

The National Academies of SCIENCES ENGINEERING MEDICINE

The National Academies report *Accelerating Decarbonization of the U.S. Energy System* outlines the key technological and socio-economic goals that must be achieved to put the United States on the path to reach net-zero carbon emissions by 2050. This document presents the report's policy recommendations, outlining critical near-term actions for the first decade (2021-2030) of this 30-year effort.

For more information about the report, and to access a filterable web version of this table, please visit nap.edu/decarbonization.

ICON COLOR KEY

DARK GREEN icons indicate that the policy is highest priority and indispensable to achieve the goal.

MEDIUM GREEN icons indicate that the policy is important to achieve the goal.

LIGHT GREEN icons indicate that the policy would play a supporting role.

TECHNOLOGY GOALS



Produce carbon-free electricity: The nation needs to double the share of electricity generated by non-carbon-emitting sources to at least 75% by 2030.



Electrify energy services in transportation, buildings, and industry: By 2030, the nation should aim for 50% of new vehicle sales across all classes to be zero-emission vehicles and replace 20% or more of fossil fuel furnaces with electric heat pumps.



Invest in energy efficiency and productivity: By 2030, total energy use by new buildings should be reduced by 50%. Goals for industrial energy productivity (dollars of economic output per energy consumed) should increase each year.



Plan, permit, and build critical infrastructure: By 2030, the nation should increase overall electrical transmission capacity by approximately 40% in order to better distribute high quality and low-cost wind and solar power from where it is generated to where it can be used across the country.



Expand the innovation toolkit: The nation should triple federal investment in clean energy research, development, and demonstration (RD&D) and research to better understand how to manage a socially-just energy transition.

SOCIO-ECONOMIC GOALS



Strengthen the U.S. economy: The transition to a net-zero emissions economy provides an opportunity to revitalize U.S. manufacturing, construction, and commercial sectors, while providing a net increase in jobs paying higher wages than the national average.







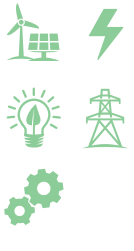











Promote equity and inclusion: Policies that facilitate the transition to a net-zero emissions economy should also work to eliminate inequities in the current energy system that disadvantage historically marginalized and low-income populations.

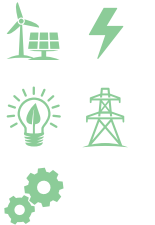

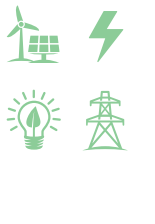





















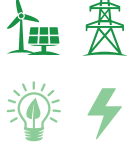











Support communities, businesses, and workers: U.S. policies should promote fair access to new long-term employment opportunities and provide financial and other support to communities that might otherwise be harmed by the transition.









Maximize cost-effectiveness: A cost-effective strategy (balanced by equity considerations) will reduce carbon emissions, strengthen the U.S. economy, and avoid undue burdens on American households and businesses during the transition to a net-zero emissions economy.

Policy	Technology Goals	Socio-Economic Goals	Gov Entities	Appropriation, if Any	Notes				
Establish U.S. commitment to a rapid, just, equitable transition to a net-zero carbon economy.									
U.S. CO ₂ and other GHG emissions budget reaching net zero by 2050.			Executive and Congress	\$5 million per year.	Budget is central for imposing emissions discipline, although any consequences for missing the target must be implemented through other policies. Funds are primarily for administration of the budget and data collection and management.				
Economy-wide price on carbon.			Congress	None. Revenue of \$40/tCO ₂ rising 5% per year, which totals approximately \$2 trillion from 2020 to 2030.	Carbon price level not designed to directly achieve net-zero emissions. Additional programs will be necessary to protect the competitiveness of import/export exposed businesses.				
Establish 2-year federal National Transition Task Force to assess vulnerability of labor sectors and communities to the transition of the U.S. economy to carbon neutrality.			Congress	\$5 million per year.	Task force responsible for design of an ongoing triennial national assessment on transition impacts and opportunities to be conducted by the Office of Equitable Energy Transitions.				
ICON KEY 	 Produce carbon-free electricity	 Electrify energy services	 Energy efficiency and productivity	 Build critical infrastructure	 Expand innovation toolkit	 Strengthen the U.S. economy	 Promote equity and inclusion	 Support communities, businesses, and workers	 Maximize cost-effectiveness

