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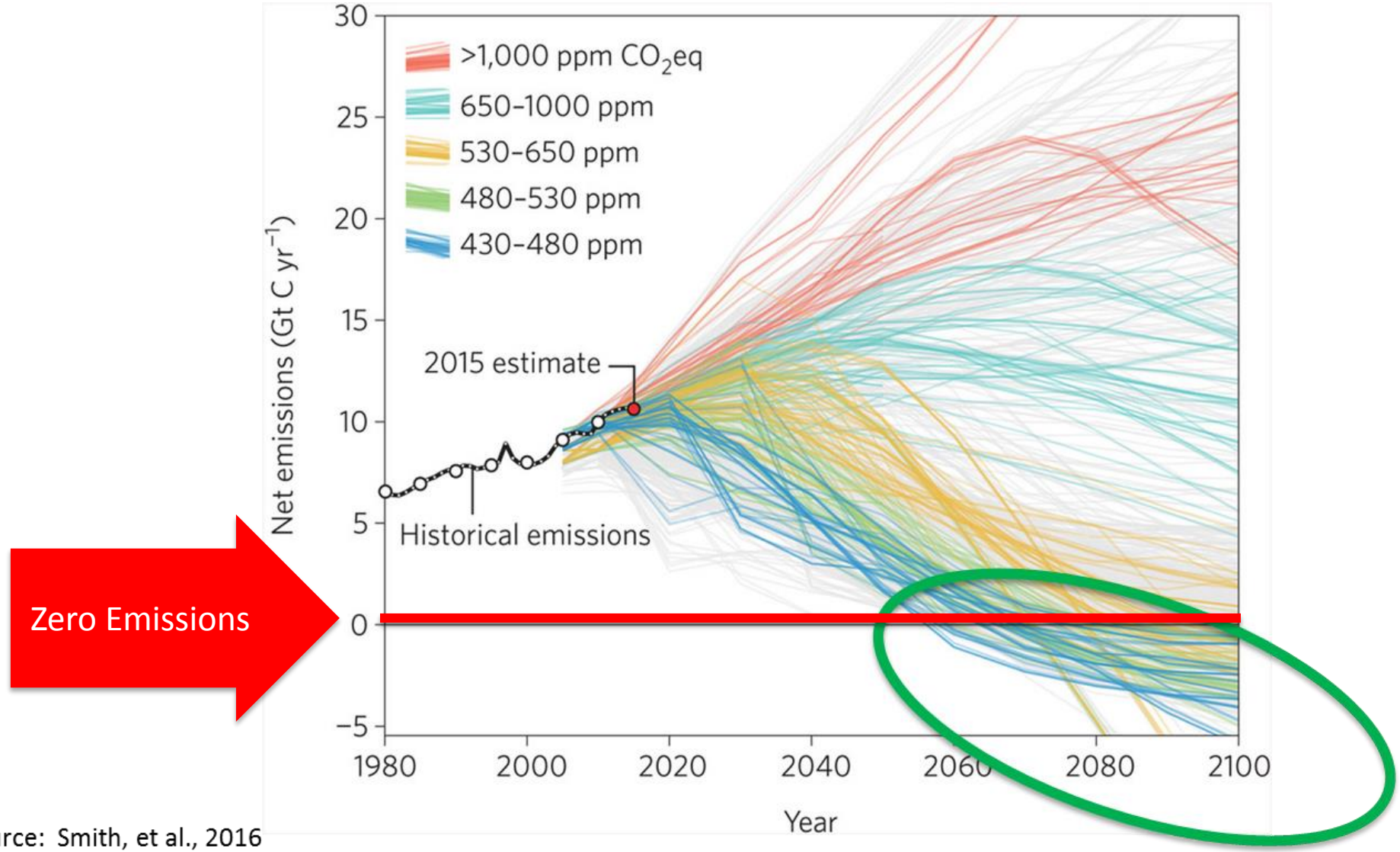
Modelling a Low Carbon Pathway for the US

