The State of US Climate Science and Research Infrastructure:

The crucial roles of social science and policy research

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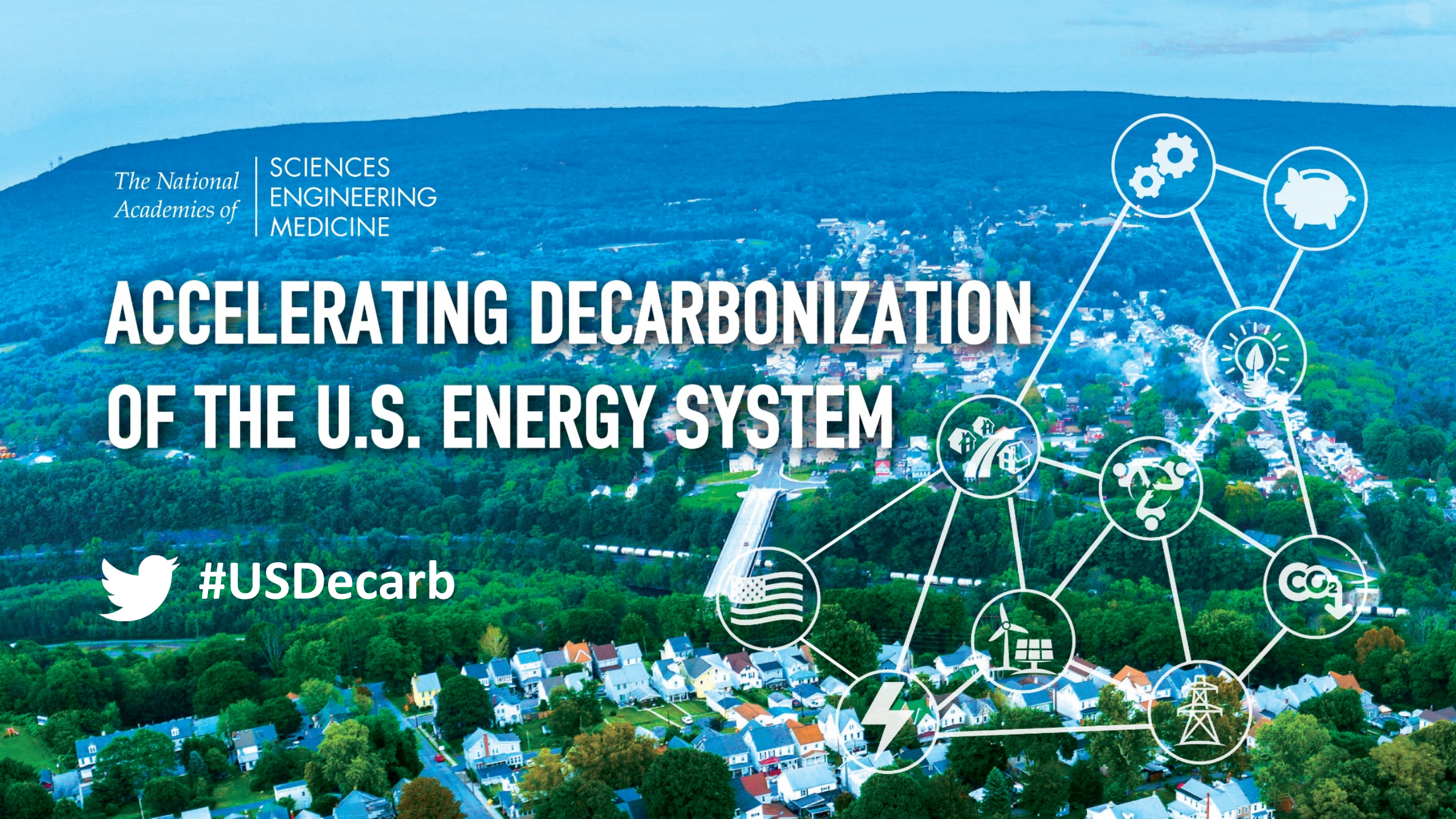
The National Academies of
SCIENCES
ENGINEERING
MEDICINE
ACCELERATING DECARBONIZATION OF THE U.S. ENERGY SYSTEM
#USDecarb
CO_2

