PROJECT 2X to 2050

Accelerating the Clean Energy Transition Reliably and Affordably

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Project 2X – Examining Pathways to CO_2 Reduction

2018 ----------> 2030 | 2030 ----------> 2050

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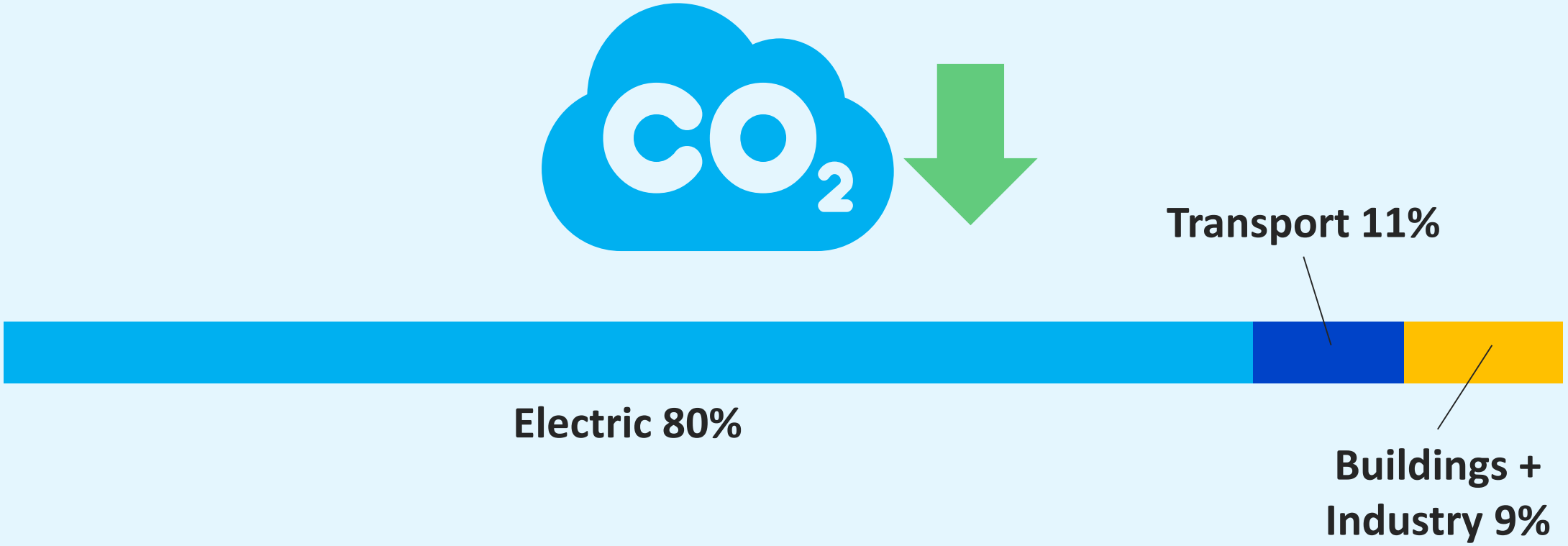
While Global CO_2 Emissions Rose Since 2005, 36 Nations Reduced Emissions

U.S. = 44% of Global CO_2 Reductions[1]

Electric Sector = 80% of U.S. CO_2 Reductions[2]



