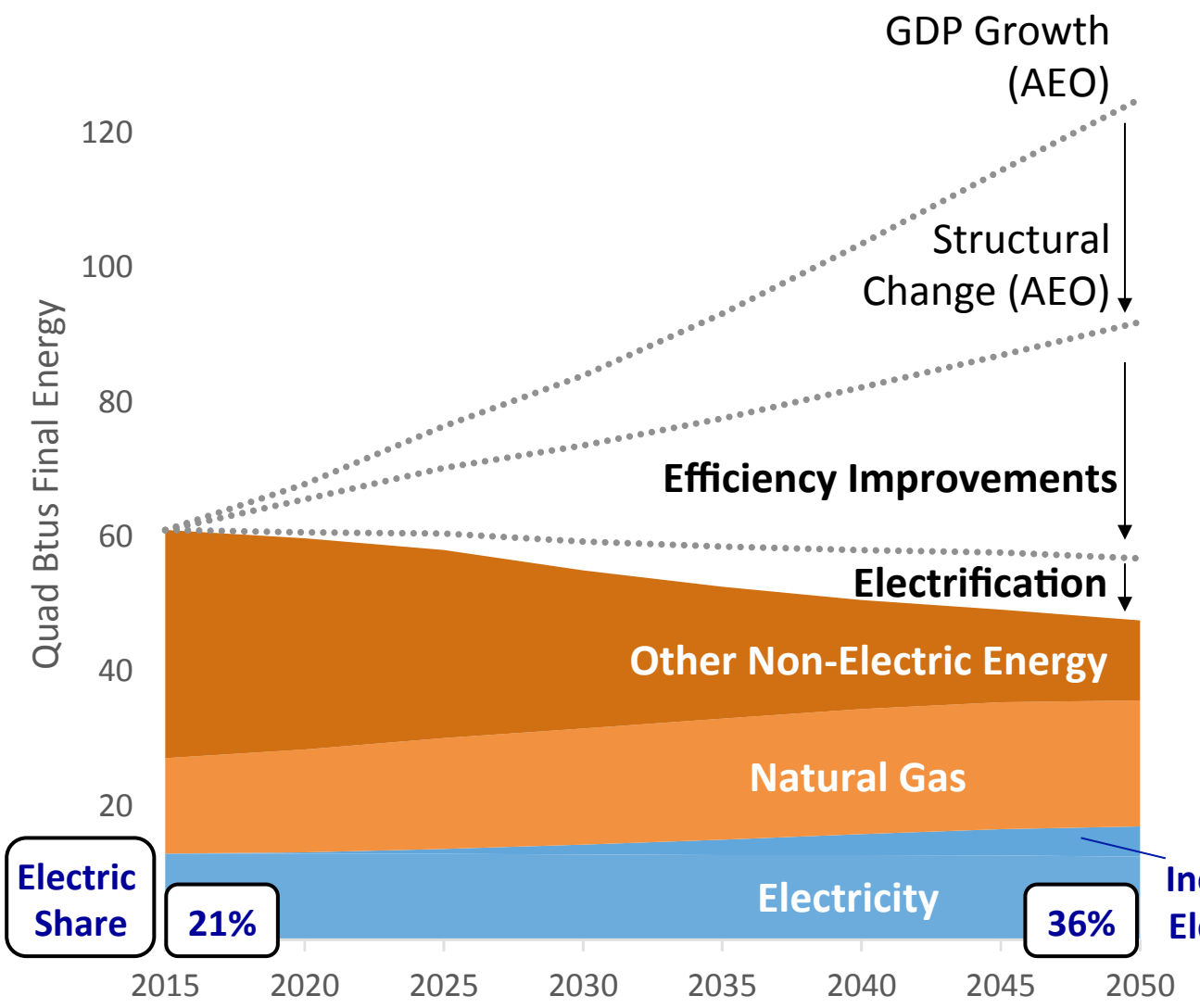
INCREASES CUSTOMER FLEXIBILITY

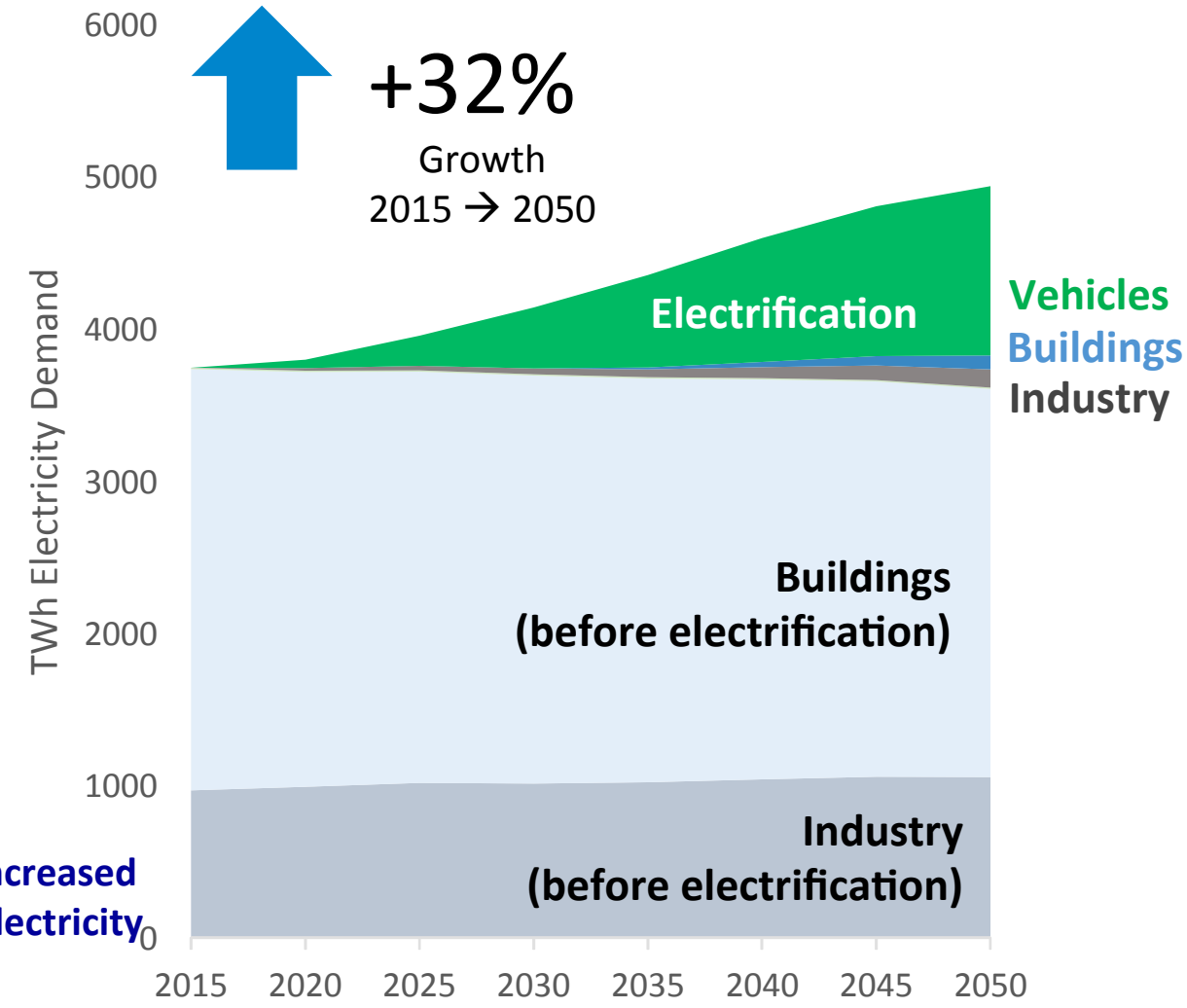