May 16, 2017

James Edmonds

Asia Pacific Energy Research Centre
Annual Conference 2017
Tokyo, Japan

Two Degrees Means Zero Emissions or Lower in This Century



Source: Smith, et al., 2016

Getting to Zero—Five strategy elements

- Energy efficiency—reduce demand for energy as much as economical
- Decarbonize power generation
  - Fossil fuel with CCS
  - Renewable power
  - Nuclear power
  - Bioenergy
  - Bioenergy with CCS
- Electrify Buildings and Industry as much as economical
- Decarbonize transport
  - Electrify
  - Biofuels
  - H2
- Halt deforestation/afforestation and continue improving crop yields

Source: http://www.energy.gov/science-innovation/energy-sources/renewable-energy/wind

A 2-Degree World Is Different with and Without CO_2 Capture and Storage (CCS)

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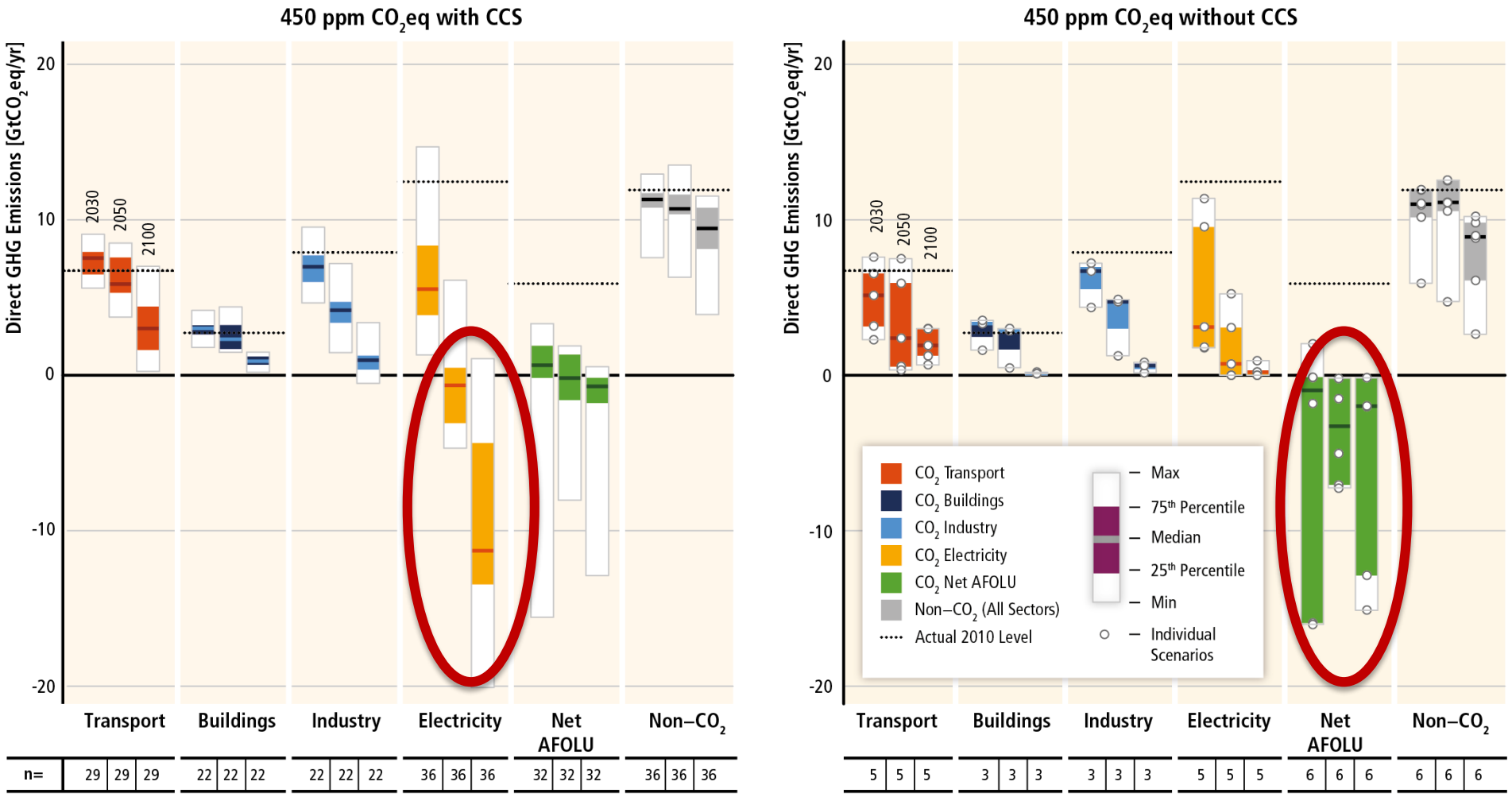
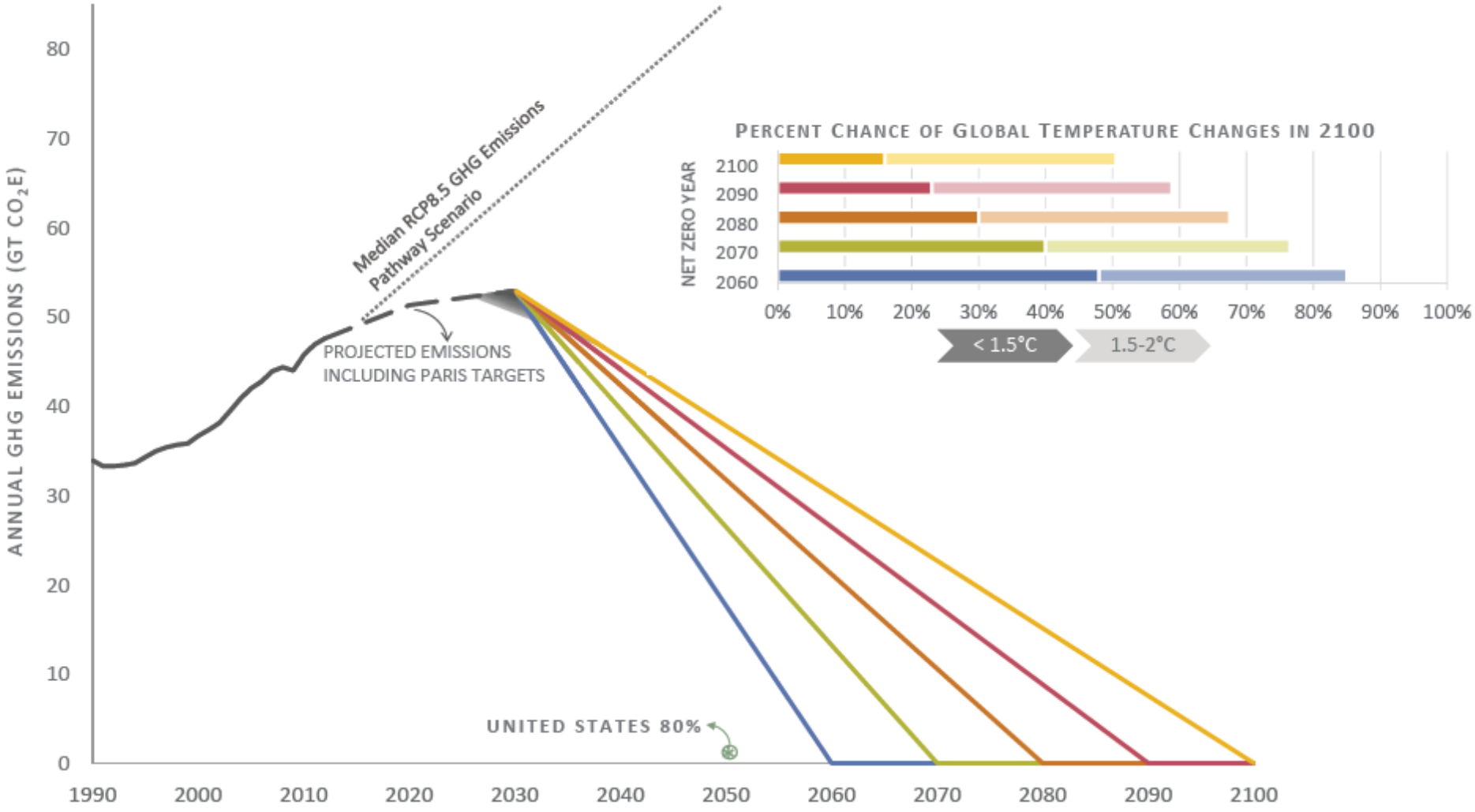


