Testimony of Dr. Ellen Hughes-Cromwick
Senior Resident Fellow
Climate and Energy Program, Third Way

U.S. House of Representatives
Energy and Commerce Committee
Oversight and Investigations Subcommittee Hearing

Testimony for
"Growing the Domestic Energy Sector Supply Chain and Manufacturing Base: Are Federal Efforts Working?"
May 23, 2023

Executive Summary

Initial results are encouraging. The Bipartisan Infrastructure Law, CHIPS and Science Act, and the Inflation Reduction Act are beginning to result in a substantial number of investments across a host of clean energy technologies and their supply chains. As an example, there is already data showing substantial investments in battery cells, critical minerals, EV assembly, and solar. However, the US is at the beginning stages of the laws' deployment of funding and incentives. It is important to monitor and track investment and job announcements, and to engage business and industry representatives in order to monitor and evaluate the impact of the laws' investments on economic growth and job creation. Finally, a sustainable, business-viable restructuring of the supply chain for manufacturing will take time. For some manufactured goods like EVs, it can take three to five years to modify purchasing strategies through amended and new contracts, as well as sourcing commodities through all sizes of suppliers. This requires adjustments to company business plans and a significant amount of due diligence and oversight of new suppliers. In summary, the evidence to date demonstrates that the laws are having their intended effect of expanding domestic private investment, economic activity, and creating new jobs in industries that are moving onshore.

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Good morning, Chairman Griffith, Ranking Member Castor, and members of the subcommittee. My name is Ellen Hughes-Cromwick and I am here representing the Climate and Energy Program at Third Way. As a team of researchers and policy experts, we design and advocate for policies that will drive innovation and deployment of clean energy technologies. I have worked at Ford Motor Company as their chief economist. I also served as associate director of the University of Michigan Energy Institute and as chief economist at the U.S. Department of Commerce during the Obama Administration. Recently, I co-led a study commissioned by Third Way and Breakthrough Energy which analyzed U.S. competitiveness across the supply chain segments of ten clean energy technologies. The focus of this research was to identify areas of opportunity for U.S. businesses and industry and measure gaps that could hinder the economic opportunity that can be garnered from these activities.

There is emerging evidence that the Bipartisan Infrastructure Law, the CHIPS and Science Act, and the Inflation Reduction Act are fostering investment in and a reshoring of the clean energy supply chain and its associated manufacturing base. This testimony will address several aspects of this by reviewing evidence from announcements and actions being taken by businesses in response to the laws. Following that section, I will highlight the results from the study on U.S. competitiveness that indicates further expansion in the domestic supply chains for clean energy technologies is projected, due in part to the laws noted above. Finally, I will provide a summary

assessment of the opportunities and challenges that lay before us as this federal support is deployed. This section will provide some observations regarding prudent oversight of federal incentives based on my expertise and experience working at a large global company.

Evidence of Impact from Laws

The deployment of funding, tax credits, and other incentives associated with the laws is still in its early stages. That is why it is even more remarkable how many investments have already been announced.

