Statement before the

U.S. House Appropriations Committee

Energy and Water Development and Related Agencies Subcommittee

Federal Strategies for Energy and Climate Innovation

Testimony of:

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Chairman Kaptur, Ranking Member Simpson, and Members of the Subcommittee:

Thank you for the opportunity to appear before you today to discuss strategies for accelerating energy and climate innovation at the federal level.[1]

This is a subject that is core to the mission of Breakthrough Energy, **a network founded by Bill Gates of philanthropic programs, investment vehicles, and policy advocacy efforts that offer a comprehensive, end-to-end approach to accelerating the clean energy transition and helping the world reach net-zero emissions by 2050.**

We thank the Subcommittee for making this a priority and for continuing to foster a bipartisan, constructive dialogue on why climate and energy innovation is vital to the future of our country.

Unfortunately, we are still in the midst of confronting the incalculable human and economic damage the COVID-19 pandemic has wrought over the past year. We have lost nearly half a million loved ones and friends. Ten million Americans remain unemployed. Innumerable small businesses have shuttered, some forever.

One of the hard but essential lessons we have learned during this time is how much our ability to respond to both seen and unforeseen crises depends on having robust domestic innovation and manufacturing capacity. This is a timely moment to discuss how federal leadership and smart, targeted investments can revive the economy, create the next generations of good-paying American jobs and ensure our nation has the full toolkit to meet future challenges.

There is perhaps no greater future challenge than climate change, which will require immediate and sustained action. First, we have some of the ready and cost-effective solutions we need to reduce our greenhouse gas (GHG) emissions today, and we should be using these options widely and deploying them rapidly. Second, we will also need a massive innovation effort to develop and scale the solutions we still lack, and to make the solutions we do have even cheaper than they are today. I will touch on specific cases below, but in sum, the question is not should we innovate, or should we deploy current technologies. The obvious and clear answer is we must do both.

Given the global nature of climate change, it is also imperative that we direct our innovation efforts toward bringing down costs of technologies so they can be used in the growing, developing parts of the world. If we can innovate, and then diffuse this innovation widely and quickly through technology cooperation agreements, international financing, and export mechanisms, what we build here in the United States can have a real and transformative impact

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[1] "Innovation" as used here broadly refers to efforts to invent and commercialize new products, improve their safety and performance, and reduce their end costs.

on the emissions profile of the rest of the world. By doing so we can also realize large economic benefits for both American businesses and workers.

There is no question we have daunting problems before us, but I believe we have every reason to be hopeful. By making bold, strategic investments in innovation we can unlock economic opportunity and growth at home, meet the national imperative to act on climate change, and have outsized global impact in reducing GHGs.

However, few policy choices are straightforward, and Congress must weigh multiple concerns as it determines which innovation investments to prioritize. Of import is ensuring investments deliver equitable outcomes in the energy transition for fossil fuel communities, historically marginalized communities affected most by pollution, and low-income households.

Congress will also need to consider how to prioritize technologies given numerous options and needs in multiple economic sectors. Breakthrough Energy's founder Bill Gates calls for prioritizing our innovation efforts using the "Green Premium." The insightful Columbia Global Center on Energy Policy book *Energizing America* lays out a detailed, program-level funding strategy based on ten "technology pillars."[2] Both are outcome-centric frameworks that can help us understand how to allocate our finite public resources wisely.

To provide broader context for these choices, my remaining remarks will focus on these topics:

- **The need for climate and energy innovation**
- **The role of the federal government in accelerating energy innovation**
- **Economic benefits of investing in energy innovation**
- **Thoughts on a future national energy innovation investment strategy**

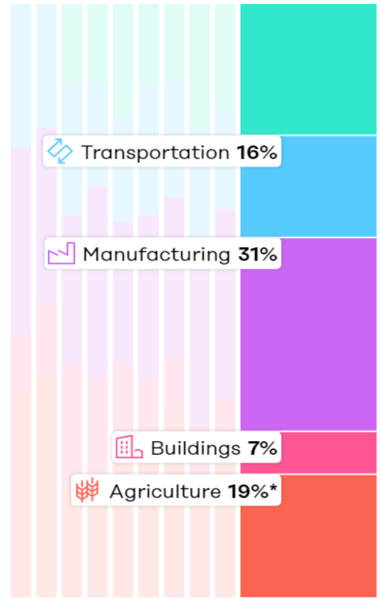
The need for climate and energy innovation

A 2018 Breakthrough Energy report led by former Secretary Ernest Moniz and IHS Markit Vice Chairman Dan Yergin notes, "Clean energy innovation supports multiple national goals: economic competitiveness, environmental responsibility, energy security, and national security. [However,] in serving these goals, **the need to address climate change is the challenge that calls most urgently for accelerating the pace of clean energy innovation**."

