



Jumpstarting U.S. Clean Energy Manufacturing in Economic Stimulus and Infrastructure Legislation

PAUL BLEDSOE

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AMERICA'S NEW CLEAN ENERGY MANUFACTURING OPPORTUNITY

In his 2016 campaign, candidate Donald Trump famously promised to revitalize American manufacturing and to pass major legislation to rebuild crumbling U.S. infrastructure. So far, in more than three years as President, he has done neither.

But in the face of the unprecedented COVID crisis, economic downturn and the worst unemployment since the Great Depression, many Democrats and some Republicans have begun to urge enactment of ambitious economic stimulus and recovery legislation, including a major infrastructure bill with a job-creating focus.

Properly structured stimulus and infrastructure legislation could help jumpstart U.S. manufacturing, which was already slumping badly under Trump throughout 2019, long before the COVID-crisis. In particular, the U.S. has an opportunity to create high-paying jobs and production in the fast-growing clean energy manufacturing sector, an industry that has been dominated by our global competitors, especially China, for the last decade.

Clean energy manufacturing represents perhaps the biggest single new growth opening for American industry in the coming years, as the transition to zero-carbon global and domestic economies creates unprecedented demand

for dozens of clean energy technologies to address climate change. The U.S. is especially well-positioned to capture these markets as our national and corporate laboratories have created far more clean energy innovation breakthroughs than any other nation.

But we have not had a concerted national policy of turning those lab breakthroughs into American-made products to help our manufacturing job growth. Instead, our competitors have used U.S. innovations to bolster their own clean technology manufacturing in areas like solar panels, wind turbines, and electric vehicles.

Remarkably, in the last three years, the Trump Administration has gone out of its way to directly kill the creation of tens of thousands of clean energy manufacturing jobs, seemingly due to President Trump's own ideological obsession with doing nothing that may have ancillary climate change benefits. Sectors including electric vehicles production and energy efficient refrigeration and air conditioning manufacturing where already tens of thousands of jobs are at stake have suffered from Trump's animus toward clean manufacturing, while China continues to walk away with contracts, production and jobs.

The current economic crisis provides yet another opportunity to invest in domestic manufacturing in the crucial clean energy sector, creating good jobs in our industrial heartland. Democrats in Congress should include robust clean energy manufacturing incentives as they prepare major stimulus and infrastructure legislation. If Republicans in Congress will not support this agenda, as recent statements by their leader's suggest, then Democrats, including presidential

nominee Joe Biden, will make these issues a centerpiece of the 2020 election debate.

TRUMP'S MANUFACTURING FAILURE

In an effort to appeal to industrial heartland voters and fulfill his "make American great again" claims, Donald Trump made rebuilding America's manufacturing sector the signature promise of his 2016 campaign. "My plan includes a pledge to restore manufacturing in the United States," Trump explicitly said at a Detroit rally immediately before the election, in one of many instances.¹

U.S. manufacturing actually declined sharply in each quarter of 2019, despite Trump inheriting a growing manufacturing sector from Obama and the massive Republican corporate tax giveaway that acted as short-term stimulus for much of 2018.² Rhetoric aside, Trump has had no real manufacturing "plan" at all, attempting precious few manufacturing policy initiatives, with those he has tried largely backfiring.

In 2017, Trump briefly created the Manufacturing Jobs Initiative, made up of 24 chief executives.³ But soon afterward he petulantly closed it down as many of the CEOs resigned in the wake of Trump's widely denounced response to the Charlottesville racial disturbances.⁴

Trump's repeated contention that his tariff-driven trade policy would help US manufacturers has proven equally specious. Most studies, including analysis by two leading Federal Reserve economists, find that his trade and tariff policies are "associated with relative reductions in manufacturing employment and relative increases in producer prices" and that "tariffs have not boosted manufacturing employment or output."⁵