INCREASES PRODUCTIVITY

INCREASES PRODUCT QUALITY

REDUCES END-USE WATER CONSUMPTION

Efficient Electrification: Reference Scenario





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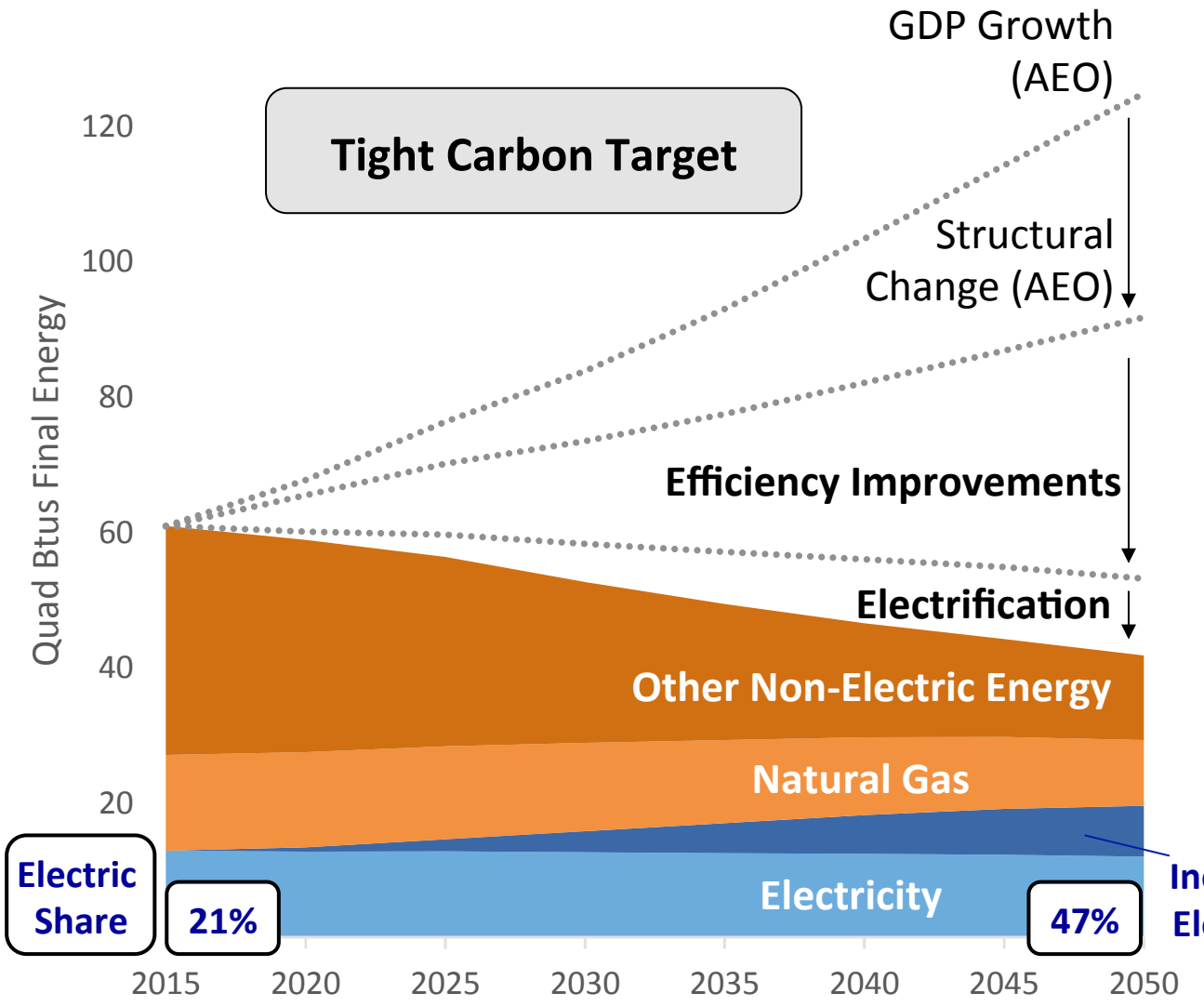
