Overcoming Barriers To Clean Energy Innovation

U.S. Congress Joint Economic Committee

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Just a few decades ago, clean energy was a concept known to few people, today it is an industry powering millions of American homes and businesses. Clean and renewable energy sources like solar and wind are quickly becoming cheaper, more reliable, more efficient, and widespread. Clean energy plays a substantial role in U.S. energy markets, and is contributing to a decline in overall carbon emissions.[1] Rapidly developing technology is behind these trends, and new innovations will drive clean energy prices down further and increase the spread of renewable energy in the coming decades.

Congress must address the barriers to clean energy innovation and support the innovators and entrepreneurs that will create good jobs and investment today and power the economy of the future.

Advances in clean energy technology have the potential to boost the overall U.S. economy, create millions of jobs, and establish the United States as a global technology leader in clean energy—all while lowering energy costs and mitigating the worst effects of climate change. However, a number of critical barriers are preventing the U.S. economy from fully capitalizing on the clean energy's vast economic potential. An uneven playing field with traditional energy sources, incentive problems leading to underinvestment in innovation, lack of access to capital, energy systems that were built for older technologies, fierce international competition, and policy uncertainty are all holding back clean energy in America.

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Barriers to Clean Energy Innovation

Despite the promise of enormous benefits from the clean energy economy, a range of market and policy failures stand in the way of private sector actors fully realizing this potential.

Renewables are at a disadvantage in energy markets. Renewable energy must compete in markets currently dominated by incumbent fossil fuel energy sources. As technology develops, price competition is becoming easier, with renewable energy already on par with, or even cheaper than, fossil fuels in many areas of the country.[2] However, implicit and explicit subsidies artificially lower the price of fossil fuels below their true costs, making it tougher for renewables to compete and for consumers to make informed decisions.

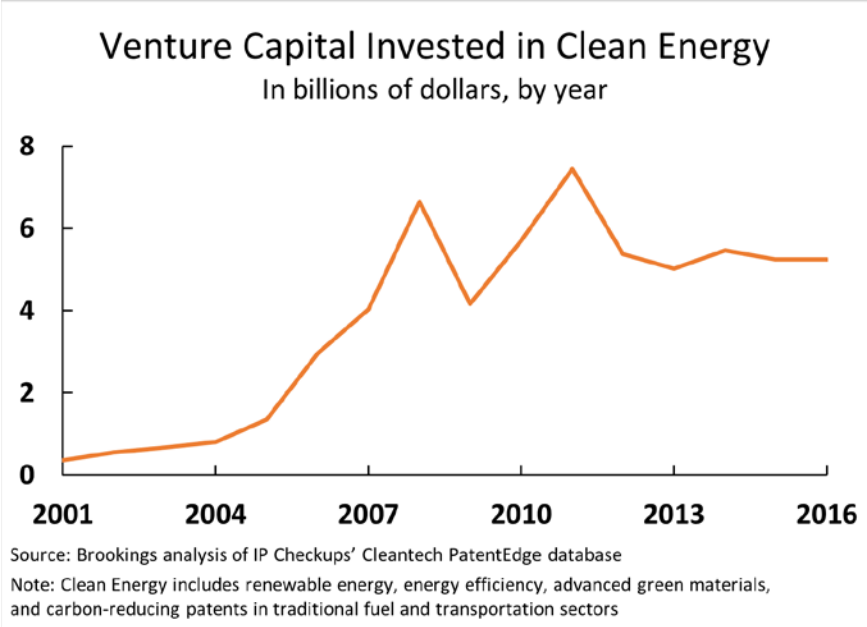
The primary factor resulting in underpriced fossil fuels is the failure of market prices to reflect the true and complete costs to society from their use. Fossil fuels generate greenhouse gases and other airborne pollutants that contaminate our natural assets, cause a range of health problems for individuals, and contribute to climate change. The International Monetary Fund estimates that the United States subsidizes fossil fuels by $700 billion annually by failing to

account for the environmental costs of consuming fossil fuels.[3] On top of this, the federal government subsidizes fossil fuel production by providing approximately $5 billion a year in tax preferences and below-market land leases for fossil fuel companies, further lowering the prices.[4]

The private sector underinvests in innovation. Because others are able to learn from and emulate groundbreaking innovations, innovators are not able to capture all of the returns their discoveries generate. This leads to the private sector underinvesting in research.[5] Federal policy seeks to overcome this investment gap by funding basic and applied research through various agencies, providing grants to universities and other researchers, and offering tax credits on private-sector research. Advances from federally-funded basic and applied research supply a steady stream of knowledge from which private sector actors are free to learn and apply in the invention of their own marketable products and services.