Policy	Technology Goals	Socio-Economic Goals	Gov Entities	Appropriation, if Any	Notes
<p>Establish White House Office of Equitable Energy Transitions.</p> <ul style="list-style-type: none"> Establish criteria to ensure equitable and effective energy transition funding. Sponsor external research to support development and evaluation of equity indicators and public engagement. Report annually on energy equity indicators and triennially on transition impacts and opportunities. 			Congressional appropriation	\$25 million per year, rising to \$100 million per year starting in 2025.	Federal office establishes targets and monitors and advances progress of federal programs aimed at a just transition.
<p>Establish an independent National Transition Corporation to ensure coordination and funding in the areas of job losses, critical location infrastructure, and equitable access to economic opportunities and wealth, and to create public energy equity indicators.</p>			Congressional appropriation	\$20 billion in funding over 10 years.	Primary means to mediate harms that occur during transition, including support for communities that lose a critical employer, support for displaced workers, abandoned site remediation, and opportunities for communities to invest in a wide range of clean energy projects.
Set rules/standards to accelerate the formation of markets for clean energy that work for all.					
<p>Set energy standard for electricity generation, designed to reach 75% zero-emissions electricity by 2030 and decline in emissions intensity to net-zero emissions by 2050.</p>			Congress	None.	
<p>ICON KEY</p>  <ul style="list-style-type: none">  Produce carbon-free electricity  Electrify energy services  Energy efficiency and productivity  Build critical infrastructure  Expand innovation toolkit  Strengthen the U.S. economy  Promote equity and inclusion  Support communities, businesses, and workers  Maximize cost-effectiveness 					

Policy	Technology Goals	Socio-Economic Goals	Gov Entities	Appropriation, if Any	Notes
Set national standards for light-, medium-, and heavy-duty zero-emissions vehicles, and extend and strengthen stringency of CAFE standards. Light-duty ZEV standard ramps to 50% of sales in 2030; medium- and heavy-duty to 30% of sales in 2030.			Congress	None.	
Set manufacturing standards for zero-emissions appliances including hot water, cooking, and space heating. Department of Energy (DOE) continues to establish appliance minimum efficiency standards. Standard ramps down to achieve close to 100% all-electric in 2050.			Congress	None.	
Enact three near-term actions on new and existing building energy efficiency, two by DOE/Environmental Protection Agency (EPA) ^a and one by the General Services Administration (GSA).			DOE, GSA	None.	GSA to set a cap on existing and new federal buildings that declines by 3% per year.
Enact five federal actions to advance clean electricity markets, and to improve their regulation, design, and functioning. ^b			Congress	\$8 million per year for Federal Energy Regulatory Commission (FERC) Office of Public Participation and Consumer Advocacy.	Two of these actions involve FERC utilizing existing authorities and three involve congressional actions, two directed to FERC and one to DOE.
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Deploy advanced electricity meters for the retail market, and support the ability of state regulators to review proposals for time/location-varying retail electricity prices.			Congressional appropriation for DOE	\$4 billion over 10 years.	
Recipients of federal funds and their contractors must meet labor standards, including Davis-Bacon Act prevailing wage requirements; sign Project Labor Agreements (PLAs) where relevant; and negotiate Community Benefits (or Workforce) Agreements (CBAs) where relevant.			Congress	None.	
Report and assess financial and other risks associated with the net-zero transition and climate change by private companies, government agencies, and the Federal Reserve. Private companies receiving federal funds must also report their clean energy research and development (R&D) by category (wind, solar, etc.).			Congress	None.	Risk disclosures to be included in annual SEC reports for private companies. Federal Reserve to use climate-related risks in financial stress tests. Federal agencies to include climate-related risks in all benefit cost analyses. All banks to report on comparative financial investments in all energy sources.
Ensure that Buy America and Buy American provisions are applied and enforced for key materials and products in federally funded projects.			Congress	None.	