Well before the coronavirus onset, U.S. manufacturing had already fallen to depths not seen since the Great Recession of 2009. Moreover, the 2019 manufacturing downturn has been especially severe in the battleground Great Lakes industrial states that will decide the 2020 election, with widespread factory job losses in Pennsylvania, Ohio, Michigan and Wisconsin.⁶

Polling last fall found Americans worried about the negative economic impact of Trump's tariffs and ready to blame Trump in the event of an economic slowdown.⁷ "An economic downturn, especially manufacturing job losses, would hurt any president, but could be especially damaging to Trump because they go against the brand he has so carefully created for himself," said Douglas Heye, a former communications director at the Republican National Committee.⁸ In fact, on April 15, 2020, the Federal Reserve reported the largest sustained drop in industrial and manufacturing production since February of 1946, when the U.S. geared down war-time military equipment production.⁹

Trump's mishandling of the coronavirus crisis and resulting human tragedy and economic devastation will of course be a leading issue in November. But Trump's failure on manufacturing policy both before and during the corona-crisis should also be a major political topic in the industrial swing states that will likely decide the 2020 election.

RIDING A CLEAN INFRASTRUCTURE BILL TO THE MANUFACTURING RESCUE?

Trump's failed manufacturing policy and America's prolonged economic shutdown worsened by his inept response to the coronavirus crisis together help explain Trump's sudden and enthusiastic support in recent

weeks for a far more expansive infrastructure bill than either the current Senate or even House bill.

After three years of shunning infrastructure investment opportunities despite promises during the election that it would be a main priority, Trump tweeted April 1 calling for a \$2 trillion infrastructure bill.¹⁰

Skepticism about Trump's sincerity and dedication regarding such a bill is certainly appropriate, not to mention credulity about the willingness of other Republicans to back an ambitious infrastructure stimulus. Yet there does appear to be an opportunity for one of the most improbable political bargains in recent U.S. history: using economic stimulus to modernize our antiquated transportation and communications infrastructure and boost manufacturing through tax and other incentives, a policy approach that has worked for essentially all of America's industrial competitors.

One especially intriguing potential political deal lies in Democrats supporting infrastructure and stimulus bill incentives to jumpstart U.S. clean energy manufacturing, one of the world's fastest growing sectors, while also lowering greenhouse gas emissions. For their part, Republicans would get to claim they are beginning to create the manufacturing economy that Trump has long promised, one that would especially benefit their voting base in small cities and rural areas where many workers have been left behind by the technology-based economy.

The advanced energy manufacturing products sector is expected to grow globally with remarkable speed in coming years, attracting \$10 trillion in investment by 2050, although many analysts believe even this huge figure is too low.¹¹ Already, renewable electricity sources such as wind, solar and hydro-electric plants will

gain investment of \$322 billion a year through 2025, nearly triple the \$116 billion annual that will go into fossil fuel plants, according to forecasts from the International Energy Agency.¹²

But wind and solar are only part of a far larger clean energy manufacturing sector opportunity. The sector includes: electric cars, buses, and trucks, EV charging stations, electricity storage capacity, next generation biofuels, smart electric grids, hydrogen-based fuel cells, advanced transformers, microscale hydropower and pumped storage, carbon capture facilities and retrofits to natural gas and industrial plants, carbon-based products, direct air carbon capture, advanced or modular nuclear plants, and many other technologies.

These products and infrastructure elements are not tangential to America's future, but instead would help form the new backbone of an advanced, efficient, and more resilient U.S. energy and transport economy for decades to come, just as New Deal infrastructure and World War II industrial development did.

Rather than creating new sectors out of whole cloth, the clean manufacturing stimulus should be thought of as nudging major industries—including, but not at all limited to, automakers, electric utilities, oil companies, advanced energy and climate technology companies, commercial and residential real estate developers and builders, the heating and cooling, advanced communications, information technology and internet providers—toward making much larger investments in more advanced, lower-emitting technology production they are already considering, and in all cases see as the future of theirs and many other industries.