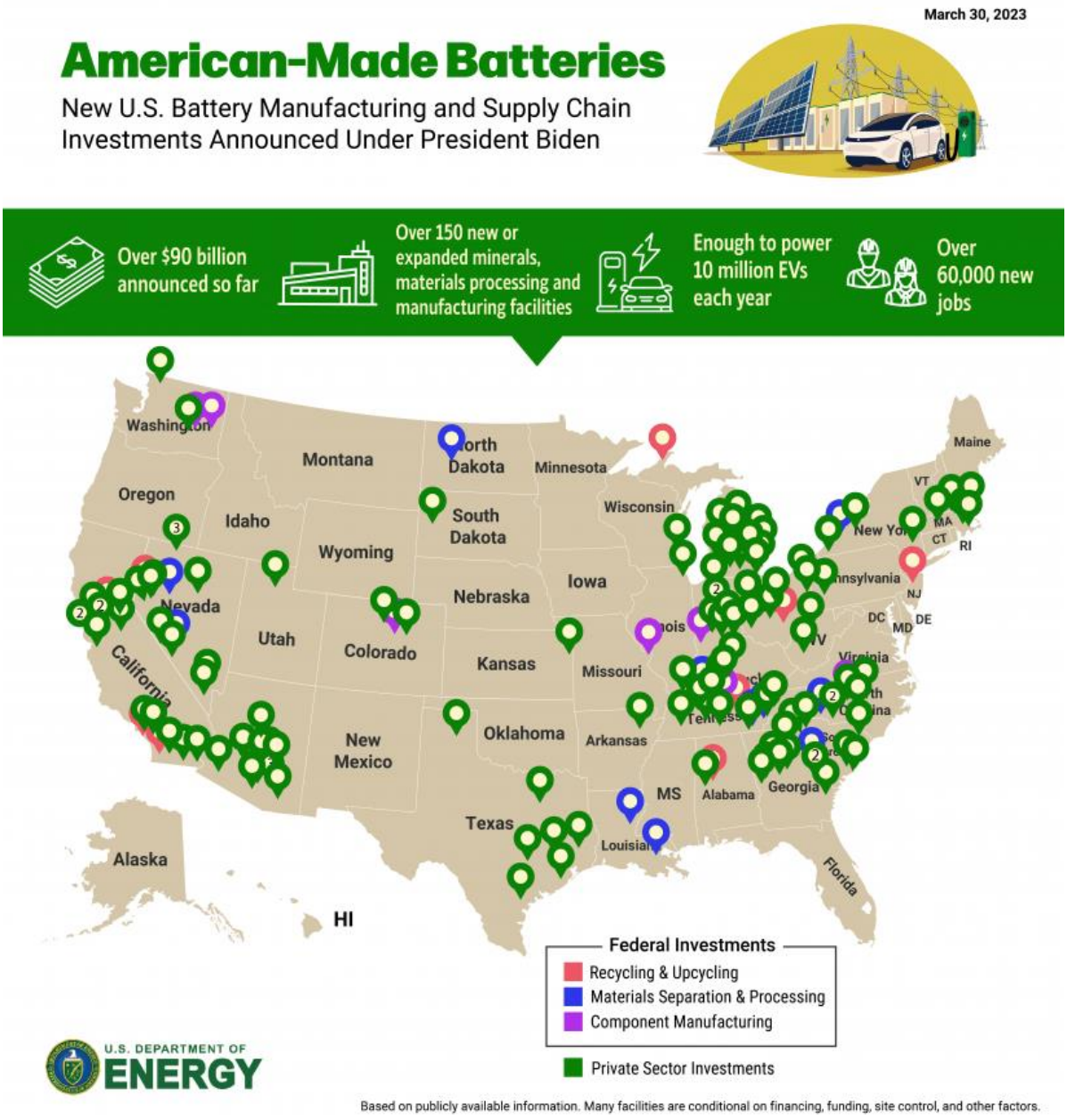
1. Battery Cells

   The response to the laws' provisions on battery cells is substantial. The Department of Energy is tracking these investments. At the end of March 2023, there had been nearly $100 billion in investments announced for over 150 new and expanded minerals, materials processing, and manufacturing facilities. The data show that this will generate over 60,000 new jobs (see chart below).[1]

   Our own Third Way tracking of announcements indicates several new battery factories since the Bipartisan Infrastructure Law was signed, which will create tens of thousands of jobs in every part of the country. We have seen an estimated $93.15 billion dollars invested in over 22 different states across the country.[2]