ICON KEY



Produce carbon-free electricity



Electrify energy services



Energy efficiency and productivity



Build critical infrastructure



Expand innovation toolkit



Strengthen the U.S. economy





















Promote equity and inclusion







Support communities, businesses, and workers





Maximize cost-effectiveness

Policy	Technology Goals	Socio-Economic Goals	Gov Entities	Appropriation, if Any	Notes
Establish an environmental product declaration library to create the accounting and reporting infrastructure to support the development of a comprehensive Buy Clean policy.			Congressional appropriation for EPA and DOE	\$5 million per year.	
Invest (research, technology, people, and infrastructure) in a U.S. net-zero carbon future.					
Establish a federal Green Bank to finance low- or zero-carbon technology, business creation, and infrastructure.			Congressional authorization and appropriation	Capitalized with \$30 billion, plus \$3 billion per year until 2030.	Additional requirements include public reporting of both energy equity analyses of investment and leadership diversity of firms receiving funds.
Amend the Federal Power Act and Energy Policy Act by making changes to facilitate needed new transmission infrastructure. ^c			Congress	None.	
Plan, fund, permit, and build additional electrical transmission, including long-distance high-voltage, direct current (HVDC). Require fair public participation measures to ensure meaningful community input. ^d			Congressional authorization and appropriation for DOE and FERC	\$25 million per year to DOE for planning; \$50 million per year for DOE and FERC to facilitate use of existing rights-of-way; finance build through Green Bank; \$10 million per year to DOE for distribution system innovations.	Funds provide support for technical assistance to states, communities, and tribes to enable meaningful participation in regional transmission planning and siting activities. Funds to distribution utilities to invest in automation and control technologies.
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Policy	Technology Goals	Socio-Economic Goals	Gov Entities	Appropriation, if Any	Notes
Expand EV charging network for interstate highway system. ^e			Congressional directive to Federal Highway Administration (FHWA) and National Institute of Standards and Technology (NIST); congressional appropriations to DOE	\$5 billion over 10 years to expand charging infrastructure.	<p>FHWA to expand its “alternative fuels corridor” program. NIST to develop interoperability standards for level 2 and fast chargers.</p> <p>DOE to fund expansion of interstate charging to support long-distance travel and make investments for EV charging for low-income businesses and residential areas.</p>
Expand broadband for rural and low-income customers to support advanced metering.			Congress to authorize and fund rural electric cooperatives and private companies to offer broadband	\$0.5 billion for rural electric cooperatives and \$1.5 billion for private companies.	10% of investment costs to expand capabilities of smart grid to underserved areas. Grants or loans to rural electric providers and investment tax incentives to companies, both focused on rural and low-income communities.

ICON KEY







Produce carbon-free electricity




Electrify energy services




Energy efficiency and productivity




Build critical infrastructure




Expand innovation toolkit




Strengthen the U.S. economy

















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Policy	Technology Goals	Socio-Economic Goals	Gov Entities	Appropriation, if Any	Notes
<p>Plan and assess the requirements for national CO₂ transport network, characterize geologic storage reservoirs, and establish permitting rules.^f</p> <p>Require fair public participation measures to ensure meaningful community input.</p>			<p>Congressional authorization and appropriation to multiple agencies</p>	<p>\$50 million to Department of Transportation (DOT) with other agencies involved for 5-year planning plus \$50 million for block grants for community and stakeholder engagement. \$10 billion to \$15 billion total during the 2020s to DOE, United States Geological Survey (USGS), and Department of Interior (DOI) to characterize reservoirs. Extend 45Q and increase to \$70/tCO₂—\$2 billion per year.</p>	<p>Modeling studies and other analysis indicate that significant amounts of negative emissions will be needed to meet net-zero emissions. The CO₂ pipeline network is needed even with 100% non-fossil electric power to enable carbon capture at cement and other industrial facilities with direct process emissions of greenhouse gases and to enable capture of CO₂ from biomass or via direct air capture for use in production of carbon-neutral liquid and gaseous fuels.</p>
<p>Establish educational and training programs to train the net-zero workforce, with reporting on diversity of participants and job placement success.^g</p>			<p>Congressional appropriations to Department of Education, DOE, and NSF</p>	<p>\$5 billion per year for GI Bill-like program. \$100 million per year for new undergraduate programs. \$50 million per year for use-inspired and \$375 million per year for other doctoral and postdoctoral fellowships. Eliminate visa restrictions for net-zero students. \$7 million over 2020–2025 for the Energy Jobs Strategy Council.</p>	<p>Fields covered include science, engineering, policy, and social sciences, for students researching and innovating in low-carbon technologies, sustainable design, and the energy transition.</p>
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Revitalize clean energy manufacturing. ^h			Congressional appropriation and direction of Green Bank and U.S. Export-Import Bank	Manufacturing subsidies for low-carbon products starting at \$1 billion per year and phased out over 10 years. No additional appropriation required for loans and loan guarantees from Green and Export-Import Bank.	Export-Import Bank should make available at least \$500 million per year in low-carbon product and clean-tech export financing and eliminate support for fossil technology exports.
Increase clean energy and net-zero transition RD&D that integrates equity indicators. ⁱ			Congressional appropriation for and directions to DOE and NSF	DOE clean energy RD&D triples from \$6.8 billion per year to \$20 billion per year over 10 years. DOE funds studies of policy evaluation at \$25 million per year and regional innovation hubs at \$10 million per year; DOE- and NSF-funded studies of social dimensions of the transition should be supported by an appropriation of \$25 million per year.	Establish criteria for receiving funds on equity analysis, appropriate community input, and leadership diversity of companies applying for public investments. DOE to report on equity impacts and diversity of entities receiving public funds.
Increase funds for low-income households for energy expenses, home electrification, and weatherization.			Congressional appropriation	Increase Weatherization Assistance Program (WAP) funding to \$1.2 billion per year from \$305 million per year. Direct HHS to increase state's share of LIHEAP funds for home electrification and efficiency.	