[1] BP Statistical Review of World Energy, June 2018

[2] EIA Monthly Energy Review, Feb 2019

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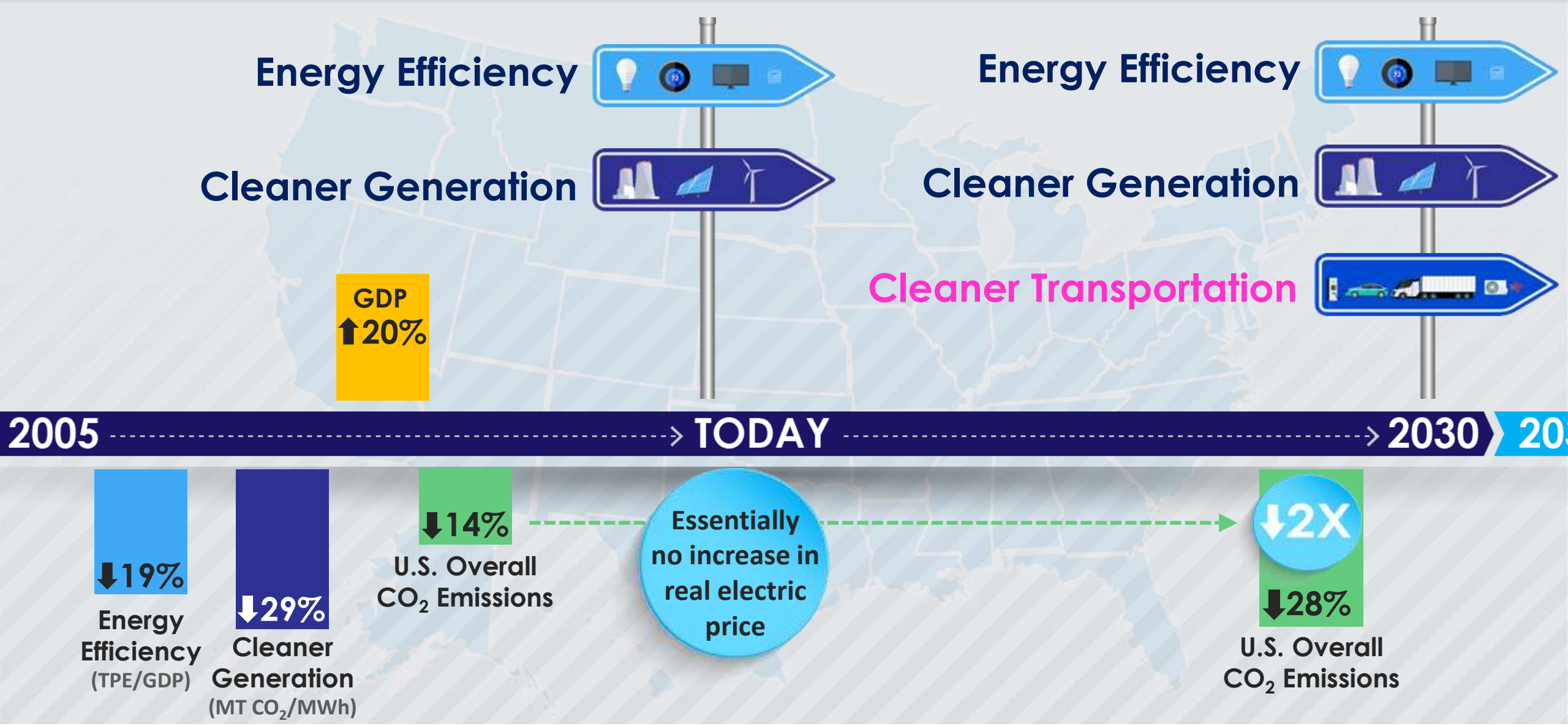
Project 2X – Examining Pathways to CO_2 Reduction



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Electrification of Vehicles Reduces Emissions and Energy Costs

Household with 2 Gasoline Vehicles

Expenses:

Gasoline | Electricity | Natural Gas | Other

Average Energy Bill:	$4,528/year
Average CO_2 Emissions:	18 tCO_2/year

Household with 1 Gasoline Vehicle and 1 Electric Vehicle

Average Energy Bill:	Average CO_2 Emissions:
$4,050/year	15 tCO_2/year
↓ 11%	↓ 17%

Average Energy Bill:	Average CO_2 Emissions:
$3,571/year	12 tCO_2/year
↓ 21%	↓ 34%

Household with 2 Electric Vehicles

Based on data from Energy Information Administration (EIA). The average U.S. household has 2.1 vehicles and 26,000 vehicle miles.