[1] https://www.energy.gov/investments-american-made-energy

[2] https://li-cycle.com/press-releases/li-cycle-opens-lithium-ion-battery-recycling-facility-in-alabama/; https://www.reuters.com/business/autos-transportation/honda-lg-locate-44-billion-battery-plant-ohio-2022-10-11/; https://www.mlive.com/news/grand-rapids/2022/10/chinese-battery-manufacturer-to-bring-26b-investment-up-to-2350-jobs-to-big-rapids.html; https://www.wxyz.com/news/our-next-energy-investing-1-6b-to-build-battery-manufacturing-campus-in-wayne-county; https://electrek.co/2022/10/03/tesla-expand-gigafactory-nevada/; https://www.recyclingtoday.com/news/cirba-solutions-expands-lancaster-ohio-libs-recycling-plant/; https://insideevs.com/news/612359/gotion-ev-battery-plant-michigan/; https://www.detroitnews.com/story/business/autos/general-motors/2022/09/22/gm-forms-partnership-with-battery-recycler/69511452007/; https://www.wsj.com/articles/tesla-supplier-panasonic-plans-additional-4-billion-ev-battery-plant-in-u-s-11661495847?siteid=yhoof2; https://www.nytimes.com/2022/08/31/business/energy-environment/toyota-battery-plant-north-carolina.html; https://apnews.com/article/technology-west-virginia-climate-and-environment-a8a5ae2cc374e87771664a95397ddc91; https://www.kedglobal.com/batteries/newsView/ked202208260018; https://www.press.bmwgroup.com/global/article/detail/T0404837EN/bmw-group-announces-1-7-billion-usd-investment-to-build-electric-vehicles-in-the-u-s-and-signs-agreement-with-envision-aesc-for-the-supply-of-battery-cells-to-plant-spartanburg?language=en; https://ktul.com/news/local/canoo-announces-ev-battery-module-manufacturing-facility-in-pryor-oklahoma; https://buffalonews.com/business/local/electrovaya-plans-75-million-lithium-ion-battery-plant-in-chautauqua-county/article_0709402e-4345-11ed-8164-5348836f9577.html; https://www.solvay.com/en/press-release/solvay-and-orbia-join-forces-create-joint-venture-north-america-supply-critical; https://www.mlive.com/news/grand-rapids/2022/10/chinese-battery-manufacturer-to-bring-26b-investment-up-to-2350-jobs-to-big-rapids.html; https://www.wxyz.com/news/our-next-energy-investing-1-6b-to-build-battery-manufacturing-campus-in-wayne-county; https://subscriber.politicopro.com/article/eenews/2022/11/14/norwegian-battery-firm-plans-2-6-billion-plant-in-georgia-00066639;



https://tnecd.com/news/governor-lee-commissioner-mcwhorter-announce-lg-chem-to-invest-more-than-3-billion-to-establish-manufacturing-operations-in-clarksville/; https://www.reuters.com/business/hyundai-motor-sk-build-19-bln-jv-battery-plant-us-report-2022-11-25/; https://www.wltx.com/article/news/local/envision-aesc-electric-battery-company-florence-south-carolina/101-40550fdc-9fd4-4a76-8086-3f7409b28e60; https://techcrunch.com/2022/12/06/american-battery-factorys-first-gigafactory-inches-toward-reality/; https://subscriber.politicopro.com/article/eenews/2023/01/25/tesla-supersizes-gigafactory-with-big-trucks-and-batteries-00079312; https://s201.q4cdn.com/693218008/files/doc_financials/2023/02/mi-lfp-plant-press-release-feb.-13-2023.pdf; https://asia.nikkei.com/Spotlight/Supply-Chain/Foxconn-says-it-will-build-EV-batteries-in-Wisconsin-and-Ohio; https://news.lgensol.com/company-news/press-releases/1613/; https://www.fox5atlanta.com/news/sk-battery-announces-it-facility-in-roswell-200-new-jobs; https://www.commercialsearch.com/news/1-25b-battery-gigafactory-set-to-rise-near-phoenix/;https://www.utilitydive.com/press-release/20220816-kontrolmatik-revised-its-lfp-battery-factory-plans-increasing-the-capacity/; https://www.utilitydive.com/news/panasonic-to-open-ev-battery-factory-in-kansas/627456/; https://global.honda/newsroom/news/2023/c230113beng.html?from=RSS&from=newsrelease_area; https://www.cnbc.com/2023/01/10/tesla-plans-to-spend-more-than-770-million-on-texas-factory-expansion.html; https://www.waka.com/2022/10/27/hyundai-parts-maker-to-build-ev-battery-plant-in-montgomery-creating-jobs/; https://sionpower.com/2022/sion-power-announces-plans-to-expand-battery-manufacturing-operations/

2. EV Assembly

The automotive industry is projected to become even more competitive, thanks to the laws' provisions to incentivize both demand and production of EVs. Moreover, the industry landscape is evolving from a few large industrial players, to now include startups that are penetrating different segments of the market, from pickup trucks to vans. These investments are being made across the U.S., from western states like Nevada and Texas, to Michigan, Ohio, Kentucky, Alabama, South Carolina, and Georgia. The impact of the laws has been to expand investment but also to broaden the landscape for the positive impacts of this industry growth on communities. This expansion of economic activity has positive spillover effects on job creation in retail trade, housing, and other non-auto sectors of local economies.

