



DATA FOR *PROGRESS*

**POLICY BRIEF**

A Progressive Climate  
Innovation Agenda:

# Federal Policy Recommendations

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# COMPONENTS OF A PROGRESSIVE CLIMATE INNOVATION PLATFORM

The coronavirus pandemic has rattled the U.S. economy, leaving more than 170,000 Americans dead, millions sick, and tens of millions unemployed as we write. The nation needs expanded and prolonged federal relief to help people weather this storm, followed by a renewed commitment to the institutions and approaches that can prevent looming social, economic, and environmental crises. To help avoid the worst effects of the climate crisis and contribute to economic recovery, the federal government should invest in developing and deploying the next generation of clean technologies and infrastructure that can make us safer, healthier, and more resilient, and in doing so mobilize millions of Americans to create the low-carbon economy we need. In our *A Progressive Climate Innovation Agenda*, we detail the shortcomings of existing programs and argue that progressives should develop and push a bold climate innovation platform. In that report, we lay out three questions that should guide development of a progressive innovation platform. Here, we recommend components of a climate innovation platform to satisfy these criteria.



## EXPANSION.

Does it expand the federal innovation apparatus to include the full suite of activities necessary to integrate new clean technologies into the energy system at scale?



## EMISSIONS.

Does it reduce the cost and improve the performance of technologies and strategies that can rapidly decarbonize the most polluting and hard-to-tackle areas of the economy?



## EQUITY.

Does it combat the historically unequal impacts of pollution, while increasing equitable access to new economic opportunity, improved public health, and resilience?



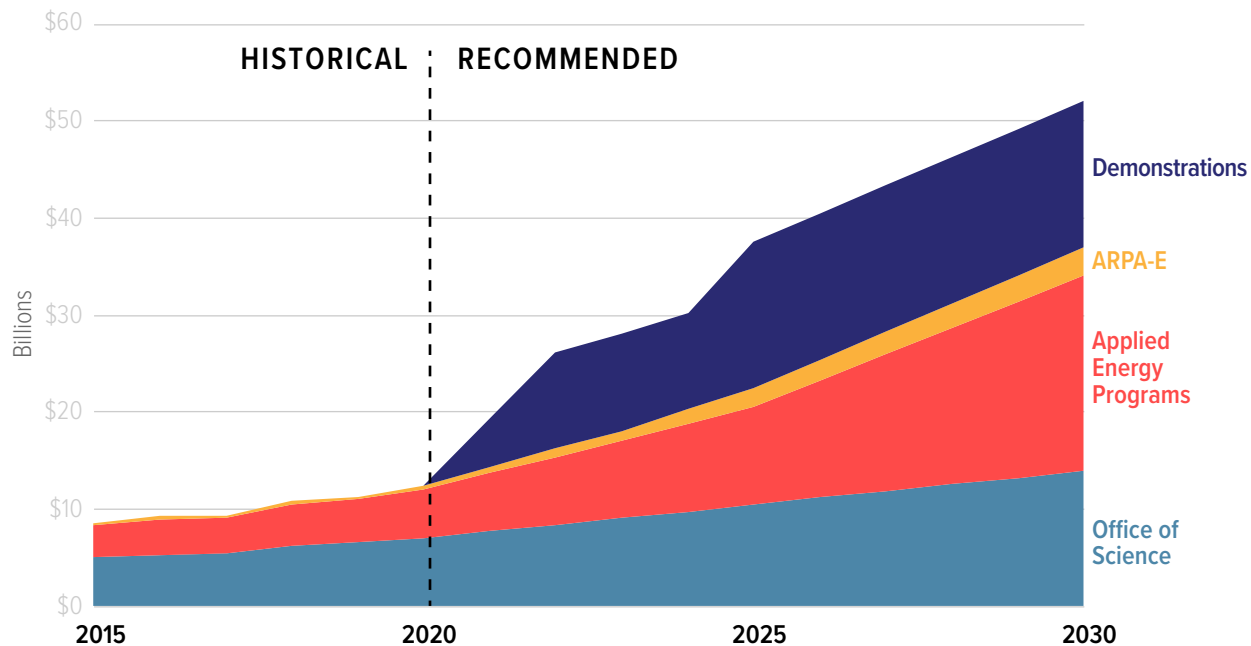
## EXPANSION

A progressive innovation platform must include the full suite of innovation activities necessary to integrate new technologies into the energy system at scale. That means moving beyond proposals that focus on research and development alone to significantly ratcheting up the ambition of clean energy demonstration, deployment, and enabling policies.