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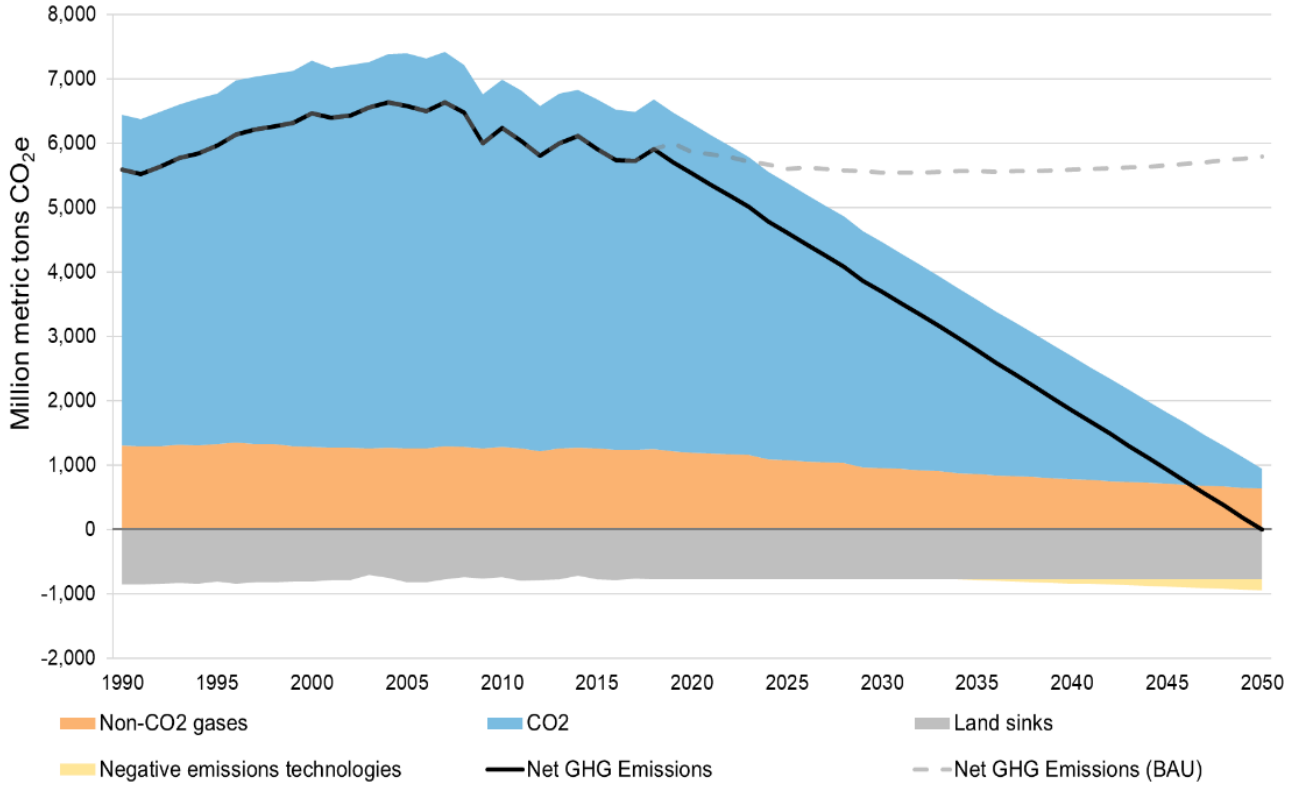
Climate Change and Decarbonization

Limiting climate change to substantially less than 2 degrees Celsius requires global emissions to reach net-zero by mid-century (IPCC 2018)

U.S. emissions for 2019 were 6 Gt CO_2e/y of all greenhouse gases and 5 Gt CO_2/y, partially offset by a large CO_2 sink from its managed forests



Pathways to reducing GHG emissions in the U.S., informed by four lenses

- Economics
- Equity and fairness
- Energy technology
- Energy policy

Technology Goals

Electrify energy services in transportation, buildings, and industry

Examples include moving half of vehicle sales (all classes combined) to EV's by 2030, and deploying heat pumps in one quarter of residences.

Improve energy efficiency and productivity

Examples include accelerating the rate of increase of industrial energy productivity (dollars of economic output per energy consumed) from the historic 1% per year to 3% per year.