We have seen at least 10 new and expanded assembly factories since the Bipartisan Infrastructure Law was signed, which will create tens of thousands of jobs in every part of the country. We have seen an estimated $14.38 billion dollars invested in over eight different states across the country.[3] For example, the U.S. Department of Energy's Loan Programs Office announced a conditional commitment to CelLink Corporation to support the financing of a new manufacturing plant in Texas. This company makes innovative and commercially proven wiring harnesses for electric vehicles. The announcement indicates that at full capacity, this plant can make harnesses for 2.7 million EVs per year, adding 165 construction jobs and more than 1,200 permanent jobs.[4]

[3] https://www.nyc.gov/office-of-the-mayor/news/003-23/mayor-adams-nearly-1-000-new-electric-vehicles-replace-fossil-fuel-powered-city-fleet#/0; https://subscriber.politicopro.com/article/eenews/2022/10/18/pentagon-taps-gm-to-develop-ev-battery-for-battle-vehicles-00062175; https://www.constructiondive.com/news/form-energy-weirton-west-virginia/640030/; https://www.oklahoman.com/story/news/2022/11/25/oklahoma-city-council-will-hear-canoo-request-for-economic-incentives/69672326007/; https://www.just-auto.com/uncategorized/kia-to-produce-ev9-in-existing-us-plant/

[4] https://www.energy.gov/lpo/articles/lpo-announces-conditional-commitment-loan-cellink-corporations-us-manufacturing

3. Critical minerals

The Department of Energy's Loan Programs Office (LPO) has offered a conditional commitment to lend up to $107 million to Syrah Technologies, LLC to "expand its capacity to produce critical materials for lithium-ion batteries at the Syrah Vidalia Facility in Vidalia, Louisiana."[5] Two additional LPO conditional commitments have been made to battery recyclers: Li-Cycle and Redwood Materials. Li-Cycle is North America's largest recycling entity looking to expand its existing operations in the Rochester, New York area. Recycling lithium-ion and other raw materials at this plant will support over 200,000 EVs annually. They estimate the creation of 270 permanent jobs and 1,000 construction jobs. Redwood Materials will recycle batteries and remanufacture into critical materials used in EVs. Redwood Materials' Nevada facility is expected to create approximately 3,400 good-paying construction jobs and employ approximately 1,600 full-time employees, including labor, technical staff, and on-site management.[6]

4. Solar

A Korean solar company, Qcells, announced that it will invest $2.5 billion to build a large manufacturing facility in Georgia. "The plant will produce critical components for solar panels and build complete panels. If realized, the company's plans could bring some of the supply chains for solar energy, which is largely based in China, to the United States."[7]

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[5] https://www.energy.gov/lpo/articles/lpo-offers-first-conditional-commitment-critical-materials-project-syrah-vidalia

[6] https://www.energy.gov/lpo/articles/lpo-announces-conditional-commitment-loan-li-cycles-us-battery-resource-recovery
https://www.energy.gov/lpo/articles/lpo-offers-conditional-commitment-redwood-materials-produce-critical-electric-vehicle

[7] https://www.nytimes.com/2023/01/11/business/energy-environment/qcells-solar-panel-factory-georgia.html

According to our Third Way tracker, there have been 17 solar company announcements total $5.94 billion in investments since the laws were passed.[8] Last month, the Loan Programs Office (LPO) announced a conditional commitment to Sunnova Energy Corporation's Project Hestia to make distributed energy resources (DERs), including rooftop solar, battery storage, and virtual power plant (VPP)-ready software available to more American homeowners. If finalized, the partial loan guarantee would enable Sunnova, a leading Energy as a Service provider, to provide loans for clean energy systems for approximately 75,000 to 115,000 homeowners throughout the United States, including its territories. "The 568 MW project, comprised of solar installations, battery systems, and smart software to reduce energy waste, is expected to avoid an estimated 7.1 million tons of carbon dioxide over the 25-year life of the project. That's equivalent to eliminating carbon emissions from 1.5 million vehicles on the nation's roads. If finalized, the project is estimated to create over 3,400 American jobs."[9]

5. Geothermal

Announcements of active oil and gas companies positioning to expand geothermal projects are starting. For example, Devon Energy Corporation, a company that is expert in oil and gas drilling, recently made a strategic investment in Fervo, a leader in next-generation geothermal.[10]

