Energy+Environmental Economics

Insights on Electrification and Energy Resilience

USD Law Webinar: Energy Resilience and Deep Decarbonization

November 12th, 2021

Tory Clark, Director

Major Storms

Wildfires

Rising Sea Levels

Rising Heat/ Heatwaves

Drought

Land Subsidence

Overlapping Disasters Expose Harsh Climate Reality: The U.S. Is Not Ready

Blackouts in US Northwest due to heat wave, deaths reported

'This is code red.' Biden visits areas of New York and New Jersey hit hard by Ida.

Wildfires explode again in the West, fanned by turbulent winds

Elevated fire danger in large part of West as California's Dixie and Caldor blazes rapidly expand

Extreme weather is pummeling the Midwest, and farmers are in deep trouble

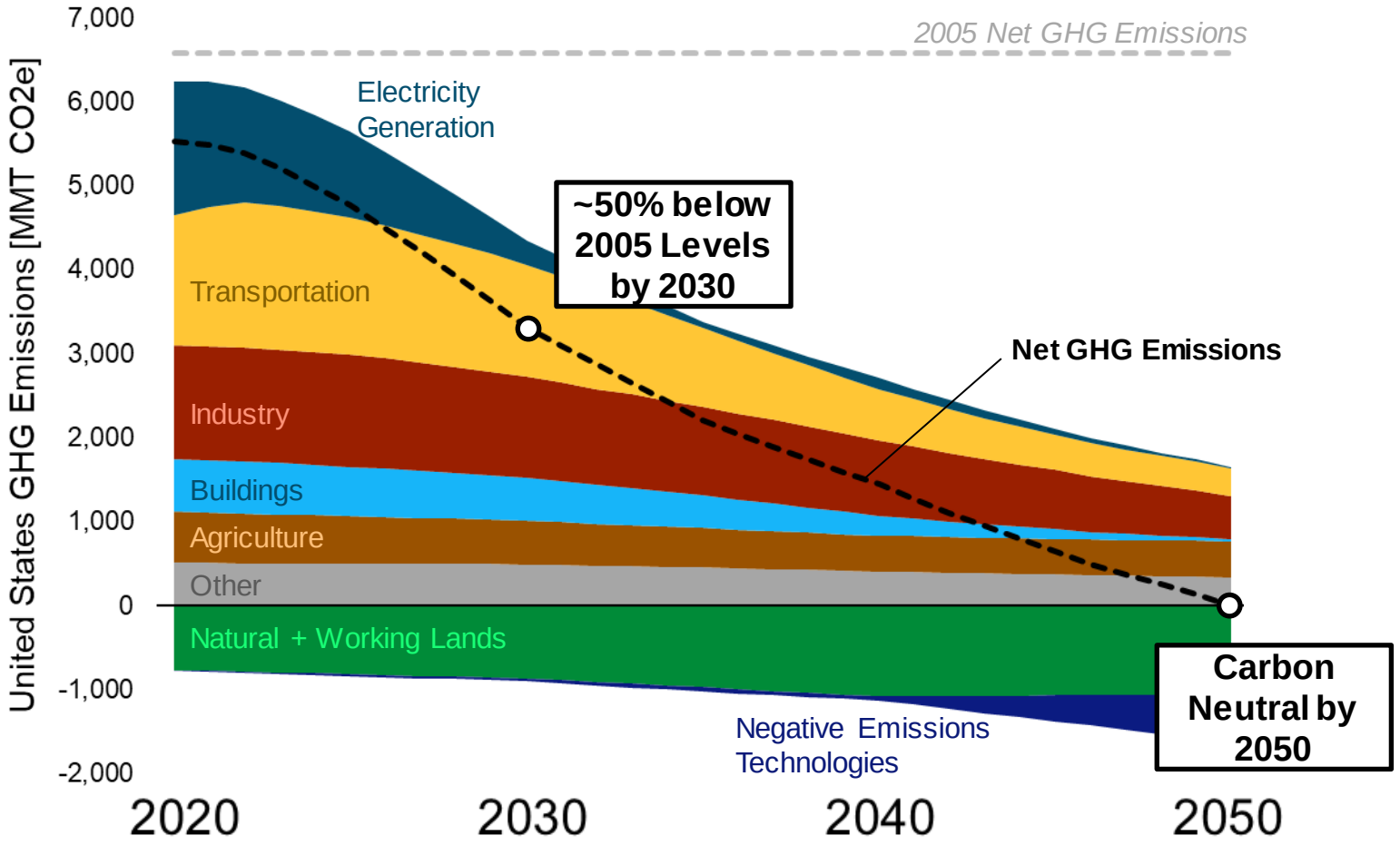
Climate Change Is Central to California's Wildfires