For example, automakers like General Motors and Ford have announced billions in investments in electric vehicle factories and production. But they are deeply worried about lack of consumer demand, especially now given the recent huge drop in oil prices resulting from the coronavirus crisis.

With gasoline so cheap, additional incentives like more robust tax credits for EV purchases will be needed to jumpstart consumer demand, with a particular focus on making EVs affordable for all drivers, not just upper-income consumers. An EV affordable for everyone is a crucial concept, and hardly impossible. Note that by 1925, Henry Ford's model-T sold for \$260 (or about \$3,700 in today's dollars). Why must even the cheapest cars today be 10 times the price of the most popular American car a century ago?

EVs are in fact simpler and cheaper to build at scale and easier and cheap to run and maintain, as well as cutting greenhouse substantially and providing remote electricity storage capacity with a smart grid. How is it that America, the most technologically advanced country in history, can solve this engineering and production challenge? The answer of course is we can, but as a matter of public policy, we simply haven't tried.

Equally important will be initial direct state and federal government procurement programs for US-built electric cars, buses, trucks and many other related products. These contracts can enable US auto companies to begin scaling production with long-term contracts, reducing costs, and driving down prices to capture the domestic and international consumer market.

The rapid retooling of GM and Ford to build ventilators to address the Covid-19 crisis

illustrates the technical ability of automakers to adapt to new market demands and government incentives. The fact that the Trump Administration asked them too late to do most initial good is the fault of government, not industry.¹³ Indeed, it should serve as a cautionary tale against listening to naysaying, modern-day Herbert Hoovers, who oppose quick action to create economic recovery, including government incentives for private sector production and job creation.

Automakers are not the only industry at an investment inflexion point. U.S. major oil companies are also at a crucial crossroads in investment decisions as they currently sit on tens of billions in uninvested cash.

With the collapse of oil prices, which are likely to stay well below \$40 a barrel for some time to come as demand lags, much of U.S. oil production will remain uncompetitive against competitors like Saudi Arabia and Russia. Thousands of oil workers will not be headed back to the production jobs any time soon. This would be a logical time for oil majors with billions in frozen investment potential to begin investing more seriously in oil alternatives, a transition that incentives in infrastructure and stimulus legislation could help jumpstart, and which could gain uniquely strong support from both parties.

“It doesn’t make sense to reduce your investment in renewables if the oil price crashes,” said Mark Lewis, head of sustainability at BNP Paribas Asset Management.¹⁴ “It’s more logical to reduce your investment in oil.”

As it stands, the Trump Administration’s primary ideas for helping the oil industry are jaw-boning

the Saudis into temporarily lowering production to raise oil prices, buying cheap oil to fill the US Strategic Petroleum Reserve. While both might have some modest short-term value to the industry and country, neither grapples with the long-term challenges facing the US oil industry and energy economy. These include shareholder and public pressures to cut carbon emissions to address climate change, and increasingly formidable competition from foreign producers and oil alternatives.

Providing oil companies with incentives for clean investments could fulfill many industry goals at once, and gain support from Republican oil allies and even many Democrats eager for the fossil fuel industry to make billions in cleaner investments. Instead, the Administration is simply providing loans to even mid-sized oil companies through the Federal Reserve’s “Main Street” lending program, which would also prop up smaller firms who are longer competitive.

Another option proposed by former George W. Bush energy official Andy Karsner is to apply automatic tariffs on oil imports when global oil prices fall below \$40 or \$50 a barrel, to help both US oil producers keep producing in the short-term but also keep oil and gasoline prices high enough to allow alternatives like electric vehicles to compete.¹⁵ But such a policy would purposely raise gasoline prices on employed Americans during the worst economy since the Great Depression, and is unlikely to be politically viable.

Yet far from helping clean energy manufacturing, Trump and most Republicans have been strangling these young industries in their cribs, choking off future manufacturing and job growth.

