

The Role of CO2 Infrastructure in Achieving US Economy-Wide Net-Zero Emissions

Derek Wissmiller, *PhD, Director of Energy Systems Modeling* DOE CO2 Transport Workshop | 2/22/2023

Energy transitions will require development, deployment and adoption of **low-cost**, **low-carbon** energy **systems** at scale.







Net-Zero 2050: U.S. Economy-Wide Deep Decarbonization Scenario Analysis

Report Available at: lowcarbonlcri.com/netzero

Economy-Wide Net-Zero 2050 Analysis – Pathways



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Economy-Wide Net-Zero 2050 Analysis – Scenarios 💰



	All Options	Higher Fuel Cost	Limited Options
Geologic Storage of CO ₂	Lower Costs	Higher Costs	Not Available
Natural Gas Supply Costs	Lower Costs	Higher Costs	Lower Costs
Bioenergy Feedstock Supply	Full	Supply Limited	Supply Limited



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Economy-Wide Net-Zero 2050 Analysis – Scenarios 💰



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Primary and Final Energy in Net-Zero 2050 Scenarios





*Carbon capture, with storage or utilization

**Low-carbon fuels include hydrogen, hydrogen-derived fuels (e.g., synthetic fuels and ammonia) and bioenergy.



Primary and Final Energy in Net-Zero 2050 Scenarios



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Primary and Final Energy in Net-Zero 2050 Scenarios



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Pipeline Gas Supply and Infrastructure in Net-Zero Scenarios



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Coal w/ CC Natural Gas w/ CC Biomass & Waste w/ CC

> bars represent range of values across net-zero scenarios

Carbon management in net-zero energy systems



	LOW-CARBON RESOURCES INITIATIVE	Coal w/ CC Natural Gas w/ CC Biomass & Waste w/ CC	bars represent range of values across net-zero scenarios
nt	Carnegie Mellon University	Coal w/ CC Natural Gas w/ CC Biomass & Waste w/ CC	not reported not reported
	PRINCETON UNIVERSITY	Coal w/ CC Natural Gas w/ CC Industry Biomass & Waste w/ CC	
	EVOLVED ENERGY RESEARCH	Coal w/ CC Natural Gas w/ CC Hydrogen Industry Biomass & Waste w/ CC	
GtCO2	-2.0 -1.8 -1.6 -1.4 -1.2 -1.0	-0.8 -0.6 -0.4 -0.2 0	0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4



al w/ CC as w/ CC te w/ CC DAC bars represent range of values across net-zero scenarios	Coal w/ CC Natural Gas w/ CC Biomass & Waste w/ CC DAC
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al w/ CC as w/ CC Industry te w/ CC DAC	PRINCETON Coal w/ CC Natural Gas w/ CC Industry Biomass & Waste w/ CC DAC
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Nature Na	Coal w/ CC ral Gas w/ CC Waste w/ CC DAC bars represent range of values across net-zero scenarios
Carnegie Mellon University Biomass &	Coal w/ CCnot reportedral Gas w/ CCnot reportedWaste w/ CCDACSequestration
PRINCETON UNIVERSITY Biomass &	Coal w/ CC ral Gas w/ CC Industry Waste w/ CC DAC DAC
EVOLVED Natu ENERGY RESEARCH Biomass &	Coal w/ CC ral Gas w/ CC Hydrogen Industry Waste w/ CC DAC DAC



	CRI OW-CARBON ESOURCES INITIATIVE	Coal w/ CC Natural Gas w/ CC Biomass & Waste w/ CC	
		DAC	<i>bars represent range of values</i>
		Sequestration	across net-zero scenarios
		Utilization	
Comment		Coal w/ CC	not reported
Carnegie Mellon		Natural Gas w/ CC	not reported
University		Biomass & Waste w/ CC	
		DAC	
		Sequestration	
		Utilization	
		Coal w/ CC	
	INCETON	Natural Gas w/ CC	
🔨 UNIVERSITY	- Industry		
•		Biomass & Waste w/ CC	
		DAC	
		Sequestration	
		Utilization	
		Coal w/ CC	
EVOLVED	Natural Gas w/ CC		
	ENERGY	Hydrogen	
	RESEARCH	Industry	
		Biomass & Waste w/ CC	
		DAC	
		Sequestration	
		Utilization	



Holistic Infrastructure Planning





Holistic Infrastructure Planning







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backup

CO₂ Emission Reductions by Sector, 2005–2050 Net-Zero 2050 Scenarios



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2050 Electric Generation Capacity By Resource Ranges (GW) from Net-Zero 2050 Scenarios