Source: IPCC, AR5, SPM


United States Mid-Century Strategy
FOR DEEP DECARBONIZATION
http://unfccc.int/files/focus/long-term_strategies/application/pdf/us_mid_century_strategy.pdf
NOVEMBER 2016

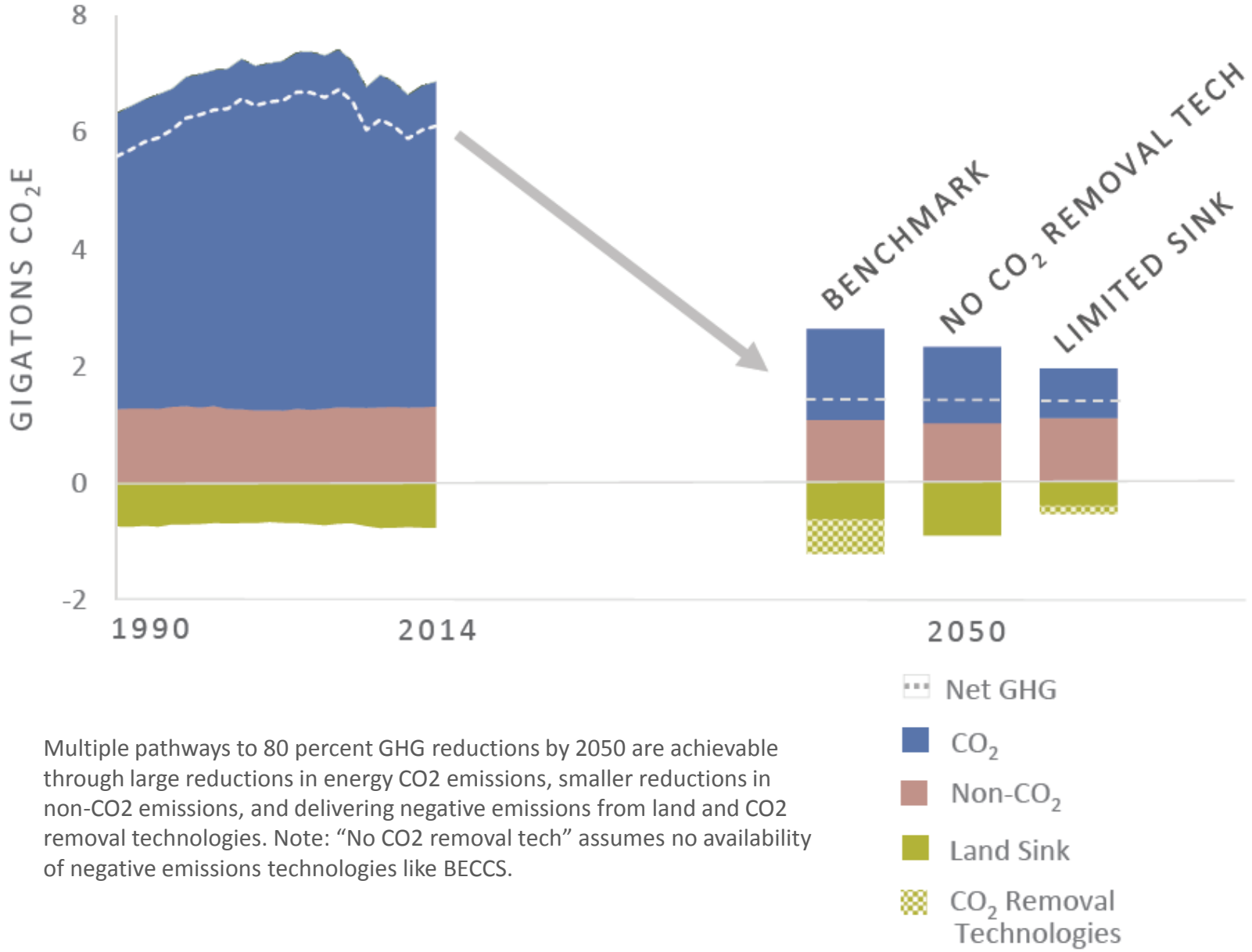
Global emissions trajectories to net-zero GHG emissions and probability of global temperature changes