In December, Trump killed Congressional efforts to extend electric vehicle tax credits above 200,000 units per company, a threshold GM and Tesla have already hit.¹⁶ In fact, Trump opposes all EV consumer tax credits, as he has stated in each of his federal budget proposals, despite pleas by the auto industry, auto workers, industrial states and economists that they are the key to the future.

"There has been extreme resistance from the president. I don't know why the White House would want to stop jobs and the future of the auto industry," said industry ally Michigan Senator Debbie Stabenow at the time Trump killed the electric vehicle extension.¹⁷

Trump's killing of the extension of the federal tax credits for electric cars made by Tesla and General Motors has badly hurt U.S. production, since GM and Tesla together make up around 60% to 70% of the U.S. market.

But Trump has also gone out of his way to spike other obvious clean energy manufacturing sectors and job growth. He has ignored efforts by the U.S. heating and cooling industry to pass bipartisan legislation, The American Innovation and Manufacturing Act, that would help U.S. industry manufacture the next generation of air conditioners, refrigerators and other cooling devices by phasing out super greenhouse chemicals HFCs, and using lower greenhouse gas emitting new chemicals pioneered by American chemical companies.¹⁸

A major industry study found that a new federal standard to phase down HFCs would create 33,000 new American manufacturing jobs, adding \$12.5 billion annually to the economy, and expanding sector exports by 25%.¹⁹ Crucially, these jobs would largely go to China

without U.S. action. Yet Trump apparently opposes the bill simply because he views it as having climate change benefits. In fact, Trump's opposition to the cooling industry legislation with obvious U.S. manufacturing benefits ended up killing the recent Senate energy bill in February, despite widespread bipartisan support for the measure.

In short, Trump and many other Republican allies are preventing a manufacturing renaissance, not helping to achieve it. And while manufacturing accounts for less than 12% of gross domestic product, manufacturing jobs are highly paid compared to service employment, and deeply tied to broader activity in the economy, especially in small cities, towns and rural areas.

Of course, infrastructure and stimulus legislation should and must include incentives for other manufacturing sectors in addition to clean energy. For example, shortening supply chains and doing more work in the United States becomes more feasible with flexible digital manufacturing., so that factories can easily shift between products without expensive retooling. But driving the adoption of these new technologies can be aided by access to inexpensive capital and government technical assistance, as well as the funding of "manufacturing platforms."²⁰

Similarly, support for upgrading the quality and expanding the geographical reach of America's wired and wireless broadband seems an obvious priority for both parties, especially in wake of the reliance on the internet for economic activity during the coronavirus shutdowns and sheltering. It is notable, however, that even this advance would have energy efficiency and emission-reduction benefits, as universal fast

broadband and expanded 5G would enable greater telework and telecommuting, and enable technology advancements that reduce auto and other emissions in the process. For example, Chinese companies are using its 5G connectivity advantage to help manufacture many electric and driverless vehicles together, with an opportunity to leapfrog competitors focused on only one technology advance or the other.

America needs more robust and strategic policies to promote competitive domestic manufacturing across all sectors. But clean energy manufacturing opportunities are especially bright if we take the actions needed to capture them.

CHINA'S 2009 STIMULUS CREATED A CLEAN MANUFACTURING BONANZA – AMERICA'S DID NOT

One of the strongest arguments in favor of U.S. clean energy manufacturing incentives may be found in the contrast between the U.S. and Chinese approaches to economic stimulus and manufacturing incentives during and after the Great Recession of 2008-2010:

- China devoted nearly half of its entire \$650 billion 2008 stimulus—more than \$300 billion—directly to clean energy manufacturing, including production of photovoltaic (PV) solar panels and electric vehicles (EVs).²¹

China in 2010 also designated PV solar panels and EV production two of seven “Strategic Emerging Industries” and in 2015 included them as centerpieces of Xi Jinping’s “Made in China 2025” plan.²² In practice, this meant that China began prioritizing domestic purchase of these products, by both the government and consumers, to create demand.