[2] Sivaram et al. (2020). *Energizing America: A Roadmap to Launch a National Energy Innovation Mission*, Columbia Center on Global Energy Policy, https://www.energypolicy.columbia.edu/sites/default/files/file-uploads/EnergizingAmerica_FINAL_DIGITAL.pdf.

Every year, the world adds 51 billion tons of greenhouse gases to the atmosphere, a number which will likely grow as we add more people, living standards rise around the world, and demand for energy increases. To avoid the worst impacts of climate change, some of which we saw in my home state of Texas last week, we need to bring this number to net-zero within the next 30 years – eliminating emissions from electricity, transportation, industry, buildings, and agriculture, and finding ways to offset emissions with carbon removal where they cannot be eliminated. This endeavor is, without question, one of the most difficult challenges humans will have ever taken on.

Figure 1: Sources of Emissions (Global), 2019



The good news is the path to zero does not require us to make a choice between reducing emissions or living well. Nor is it a choice between growing our economy or shrinking it. If we can eliminate GHGs from the energy that makes both essential needs and modern conveniences possible it will set our nation on the pathway to prosperity. This may in fact be the only path forward, as COVID19 has exposed how difficult it is to forego modern life even if conveniences come at great peril.

To get to the goal of affordable, reliable, and clean energy, we'll need a massive acceleration in technological progress in the next 10 years to complete our toolkit. Recent mega-studies have validated that scenarios involving a broad mix of technologies stand the best odds of achieving the goals of the energy transition, while incurring the least overall cost.

Fortunately, we've already made terrific progress in some areas such as bringing down the cost of renewable energy. For example, the cost of solar photovoltaic (PV) systems has decreased 90 percent in the last decade as the technology has matured,[3] and Wood Mackenzie projects PV will be the lowest-cost source of new generation in all U.S. states by 2030.[4]

However, a National Academies consensus study released this month found that in order to have a fully reliable, zero-carbon electricity system, a significant scale up of renewable energy must be complemented by one or more clean, "on-demand" electricity sources, including "geothermal energy, biogas, nuclear energy, natural gas with carbon capture and sequestration

[3] Lazard. (2020). *Levelized Cost of Energy and Levelized Cost of Storage*. https://www.lazard.com/perspective/levelized-cost-of-energy-and-levelized-cost-of-storage-2020/
[4] Wood Mackenzie. (2021). *Total eclipse: How falling costs will secure solar's dominance in power.* https://www.woodmac.com/horizons/how-falling-costs-will-secure-solars-dominance-in-power/

(CCS), and hydrogen or other carbon-free fuels produced from net-zero carbon processes."[5] Development of long-duration, seasonal storage can also ensure renewable energy can be stored when it is abundant, and used later during the days or weeks it may not be available in sufficient quantities.

In contrast to electricity, other sectors lack as many promising options that can be readily deployed today. The same National Academies study found that while technology has been invented to reduce emissions from hard-to-decarbonize areas like aviation, shipping, steel, cement, and chemicals manufacturing, these solutions are largely at pre-commercial or first-of-a kind phases and will require "significant improvement in cost and performance."

Similarly, the International Energy Agency (IEA)'s *Technology Perspectives 2020* report released last September finds that almost half of the global annual emissions reductions necessary to achieve the energy transition by 2050 will likely have to come from technologies that are currently at the prototype or demonstration stage of development.[6]

Unfortunately, we face significant headwinds in developing and commercializing these new sources of energy. As the Breakthrough Energy report *Advancing the Landscape of Clean Energy Innovation* notes, "Key features of energy systems… impede accelerated innovation. Energy is a highly capitalized commodity business, with complex supply chains and established customer bases, providing essential services at all levels of society. These features lead to systems with considerable inertia, focus on reliability and safety, aversion to risk, extensive regulation, and complex politics."