The United States MCS puts the nation on a path consistent with a successful global outcome. Achieving the Paris Agreement temperature goals will require increasing global ambition leading to 2030 and steep reductions to net-zero global GHG emissions following 2030. We show the probability of staying below 2°C and 1.5°C across global scenarios by 2100. While there could be an overshoot of the Paris Agreement temperature objectives before 2100, achieving net-zero GHG emissions globally could bring temperatures below peak levels in 2100 and beyond.

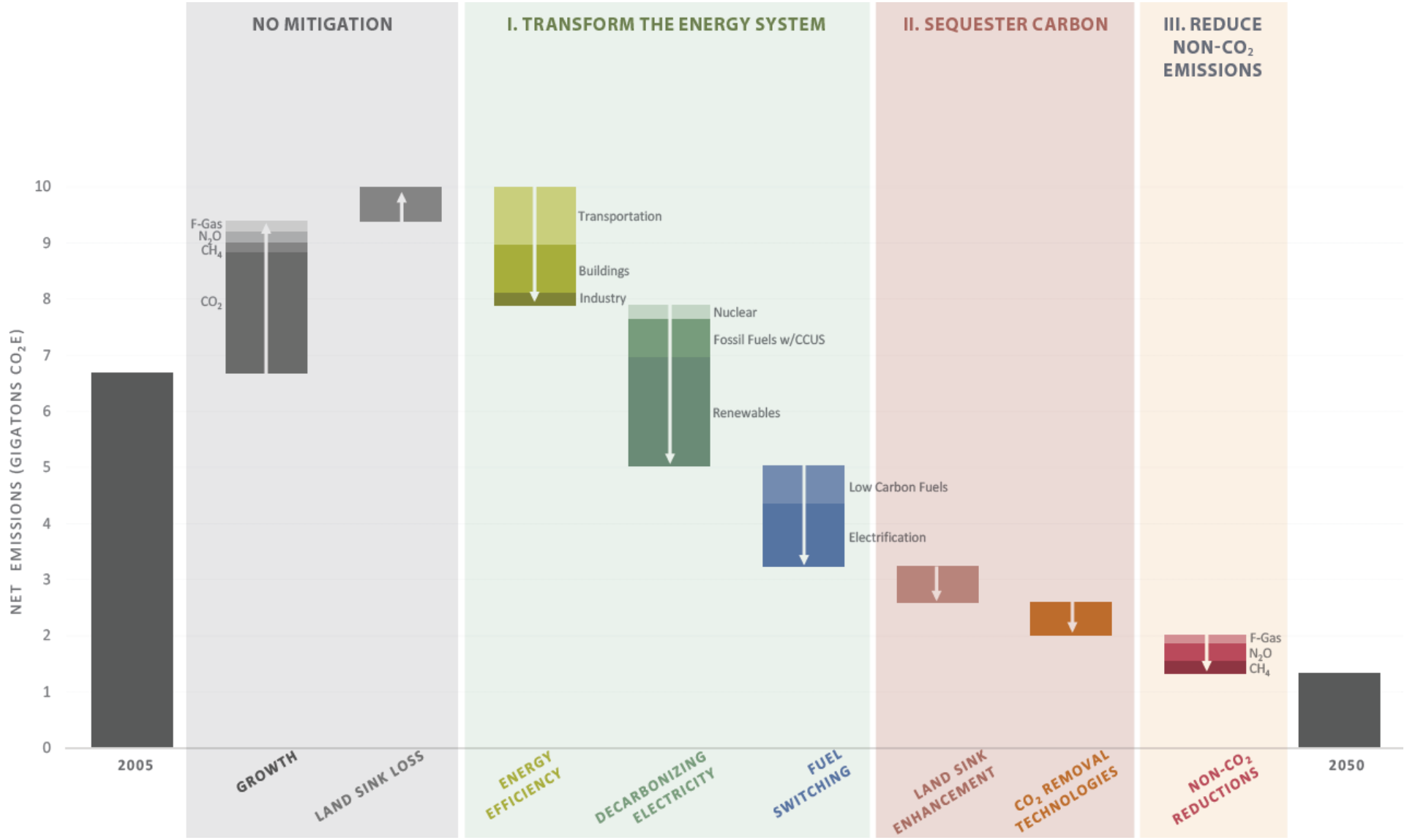

A VISION
FOR 2050

U.S. Net GHG Emissions under three MCS scenarios



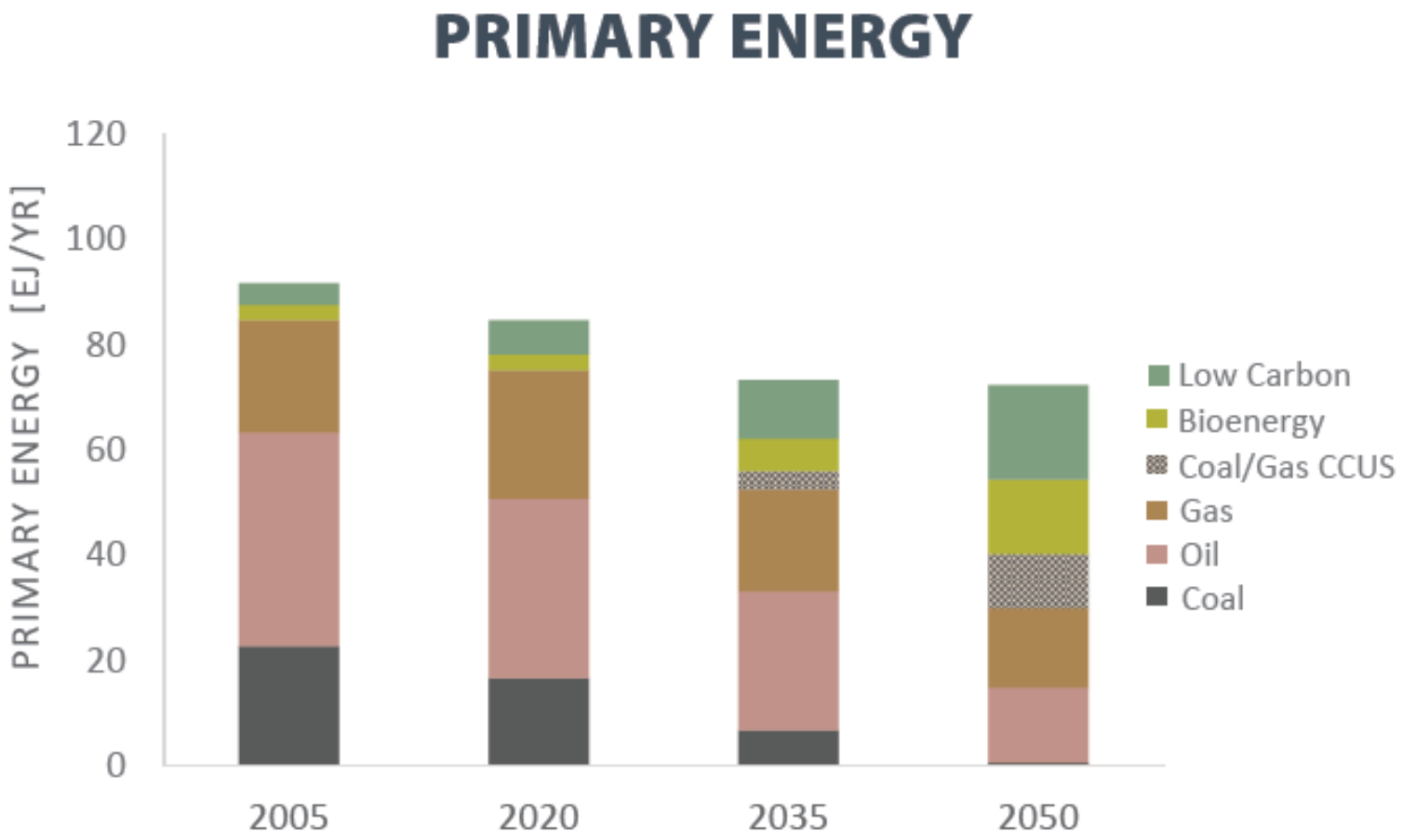
Multiple pathways to 80 percent GHG reductions by 2050 are achievable through large reductions in energy CO2 emissions, smaller reductions in non-CO2 emissions, and delivering negative emissions from land and CO2 removal technologies. Note: "No CO2 removal tech" assumes no availability of negative emissions technologies like BECCS.

