

Technology Areas of Focus in a Net-Zero Energy Economy

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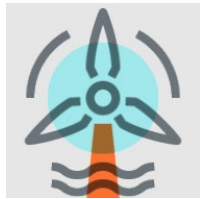


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Four Pillars of a Net-Zero or Net-Negative Energy System

U.S. Benchmarks

Electricity Decarbonization



95% reduction in emissions intensity

Energy Efficiency



40% reduction in per capita final energy demand

Electrification



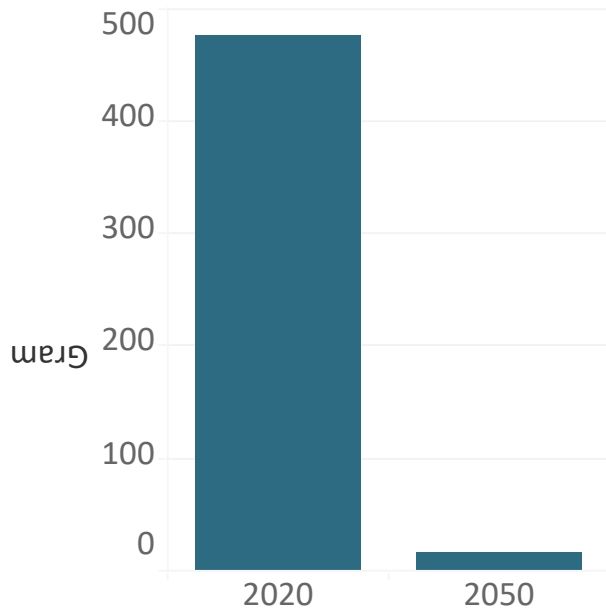
300% increase in share of energy from electricity