Produce carbon-free electricity

Roughly double the share of electricity generated by carbon-free sources from 37% to 75%.

Expand the innovation toolkit

Triple federal support for net-zero RD&D.

Plan, permit, and build critical infrastructure

Examples include new transmission lines, an EV charging network, and a CO_2 pipeline network.

Socio-Economic Goals

Strengthen the U.S. economy

Use the energy transition to accelerate US innovation, reestablish US manufacturing, increase the nation's global economic competitiveness, and increase the availability of high-quality jobs.

Support communities, businesses, and workers

Proactively support those directly and adversely affected by the transition

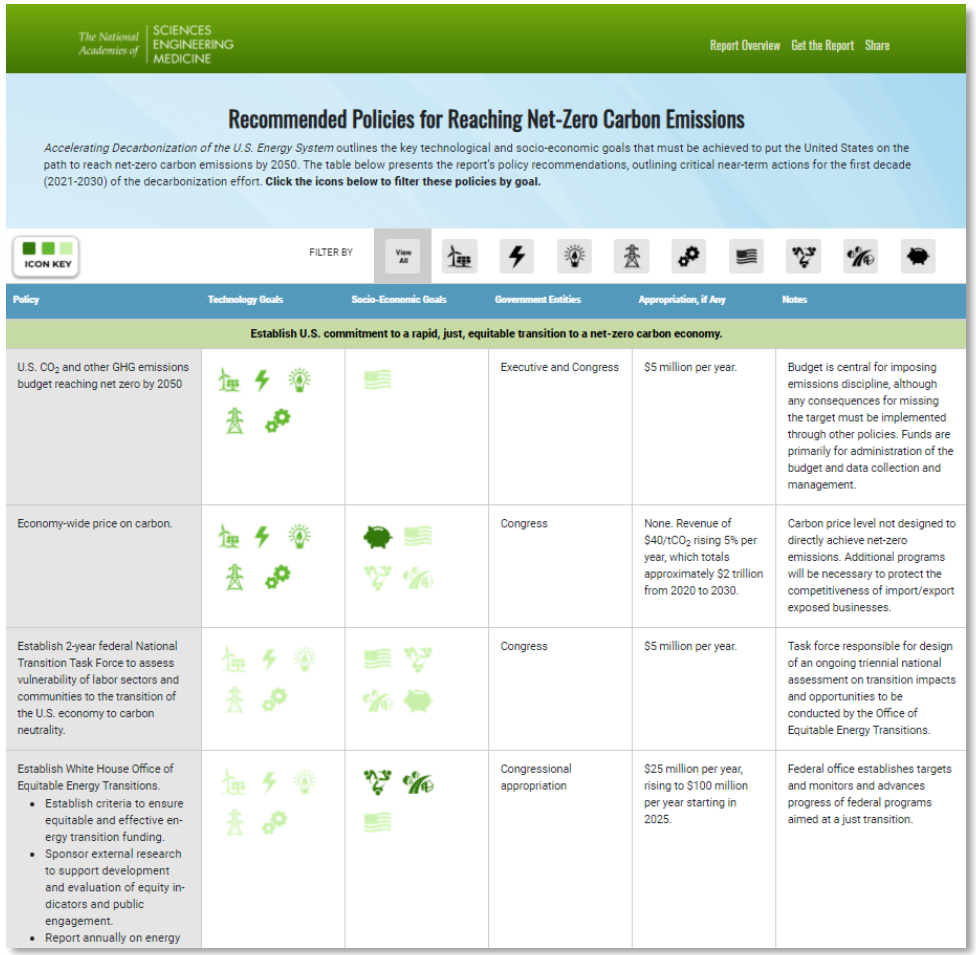
Promote equity and inclusion

Ensure equitable distribution of benefits, risks and costs of the transition to net-zero.

Integrate historically marginalized groups into decision-making by ensuring adherence to best practice public participation laws.

Ensure entities receiving public funds report on leadership diversity to ensure non-discrimination.