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[8] https://www.kwch.com/2023/02/02/integra-tecnologies-bring-thousands-jobs-wichita/; https://subscriber.politicopro.com/article/eenews/2023/01/11/georgia-receives-largest-solar-investment-in-u-s-history-1-00077329; https://www.areadevelopment.com/newsItems/1-11-2023/ja-solar-phoenix-arizona.shtml; https://pv-magazine-usa.com/2022/12/15/cubicpv-plans-10-gw-of-conventional-silcon-wafer-production/; https://www.pv-tech.org/philadelphia-solar-translucent-energy-form-jv-to-open-1-2gw-us-solar-factory/; https://www.reuters.com/business/first-solar-picks-alabama-new-solar-factory-2022-11-16/; https://www.reuters.com/business/energy/italys-enel-build-solar-pv-cell-panel-factory-us-2022-11-17/; https://www.bloomberg.com/news/articles/2022-10-27/first-solar-plans-270-million-r-d-center-in-ohio-for-prototypes#xj4y7vzkg; https://www.utilitydive.com/news/nextera-pge-first-wind-solar-battery-project-inflation-reduction-act-spurs-storage-options/633097/; https://www.yahoo.com/?err=404&err_url=https%3a%2f%2fwww.yahoo.com%2fnow%2fspi-energy-launches-solar-wafer-074500561.html; https://investor.firstsolar.com/news/press-release-details/2022/First-Solar-to-Invest-up-to-1.2-Billion-in-Scaling-Production-of-American-Made-Responsible-Solar-by-4.4-GW/default.aspx; https://www.accesswire.com/713164/SPI-Energy-Signs-Letter-of-Intent-for-15GW-Solar-Wafer-Manufacturing-Equipment-for-USA-Manufacturing; https://pv-magazine-usa.com/2022/08/18/meyer-burger-ramps-up-solar-panel-plans/

[9] https://www.energy.gov/lpo/articles/lpo-offers-first-conditional-commitment-virtual-power-plant-sunnovas-project-hestia

[10] https://www.businesswire.com/news/home/20230418005349/en/Fervo-Energy-Announces-Investment-From-US-Oil-and-Gas-Leader-Devon-Energy

And later this year, the U.S. Department of Energy's Office of Clean Energy Demonstrations will announce the awards of $84 million for Enhanced Geothermal Systems Demonstration projects, pursuant to funds provided in the BIL.

Baker Hughes, an oil and gas technology firm, recently invested in GreenFire Energy Inc., an innovator in geothermal technology. According to the announcement, "GreenFire Energy's technology has been developed with grants from the U.S. Department of Energy, the California Energy Commission, and research conducted with U.S. National Laboratories, major universities, and eminent experts."[11]

6. Direct Air Capture (DAC) and Carbon Capture, Utilization and Storage (CCUS)

The U.S. Department of Energy's Office of Clean Energy Demonstrations (OCED) will issue the first tranche of awards for the DAC hubs and the carbon capture demonstrations programs by the fall of 2023. The Office of Fossil Energy and Carbon Management (FECM) will be initiating the carbon capture large-scale pilot program. The BIL provided a $3.5 billion investment in order to scale up carbon removal and commercialize the technology by establishing four regional DAC hubs. In addition, $5 billion in federal funding will prepare geological storage sites and develop a network of carbon dioxide pipelines to make sure captured carbon from these and other projects can be delivered to industrial users and permanently stored underground and keep it out of the atmosphere. The BCG study projects that CCUS technologies can give the US an opportunity to capture an $800 billion market in manufacturing and project development supply chain segments from 2020-2050. Furthermore, the combined incentives of BIL funding

[11] https://www.bakerhughes.com/company/news/baker-hughes-announces-investment-geothermal-technology-company-greenfire-energy

plus expanded tax credits via IRA for DAC are estimated to increase the US cumulative domestic market for DAC by $1.6 billion through 2030 and triple America's cumulative DAC export market during that time.[12]

7. Low and Zero Carbon Hydrogen

The IRA contains an enhanced Production Tax Credit of up to $3/kg will enable low-carbon hydrogen to be cost competitive across applications by 2030, driving increased domestic demand and allowing the US to be a lead exporter to key markets. With the passing of the IRA both the US domestic market and US job creation projection through 2030 have seen a sharp increase—by nearly double what it is today. The hydrogen market is projected to cumulate over $3 trillion between 2020 and 2050 with a global demand generating over 540,000 annual jobs between 2020 and 2050.