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Key to Lower Carbon: Expanded Charging Infrastructure to Support EV Adoption

160,000 gas stations

The Utility's Role

- Charge-ready grid infrastructure and charging stations
- Rates to incentivize EV smart charging
- Energy storage infrastructure for fast charging

Level 2 Stations (Workplace and Public)

2018: 50,000

2030*: 1,000,000 – 3,000,000

Fast Charging Stations

2018: 10,000

2030*: 50,000 – 80,000

**Projections based on U.S. DOE Alternative Fuels Data Center EVI-Pro Lite tool and EPRI USNEA Progressive scenario*

2018-2030 Estimated installation cost of public and workplace charging infrastructure:

$4B-$30B

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Key to Lower Carbon: Grid Flexibility

Many drivers and potential uses for 2-4 hour flexibility resource:

- System capacity and energy value
- Integration with renewable generation or EV fast charging
- Ancillary services
- Customer-side applications, e.g., reliability or demand shifting
- State and Federal mandates/incentives

Estimate of Grid Flexibility Needs Based on Capacity and Energy Value (GW)

Energy Storage & Active Demand Management Key Resource for Grid Flexibility

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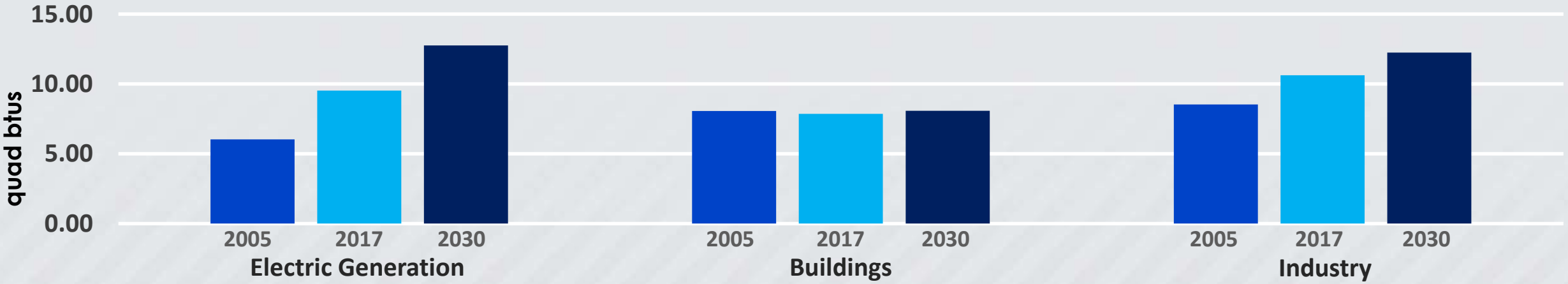
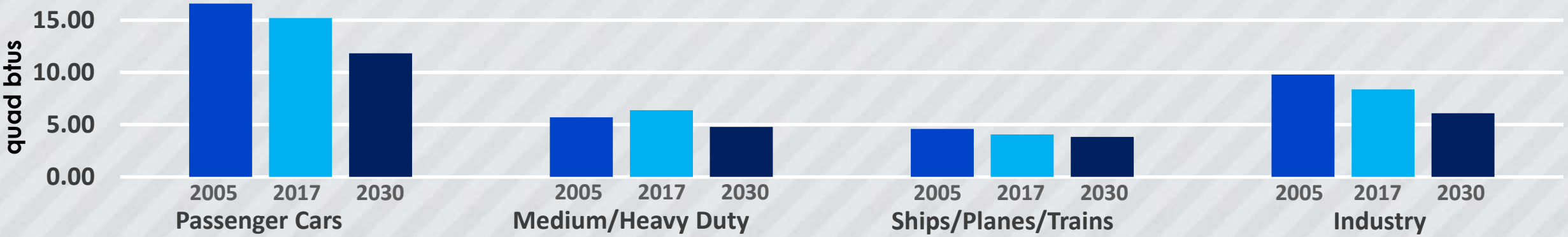
2030 Reality: Projected Natural Gas and Petroleum use in 2030