Hurricane Ida power outages, misery persist 9 days later

The damage in Florida from rising sea levels already is here |

Almost 70% of ERCOT customers lost power during winter storm, study finds

Achieving net zero GHGs by 2050 is our best chance of staying within a 1.5°C warming future



Key Decarbonization Actions

Coal retirements, renewable generation, energy storage, new transmission

Vehicle electrification + charging infrastructure (LDV + MHDV), improved transit and smart growth

Energy efficiency, targeted electrification and hydrogen fuel substitution, carbon capture and storage, climate-friendly refrigerants

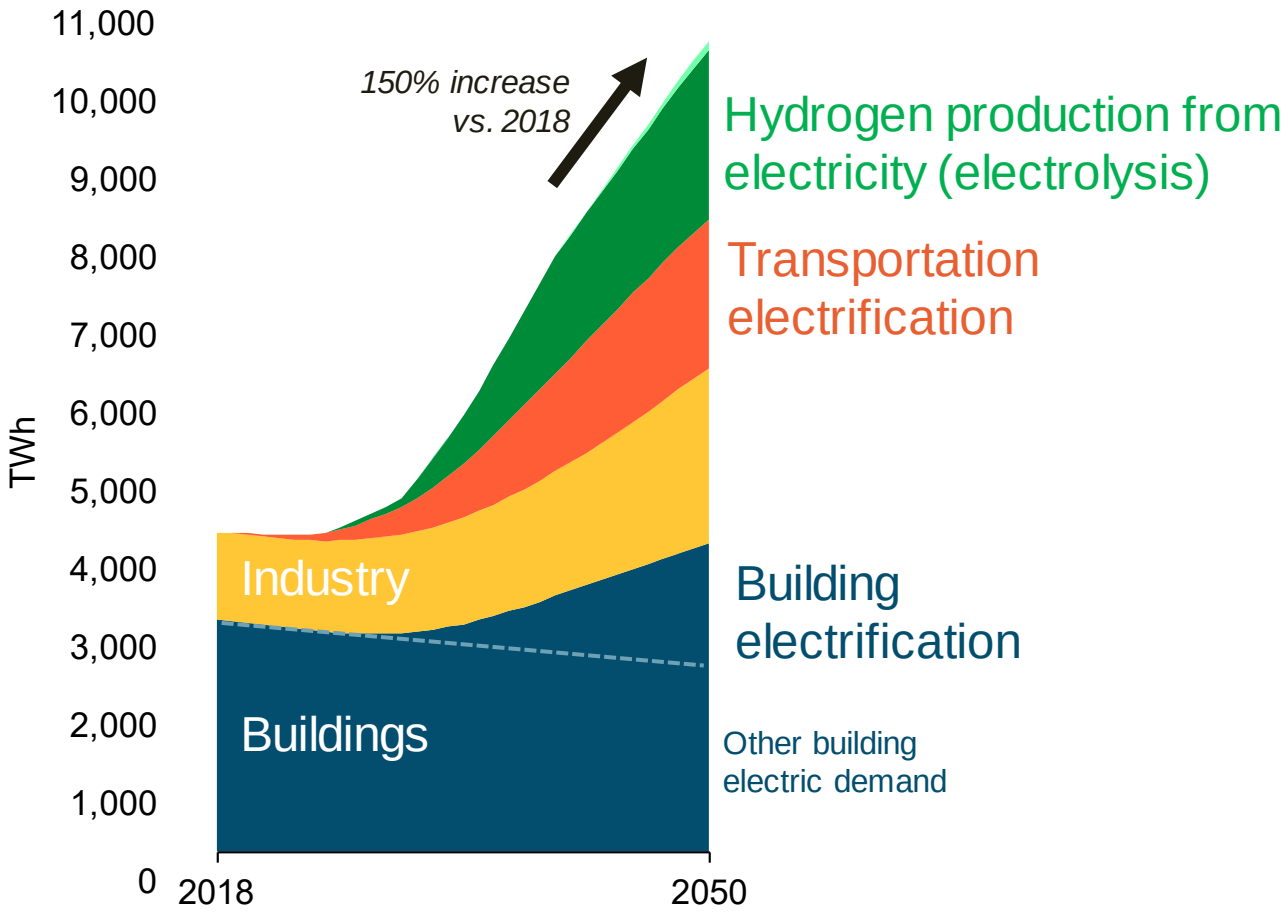
Energy efficiency, residential & commercial building electrification