### Increase funding for research and development

While basic R&D is just one piece of the innovation ecosystem, federal clean energy R&D spending should be much greater than current levels to help make climate solutions more equitable, less costly, and less extractive. The United States should at least double annual funding for R&D over the next five years and increase funding to three or four times current levels by 2030.

Figure 1 shows 2015-2020 funding levels for DOE's RD&D programs, as well as future funding levels based on the following trajectories: 1) Funding for the Office of Science increases by 50 percent by 2025 and doubles by 2030; 2) Funding for the Applied Energy offices doubles by 2025 and quadruples by 2030; 3) Funding for ARPA-E reaches \$1B by 2023, \$2B by 2025, and \$3B by 2030; and 4) the federal government invests \$50 billion in large-scale demonstrations through 2025. All together, these funding levels represent slightly more than a three-fold increase in R&D spending and a four-fold increase in RD&D spending by 2030.

**FIGURE 1. Historical and Recommended Budget Allocations for DOE Innovation Programs**

### Ramp up large-scale demonstration programs

Demonstration projects help push technologies from the R&D stage to readiness for public deployment grants and financing, large-scale private investment, and regulation that requires adoption of new technologies. Commercial scale projects help sort out issues with the technology, bring down costs, and reduce risk for further investment.

The federal government should invest at least \$50 billion in large-scale demonstrations for technologies and systems that contribute to deep decarbonization in the next 5 years. Large-scale technology demonstrations are critical to the energy innovation process. They also provide an opportunity to put people back to work in meaningful jobs in the near term as part of an economic recovery effort.

Lawmakers should also create new management structures to set demonstration programs up for success. Past large-scale demonstration programs in the United States have a mixed track record of success, as a result of political influence over project selection, a lack of sustained funding to create a robust demonstration program, and poorly designed management structures. Building a successful innovation ecosystem requires us to address these issues. For example, a centralized demonstration office at DOE could coordinate funding allocation and project selection and conduct long-term planning to make projects more effective.

Beyond funding large single-technology projects, demonstration programs can also test and improve the operation of systems that we need to address climate change and help inform further policies. For example, a demonstration program could support a utility or municipality to build out a smarter and cleaner distribution system in their territory. Such a project could include targeted retrofits to electrify buildings and make them more efficient, installation of advanced building sensors and controls,

purchasing of a fleet of electric buses and charging equipment, and necessary upgrades to distribution grid infrastructure, alongside policies to ensure operation of the grid maximizes renewable energy generation and minimizes emissions. Cross-sectoral, multi-technology demonstrations like these could lay the groundwork for other utilities or municipalities to design smart programs and policies that enable deep cuts in emissions from the start. The American Recovery and Reinvestment Act of 2009 (ARRA) provided \$600 million for distribution system demonstration projects like these, though an updated version should be larger and focus on cross-sectoral projects.

### **Expand deployment programs, public financing, and procurement of clean products**

The federal government should use its spending power to drive adoption of pollution-reducing technologies and build out clean infrastructure as part of any robust energy innovation or climate policy platform. These spending programs are critical to accelerating innovation by increasing demand for innovative clean technologies and driving cost reductions through new learning from producing, building, or installing technologies at scale. As we seek to recover from the coronavirus-induced public health and economic crisis, these programs can be effective economic stimulus measures, putting people to work building better infrastructure, modernizing our electricity grid, retrofitting buildings to make them healthier and cleaner, and manufacturing clean goods.

Existing clean energy deployment programs are effective but limited in scope, and current funding levels are far too low to either make a dent in the nation's emissions or accelerate innovation. For example, DOE's deployment programs are limited primarily to the Weatherization Assistance Program (WAP) and the State Energy Program (SEP), both of which are significantly underfunded and not well-suited in their existing form to accelerate adoption of innovative technologies that can make decarbonization easier.

Congress should expand federal deployment programs to fund decarbonizing technologies across all energy-using sectors, including grants for clean power plants, energy storage, electric cars and buses, charging infrastructure, zero-carbon fuels, transit and rail infrastructure, and emissions-reducing upgrades to agricultural and industrial facilities. The federal government should expand deployment grants across all relevant agencies, with coordination between the efforts and mechanisms to build on DOE's RD&D efforts. The programs should provide funding through grants to states, municipalities, utilities, companies, and other entities. Alongside grant programs, the federal government should extend and expand tax incentives for clean technologies, with updates to provide direct payments in lieu of tax credits to make the incentives more accessible. These deployment grants and incentives help drive demand for pollution-reducing technologies and can help bring the next generation of clean technologies to scale.