Natural Gas Use in US



Petroleum Use in US



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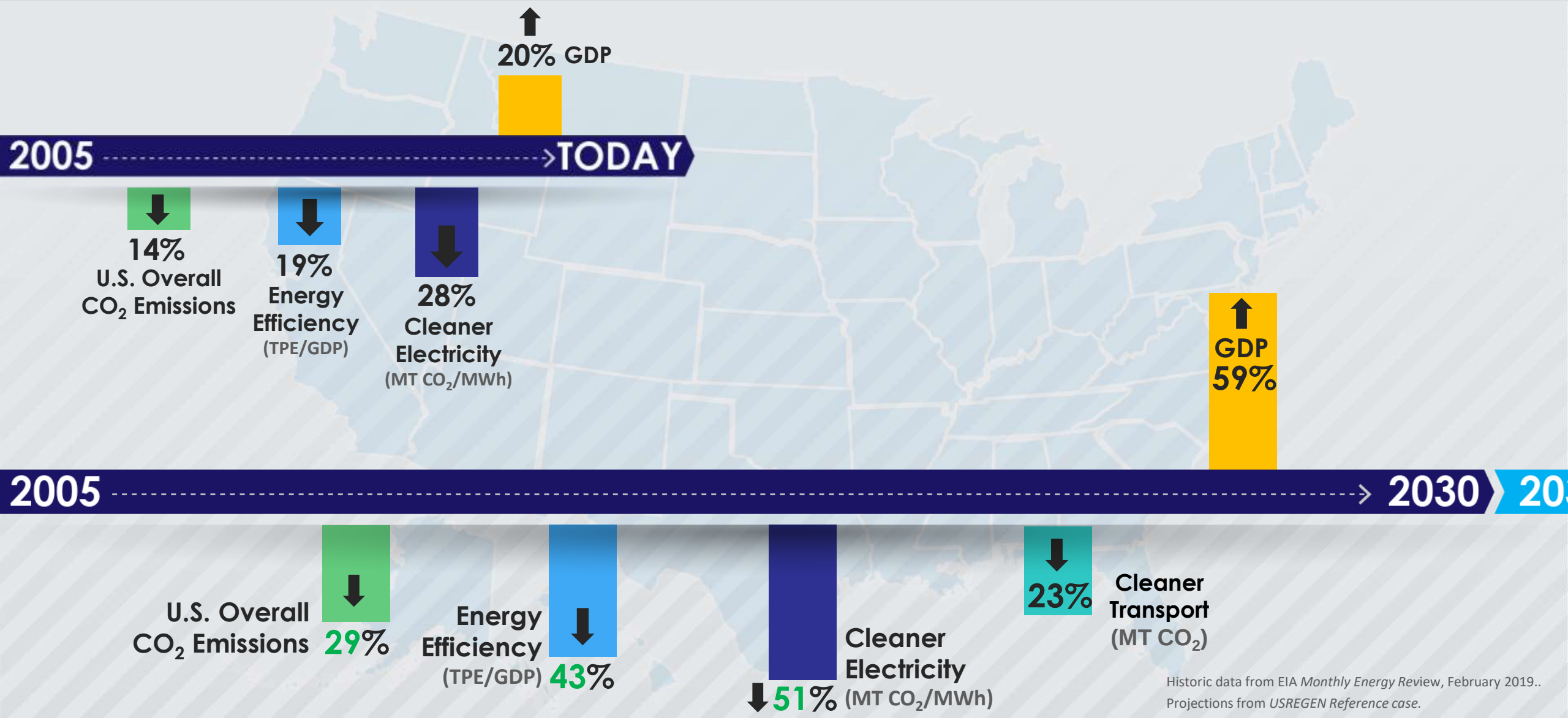
Pathway to 2X: Efficiency, Clean Generation & Electrification