Maximize cost-effectiveness



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Report Overview Get the Report Share

Recommended Policies for Reaching Net-Zero Carbon Emissions

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. The table below presents the report's policy recommendations, outlining critical near-term actions for the first decade (2021-2030) of the decarbonization effort. **Click the icons below to filter these policies by goal.**

ICON KEY FILTER BY View All

Policy	Technology Goals	Socio-Economic Goals	Government 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 $40/t$CO_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.
Establish White House Office of Equitable Energy Transitions. • 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			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.

Policy Recommendations Table

Report contains 30 near-term policy recommendations across 4 main categories.

This presentation covers 12 of these recommendations.

View full policy table at nap.edu/decarbonization-policies

The need for more social science research

- What kind of workforce is needed in net-zero world? Do we have human talent and capabilities for the workforce that is needed?
- Public acceptance of technology
- Public understanding of climate change
- Stakeholder engagement in planning the social and economic transition to a net-zero future (how to address fears, identify opportunities)
- What are effective transition strategies for individuals, towns, communities
- Technology adoption
- How to foster effective innovation systems (e.g. regional technology hubs)
- What are most important human vulnerabilities, and how to adapt or build resilience
- Supply chain risks

The need for more policy research

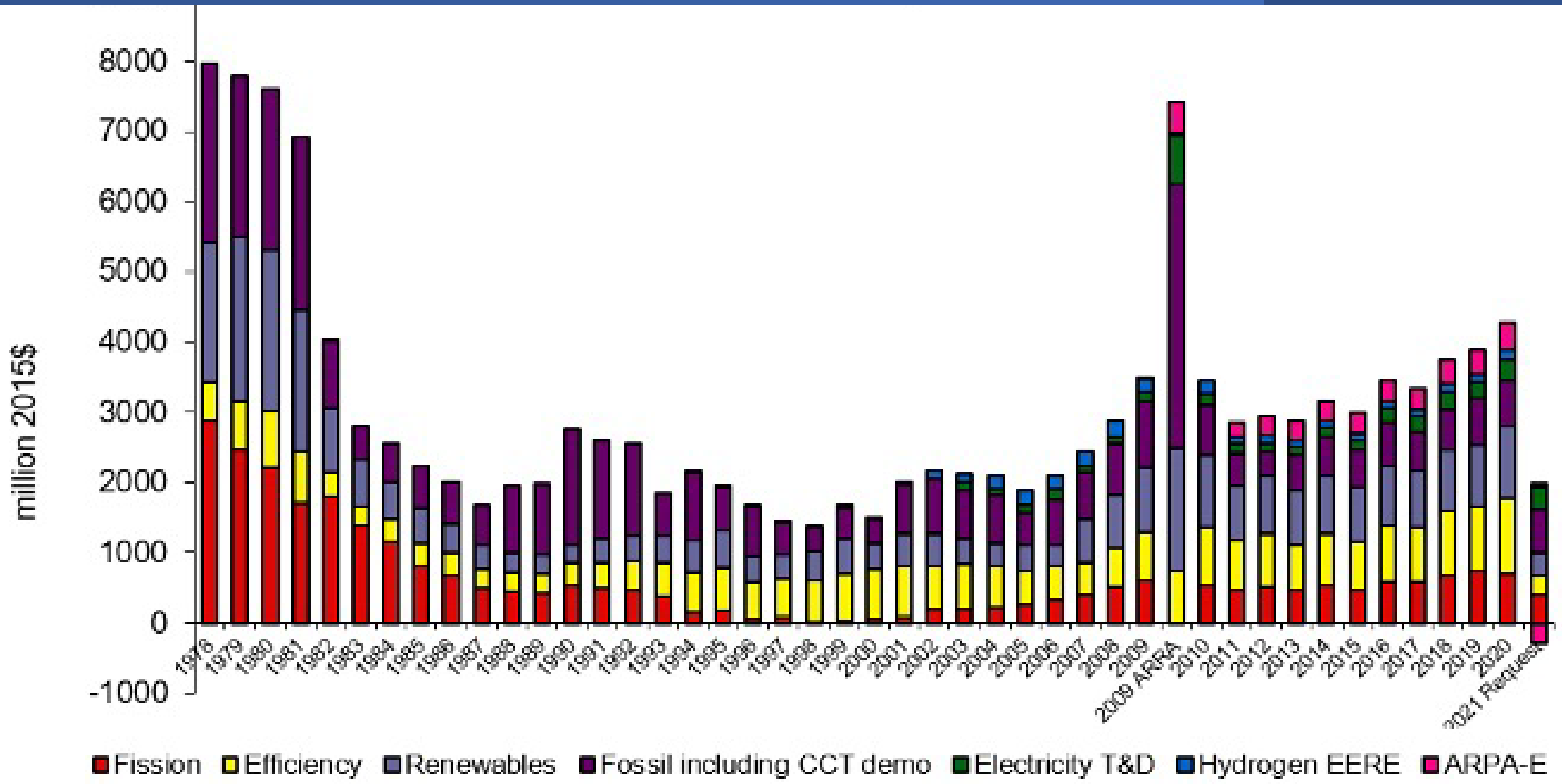
- Time is short – little opportunity for policy experimentation.
- Which climate policies are most economically efficient?
- Which climate policies work/don’t work in practice? Why does theory often fall short in the process of implementation (e.g. carbon pricing)
- Which climate policies might lead to more equitable outcomes? How do policies impact regions differently? Genders differently? Races differently?
- Why do some policies not appear to work very well?