The federal government should also provide financing for emissions-reducing projects to further accelerate buildout of green infrastructure and adoption of clean technologies. Government-backed financing is necessary at two stages:

1. First, federal loans or loan guarantees can provide low-interest financing for innovative projects that are too new and risky to receive support from private finance. DOE's Loan Programs Office (LPO) has supported innovative technologies in this way with great success. However, LPO has issued

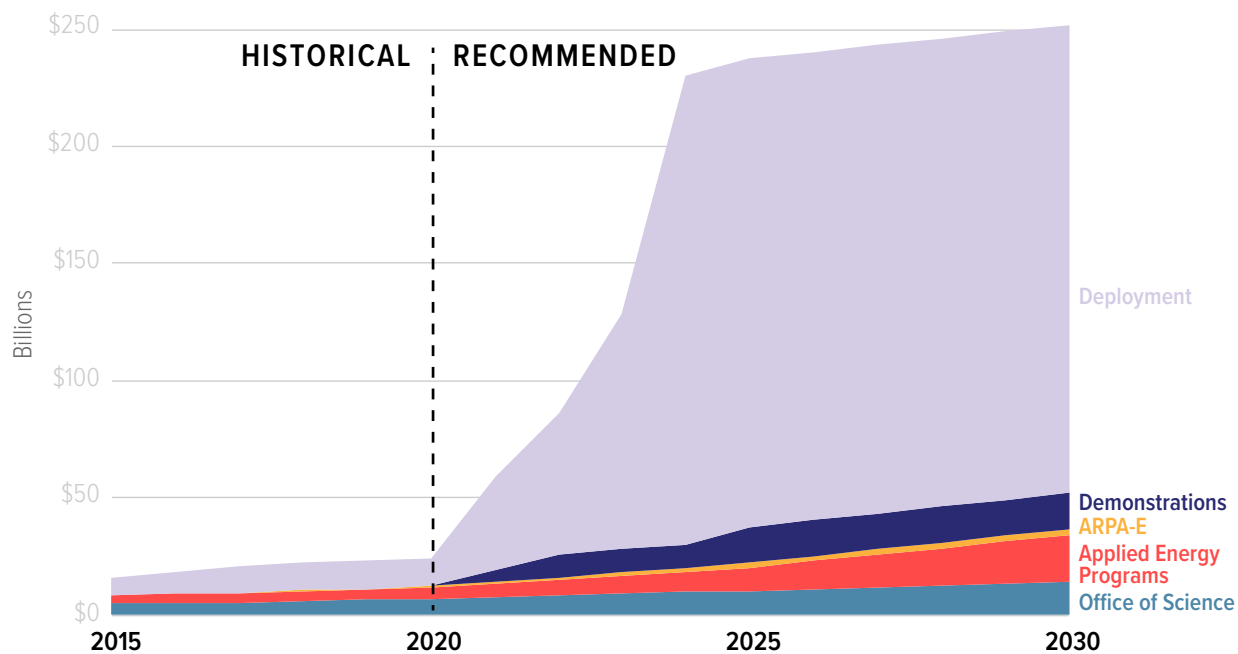
very few loans or loan guarantees in the past several years due to bureaucratic barriers, the PR difficulties of supporting cutting-edge projects that might fail, and the unwillingness of the Trump administration to support clean energy. Therefore, a strong innovation portfolio should either update LPO to make it more nimble or transfer LPO's \$40 billion in remaining loan authority to a new program with similar goals and more streamlined funding capacity, like the proposed Clean Energy Deployment Administration.

2. Second, the federal government should create a green infrastructure bank to provide government-backed financing for deployment of emissions-reducing infrastructure. A green bank capitalized with tens of billions of dollars, such as the one proposed in [the National Climate Bank Act](#), would complement deployment grants and incentives to drive the transition toward a cleaner energy system. And the availability of financing at near-zero rates for clean projects would provide a pathway to scale-up for technologies emerging from the RD&D pipeline.

These financing programs could also be complemented by a [National Investment Authority](#) to mobilize private finance to build the clean, low-carbon infrastructure projects we need.