Carbon Capture

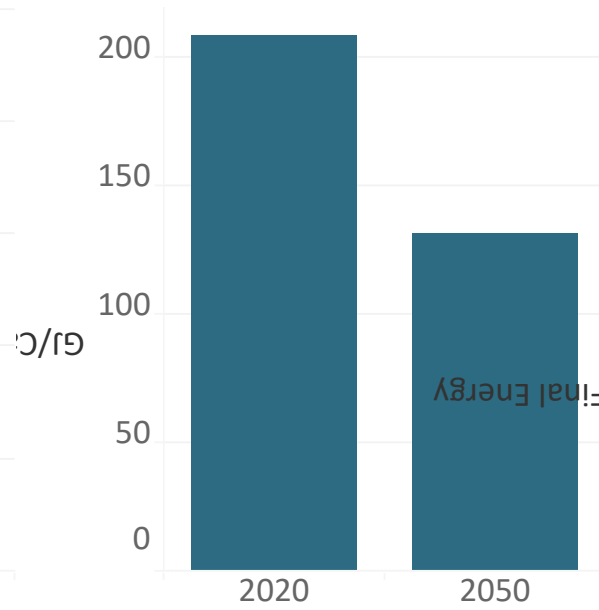


800 MMT+ carbon capture and use/storage

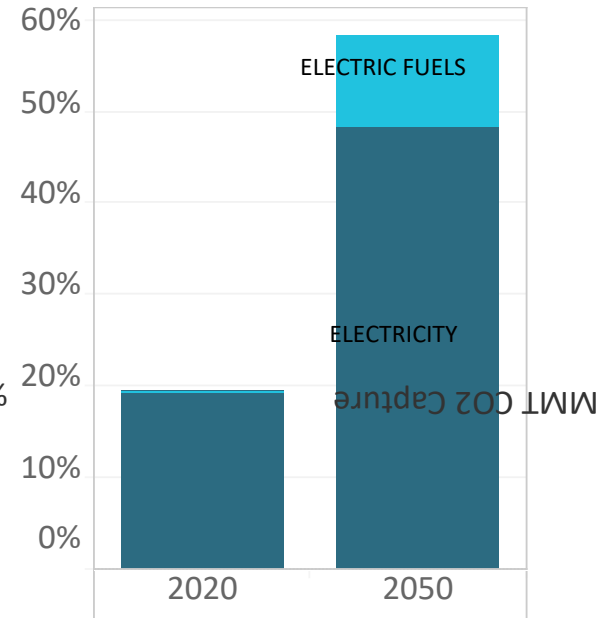
Electricity Decarbonization