Notes:

- E3 PATHWAYS analysis conducted for World Resources Institute (not yet published). Results shown above are Scenario 3
- "Industry" includes energy consumption and industrial process emissions; "Other" includes natural gas and oil systems, waste management, and coal mining
- Emissions accounting on 100-yr AR5 basis using EPA methodology

Economy-wide analysis highlights the critical need for electrification and clean electricity

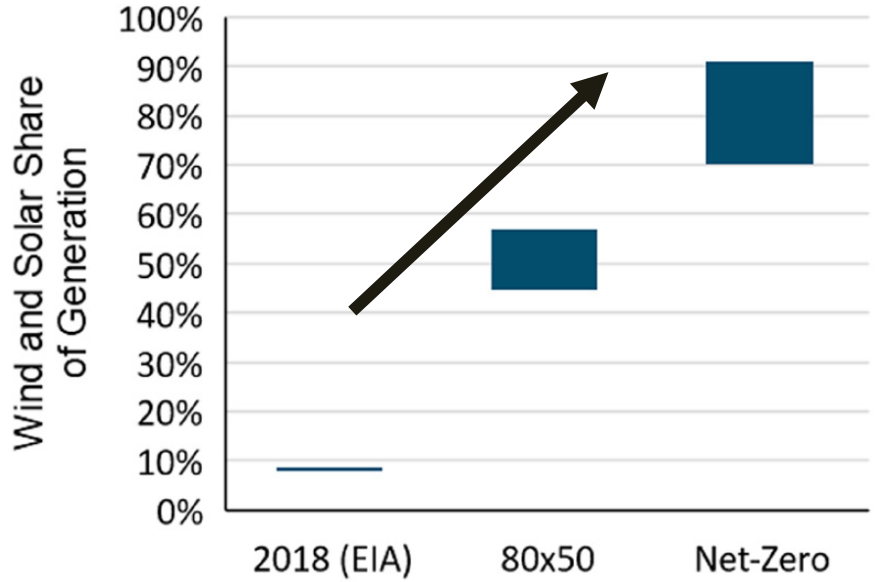
U.S. Electricity Demand under a Net Zero GHG Scenario



Source: E3 PATHWAYS analysis, 2021 (forthcoming)

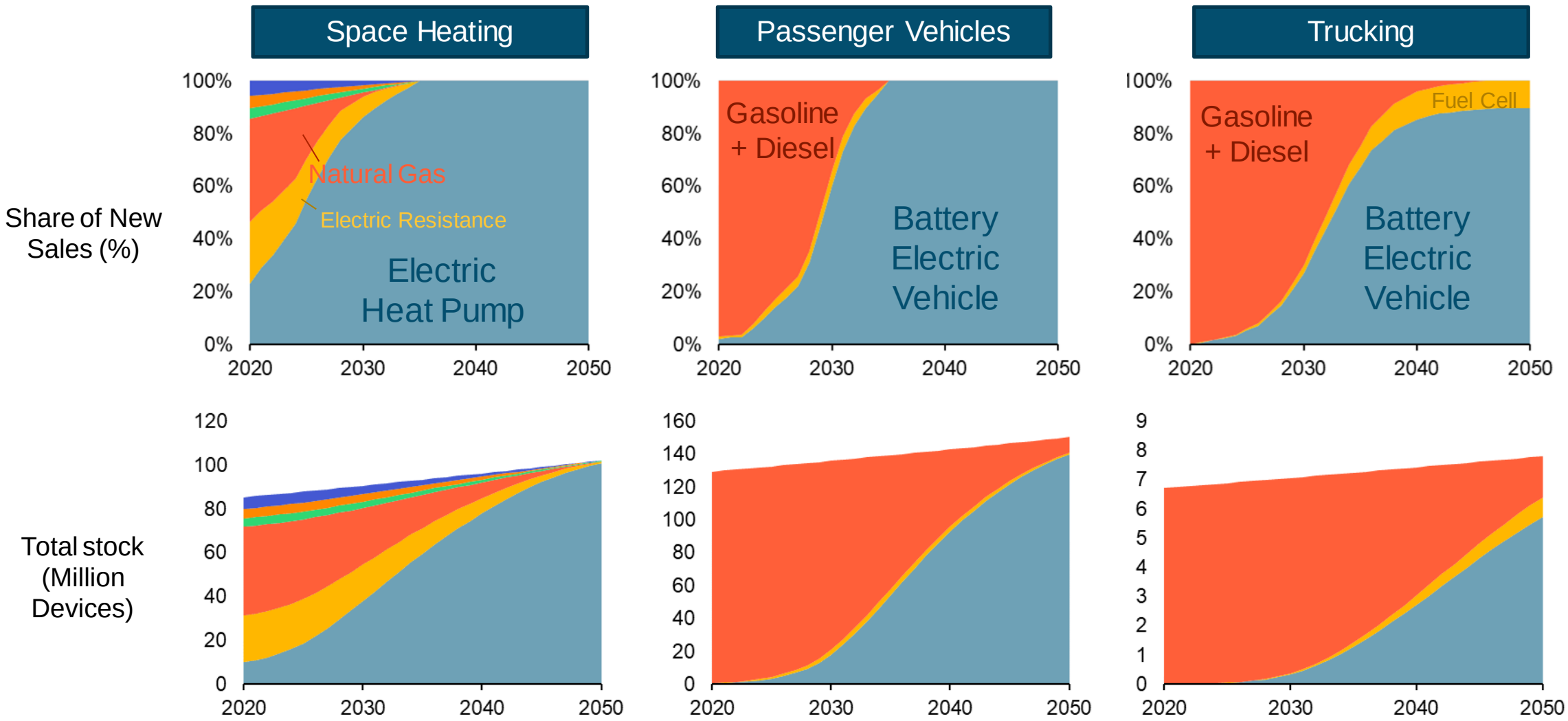
U.S. Wind and Solar Share of Generation under a Net-Zero Scenario