Funders of social science & policy research

- Philanthropic donors (e.g. William & Flora Hewlett Foundation, Energy Foundation, Bezos Earth Fund)
  - Challenge is that these donors prefer advocacy and campaigns, not research
- Corporate donors (e.g. MIT Energy Initiative supported by eni, ExxonMobil, Shell, Chevron, Exelon, Equinor, GE, Iberola)
- State governments (e.g. California Energy Commission, NYSERDA)
- Federal government (e.g. DOE solar program, NSF)

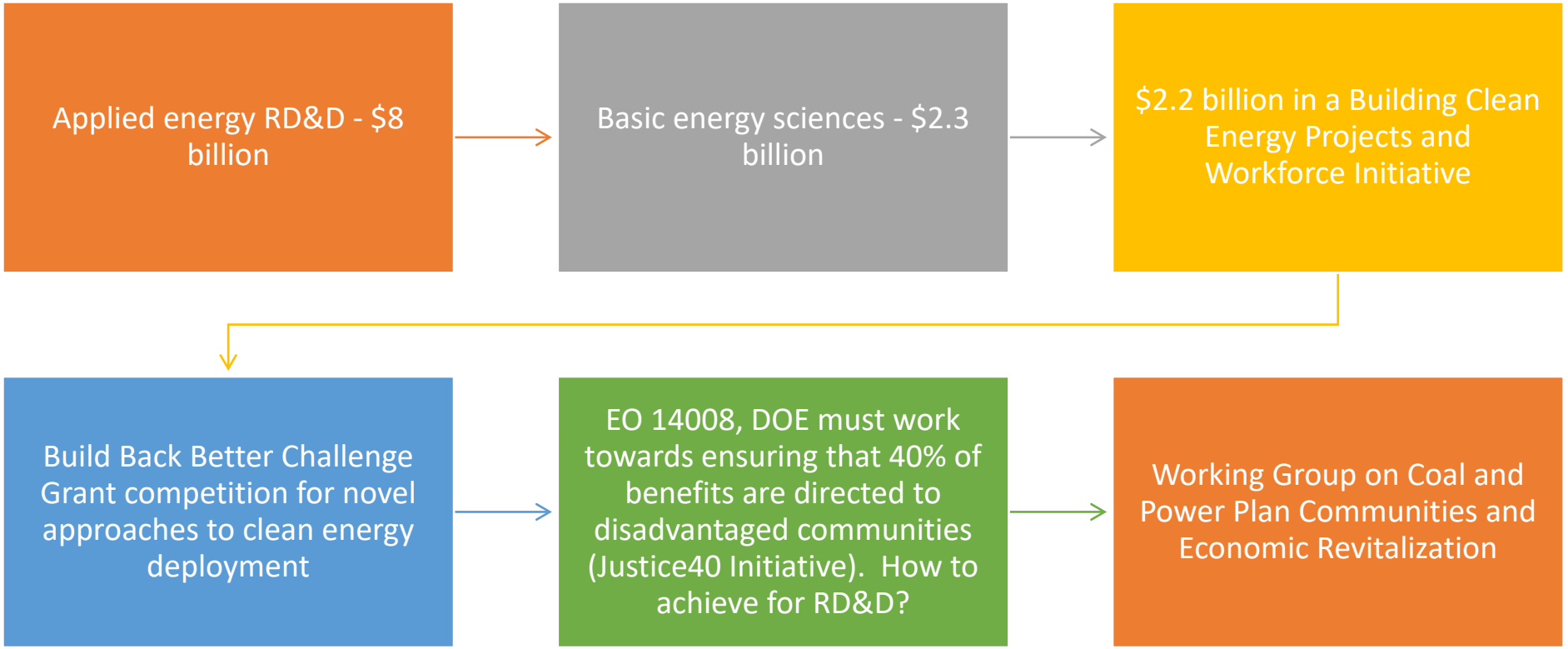
USGCRP Budget Crosscut by Agency FY18-FY20