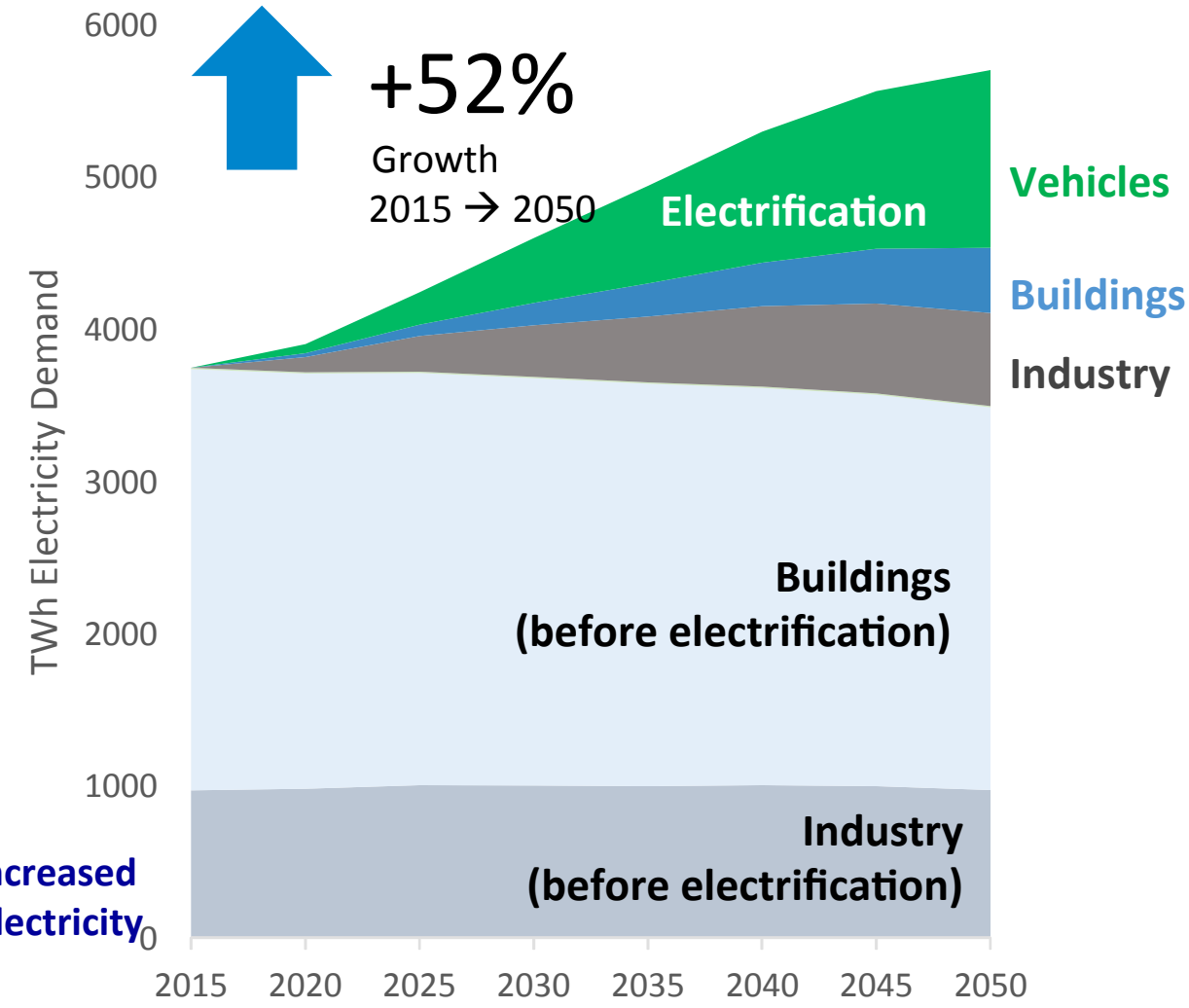
Efficient Electrification: Transformation