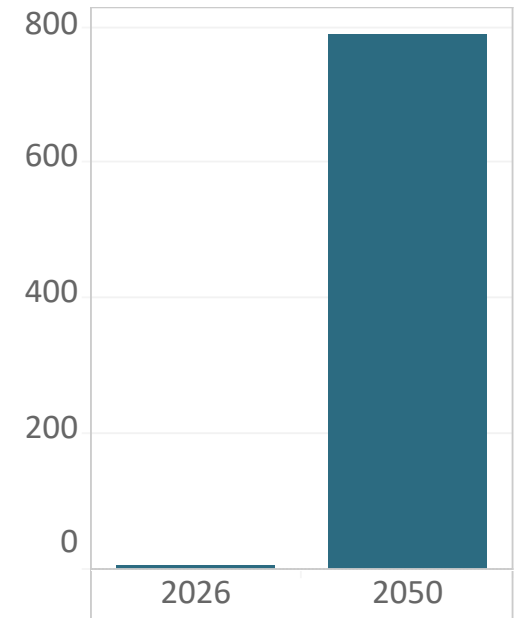
Energy Efficiency



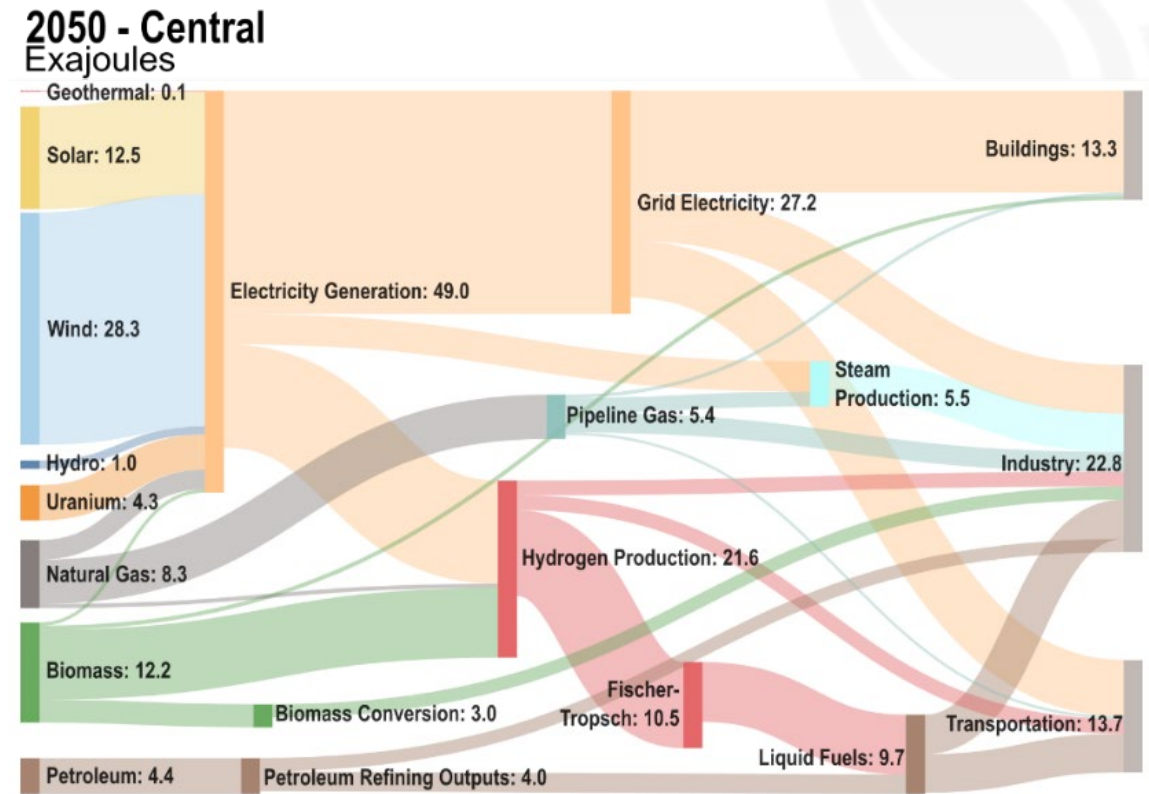
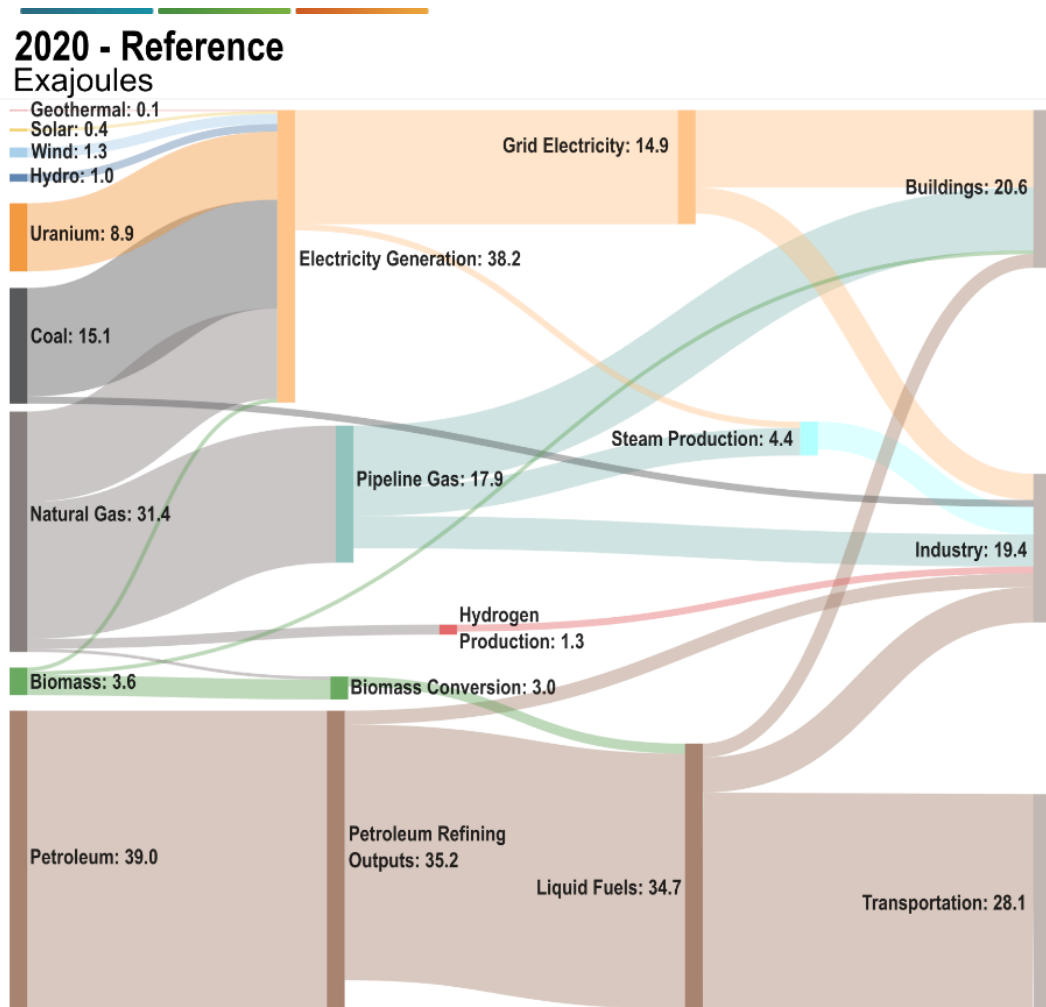
Electrification