Furthermore, the United States should use its purchasing power to drive demand for clean industrial products through a Buy Clean program. The U.S. federal government is the world's single largest customer and wields enormous power to [drive demand for materials produced with minimal or zero pollution](#) and strong labor protections. A smart federal Buy Clean policy would create demand for materials such as steel and concrete produced in innovative, low-carbon ways and provide a landing pad for industrial technologies resulting from federal RD&D efforts.

Figure 2 builds on the previous chart showing RD&D levels, this time including deployment. Historical deployment numbers include DOE programs and energy tax incentives. The future deployment numbers shown here are illustrative, based on a scenario in which DOE receives and spends a quarter (\$500 billion in the first term) of the climate investment funding in clean energy and infrastructure plan from Vice President Biden's campaign. A significant portion of this new funding would be in the form of financing rather than direct spending, some or all of which will be self sustaining and not require annual appropriations to the extent shown in this figure. In this scenario, we hold deployment funding constant from 2025 to 2030.

**FIGURE 2. Historical and Recommended Budget Allocations for DOE Innovation Programs**

### Build public manufacturing facilities

The federal government should also drive innovation by directly building and operating manufacturing facilities for clean energy technologies. Public manufacturing facilities offer the opportunity to test innovative manufacturing techniques, like printing solar panels using roll-to-roll manufacturing, and to produce clean technologies at scale. Doing so would provide direct applications for technologies developed in federal RD&D programs and would reduce supply-chain limitations to clean energy growth. It also would immediately employ people in construction and manufacturing jobs and help get the economy back on track.

### Issue performance standards that require adoption of emissions-reducing technologies

The innovation process does not end once technologies receive R&D funding, large-scale demonstration grants, and other public investment. Lawmakers should layer other policies on top of these investment programs to drive adoption of improved technologies and incentivize continued improvement of commercial technologies. Emissions performance standards, which require sectors or subsectors to continually cut pollution, create demand for newer technologies while simultaneously requiring the sectors to decarbonize. Done right, performance standards can also require pollution reductions from existing infrastructure in disproportionately burdened communities and create an incentive for innovative technologies to do so. The federal government should apply performance standards across the energy-using sectors of the economy to foster innovation and rapidly cut pollution.



## EMISSIONS

Federal innovation programs are severely lacking in resources devoted to critical sectors for tackling the climate crisis. Additionally, to align with the challenge we face, the federal government must cease investing in technologies that promote the further extraction and use of fossil fuels. Here we outline... the parts of the innovation portfolio that merit total transformation. This list is not comprehensive—other existing and new innovation activities are also essential—but it represents the areas that need the most growth.

### Building decarbonization

The United States should dramatically increase innovation efforts to reduce the cost of building decarbonization and enable greater benefits and synergies with other sectors. While energy efficiency and electrification measures are ready for rapid deployment, federal innovation programs can make the challenge easier and help design buildings to enable pollution reductions in other sectors. An expanded building innovation program should include investments in:

- ▶ Material substitution, recycling, and advanced manufacturing techniques to reduce lifecycle greenhouse gas emissions of the building stock;
- ▶ Efficient and electric building components, such as cold climate heat pumps for space and water heating;
- ▶ Advanced sensors and controls, as well as demonstrations of smart operation of buildings to maintain reliability and integrate more renewables on the grid;
- ▶ Distributed renewable energy and storage resources; and
- ▶ Technologies to reduce the costs and increase the pace of whole-building retrofits (e.g. through panelized facades that are manufactured offsite and applied to buildings to increase efficiency).

### Industrial decarbonization

While increases in the energy efficiency of industrial facilities could immediately reduce pollution, many of the technologies required to reach carbon neutrality of heavy industry still need significant investments in RD&D. Moreover, the United States could become a leader in clean manufacturing and manufacturing of clean energy with greater investments in industrial innovation. DOE's Advanced Manufacturing Office, which is the major federal vehicle for industrial innovation, primarily works on energy efficiency in manufacturing and has far too little funding, considering the scale of the challenge. The federal government should create an Office of Industrial Decarbonization within DOE and greatly increase funding for industrial RD&D. The industrial innovation program should include investments in:

- ▶ Zero-carbon technologies (e.g. electrification and carbon-neutral fuels) to provide heat for industrial processes;
- ▶ Material substitution;
- ▶ Use of clean hydrogen as a feedstock;
- ▶ Novel processes;



- ▶ Recycling of industrial products;
- ▶ Domestic manufacturing of components for clean energy resources;
- ▶ Carbon capture and sequestration for industrial process emissions that have limited substitutes.