The economic results from these policies have been remarkable:

- In 2008, China had less 30% of PV solar panel market; today it controls about 70%;
- China is on its way to dominating global electric vehicle production, one of the fastest growing manufacturing sectors in the world, as the Economist has found, with at least 45% of global market share compared to less than 20% for the U.S.;²³
- China controls 73% of the world’s lithium ion electric vehicle battery market, the key EV technology, compared to the U.S. in second at 12%, according to the most recent data from Bloomberg New Energy Finance.²⁴

“The Chinese have really captured control and dominance in lithium-ion manufacturing and may well be on their way to grab control of the leading position on the technology side as well,” says James Greenberger, executive director of the leading EV battery trade organization.²⁵ “It’s essentially a self-reinforcing system, whereby China is able to get its manufacturers to scale by subsidizing a domestic market....to create opportunities for the manufacturers that are not available in North America or the EU or really anywhere else.”

With an average subsidy of \$10,000 per vehicle and 770,000 sold EVs, China’s central and local governments spent a total of \$7.7 billion on EV subsidies in 2017 alone. The Economist magazine in a major survey of China’s EV sector dominance last year came to largely the same conclusion.²⁶

The U.S. 2009 stimulus and subsequent policies have had nothing remotely like the Chinese emphasis on clean energy manufacturing incentives. When they inherited the worst economy since the Great Depression from George W. Bush, Barack Obama and Congressional Democrats made the then controversial decision to devote 10% of the overall 2009 American Recovery and Reinvestment Act (ARRA) economic stimulus to a wide range of clean energy incentives for job creation and technology deployment.

Looking back, this decision was controversial for all the wrong reasons. Far from being too aggressive, the clean energy provisions have generally been viewed as not nearly ambitious enough, from both an economic and environmental perspective. In fact, clean energy deployment growth has been a huge bright spot in the US economy for the last 10 years.²⁷

A 2016 Council of Economic Advisors report found that “\$90 billion in strategic clean energy investments and tax incentives to promote job creation and the deployment of low-carbon technologies leverag[ed] approximately \$150 billion in private and other non-federal capital for clean energy investments.”²⁸

CEA estimated that the Recovery Act clean energy-related programs supported roughly 900,000 job-years in innovative clean energy fields from 2009 to 2015. In fact, the ARRA stimulus and rapidly falling prices for solar, wind, and other clean technologies, investment and production tax credits combined to produce huge clean energy employment surge, with nearly 4.5 million jobs across the country by 2018, up from 3.4 million in 2011, and far fewer

than that in 2009 when ARRA began.²⁹

Nearly half of these jobs involve the burgeoning field of energy efficiency, where a revolution across the economy – in manufacturing, electronics, high-tech, construction and many other sectors – is employing millions of workers and saving consumers and businesses billions of dollars. Most of these clean energy jobs provide good middle-income wages similar to those in fossil energy production with wind turbine installers earning about \$60,000, electrical installers of solar energy earned about \$76,000, while solar mechanics earned about \$73,000 and solar engineers well over \$100,000 a year.³⁰ In 2018 and 2019, wind turbine technician was still the fastest-growing profession in America.³¹

This suggests that a 2020 stimulus and infrastructure bill focused on job creation should also include significant incentives for investment in these fields, especially as current US tax credits in these areas are in most cases set to shrink or expire altogether.

Even so, the vast majority of U.S. jobs created after the 2009 stimulus involved installation of clean energy equipment and technology and other high-tech service jobs—not manufacturing, per se. This is not surprising given how little investment the U.S. made in manufacturing:

- Of a total \$840 billion stimulus, just \$2.3 billion went to the energy manufacturing tax credit, the only program entirely focused on manufacturing, and hundreds of companies who applied received no money.³²
- Thus, China provided approximately 150 times more funding to clean energy manufacturing than the US did.