ICON KEY

 Produce carbon-free electricity

 Electrify energy services

 Energy efficiency and productivity

 Build critical infrastructure





























 Expand innovation toolkit















 Strengthen the U.S. economy

 Promote equity and inclusion

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 Maximize cost-effectiveness

Policy	Technology Goals	Socio-Economic Goals	Gov Entities	Appropriation, if Any	Notes				
Increase electrification of tribal lands		 	Congressional appropriation to DOE and U.S. Department of Agriculture (USDA)	\$20 million per year for assessment and planning through DOE Office of Indian Energy Policy (DOE-IE) and USDA Rural Utilities Service (USDA-RUS); expand DOE-IE to \$200 million per year.	Increase direct financial assistance for the build-out of electricity infrastructure through DOE-IE grant programs.				
Assist families, businesses, communities, cities, and states in an equitable transition, ensuring that the disadvantaged and at-risk do not suffer disproportionate burdens.									
<i>Please note that the primary policies targeting fairness, diversity, and inclusion during the transition are the Office of Equitable Energy Transitions and the National Transition Corporation, which are the fourth and fifth policies in this table.</i>									
Establish National Laboratory support to subnational entities for planning and implementation of net-zero transition.	    	  	Congressional appropriation	Additional funding to national laboratories' annual funding commencing at the level of \$200 million per year, rising to \$500 million per year by 2025, and \$1 billion per year by 2030.	To establish a coordinated, multi-laboratory capability to provide energy modeling, data, and analytic and technical support to cities, states, and regions to complete a just, equitable, effective, and rapid transition to net zero.				
Establish 10 regional centers to manage socioeconomic dimensions of the net-zero transition. ^j	    	  	Congressional authorization and appropriations to DOE	\$5 million per year for each center; \$25 million per year for external research budget to provide data, models, and decision support to the region.	Coordinated by the Office of Equitable Energy Transitions.				
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Policy	Technology Goals	Socio-Economic Goals	Gov Entities	Appropriation, if Any	Notes
Establish net-zero transition office in each state capital.			Congressional appropriations	\$1 million per year in matching funds for each state.	Coordinate state's effort with federal and regional efforts.
Establish local community block grants for planning and to help identify especially at-risk communities. Greatly improve environmental justice (EJ) mapping and screening tool and reporting to guide investments.			Congressional appropriations to DOE	\$1 billion per year in grants administered by regional centers.	Required to qualify for funding from the National Transition Corporation. Block grant funding requires inclusive participation and engagement by historically marginalized and low-income groups.
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FOOTNOTES

^a Direct DOE/EPA to expand its outreach of and support for adoption of benchmarking and transparency standards by state and local government through the expansion of Portfolio Manager. Direct DOE/EPA to further investigate the development of model carbon-neutral standards for new and existing buildings that, in turn, could be adopted by states and local authorities. Policies targeting retrofits of existing buildings will be in the final report.