The Trump administration cast doubt on the future of federally funded research with substantial cuts proposed in their first budget. Research into renewable energy is specifically in doubt, as Republicans frequently cite federal funding in climate change related programs to be a source of government waste. This comes on top of budget cuts under sequestration that have already strained research spending. Rather than expanding or even keeping pace with our growing economy, federal nondefense research and development spending declined by more than $6 billion from 2011 to 2015.[6]

Lack of access to capital and the valley of death. Access to capital is a critical barrier for any young company, and many promising startups fall victim to the *valley of death*, where they fail to reach market due to insufficient funding after the initial capitalization. This is a particular challenge in the clean energy sector. Compared to other advanced industries, energy technologies typically require more capital, take longer to reach market, and have fewer ways for investors to monetize their early investment stakes.[7] These features disadvantage clean energy innovators in competing for capital and can lead to promising clean energy innovations failing due to insufficient funding. Overall, venture capital investment in the clean energy economy has fallen in recent years—nearly 30 percent from 2011 to 2016 (see figure below)—and is largely focused on late-stage deals, with 87 percent of funding going to companies near commercialization.[8]



Venture capital is heavily concentrated in a few major cities—more than three quarters of venture capital went to companies from San Francisco, New York, Boston, and Los Angeles in 2015.[9] Innovations, though, occur all across the country.[10] If inventors in smaller cities and rural areas do not have access to capital, they could be more likely to sell their patents to large incumbents rather than building on their ideas and turning them into successful startups that create good jobs and bring the benefits of new innovations to their communities. Competitive acquisitions of early-stage companies or intellectual properties can result in promising ideas never coming to fruition.

The importance of expanding access to venture capital is underscored by research showing venture-backed startups are the primary source of radical innovations.[11] To address the environmental challenges that we face, it is the radical innovations from new firms that we most need. It is also these radical innovations that will provide the largest boost to our economy.

Existing energy systems are built for conventional fuels. Most of the energy infrastructure in the United States was built with traditional energy in mind, requiring systems to be adapted or newly built in order to integrate renewable energy. With renewable electricity generation often occurring farther from population centers than fossil fuel power plants, and with more variable production, it is difficult for renewables to seamlessly integrate with many of the existing systems. Further, existing rate structures are often ill-suited for renewable energy, and state regulations implemented with conventional fuels in mind can present a barrier for new renewable development and ongoing operations.[12]

Emerging energy storage and transmission innovations, like smart grids and distributed energy systems, and new regulatory approaches, such as renewable portfolio standards, present opportunities to address these challenges. Technological development and implementation will lag, though, without a federal role to coordinate the necessary investments and regulations across regions of the country and in international border communities.[13]

America risks losing out to international competitors. The global market for advanced energy is booming, already at $1.35 trillion, and with estimates that it will grow to tens of trillions of dollars over the next several decades.[14] With this, the market for many of the inputs will grow as well. Countries around the globe have recognized this, and are working to ensure that the photovoltaic cells, wind turbine parts, and batteries that will power the future economy are produced in their manufacturing plants. Eleven countries spend more than the United States on clean energy research and development as a percent of their economy.[15] China, alone, plans to invest $360 billion in clean energy by 2020, far outpacing the investments that the United States has made in recent years.[16]

In addition to research funding, many countries are providing other direct and indirect support for clean energy companies, like direct subsidies and preferential credit for producers and tariffs and non-tariff barriers on imports. Some of these supports run afoul of international agreements, and already dispute cases related to these supports have been brought before the World Trade Organization.[17] However, disputes are slow to be resolved and their outcomes are uncertain—meanwhile, innovation keeps moving forward, enabling preferred companies to establish market and technological dominance. If America's clean energy companies are competing on an uneven playing field, it could hinder their success and discourage future investment, leaving American businesses and consumers dependent on foreign sources of energy technology and ceding the opportunity to supply U.S. products and innovation to a growing global market.

Policy uncertainty undermines markets. Investments in clean energy technologies can take decades to pay off. When investors are making decisions today, therefore, they are evaluating what market conditions will be years in the future. Inconsistent or unclear policy directions can create uncertainty and discourage investors from entering a market, perpetuating the lack of capital. For example, there is doubt over whether or not the United States will remain committed to supporting the clean energy transition, due to the Trump administration's withdrawal from the Paris Agreement and proposal to cut the Department of Energy's renewable and energy efficiency program by nearly 70 percent.[18] Tax credits that expire every year can create uncertainty as well, as investors are unsure of how their investment will be taxed on a year-to-year basis.[19]

Clean Energy Needs Congress to Overcome These Barriers

These market and policy failures hold back clean energy innovation and entrepreneurship, and lengthen the transition away from traditional energy sources. In the process, higher than

optimal carbon emissions will continue to plague Americans' health, the health of the environment, and the health of the economy. Congress must work to mitigate these failures and ensure that renewable energy technology develops at a rapid pace, benefiting both the environment and the economy.