These barriers would be daunting for any new competitor, but low-carbon products are at a particular disadvantage. We currently rely on powerful, unconstrained sources of energy that have trillions of dollars worth of built-up infrastructure specifically designed to extract, process, and deliver their services at the least possible cost. Further, their costs do not account for the various environmental, climate, and public health impacts that they have. The market has therefore required alternative technology – especially that which requires new infrastructure – to either provide visibly and radically differentiated value to the end consumer, or rely heavily on public policy or voluntary sustainability commitments by individuals and companies to gain an early foothold in the marketplace.

For all these reasons, the transition to cleaner sources will not happen on its own. If we want to make new, clean products competitive with existing ones, and scale them quickly, we'll need

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[5] National Academies of Sciences, Engineering, and Medicine. (2021). *Accelerating Decarbonization in the United States: Technology, Policy, and Societal Dimensions*. https://www.nationalacademies.org/our-work/accelerating-decarbonization-in-the-united-states-technology-policy-and-societal-dimensions

[6] International Energy Agency. (2020). *Energy Technology Perspectives 2020*. https://www.iea.org/reports/energy-technology-perspectives-2020/clean-energy-technologies-the-state-of-play#abstract

supportive public policy including creative approaches to finance and investment, and much greater focus going toward advancing technology that isn't yet commercially viable.

The role of the federal government in accelerating energy innovation

Unlike software and biotech, which attract significant venture capital funding, clean energy faces substantial commercialization challenges. Technology development lifecycles are long, and projects are often capital-intensive with significant technical and engineering needs (i.e., risks). Compounding this situation are the absence of a natural market for low-carbon products, and legacy infrastructure that cannot always be easily converted to different uses as mentioned above. These constraints discourage private investment, especially at the early stages of a technology. For these reasons the federal government can and must play a leadership role in climate and energy innovation, especially in taking chances on bold ideas that might fail or might not pay off right away.

Breakthrough Energy's Policy Playbook, released in February 2021, outlines recommendations on how the federal government can support innovation across the major emitting sectors (electricity, transportation, industry, buildings, and agriculture). To summarize in brief, the primary strategies for innovation are:

- **Increase the supply of innovation:** The federal government does this primarily through funding climate and energy research, development, and demonstration (RD&D) efforts at the Department of Energy (DOE) and National Laboratories, Department of Defense, National Science Foundation, and other agencies. Extramural funding through the Small Business Innovation Research Program also supports RD&D activities at startups and small businesses, and the DOE Lab Embedded Entrepreneurship Program provides innovators with access to National Laboratory facilities and capital. All of these efforts (both intramural and extramural) are critical to providing a pipeline of technology that the private sector and other entities can later invest in and bring to scale.

- **Increase demand for innovation**: Once technology is developed and de-risked, it faces a second challenge in getting from lab to market. Here, technologies may need to rely on demand-pull incentives that can help drive down costs and create markets for low-emissions products. This can be accomplished through procurement, by providing financing and incentives to commercialize and scale clean products that we've invented, and by setting market requirements to use more clean energy.

- **Diffuse innovation globally**: Climate change is a global problem that requires global solutions, so it is key that our innovation efforts reduce the cost of technology so that it can be used in growing, developing countries where most future emissions growth will occur. By investing heavily in reducing the cost of these solutions at home, and then employing a robust strategy of international cooperation and exporting these solutions to the rest of the world, we can realize global climate benefits. We can do this by leading international collaborations to develop and invest in clean technology (both bilateral and multilateral), coordinate global policies to build market demand and sync up regulatory requirements, and promote exports of U.S. clean energy technologies with export finance and other investments. By doing so, we can also realize large economic benefits.

Economic benefits of investing in energy innovation

In addition to the climate, environmental responsibility, energy security, and national security benefits of innovation, it can also have substantial economic multiplier effects. Here, I want to address two key points.

First, despite popular misconception, investments in innovation can and do provide economic opportunity and job creation in the near-term.

For example, funding for low-carbon demonstration projects provides immediate jobs and opportunities, builds useful infrastructure that will be in operation for decades to come, and lays the foundation for follow-on private sector activity.