^b FERC should work with regional transmission organizations (RTOs) and independent system operators (ISOs) to ensure that markets in all parts of the country are designed to accommodate the shift to 100 percent clean electricity on the relevant timetable. Congress should clarify that the Federal Power Act does not limit the ability of states to use policies (e.g., long-term contracting with zero-carbon resources procured through market-based mechanisms) to support entry of zero-carbon resources into electric utility portfolios and wholesale power markets. Congress should further direct FERC to exercise its rate-making authority over wholesale prices in ways that accommodate state action to shape the timing and character of the transitions in their electric resource mixes. Congress should reauthorize the FERC Office of Public Participation and Consumer Advocacy to provide grants and other assistance to support greater public participation in FERC proceedings. FERC should direct NERC to establish and implement standards to ensure that grid operators have sufficient flexible resources to maintain operational reliability of electric systems. Congress should direct and fund DOE to provide federal grants to support the deployment of advanced meters for retail electricity customers as well as the capabilities of state regulatory agencies and energy offices to review proposals for time/location-varying retail electricity prices, while also ensuring that low-income consumers have access to affordable basic electricity service.

^c (1) Establish National Transmission Policy to rely on the high-voltage transmission system to support the nation's (and states') goals to achieve net-zero carbon emissions in the power sector. (2) Authorize and direct FERC to require transmission companies and regional transmission organizations to analyze and

plan for economically attractive opportunities to build out the interstate electric system to connect regions that are rich in renewable resources with high-demand regions; this is in addition to the traditional planning goals of reliability and economic efficiency in the electric system. (3) Amend the Energy Policy Act of 2005 to assign to FERC the responsibility to designate any new National Interest Electric Transmission Corridors and to clarify that it is in the national interest for the United States to achieve net-zero climate goals as part of any such designations. (4) Authorize FERC to issue certificates of public need and convenience for interstate transmission lines (along the lines now in place for certification of gas pipelines), with clear direction to FERC that it should consider the location of renewable and other resources to support climate-mitigation objectives, as well as community impacts and state policies as part of the need determination (i.e., in addition to cost and reliability issues) and that FERC should broadly allocate the costs of transmission enhancements designed to expand regional energy systems in support of decarbonizing the electric system.

^d (1) Congress should authorize and appropriate funding for DOE to provide support for technical assistance and planning grants to states, communities, and tribal nations to enable meaningful participation in regional transmission planning and siting activities. (2) Congress should authorize and appropriate funding for DOE and FERC to encourage and facilitate use of existing rights of way (e.g., railroad; roads and highways; electric transmission corridors) for expansion of electric transmission systems. (3) Congress should authorize and appropriate funding for DOE to analyze, plan for, and develop workable business model/regulatory structures, and provide financial incentives (through the Green Bank) for development of transmission systems to support development of offshore wind and for development, permitting, and construction of high-voltage transmission lines, including high-voltage direct-current lines.

^e (1) Congress should direct the Federal Highway Administration (a) to continue to expand its “alternative fuels corridor” program, which supports planning for EV charging infrastructure on the nation’s interstate highways, and (b) to update its assessment of the ability and plans of the private sector to build out the EV charging infrastructure consistent with the pace of EV deployment needed for vehicle electrification anticipated for deep decarbonization, the need for vehicles on interstate highways and in public locations or high-density workplaces, and to identify gaps in funding and financial incentives as needed. In coordination with FHWA, DOE should provide funding for additional EV infrastructure that would cover gaps in interstate charging to support long-distance travel and make investments for EV charging for low-income businesses and residential areas. (2) NIST should develop communications and technology interoperability standards for all EV level 2 and fast charging infrastructure.

^f Extend 45Q tax credit for carbon capture, use, and sequestration for projects that begin substantial construction prior to 2030 and make tax credit fully refundable for projects that commence construction prior to December 31, 2022. Set the 45Q subsidy rate for use equal to \$35/tCO₂ less whatever explicit carbon price is established and the subsidy rate for permanent sequestration to be equal to \$70/tCO₂ less whatever explicit carbon price is established. A hydrogen pipeline network will ultimately also be needed, but, as indicated in Chapter 2, the time pressure to build a national hydrogen pipeline network is less severe than for CO₂. This is because hydrogen production facilities can be located close to industrial hydrogen consumers, unlike CO₂ pipelines, which must terminate in geologic storage reservoirs. Also, hydrogen can be blended into natural gas and transported in existing gas pipelines, and gas pipelines could ultimately be converted to 100% hydrogen.