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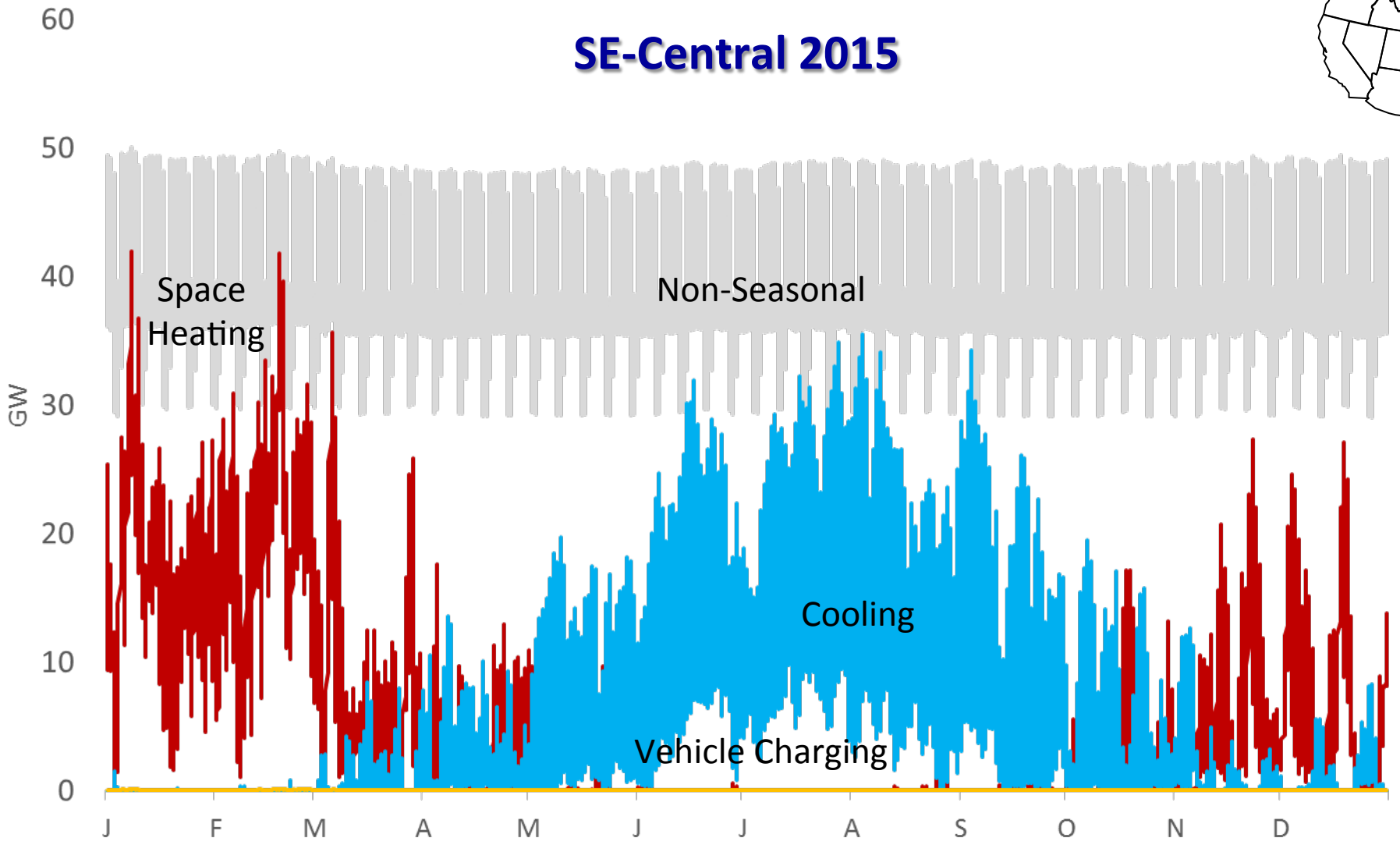
Base Year Load Shape Reflects Current Technology Stock