The biggest step that Congress could take would be to "price-in" the negative externalities of greenhouse gases, with a policy such as a tax on carbon pollution or an emissions trading system like the one used in the European Union. For example, some economists have suggested levying a tax on each ton of carbon pollution, and then distributing the revenues back to taxpayers in the form of a dividend, thus making the tax budget neutral and ensuring that the tax does not place a burden on low- and middle-income families.[20] This would ensure that the price of fossil fuel energy reflects the full costs that society bears from its use, enabling market prices to provide accurate price signals that guide consumer choices. Since renewable energy does not result in these negative costs, prices would accurately reflect the actual benefits and costs, and make renewable technology more competitive. Ending federal tax credits for fossil fuel production and sweetheart leases on federal lands would also be a step in this direction.

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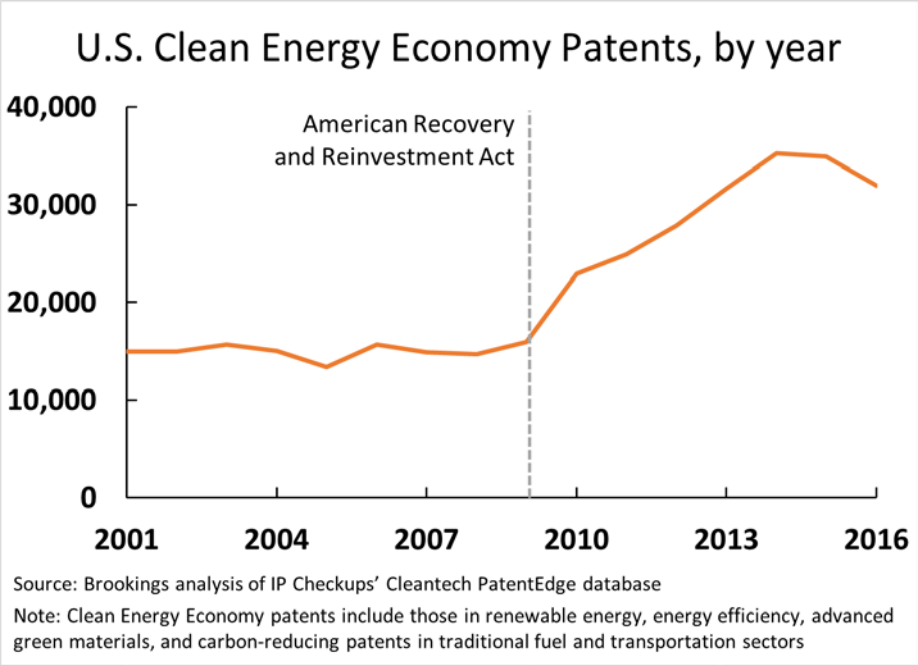
There are other areas where Congress should act to advance clean energy innovation and make it easier for U.S.-based firms to develop and succeed in global markets. Mechanisms that make investing in clean energy startups more attractive for investors are one path. Prize competitions give promising companies that have yet to reach commercial markets the opportunity to win cash prizes and investors an opportunity to generate returns on their investment earlier than they typically would.[21] Incubators and other partnerships can also make investing in clean energy startups more attractive, as they provide resources and expertise that increase the chances of success for participating companies.

Financing assistance and tax credits are another path that can provide crucial support to developing and deploying new technologies and helping young firms get through the valley of death. Federal tax credits for solar and wind research and production have helped renewable energy expand at a rapid pace in recent years.[22] Streamlining existing tax credits and expanding them to technologies like energy storage could also spur innovation and deployment of new technology.[23] Similarly, government-backed bonds can lower the cost of investment and help get projects off the ground.[24]



Congress can address below-optimal levels of research funding by investing in research through the national labs, universities, and other organizations. After the $90 billion investment in clean energy that was a part of the American Recovery and Reinvestment Act, clean energy innovation took off, but has plateaued as that investment waned (see figure above).[25] Congress must ensure that the United States continues to fund this economy-boosting research.

Clean energy innovation will be a boon to the global economy. It is up to Congress to ensure that the United States fully realizes the potential benefits of this enormous opportunity.

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