R&D creates jobs in the near-term as well and can act as a lifeline to sustain the important efforts undertaken by small businesses, startups, and colleges and universities in communities across the country.

There is precedent for these investments being part of a comprehensive recovery agenda. For example, the American Recovery and Reinvestment Act directed an additional $3.5 billion towards programs to support research and development, and $400 million went toward funding the first projects at ARPA-E.[7]

A 2020 analysis done by PricewaterhouseCoopers LLP (PwC) for Breakthrough Energy shows how important R&D is to the economy today. It found that $131 billion in total federal R&D investment in 2018 supported 1.6 million jobs across the economy (see

Box 1: Economic Impacts of All Federal R&D Investment

In 2018, $131 billion in federal R&D investment (all sectors) supported:

- 1.6 million **jobs**
- $125 billion in **labor income**
- $197 billion in **value added**
- $39 billion in **tax payments**

Large Multiplier Effect

- For every 1 direct job generated by federal R&D, another 2.7 jobs are supported throughout the rest of the economy.

Higher than Average Wages

- **Direct R&D** jobs have wages over 80 percent higher than the national average
- **Indirect R&D jobs** such as vendors and suppliers have wages almost 25 percent higher than the national average.

[7] Council of Economic Advisers. (2016). *A Retrospective Assessment of Clean Energy Investments in the Recovery Act.* https://obamawhitehouse.archives.gov/sites/default/files/page/files/20160225_cea_final_clean_energy_report.pdf

Box 1) – jobs including not just researchers and scientists directly receiving funds, but also lab technicians, maintenance staff, and other employees that indirectly support their work. Moreover, every direct job generated by federal R&D investment supported another 2.7 jobs throughout the rest of the economy. These jobs are in every state in the country (see **Figure 2** below). This investment contributed almost $200 billion in added value to the economy, which is a conservative estimate of the total impact because it does not capture follow-on investment by the private sector, or patents generated by the investments.

Looking specifically at energy, PwC found that $9.5 billion in energy R&D and associated infrastructure investments supported over 112,000 jobs, while also contributing $9 billion in labor income, $2.8 billion in tax payments, and $14 billion in value added to the economy (see **Box 2**).

If we increased federal energy R&D to an annual discretionary budget of approximately $35 billion dollars per year by 2030, as Breakthrough Energy recommends, analysis by PwC estimates this investment could support over 372,000 jobs and add $53 billion in value to the economy annually (see **Box 2)**.

Box 2: Economic Impacts of Federal Energy R&D Investment

- **In 2018, $9.5 billion in energy R&D investments supported:**
  - 112,000 jobs
  - $9 billion in labor income
  - $2.8 billion in tax payments
  - $14 billion in value added to the economy
- **If increased to $35 billion, energy R&D investments could support:**
  - Over 372,000 jobs
  - $33 billion in labor income
  - $9 billion in tax payments
  - $53 billion in value added to the economy

Beyond R&D, other innovation efforts, such as public procurement and tax incentives, can have similarly large economic benefits. Installation and maintenance jobs for wind and solar now comprise two out of the top-three fastest growing occupations in the United States; domestic expansion of these industries was facilitated first by government R&D, and then a program of federal tax credits and state policies.[8]

My takeaway from this is we should be investing in R&D, job-creating demonstration projects, and deployment of clean energy – all are necessary parts of a near-term recovery strategy.

Which leads to a second point: investments in innovation can also provide the foundation for economic growth in the long-term, after short-term projects end and short-term jobs go away.

Analysis published in the peer-reviewed journal *Science* traced bibliometric linkages in scientific publications and found that nearly one-third of all patents rely on underlying federally funded research – demonstrating how federal R&D underpins ideas which eventually become