Figure 4 | Wind and solar combined share of electricity generation in 2050 from reviewed studies with historical comparison (results are net curtailment)



Source: "Getting to Net Zero U.S. Report", California Climate Change Institute (CCCI) and E3, 2021

Rapid deployment of electric cars and appliances will be required, relying on consumer adoption

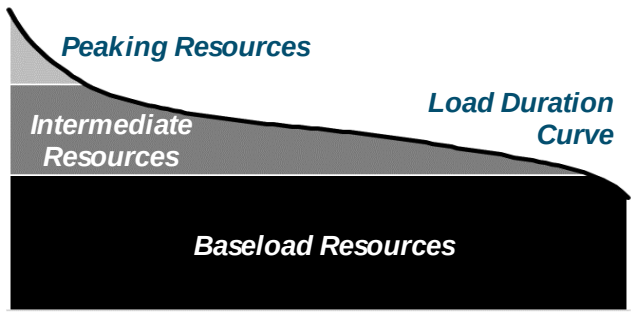


Source: Illustrative net zero scenario adoption for portion of US states

Electric resource planning must adapt to new challenges in order to maintain reliability while decarbonizing

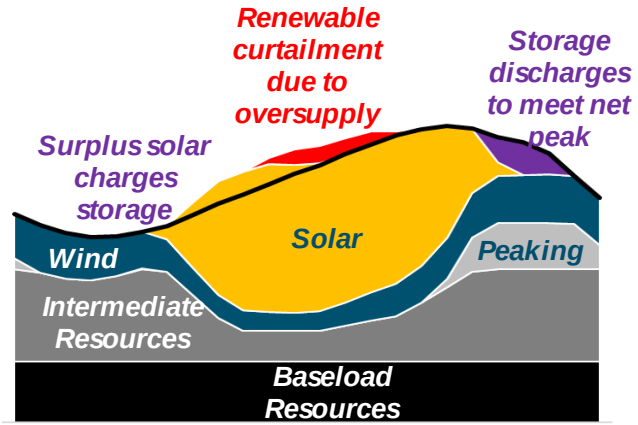
Yesterday's Planning Paradigm

+ Reliability driven by summer (or winter) **peak demand**



Today's Planning Paradigm

+ Understanding **chronological system dispatch** becomes necessary to evaluate investments & integration challenges for wind, solar, and batteries



Tomorrow's Planning Paradigm

+ Increasing investment & operational uncertainty requires greater **spatial & temporal granularity** to capture system conditions & value streams for new technologies like long duration storage

+ Reliability driven by **"dark doldrums"** when renewables are unavailable to serve demand for extended periods