Agency	FY2018 Enacted ($M)	FY2019 Enacted ($M)	FY2020 President's Budget ($M)
Department of Agriculture (USDA)	103	101	96
Department of Commerce (DOC)	320	293	194
Department of Energy (DOE)	239	259	117
Department of Health and Human Services (HHS)	10	11	10
Department of the Interior (DOI)	25	25	13
Department of Transportation (DOT)	0	0	0
Environmental Protection Agency (EPA)	18	19	0
National Aeronautics and Space Administration (NASA)	1,499	1,484	1,286
National Science Foundation (NSF)	254	237	219
Smithsonian Institution (SI)	8	8	8
TOTAL (USGCRP)	2,477	2,436	1,943



Gallagher, K.S. and L.D. Anadon, "DOE Budget Authority for Energy Research, Development, and Demonstration Database," The Fletcher School, Tufts University; Department of Land Economy, University of Cambridge; and Belfer Center for Science and International Affairs, Harvard Kennedy School; July 3, 2020.

FY22 DOE budget request



Solar energy FY22 budget request

- Advanced R&D
- Validation of solar technologies
- Support for robust American manufacturing and supply chain
- Training for workforce
- Community resilience

NSF Social, Behavioral, and Economic Sciences

BCS Core Programs:

- Archaeology and Archaeometry
- Biological Anthropology
- Cognitive Neuroscience (CogNeuro)
- Cultural Anthropology
- Developmental Sciences (DS)
- Documenting Endangered Languages (DEL)
- Geography and Spatial Sciences (GSS)
- Linguistics
- Perception, Action and Cognition (PAC)
- Science of Learning (SL)
- Social Psychology

SES Core Programs:

- Decision, Risk and Management Sciences (DRMS)
- Economics
- Law & Social Sciences (LSS)
- Methodology, Measurement and Statistics (MMS)
- Political Science
- Science of Organizations (SoO)
- Science, Technology, and Society (STS)
- Sociology

NCSES Core Program:

- Research on the Science and Technology Enterprise: Statistics and Surveys

SMA Core Programs:

- Cultivating Cultures for Ethical STEM (CCE STEM)
- SBE Research Experiences for Undergraduate Sites (SBE REU Sites)
- SBE Postdoctoral Research Fellowships (SPRF)
- Science of Science and Innovation Policy (SciSIP)

Additional Funding Opportunities Relevant to SBE Scientists and Students:

- Understanding the Brain (UtB)
- Innovations at the Nexus of Food Energy and Water Systems (INFEWS)
- Robust and Reliable Research
- Critical Resilient Interdependent Infrastructure Systems and Processes (CRISP)
- Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (NSF INCLUDES)
- Secure and Trustworthy Cyberspace (SaTC)
- Smart and Connected Communities (S&CC)
- Dynamics of Coupled Natural and Human Systems (CNH)
- Ecology and Evolution of Infectious Diseases (EEID)
- Major Research Instrumentation Program (MRI)
- Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers (ADVANCE)
- NSF Graduate Research Fellowship Program (GRFP)
- Partnerships for International Research and Education (PIRE)
- Science and Technology Centers: Integrative Partnerships (STCs)
- NSF Innovation Corps (I-Corps)
- Facilitating Research at Primarily Undergraduate Institutions(RUI/ROA)

No dedicated climate programs listed on SBE website