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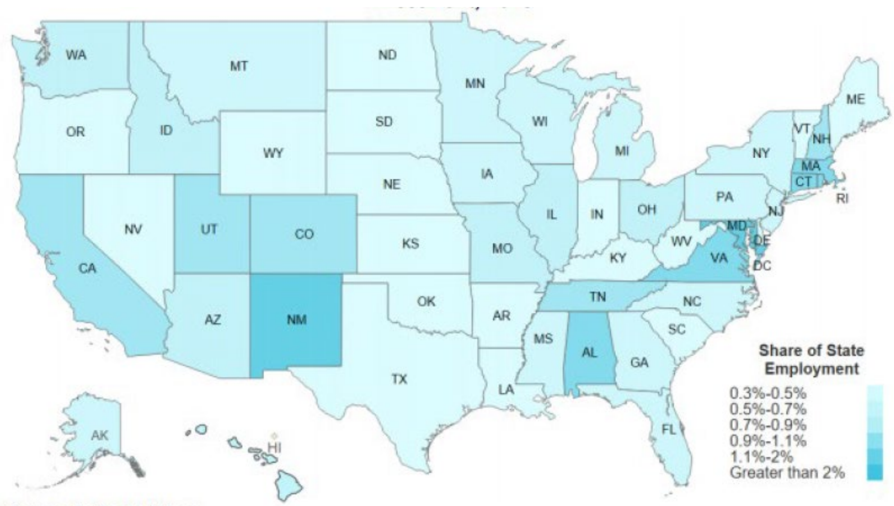
[8] U.S. Bureau of Labor Statistics (2020). *Fastest Growing Occupations*. https://www.bls.gov/ooh/fastest-growing.htm. Accessed February 2021.

companies and products. Startups are particularly reliant on federal research, with 35 percent of patents assigned to venture-backed companies citing federally supported research. Investments we make today can become the growth industries of the future, keeping America at the bleeding edge of the global economy. Similarly, the infrastructure we build today to enable use of new technologies can provide the launch pad for innovation in the long term.

Figure 2: Share of Employment Directly and Indirectly Supported by Federal R&D Investment, 2018



Source: PwC calculations.

Thoughts on a future national energy innovation investment strategy

As noted above, a successful national energy innovation strategy must do three things well: **increase the supply of innovation** through RD&D; **increase demand for innovation** through incentives, procurement, and standards; and **spread innovation globally**.

Given the Subcommittee's jurisdiction in overseeing funding for RD&D activities that are critical to the "supply of innovation" strategy**, I want to offer five key points** on what is needed to further accelerate federal efforts in this domain.

<u>Point #1: We should expand federal funding for clean energy RD&D overall, to address climate change and remain globally competitive.</u>

Globally, only $22 billion in public funds are spent on clean energy research and development each year. The United States currently spends just over $7 billion per year on clean energy innovation, according to official data reported to the International Energy Agency in 2019. About 75 percent of this funding is provided through the DOE. Congress should consider greatly increasing this budget, building on new authorizations in the Energy Act of 2020. The ultimate level of federal investment will need to be based on a bottom-up assessment of actual needs; however, a few considerations are instructive as to the level of ambition we should be aiming for as a country:

- **In context of overall decarbonization investment needs**: The International Energy Agency estimates the world currently invests $1.5 trillion in energy systems every year, and forecasts that investment will need to increase to $3.3 trillion per year from now until 2040 to achieve our energy transition goals and to provide universal energy access. If we increased the entire world's RD&D budget, including that of the U.S., by five-fold, it would still account for less than 1/30th of projected necessary investment every year.

- **Energy RD&D intensity and global competitiveness**: In the United States, investment in energy RD&D as a portion of GDP (R&D intensity) has declined over the past four decades—from 0.14 percent of GDP in 1978 to 0.04 percent of GDP in 2019. The U.S. is now 14th in the world according to this measure, while China's energy R&D intensity (0.08 percent) has increased greatly in recent years and is now twice that of the United States.

- **Climate and energy RD&D relative to other national priorities:** The National Institutes of Health have a budget that is around $40 billion for biomedical research (not including administrative overhead). Climate and energy is arguably an issue of similar import, but receives far less funding than defense, health, space, agriculture, and general science (see **Figure 3** below from the American Energy Innovation Council).