CEA was able to point to a few clean energy manufacturing bright spots after the 2009 stimulus, “a dramatic increase in the share of domestically-produced wind turbine components used in the United States from 25 percent in 2006-2007 to 72 percent in 2012” and rather lamely claimed it was “setting the foundation for the plug-in electric vehicle market by accelerating the development of advanced battery and electric drive manufacturing plants.”³³ But given the overall numbers by 2020, it is clear the U.S. invested far too little to jumpstart production of EVs and other clean manufacturing. Moreover, we have not pursued the robust consumer incentive and government procurement policies that have been crucial to China’s success.

STILL TIME FOR AMERICA TO CATCH UP IN CLEAN MANUFACTURING

Fortunately, the global electric vehicle sector is still in infancy. Only two million EVs are produced globally each year today. Yet key estimates suggest more than 30 million EVs will be manufactured a year by 2030, making it the fastest growing manufacturing sector in the world over the coming decade.³⁴ On electric vehicles, as with many other advanced energy technologies, there are good reasons to believe that if the US puts strong incentives in place quickly, it can capture a significant share of the global clean manufacturing market during the coming decade of remarkable growth.

For one thing, despite its outward success, all is not perfect with the Chinese approach, and some of its flaws suggest specific U.S. opportunities. A Center for Strategic and International Studies report on EVs finds that China’s “chances for profitability in the near-to-medium term are low and the chances for

overcapacity are high,” the latter point especially relevant given the unprecedented global slowdown caused by Covid-19 pandemic.³⁵ Further, the study notes that “the quality of China’s NEVs is still not equivalent to that of traditional cars,” suggesting a focus on quality by US manufacturers will be crucial, as will be aggressive domestic demand creation and export marketing.

But the report’s conclusion that the U.S. auto sector is not threatened by Chinese EV dominance is highly suspect, and doesn’t comport with essentially all other major independent industry analysis. It largely ignores the essential imperative to reduce greenhouse emissions from the transportation sector globally—with many major markets across Europe having enacted bans on new oil-powered cars beginning within a decade or two, and in the U.S. where transport is now the largest source of CO2 emissions.

Moreover, the unique role a large fleet of EVs can play in the key goal of large scale electricity storage is a crucial advantage of the electric vehicle adoption, as a 2019 PPI white paper “Winning the Race on Electric Cars” found.³⁶ Tens of millions of cars connected to the electric grid at different points become a flexible and ideally distributed repository of power storage, with electricity storage itself being a key component in low-cost, low-emissions energy transition. And finally, as the recent crash of global oil prices has dramatically demonstrated, the U.S. remains economically (and ecologically) vulnerable to global oil price swings it cannot control, despite (and in some ways because of) its own increasing production and investment in oil production.

For all these reasons, the vast majority of analysts believe that EV markets will grow very rapidly in years to come, both in the U.S. and around the world, eventually overtaking and even making obsolete oil-powered transport in most regions within several decades. And as *The Economist* magazine emphasized in a special report in 2019, China's emphasis on both EVs and autonomous vehicle technology at the same time may provide it unique advantages.³⁷

But most analysts see the COVID-crisis hitting the nascent EV industry in the U.S. especially hard. Far more robust consumer tax credits as well as EV charging infrastructure and government procurement of EVs will be necessary if U.S. automakers are going to gain market share. Morgan Stanley analysts "anticipate many auto companies will cut back on their EV efforts or delay them significantly to address near term cash needs" due to the COVID-crisis.

The consultancy Wood Mackenzie sees a near-term decline in consumer demand for EVs, but found pent-up EV demand is expected to help a bounce back later in 2020 and 2021.³⁸ Moreover, pending European emissions rules, China's support for its EV industry and plans for more EV models by many international automakers mean the sector will continue to be competitive globally.

The International Council on Clean Transportation's electric vehicles program notes the Trump administration's weaker fuel economy standards also will "greatly undercut investments on vehicle efficiency and EV investments through 2026." Joe Biden has indicated he would raise fuel economy standards again over time if elected.