Components of MCS 80 Percent GHG Reductions in MCS Benchmark Scenario



DECARBONIZING THE U.S. ENERGY SYSTEM

U.S. ENERGY SYSTEM TRANSITION BY SECTOR IN MCS BENCHMARK SCENARIO



Primary Energy declines over time with a growing economy as a result of improved energy efficiency across sectors. The electricity system is nearly decarbonized by 2050, and electricity production increases to support electrification across transportation, buildings, and industry. Efficiency increases markedly in the transportation sector, largely through the deployment of electric vehicles, which consume 1.6 to 3.7 times less energy per mile than conventional vehicles.

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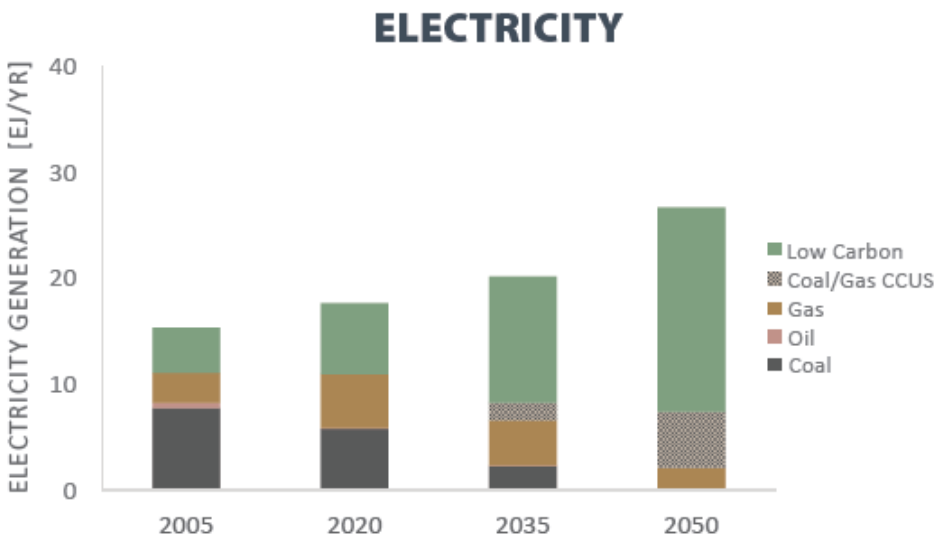