Taking these factors into account, Breakthrough Energy recommends increasing climate and energy RD&D funding to $35 billion by 2030, a five-fold increase to roughly 0.1 percent of GDP.[9]

While this is a considerable amount of funding, President Biden has called for increasing climate and energy RD&D to $400 billion over ten years. Other entities have recommended similarly ambitious increases. The National Academies' consensus study *Accelerating Decarbonization in the United States: Technology, Policy, and Societal Dimensions* recommends a three-fold increase in RD&D. Reports from the American Energy Innovation Council and the Columbia Center on Global Energy Policy also recommend tripling RD&D funding, by 2025 in the latter case.[10]

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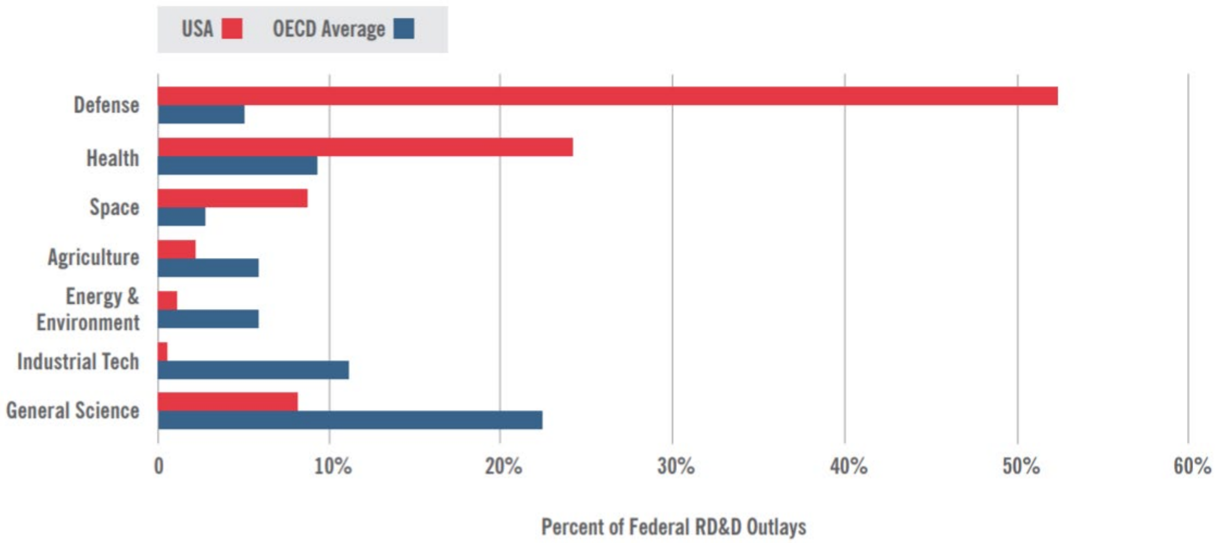
[9] GDP projections are based on Congressional Budget Office, An Update to the Economic Outlook: 2020 to 2030, July 2020, available at https://www.cbo.gov/publication/56465.

[10] American Energy Innovation Council. (2020). *Energy Innovation: Developing the Technologies for Decarbonization*. http://americanenergyinnovation.org/wp-content/uploads/2020/12/BPC_AEIC-Policy-Memo_RV4.pdf and Sivaram et al. (2020). *Energizing America: A Roadmap to Launch a National Energy Innovation Mission*, Columbia Center on Global Energy Policy, https://www.energypolicy.columbia.edu/sites/default/files/file-uploads/EnergizingAmerica_FINAL_DIGITAL.pdf.

Figure 3: R&D by Socioeconomic Objective, 2019



Source: American Association for the Advancement of Science. "Federal RD&D Budget Trends: A Short Summary." January 2019.
Available at: https://www.aaas.org/sites/default/files/2019-01/AAAS%20R%26D%20Primer%202019.pdf

Further, there is substantial evidence that public investments in RD&D incents more private sector investments. Recent studies, for instance, show that federal RD&D "crowds in" private capital – that is, provides the catalyst for follow-on investment.[11] One such study found firms that received public funding for R&D increased their own spending on R&D by 70 cents for each dollar of government funding, and this effect was most evident for non-defense R&D.[12]

Another study found that a Phase I SBIR award increases a firm's subsequent patents by more than 30 percent, increases the chance of receiving venture capital (VC) investment from 10 percent to 19 percent (and increases the amount of money raised), nearly doubles the probability of positive revenue (and among those with positive revenue, increases revenue by 30 percent), and increases the probability of survival and either IPO or acquisition.[13]