^g (1) Congress should establish a 10-year GI Bill-type program for anyone who wants a vocational, undergraduate, or master’s degree related to clean energy, energy efficiency, building electrification, sustainable design, or low-carbon technology. Such a program would ensure that the U.S. workforce transitions along the physical infrastructure of our energy, transportation, and economic systems. (2) Congress should support the creation of innovative new degree programs in community colleges and colleges and universities focused uniquely on the knowledge and skills necessary for a low-carbon economic and energy transformation. (3) Congress should provide funds to create interdisciplinary doctoral and postdoctoral training programs, similar to those funded by the National Institutes of Health (NIH), which place an emphasis on training students to pursue interdisciplinary, use-inspired research in collaboration with external stakeholders that can guide research and put it to use in improving practical actions to support decarbonization and energy justice. (4) Congress should provide support for doctoral and postdoctoral fellowships in science and engineering, policy, and social sciences for students researching and innovating in low-carbon technologies, sustainable design, and energy transitions, with at least 25 fellowships per state to ensure regional equity and build skills and knowledge throughout the United States. (5) The Department of Homeland Security (DHS) should eliminate or ease visa restrictions for international students who want to study climate change and clean energy at the undergraduate and graduate level, where appropriate. (6) Congress should pass the Promoting American Energy Jobs Act of 2019 to reestablish the Energy Jobs Strategy Council under DOE, require energy and employment data collection and analysis, and provide a public report on energy and employment in the United States.

^h (1) Congress should establish predictable and broad-based market-formation policies that create demand for low-carbon goods and services, improve access to finance, create performance-based manufacturing incentives, and promote exports. Specifically, Congress should provide manufacturing incentive through loans, loan guarantees, tax credits, grants, and other policy tools to firms that are matched with corresponding performance requirements. Subsidies provided directly to manufacturers must be tied to the meeting of performance metrics, such as production of products with lower embodied carbon or adoption of low-carbon technologies and approaches. Specific items could include expanding the scope of the energy audits in the DOE Better Plants program and expanded technical assistance to focus on energy use and GHG emissions reductions at the 1,500 largest carbon-emitting manufacturing plants; supporting the hiring of industrial plant energy managers by having DOE provide manufacturers with matching funds for 3 years to hire new plant energy managers; enabling the development of agile and resilient domestic supply chains through DOE research, technical assistance, and grants to assist manufacturing facilities in addressing supply chain disruptions resulting from COVID-19 and future crises. (2) Congress should provide loans and loan guarantees to manufacturers to produce low-carbon products, ideally through a Green Bank (see Chapter 4). (3) Congress should require the U.S. Export-Import Bank to phase out support for fossil fuels and make support for clean energy technologies a top priority with a minimum of \$500 million per year. (4) Congress should create a new Assistant Secretary for Carbon Smart Manufacturing and Industry within DOE.

ⁱ (1) Congress should triple the DOE's investments in low- or zero-carbon RD&D over the next 10 years, in part by eliminating investments in fossil-fuel RD&D. These investments should include renewables, efficiency, storage, transmission and distribution (T&D), carbon capture, utilization, and storage (CCUS), advanced nuclear, and negative emissions technologies and increase the agency's funding of large-scale demonstration projects. By eliminating investments in non-carbon capture and storage (CCS) fossil-fuel RD&D, the net increase to the energy RD&D budget will be partially offset. (2) Congress should direct DOE to fund energy innovation policy evaluation studies to determine the extent to which policies implemented (both RD&D investment and market-formation policies) are working. (3) Congress should direct DOE and the National Science Foundation (NSF) to create a joint program to fund studies of the social, economic, ethical, and organizational drivers, dynamics, and outcomes of the transition to a carbon-neutral economy, as well as studies of effective public engagement strategies for strengthening the U.S. social contract for decarbonization. (4) Congress should direct DOE to establish regional innovation hubs where they do not exist or are critically needed using funds appropriated under item 1 above. (5) Congress should direct DOE to enhance public-private partnerships for low-carbon energy.

^j (1) Congress should coordinate federal agency actions at the regional scale through the deployment of federal agency staff to regional offices. (2) Congress should host a coordinating council of regional governors and mayors that meets annually to establish high-level policy goals for the transition. (3) Congress should establish mechanisms for ensuring the effective participation of low-income communities, communities of color, and other disadvantaged communities in regional dialogue and decision making about the transition to a carbon-neutral economy. (4) Congress should provide information annually to the White House Office of Equitable Energy Transitions detailing regional progress toward decarbonization goals and benchmarks for equity.

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