SE-Central 2015



How Will Sectoral Loads Change Over Time?

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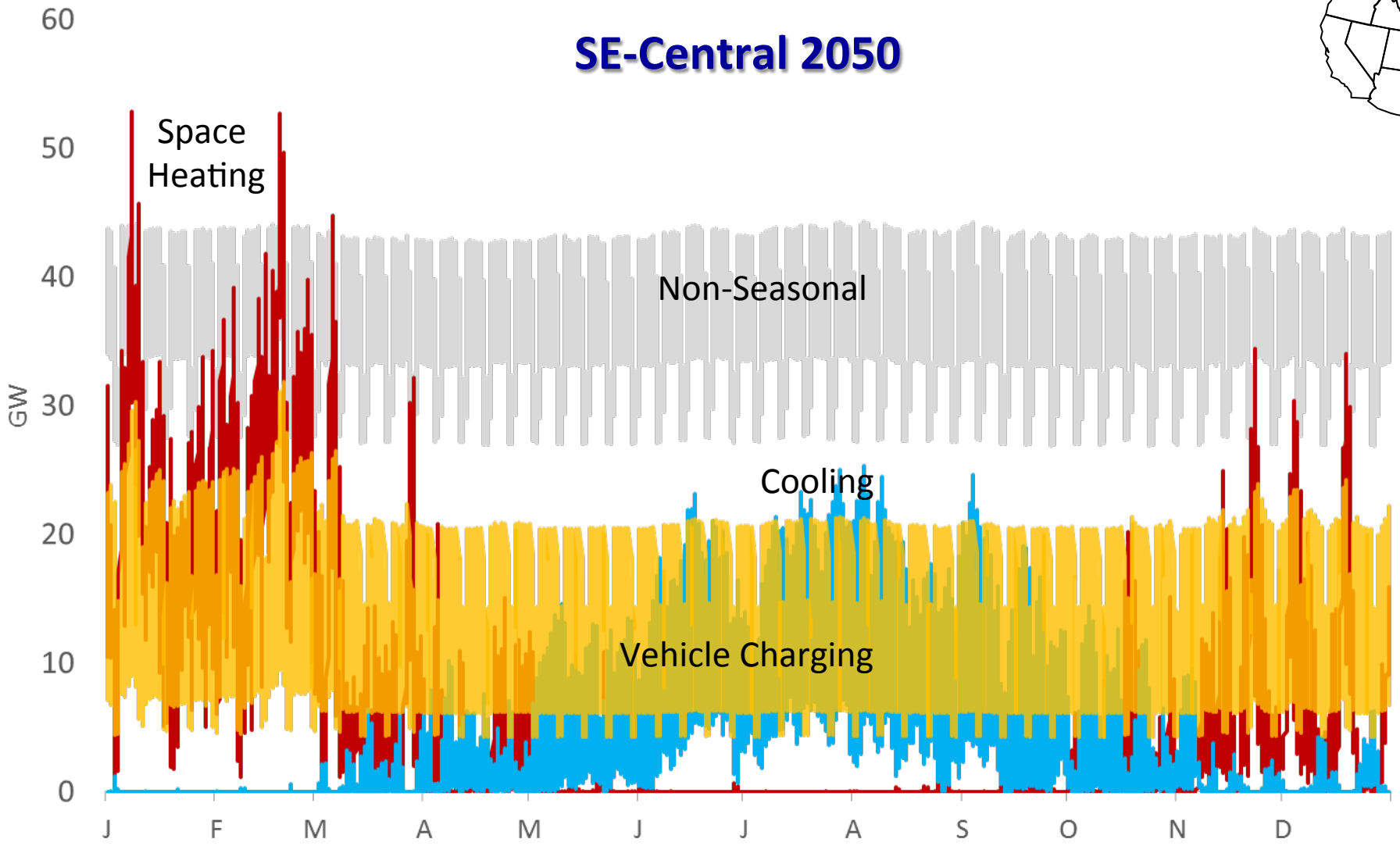
Reference Projections Reflect Electrification / Efficiency