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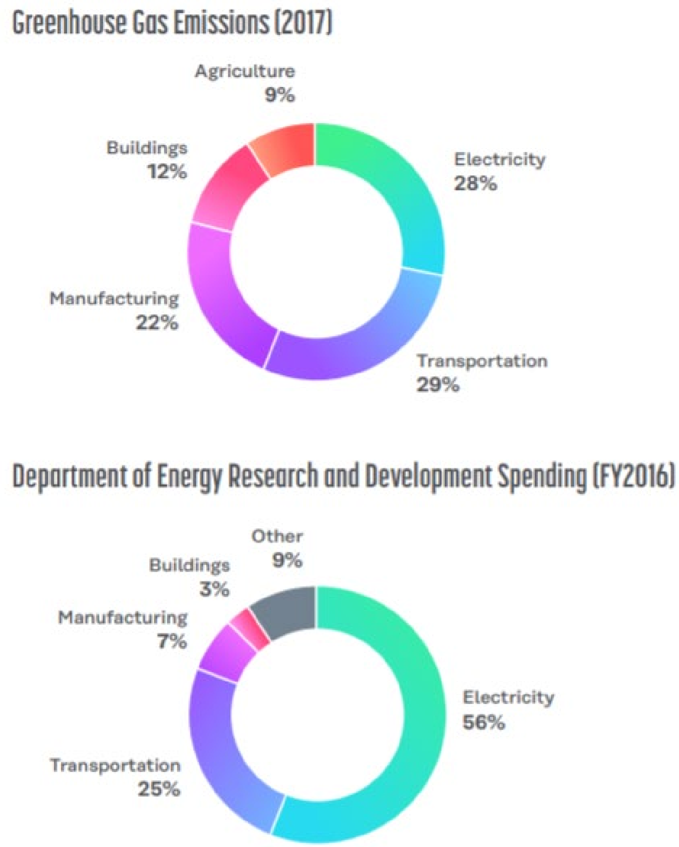
[11] PricewaterhouseCoopers LLP. (2020). *Impacts of Federal R&D Investment on the US Economy*. Breakthrough Energy. https://www.breakthroughenergy.org/-/media/files/bev/bepwcreport09162020.pdf
[12] Guellec and van Pottelsberghe de la Potterie. (2003). The Impact of Public R&D Expenditure on Business R&D. *Economics of Innovation and New Technology, Vol. 12(3),* pp. 225–243.
[13] Howell, Sabrina. (2017). Financing Innovation: Evidence from R&D Grants. *American Economic Review, Vol. 107(4),* pp. 1136-64.

Point #2: Additional funding should add coverage in underinvested, but critical, technology areas.

Figure 4: U.S. Greenhouse Gas Emissions and Department of Energy Research, Development, and Demonstration Funding According to Sector



The Department of Energy is the largest funder and performer of federal climate and energy RD&D, but as **Figure 4** shows, its efforts are overweight in areas like electricity and are underweight in areas like industry, relative to their annual emissions contributions. Congress should take a more strategic approach to funding RD&D, one that better targets sources of emissions across sectors of the economy, as recommended in Breakthrough Energy's Policy Playbook as well as Columbia University's *Energizing America* report.

Moreover, many climate challenges are inherently interdisciplinary and require collaboration that is difficult within DOE's current structure. Congress has approved cross-cutting initiatives for areas like industrial decarbonization and energy storage, but additional crosscuts can help with coordination in areas such as advanced fuels. Over the longer term, Congress may need to consider updates to the DOE's internal structure to enable clearer ownership and accountability for these critical areas. We also support aligning appropriations against discrete cost and performance goals, such as those the DOE set forth in its Energy Storage Grand Challenge Roadmap released in December 2020.

Point #3: Congress should allocate greater resources toward demonstration and deployment activities, given the number of technologies at the pre-commercial phase.

As mentioned above, low-carbon solutions in hard-to-decarbonize areas like aviation, shipping, steel, cement, and chemicals manufacturing are largely at the pre-commercial phase.

Demonstration is needed to de-risk new technologies – proving that they can work in a real operational environment – and to bring down costs for subsequent projects by refining and standardizing engineering specifications and materials. Federal demonstrations should be co-funded and co-implemented with industry because it has the operational experience necessary to execute projects and will need to eventually bring technology to scale.