### **Transportation decarbonization**

The United States should significantly expand transportation-sector innovation efforts, with a focus on hard-to-decarbonize transportation needs like heavy-duty land transportation, maritime shipping, and aviation. An expanded transportation innovation program should increase investments in:

- ▶ Improved batteries with fewer environmental impacts
- ▶ Improved charging technologies for electric vehicles;
- ▶ Advanced materials for vehicle lightweighting;
- ▶ Recycling or reuse of used electric vehicle batteries;
- ▶ Electric vehicles for medium and heavy duty land transportation and short-haul aviation;
- ▶ Hydrogen or other low- or zero-emissions fuels for heavy-duty vehicles;
- ▶ Zero-emissions fuels for maritime shipping and aviation;
- ▶ Technologies to increase fuel economy of vehicles and ships of all types.

### **Advanced grid technologies and energy storage**

Building out a clean, reliable, and resilient electricity grid is a cornerstone of addressing climate change. We have already made enormous progress on some technologies key to grid modernization, such as giant lithium-ion batteries, flexible load technologies, forecasting for wind and solar resources, and smart building sensors and controls. However, significant challenges remain for others, including technologies that can store energy over weeks or months and between seasons. A successful innovation effort will broaden the suite of technologies available to build a clean, modern electricity grid. DOE's Office of Electricity currently houses the bulk of the federal government's investments in grid innovation, but the Office's 2020 budget is only \$190 million, with \$56 million allocated for energy storage. Given the importance of grid technologies and especially energy storage, the federal government should greatly increase innovation funding in this arena. The program should expand investments in:

- ▶ Long-duration energy storage technologies, including large-scale demonstrations of promising technologies;
- ▶ Advanced grid operations and planning technologies;
- ▶ Technologies to improve dynamic locational pricing;
- ▶ Demonstrations of high-voltage direct current (HVDC) transmission lines;

- ▶ Demonstrations of highly renewable systems, integrated with flexible load technologies in the building and transportation sectors and managed using advanced grid operation technologies;
- ▶ Demonstrations of clean microgrids for resilience.

### **Carbon dioxide removal**

Even with total transformation of the global economy to carbon neutrality by 2050, nature-based strategies and technologies to remove CO<sub>2</sub> from the atmosphere will make climate impacts less severe and are likely necessary to limit warming to 1.5 degrees. Outside the scope of innovation efforts, the federal government should develop long-term land-, ecosystem-, and soil- management plans to enhance natural land-sinks and provide other non-climate benefits. In addition, the United States should invest heavily in negative emissions technologies, including direct air capture, and strategies to permanently store CO<sub>2</sub> or use it in clean cement and chemicals and carbon-neutral fuels. The World Resources Institute [has called for a federal carbon dioxide removal innovation budget](#) starting at \$325 million per year, in line with estimates from the National Academy of Sciences.

### **Agriculture and forestry**

Addressing climate change will require the U.S. agricultural system to simultaneously increase productivity, decrease food waste, reduce emissions from fertilizers and onsite energy use, and increase carbon storage—all while facing increasing rates of drought, flooding, and other climate change-accelerated extreme weather. Doing so will enable U.S. leadership in agricultural climate solutions, increase food system resilience, and pave the way for American farmers to provide climate-friendly food and fiber to the world.

Similarly, investing in sustainable forest management will be critical to meet our climate goals. Federal innovation can develop smarter monitoring, restoration, and carbon management technologies for use on both public lands and privately owned forests. It can also drive the development of innovative and efficient uses of forest biomass, such as [cross-laminated timber](#), that substitute for high-emissions products and processes.

The federal government should develop a robust climate innovation program at USDA with an explicit mandate to reduce net greenhouse gas emissions, including methane and nitrous oxide. Basic research and development into innovative emissions mitigation technologies and approaches should be led by the Agricultural Research Service, complemented by demonstration and deployment programs at the U.S. Forest Service and Natural Resources Conservation Service and building on existing efforts such as Conservation Innovation Grants.

### **Adaptation**

The effects of climate change are here and now. Even if we rapidly decarbonize the global economy, millions more people will feel severe impacts from the warming historical emissions have already locked in. Adapting to climate change involves a wide range of policies, including global cooperation, investments in natural and built infrastructure, revamped planning processes, and more. Innovation should also play a role in adaptation by improving our toolset to study and plan for climate impacts. In particular, the federal government should increase funding for agricultural resilience innovation, such as the tools and applied R&D conducted at USDA's Climate Hubs, with these goals in mind.