SE-Central 2050



Significant Shift in Pattern and Size of Load

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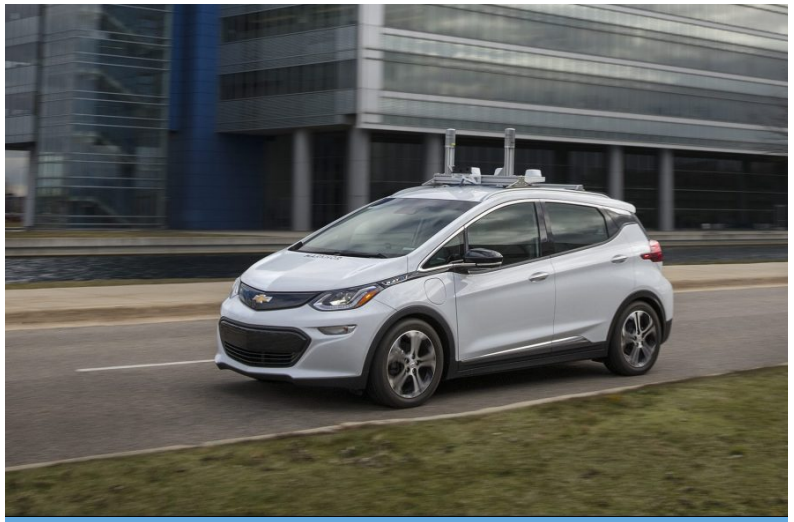
Defining the Technology Pipeline

HEATING AND COOLING

- Advanced Heat Pumps
- Heating/Drying Technologies
- Thermal Storage
- Waste Heat Recovery



TRANSPORTATION

- Advanced Energy Storage
- High Power DC Charging
- Heavy Duty, C&I Applications
- Low Cost Hydrogen Fueling
- Autonomous and other advanced Mobility Technologies

ALTERNATIVE PROCESSES

- Agriculture
- Additive and Advanced Manufacturing Techniques
- Chemical Refining
- Material Production

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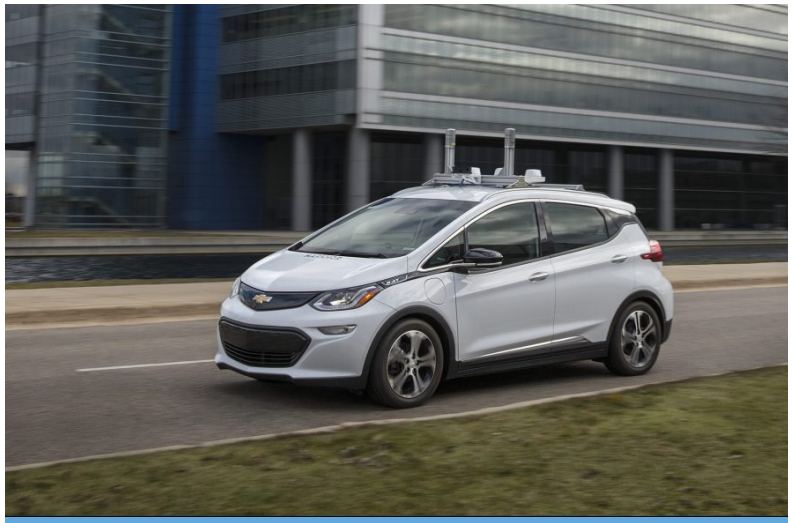

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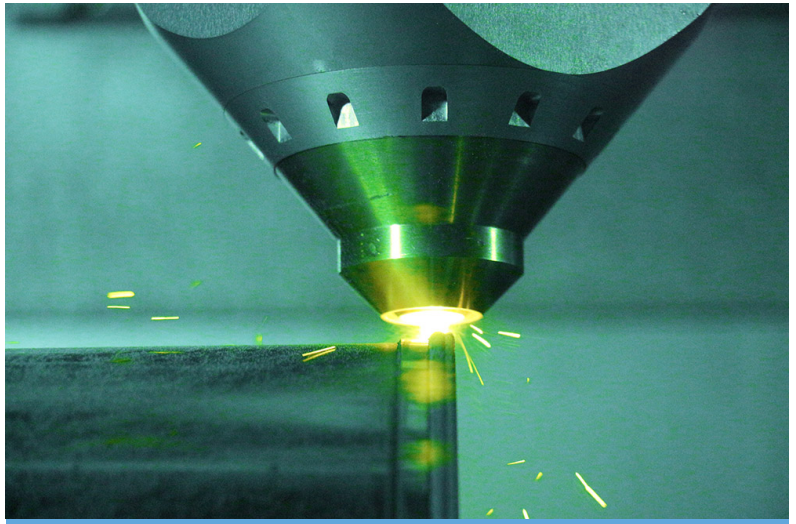