In addition, BIL also included as much as $8 billion to start as many as 10 regional clean hydrogen hubs across America. These hubs will create networks of hydrogen producers, consumers, and local infrastructure to accelerate the use of hydrogen as a clean energy carrier that can deliver or store tremendous amounts of energy. Applications have been submitted from entities around the country and notifications regarding award negotiations will be issued in the fall 2023.[13] There are other additional programs within the DOE, including: the U.S. Hydrogen Shot to reduce cost of hydrogen by 80% to $1/kg by 2030, Green Hydrogen Catapult targets $2/kg by 2027; Hydrogen Program Plan has a target of $1/kg for hydrogen industrial and stationary power applications. These are all designed to provide the support necessary for low-

[12] See BCG reports at: https://www.thirdway.org/series/when-america-leads. Energy law impacts on DAC and other clean energy technologies can be found here: https://breakthroughenergy.org/recently-enacted-legislation-can-help-the-us-lead-in-clean-technology/

[13] https://www.energy.gov/oced/regional-clean-hydrogen-hubs-update

carbon hydrogen production, which will play a central role in creating a net-zero energy system. This key role will generate a cumulative US domestic Market of nearly ~$600 billion and an estimated ~$900 billion US export market through 2050.

Low carbon hydrogen will have high abatement potential among hard-to-abate sectors such as trucking, shipping, aviation, steel, power, and cement. Advanced Clean Energy Storage (ACES) obtained a loan guarantee from LPO for a facility in Utah that will use electrolyzers and intermittent renewable energy to produce hydrogen, store it in salt caverns, and deliver that hydrogen for future electricity generation. According to ACES, the scale of deployed electrolyzers, as well as the use of salt caverns to store hydrogen, are both significant innovations. The facility "will initially be designed to convert over 220 MW of renewable energy to 100 metric tons per day of green hydrogen, which will then be stored in two massive salt caverns capable upon start-up of storing more than 300 GWh of dispatchable clean energy."[14]

U.S. Competitiveness Study: Results and Projections

A recent analysis by Boston Consulting Group (BCG), commissioned by Third Way and Breakthrough Energy, demonstrated that the United States has an opportunity to build a lasting competitive advantage across 10 clean energy technologies and seize a significant share of a global market estimated at $130 trillion through 2050.[15]

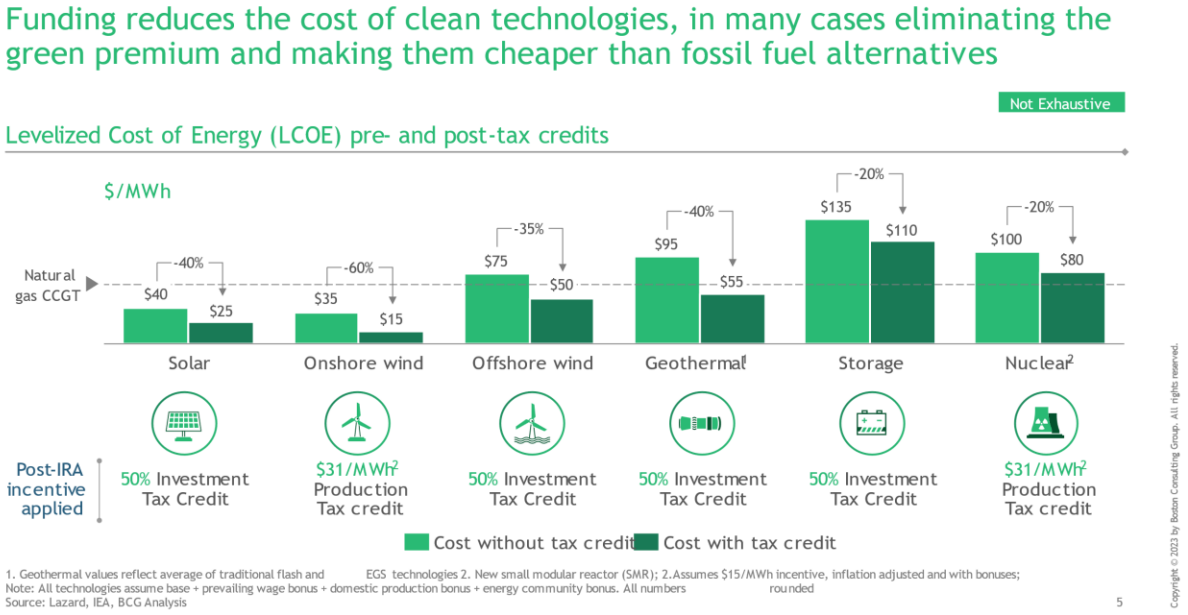
[14] Electrolyzers is a system or device using electricity to split water into oxygen and hydrogen. The LPO announcement is here: https://www.energy.gov/lpo/advanced-clean-energy-storage
https://aces-delta.com/hubs/