## EQUITY

Federal innovation programs need a reframing from the top down to properly align with the interconnected issues of social, environmental, and economic justice. That means updating the mission of federal innovation programs and expanding activities that complement RD&D investments.

### **Update the mission: global climate and environmental justice**

Federal innovation programs are not aligned with and focused on addressing the climate crisis. Part of this misalignment stems from the mission assigned to the programs. Congress sets the mission and objectives of DOE's programs, which then guide program design and grantmaking decisions. For example, the goals of DOE's energy innovation portfolio include advancing energy efficiency, energy diversity, and energy security, reducing dependence on foreign energy supplies, and decreasing the environmental impact of the energy system. While this set of goals rightly includes environmental impact, it addresses neither climate change nor the public health implications encompassed in environmental justice.

A realignment of goals, alongside implementation of these goals with new institutions, practices, and capacity, will make federal innovation programs more effective and focus investments on the most promising technologies and projects to meet those goals. Congress should assign new top-level direction to innovation programs, and the agency should transform the design of grant programs and allocation of funds and personnel accordingly. Updating these goals will also ensure these programs continue to operate through changes in administration.

Prioritizing climate change mitigation will put reductions in climate-warming pollution at the center of innovation planning and spending—and help ensure that funding goes toward projects that fit within deep decarbonization pathways. Moreover, a global lens will justify and encourage investment in technologies that are a relatively small part of decarbonization in the United States but critical elsewhere in the world (e.g. rapidly scaling new building construction, manufacturing of technology and other equipment, and other industrial sectors that are concentrated outside the United States).

Similarly, reorienting federal programs toward climate and environmental justice will focus efforts on innovations that reduce the environmental and health impact of technologies that help fight climate change and prioritize investments to address historical harm. As part of realizing this mission, federal agencies should consider historical pollution burden and cumulative impacts in allocating funds for demonstration and deployment programs.

Moreover, Congress and the agencies should center investments in equitable distribution of the benefits of clean energy growth. Federal agencies should prioritize projects that improve social and economic equity, including through business models that allow for communities to lead, own, and benefit from clean energy projects. One laudable model is [Native Renewables](#), which enables Native American families to own and access renewable distributed energy resources.

Finally, Congress and the agencies should ensure that the federal government avoids investing in technologies that might replace climate-warming, health- and community-damaging practices with climate-friendly but still health- and community-damaging ones. For example, lithium-ion batteries are

a key stationary energy storage technology and enabler of clean, electric transportation, but significant increases in demand for lithium will lead to new mining projects in the global south—projects which often deny the sovereignty of Indigenous communities and endanger water supplies. These issues need structural solutions, including strategies to reduce product demand (e.g. reduction in vehicle use) and policies to ensure the free, prior, and informed consent of Indigenous communities for projects on their land. Innovation can also contribute to solutions through improvements in recycling processes to recover lithium from used batteries and advancements in alternative technologies for stationary energy storage.

### **Prioritize funding for projects in disproportionately burdened communities**

Long histories of systemic racism and structural inequity have created large disparities in environmental impacts. Poor people, communities of color, and workers bear the brunt of the impacts of fossil fuel extraction, heavy industry, and economic exploitation. Similar disparities exist in access to clean energy technologies, such as electric vehicles and rooftop solar. Moreover, due to these same economic systems, workers in polluting industries are at risk of being left behind as the clean energy transition accelerates.

Federal investments can help address these disparities by building wealth and cutting pollution in heavily impacted communities, increasing equitable adoption of clean energy, and ensuring a just and equitable transition to a clean economy. To this end, the federal government should design investment programs (including innovation programs) to prioritize funding for disproportionately burdened communities. Lawmakers should develop a government-wide effort to incorporate data on cumulative environmental impacts, economic justice, and social equity into decision-making processes for allocation of federal dollars. Using these data, the federal government should allocate at least 40 percent of climate-related investments, including innovation spending, for disproportionately burdened communities.