Historic data from EIA *Monthly Energy Review*, February 2019..
Projections from *USREGEN Reference case.*

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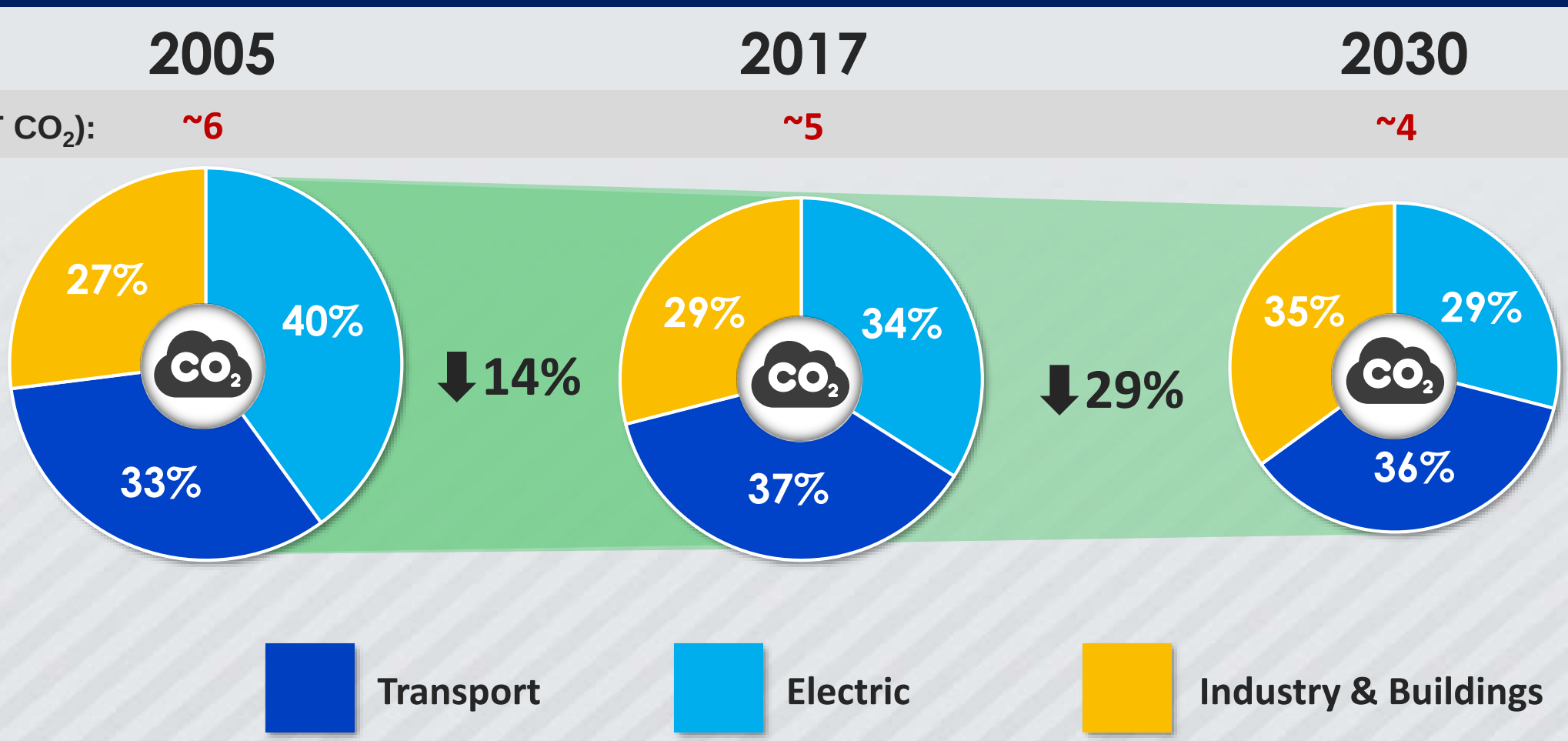
6-5-4-1: How do we get to 1GT CO2 Emission by 2050?