[15] https://thirdway.imgix.net/pdfs/override/Potential-for-US-Competitiveness-in-Emerging-Clean-Technologies.pdf
https://www.thirdway.org/appendix/potential-for-us-competitiveness-in-emerging-clean-technologies-appendix
https://thirdway.imgix.net/pdfs/override/Two-Paths-to-US-Competitiveness-in-Clean-Technologies-Report.pdf
https://www.thirdway.org/appendix/two-paths-to-us-competitiveness-in-clean-technologies-appendix
https://breakthroughenergy.org/recently-enacted-legislation-can-help-the-us-lead-in-clean-technology/

Boston Consulting Group estimated how the laws -- the Inflation Reduction Act (IRA), Bipartisan Infrastructure Law (BIL), and CHIPS and Science Act -- will drive down costs and accelerate deployment. By investing in R&D, technology demonstrations, and incentives to drive market demand, these new laws are harnessing hundreds of billions in private investment to strengthen America's global competitiveness across the value chains that make up these technologies.

For example, the new assessments find that manufacturing incentives in the IRA will help encourage cost reductions and greater domestic advantage in key "original equipment manufacturing" segments for technologies like electric vehicles, direct air capture, geothermal, and solar. And production incentives in IRA combined with infrastructure investments from the BIL hubs program will make US-produced hydrogen the most cost-competitive clean H_2 in lucrative export markets like Northern Asia.

The chart below shows the projections of the levelized cost of energy for six clean energy technologies. Here you can see that several of the technologies will have sizable cost reductions as companies take advantage of the provisions in the laws that are now being implemented.



The BCG assessments outline challenges that still must be tackled to boost US competitiveness as we accelerate the deployment of more affordable, reliable, secure, and clean energy. Solutions that reduce permitting bottlenecks, further secure vital supply chains, and expand workforce preparation efforts, for instance, can allow the US to make fuller use of recently passed laws while strengthening America's global advantage across the value chains that make up these clean technologies. That said, it is important to understand just how helpful a head start these new laws are giving the US as it seeks to expand its leadership in clean energy.

Three Observations Regarding Oversight

1. **Track and assess private investment.**

Measurement of outcomes will be a very important activity as companies and other entities take advantage of the laws' provisions. Each government agency, according to the Foundations for Evidence-Based Policymaking Act of 2018, mandates a chief evaluation officer and several activities that will provide a data and analytic foundation for program evaluation. As such, this

function at each agency should play an important role in establishing the laws' impact on its original intent.

There should be a clear understanding and empirical assessment of how these private sector investments are achieving the desired intent of Congress when these laws were passed.

2. **Measure demand and supply growth across the supply chain.**

It is also important to follow these investment flows to determine the growth in both demand and supply across the clean energy supply chains. Many clean energy technology supply chain segments are interconnected. Charging infrastructure expansion needs to accommodate the fleet of EVs on the road. Expansion of the grid is a critical infrastructure to ensure that electrification growth can match the demand from consumer, commercial, and industrial economic activities.

3. **Reach out and engage industry representatives to collect feedback.**

Ongoing engagements with industry representatives and feedback from their experiences in obtaining tax credits, grants, or RD&D funding can help to identify operational adjustments that may be necessary. This will be a significant endeavor since restructuring supply chains can take a considerable amount of time and effort. It is prudent and appropriate to identify an annual review process for each clean energy technology with business and industry representatives, informed by the evidence and data provided by agencies deploying the provisions of these laws.