Alongside industry, federal investment will be needed to support more demonstration efforts and more ambitious projects. While capital and operational expenditures vary greatly based on the technology being demonstrated, costs can run into the hundreds of millions (if not billions) for projects that rely on complex infrastructure including hydrogen, carbon capture, and advanced nuclear systems. According to analysis by the Information Technology and Innovation Foundation (ITIF), under the American Recovery and Reinvestment Act, the average bioenergy project cost nearly $100 million; for industrial CCS, the figure was nearly $360 million; and advanced clean coal projects ran well over $1 billion.[14]

Going forward, building a broader portfolio of these projects will require large upfront investment — ITIF recommends an annual demonstration project budget of at least $5 billion per year, which would support several very large projects and many smaller ones.[15]

Similar federal focus and investment will need to go toward deployment of technologies at scale, after technology has been de-risked. Despite a few noteworthy failures, the DOE Loan Programs Office has a very successful portfolio of investments – with a 3.3 percent loss rate out of $30 billion disbursed – and can play a major role alongside other deployment efforts in financing clean energy projects.[16]

Point #4: Over the longer term, Congress should consider substantial updates to the structure in which RD&D investments are allocated.

It is important to note that in the process of building the federal climate and energy innovation budget up to a much higher level, it will also be incumbent upon Congress to consider if the current system – where most RD&D efforts are performed or funded by DOE and the National Laboratories – is set up to effectively achieve the outcomes it wants. Potential areas for improvement include updating the Department of Energy's mission, modernizing the Department's internal structure (largely organized around electricity and fuels), establishing better management processes for demonstration projects to ensure unsuccessful efforts are terminated at an appropriate stage, expanding programs for deployment of technology and clean manufacturing, focusing the Lab system more on commercialization, and linking innovation programs to regional and local economic development efforts. Bill Gates called for establishing a National Institutes of Energy Innovation, which could be housed within the Department and could potentially address many of these challenges.[17]

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[14] Rozansky and Hart. (2020). *More and Better: Building and Managing a Federal Energy Demonstration Project Portfolio*. Information Technology and Information Foundation. https://itif.org/publications/2020/05/18/more-and-better-building-and-managing-federal-energy-demonstration-project
[15] Ibid
[16] U.S. Department of Energy - Loan Programs Office Portfolio, https://www.energy.gov/lpo/portfolio/. Accessed February 2021.
[17] The Gates Notes. (2020). Here's how the U.S. can lead the world on climate change innovation. https://www.gatesnotes.com/Energy/How-the-US-can-lead-on-climate-change-innovation,

Point #5: For COVID19 recovery, Congress should consider temporary measures – which may not ultimately become part of a long-term investment strategy – to fund innovation efforts that can directly support jobs and economic activity in the next few years.

Ideas for innovation investments that can support recovery efforts include:

- **Demonstration projects included in Title VI of the House-passed FY2021 appropriations minibus (H.R.7617),** which included an additional $7.8 billion investment in EERE, $3.35 billion for OE, $1.25 billion for NE, $1.25 billion for FE R&D/OCM and $250 million for ARPA-E.
- **Additional funding for DOE small business and entrepreneurship programs,** such as the Small Business Innovation Research Program and Lab Embedded Entrepreneurship Programs.
- **Increased funding to the DOE Advanced Manufacturing Office for the Manufacturing USA Program,** focusing on accelerating development of an advanced manufacturing workforce.

Conclusion

It has been encouraging to see broad bipartisan alignment within Congress in recent years on the value of energy innovation, reflected in substantial appropriations increases for DOE innovation programs and the passage of the Energy Act in December. We are now at a moment where we can continue to build on this foundation and align around a fulsome and comprehensive national innovation strategy for climate – a strategy that also helps create the jobs and opportunities we will need to recover from the COVID19 pandemic.

The United States is well positioned to do this. We have a large portion of the world's innovative capacity and a track record of success in other scientific and technical endeavors. We are also one of the most energy-advantaged countries on earth, with abundant and diverse natural resources. With sufficient resources and a clear strategy, we can play an outsized role in the global clean energy transition and enhance our national competitiveness in the process.