Carbon Capture

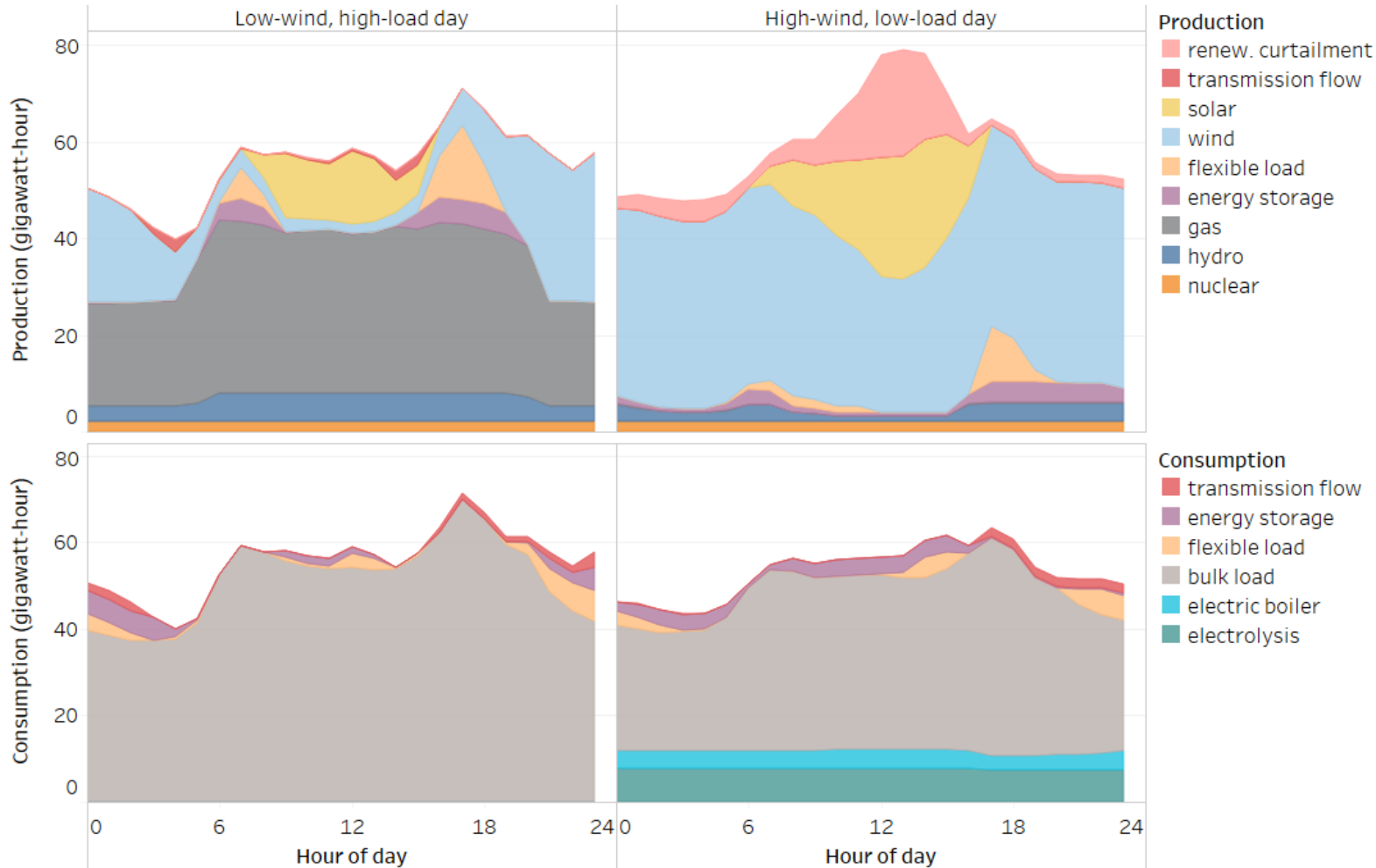


U.S. Energy System: Current vs Carbon Neutral in 2050



Decarbonized Electricity Systems

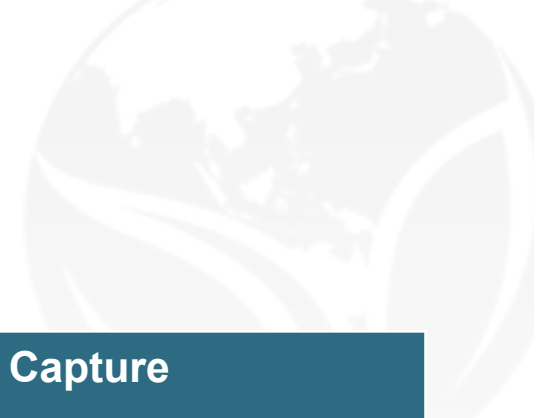
>80% wind & solar generation, thermal capacity for reliability, sector coupling



Balancing solutions

1. Thermal capacity
2. Storage
3. Flexible load
4. Transmission
5. Sectoral coupling (electrolysis & boilers)
6. Renewable curtailment

Key Technology Areas



Electricity Decarbonization	Energy Efficiency	Electrification/Fuel Switching	Carbon Capture
Zero-Carbon Thermal Resources (fuel substitution, fossil with carbon capture, advanced nuclear, etc.)	Deep home retrofits	Off-road transportation (shipping, rail, aviation)	Biofuels
Electricity Storage	Industrial material efficiency	Industrial process heat	Blue H2
Sector Coupling (hybrid boilers, electrolysis, etc.)	Industrial process efficiency	Iron & Steel	BECCS H2
Flexible end-use loads		Hybrid home-heating technologies	Heavy Industry (iron & steel, cement)
			Direct Air Capture