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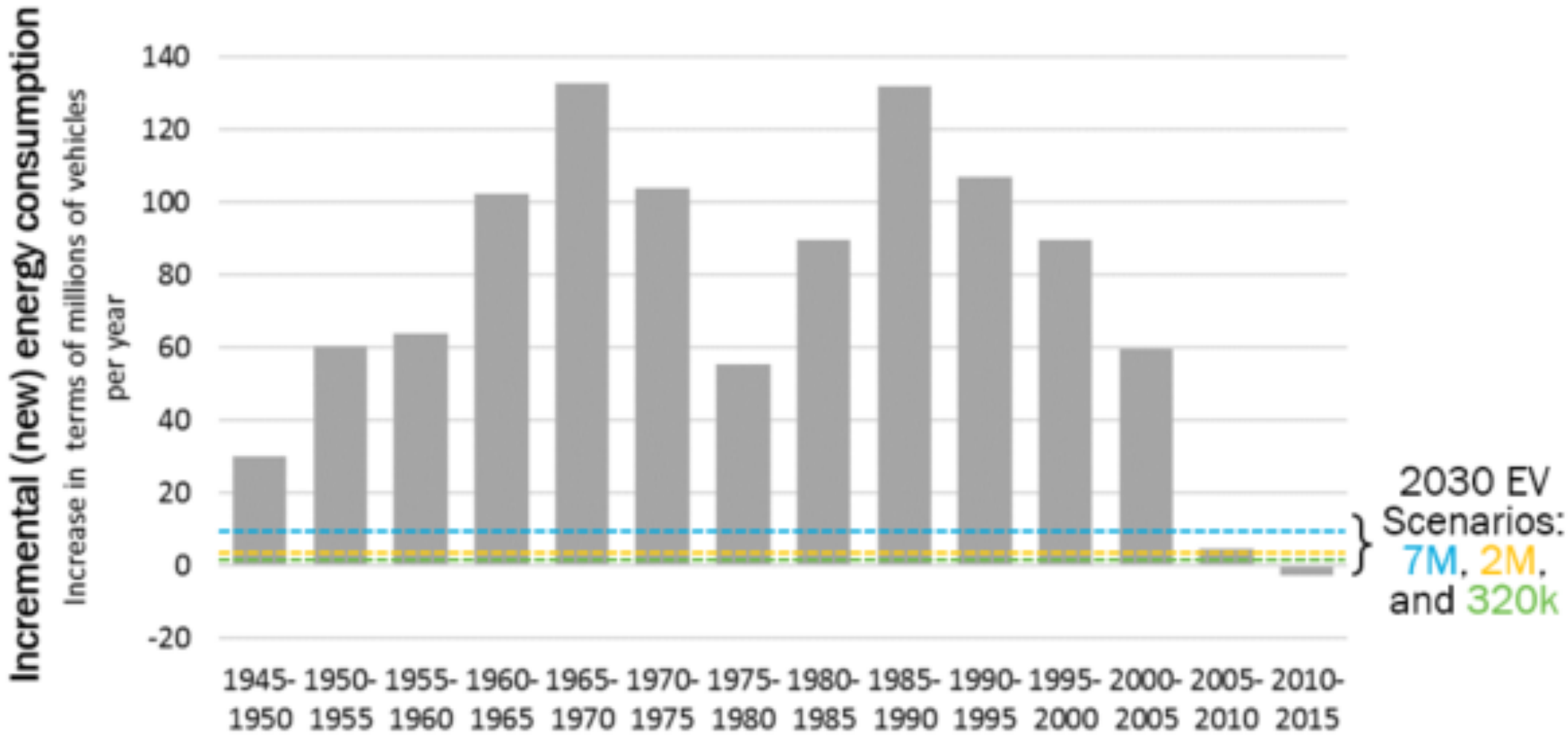
The History of Electricity Demand Includes Large Increases



Source: EPRI, 2018. *Note*: a PEV is assumed to use 3500 kWh/year; for ~12k miles per year, this is an energy consumption of about 3.5 mi/kWh