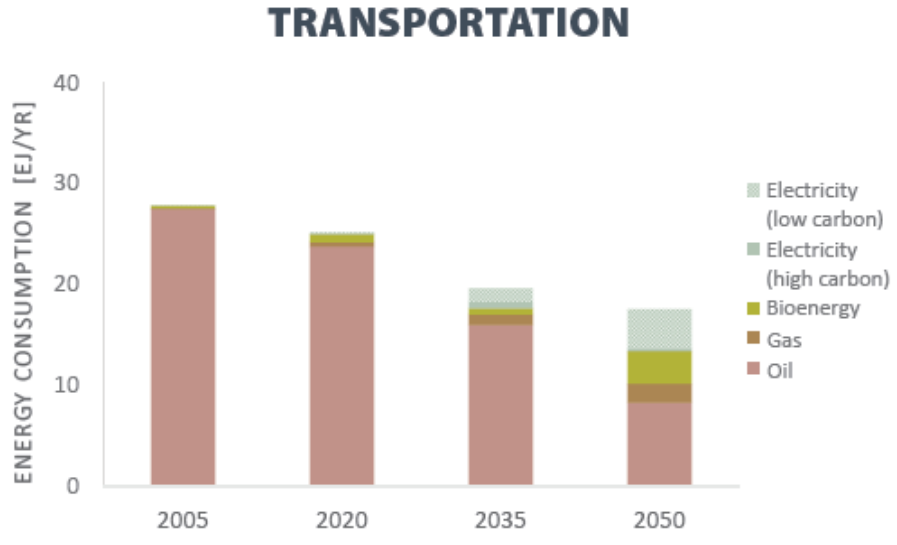

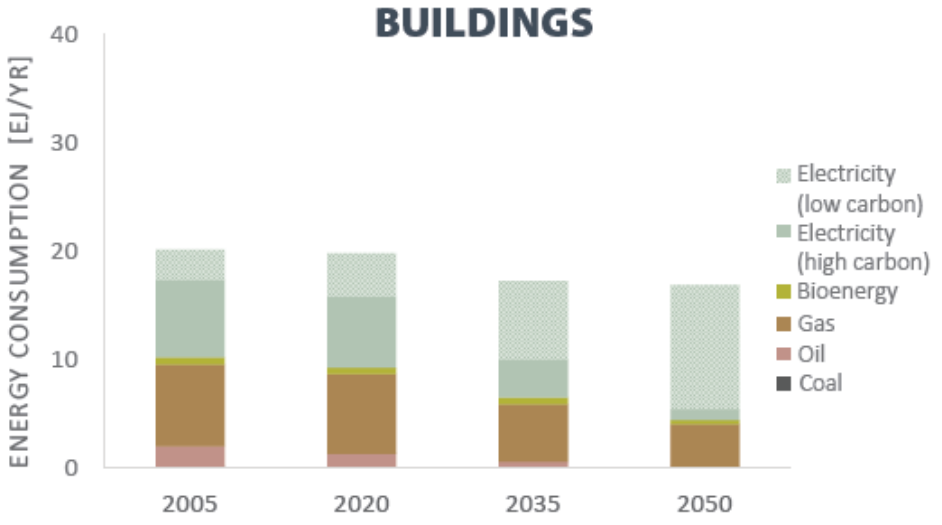

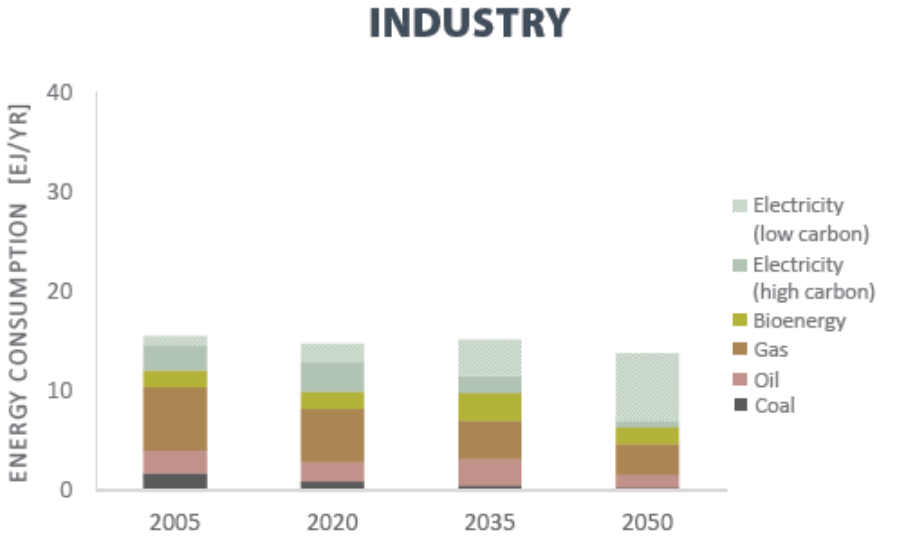

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United States Mid-Century Strategy

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Discussion