CO_2 Emissions by Sector[1]



[1] Historic data from EIA *Monthly Energy Review*, February 2019. Projections from *USREGEN working reference case.*

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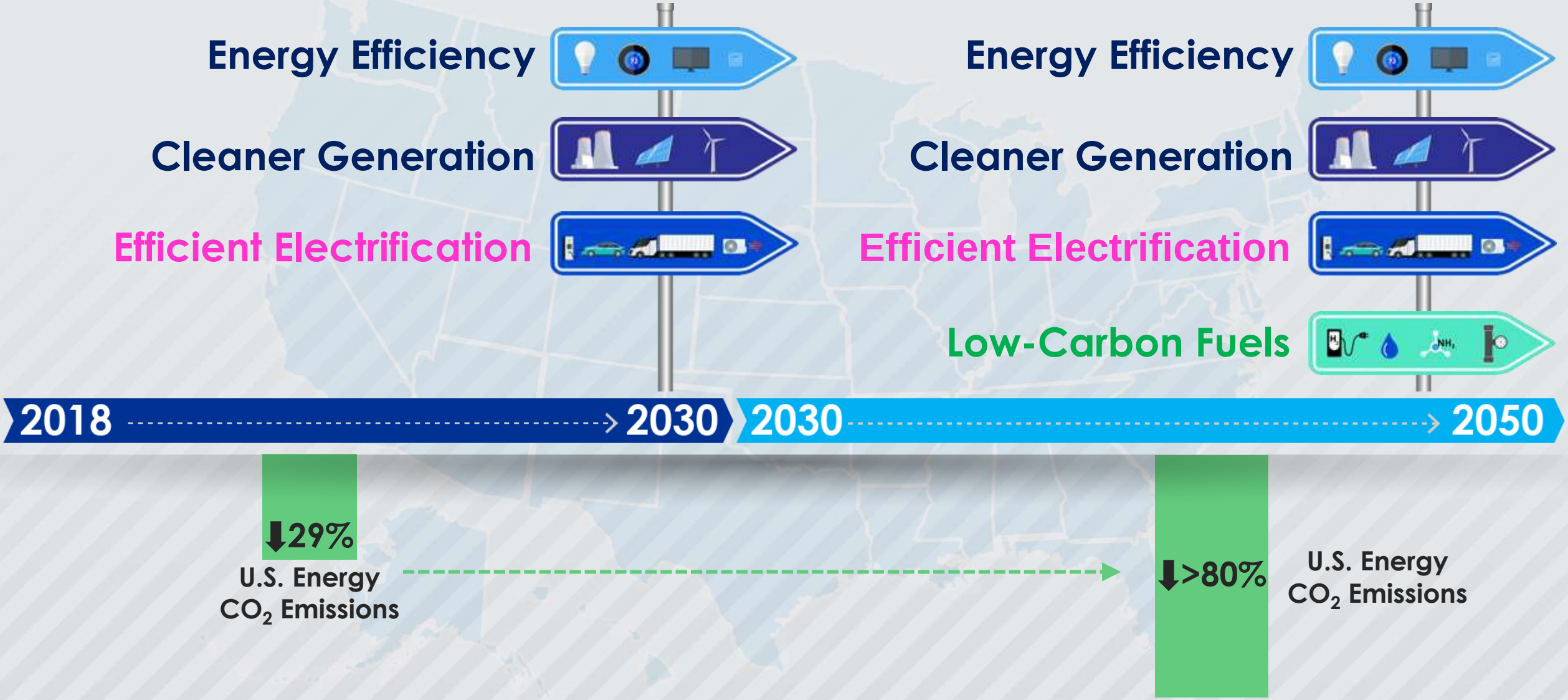
Beyond 2030



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Together…Shaping the Future of Electricity

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