The COVID-crisis has also exposed the continuing reliance of U.S. clean tech industry on key "rare earth" minerals, critical to production of lithium-ion batteries and wind turbines in particular, and on U.S. vulnerability to interruptions by Chinese supply chains for clean technologies more broadly.^{39,40} A report by Daiwa Institute of Research argues that supply chains in clean energy must shift away from China in the global economic recovery effort. "The supply chain should be rebuilt using the 'China Plus One' model," splitting manufacturing dependence between China and at least one other country.⁴¹

Beyond EVs, a similar range of benefits, opportunities and challenges faces the US on a wide range of clean energy manufacturing. Indeed, for many technologies—including electricity storage capacity, next generation biofuels, advanced mass-transit and trains, smart electric grids, hydrogen-based fuel cells, advanced transformers, carbon capture and storage facilities and retrofits to natural gas and industrial plants, carbon-based products, and direct air carbon capture—the U.S. may be even better positioned to pick up market and export share if it creates wise incentives for U.S. production in upcoming economic recovery and infrastructure legislation.

BUT AMERICA NEEDS AN ADVANCED MANUFACTURING STRATEGY

There is a growing recognition among progressive and conservative economists alike that the U.S. must begin to consider some elements of an advanced manufacturing policy if America is to compete long-term with China, Germany, Japan and other major countries who all have such manufacturing policies.

In fact, both Trump's initial success at making manufacturing a more prominent political issue and the clear failure of his tariff-based policies to expand manufacturing during his Presidency should prompt a more open-minded reexamination of manufacturing policy approaches on left and right, as a matter of political as well as policy expediency.

In a November 2019 influential essay in *The Wall Street Journal*, Dr. Sridhar Kota, director of a public-private research consortium on advanced manufacturing, and his associate Tom Mahoney, argue it is:

“Time for the U.S. to adopt an industrial policy for the century ahead—not a throwback to old ideas of state planning but a program for helping Americans to compete with foreign manufacturers and maintain our ever more precarious edge in innovation.... The slow destruction of the U.S. industrial ecosystem is a clear case of market failure, and the government has an important role to play in remedying it. Thanks to continued federal funding in the sciences, the U.S. is still the best in the world in groundbreaking scientific discoveries and inventions. But the federal government must do more than invest in basic research; it must also fill the innovation deficit by creating a new infrastructure for R&D in engineering and manufacturing.”⁴²

Nowhere is this “market failure” and opportunity more conspicuous than in clean energy manufacturing, since the U.S. national energy laboratories have invented virtually every advanced energy technology that has been adopted globally over the last 30 years.⁴³ These technologies span a remarkable gamut

transforming U.S. and global oil and gas production, drastically reducing the costs of renewable energy, revolutionizing energy efficiency and saving hundreds of billions a year in American consumer energy costs and cutting billions of tons of CO₂ globally.

High-capacity lithium ion batteries were pioneered in our labs. Photovoltaic solar technology was invented by American companies and propelled by NASA. Super-efficient LED lighting, diesel and gasoline engines, electronics and dozens of other products, originated in our laboratories. Yet most of these products are now being made primarily abroad

A February 2020 report by the American Energy Innovation Council, a group of business and technology leaders including Bill Gates and CEOs from major US energy companies finds that:

“Encouraging only early-stage R&D will not be enough, serving only to support the invention of technologies that will die an early death in the lab, or be fully developed abroad and sold back to us. Rather, well-targeted public investments and well-designed public policies for the full innovation lifecycle are needed to scale the next generation of advanced energy technologies.”⁴⁴

These views are now widely held by U.S. industry leaders as well as by organized labor and many environmental advocates.

AMERICA'S CLEAN MANUFACTURING PLAYBOOK FOR NEW ECONOMIC CHALLENGES

Given the failure of Trump's manufacturing policies, and the imperatives of economic recovery as America emerges from the

coronavirus crisis, U.S. clean energy manufacturing policies should include:

Investing in 21st Century Clean Technology Infrastructure:

- Directing government investment and private sector incentives for creation of a 21st Century advanced U.S. clean energy technology infrastructure, including smart grids, EV charging infrastructure, advanced mass-transit and trains, super high-speed wireless internet, electricity storage, carbon capture, port infrastructure for offshore wind power, solar, and many others;
- Requiring domestic manufacturing of all infrastructure components where possible.