Innovation programs also need additional tools and updated management structures to ensure that funds reach frontline communities and help ensure equitable adoption of clean energy technologies. The existing grantmaking processes favor large companies that have experience applying for federal funding and capacity to navigate the bureaucracy. Implementation of a strong innovation strategy will require reevaluation and adjustment of these processes to make them more accessible. For example, DOE should increase outreach to and involvement of frontline communities to help inform program design, and lawmakers should expand funding for community organizations and local governments, in addition to companies and university researchers, to conduct innovative projects.

### **Prioritize funding for projects in fossil fuel-dependent communities**

Just as innovation programs should actively seek to combat the long-standing systemic inequities that have concentrated pollution in communities of color and low-income communities, a truly just and progressive innovation agenda must also prioritize workers and regions that rely on fossil fuel production for economic stability. In many of these communities, fossil fuels are primary sources of employment and tax revenue, providing the backbone of local identity, opportunity, and essential services such as education. While innovation policy alone cannot ensure a just transition—and must be coupled with other economic development, workforce development, and social safety net programs—

progressives have an obligation to ensure that, to the extent federal innovation programs fund demonstration and deployment of clean energy technologies, a meaningful portion of the funds go to the communities that may be negatively affected by the shift away from fossil fuels.

When considering grants for academic research at universities or funding for demonstration projects, the Department of Energy should consider the extent to which these programs can enable communities historically dependent on fossil fuels to benefit and diversify their economies. The federal government should also design deployment programs, such as tax credits for clean manufacturing, with carve-outs or additional incentives to direct investment to these regions. These programs should include funding to help rural electric cooperatives replace stranded coal-fired power plants with 100 percent clean electricity. Finally, DOE and other agencies should engage workers and communities in decision-making and grant-making processes—and require grantees to engage workers and communities—to ensure that these voices help shape the programs and inform how federal innovation dollars are spent.

### **Expand workforce development efforts**

The United States should greatly expand workforce development and training efforts, with two major goals: 1) to reduce barriers to adoption of clean, innovative technologies and 2) to provide high-quality career opportunities for historically marginalized groups and communities. The federal government should play a major role in developing a workforce to accelerate transition of the energy system, addressing gaps in the capacity of the existing workforce, and ensuring that the clean energy economy provides family-sustaining jobs with strong labor standards.

Workforce limitations present a challenge to widespread adoption of emerging technologies. Employers across renewable energy and energy efficiency industries have reported difficulty in finding qualified employees to do a growing amount of work. Changes to the energy system require new skill sets for energy workers, which require new training curricula and programs. With new technologies and practices, robust training is necessary to ensure that newer technologies are installed correctly and lead to the expected benefits. Gaps in the workforce can lead people and companies to choose not to purchase newer technologies, even if those technologies are less costly and cleaner. The outcome is lower demand for innovative technologies, which means slower reductions in cost and improvements in performance. Federal workforce development programs, such as the DOE-funded Solar Training Network, have made great progress. However, these programs should be much larger to address remaining challenges and to build expertise in industries ancillary to clean energy, like finance and permitting. Doing so will reduce the barriers to adoption of clean technologies and in turn accelerate the innovation process.

Workforce development programs should also be designed to expand the clean energy workforce in ways that push the clean energy economy to be more equitable. That means job training for people in communities where clean energy is growing, as well as targeted programs to provide opportunities for people who are suffering economically to engage in low-carbon work. DOE's Solar Ready Vets program is a small but successful initiative to train veterans for jobs in the solar industry. The federal government can build on this model through workforce development programs for formerly incarcerated people, communities where fossil fuel resources are retiring, communities experiencing high levels of

unemployment and poverty, and others. In addition to making the distribution of clean energy benefits more equitable, these programs will create further demand for innovative technologies and address challenges to widespread adoption.

Finally, the federal government should ensure that innovation funding goes toward projects with high labor standards. Requirements for prevailing wage and/or project labor agreements on federally funded demonstration and deployment programs will help ensure that the clean energy economy is powered by workers in high-quality, family-sustaining jobs.

### **Expand international collaboration on energy innovation**

The United States should rekindle and expand partnerships with other nations to take advantage of complementary R&D efforts and to encourage greater global investment. The federal government should recommit to Mission Innovation and increase collaboration with other member nations. The United States should also expand bilateral partnerships, such as the [U.S.-India Partnership to Advance Clean Energy Research](#), which led to \$125 million in joint R&D spending and more than \$1 billion in deployment and financing. Deeper and broader collaborations will also encourage innovation to unlock global decarbonization by investing funds from the United States and other Western countries in technologies necessary to cut pollution in developing countries as they grow.