Stimulating Demand for U.S. Manufactured Clean Energy Products:

- Creating clean manufacturing demand through direct procurement of domestic manufactured goods like electric vehicles and other products by federal, state and local governments;
- Boosting consumer demand through robust tax credits for key domestically manufactured clean energy products like electric vehicles, advanced electronics, rooftop solar, wind, net metering and integrating high-speed communications;
- Restarting direct pay Treasury Cash Grant Program for clean energy tax credits;
- Making clean technology consumer tax credits instantly applicable at storefronts.

Incentivizing Greater Private Sector Clean Energy Production and Investment:

- Increasing both production and investment tax incentives to drive private sector investment and manufacture of clean energy products;
- Including technology-neutral tax credits to encourage a wide range of zero-carbon production, not just those favored by specific technology interests;
- Requiring domestic manufacturing content standards for new or expanded efforts like a proposed Clean Energy Deployment Administration (CEDA), Master Limited Partnerships for clean energy, Private Activity Bonds for Carbon Capture and Storage (CCS), and other private sector investment drivers;
- Expanding funding for the Department of Energy's loan program;
- Extend the "45Q" tax credit for CCS including direct air carbon capture;
- Providing carefully structured incentives for oil majors sitting on billions in frozen investment potential to begin investing more seriously in production and manufacturing of oil alternatives;
- Continuing some loan guarantees for major clean energy projects like CCS retrofits to gas and industrial plants, advanced nuclear plants, carbon-based manufacturing and others.

Creating Clean Energy Manufacturing Jobs and other Employment Opportunities:

- Establishing clean energy technology and manufacturing skills education programs through community colleges nationwide to train workers especially where unemployment is highest, and matching students with specific private sector jobs;
- Upgrading US infrastructure in labor intensive sectors including energy efficiency upgrades in buildings and other infrastructure;
- Creating new jobs for hundreds of thousands of clean energy workers who have lost jobs since the Covid-crisis, using government infrastructure investments, and clean energy production and investment tax credits, upgrading energy efficiency of buildings and many other employment opportunities that proved effective in the 2009 stimulus.
- Transitioning unemployed oil, natural gas, and other fossil fuel industry workers to building clean energy products with incentives for major oil and gas companies to make alternative energy investments given that much U.S. oil production will remain uneconomic;
- Incentivizing clean technology investments for agriculture and forestry management (Farms and Forests), including manufacturing and deployment of clean energy technologies as part of natural low-carbon solutions;
- Supporting DOE's weatherization assistance program, state energy programs, and HHS low income home energy assistance (LIHEAP);

- Emphasizing manufacturing and deployment incentives for production of facilities and technologies that can reduce specific short-lived climate pollutants, or super-pollutants, like methane, HFCs and black carbon, including air conditioners, refrigeration equipment, repair of natural gas pipelines and landfill methane to syngas technologies.

Connecting U.S. Clean Energy R&D Breakthroughs Directly to Domestic Manufacturing Products and Opportunities:

- Increasing U.S. clean energy R&D 8-fold to \$40 billion a year;
- Appropriating \$10 billion per year to the Department of Energy's Advanced Research Projects Agency;
- Funding programs like CEDA, Loan Guarantees and Demonstration Projects focused specifically manufacturing successful consumer products based on U.S. clean tech advances;
- Expanding to \$100 million per year for DOE's LabEmbedded Entrepreneurship.

Reinstating some Regulatory Policies that Drive Clean Energy Employment and Investment, But Revisiting NEPA and other regulations:

- Trump anti-clean energy regulatory rollbacks – on fuel economy, methane, social cost of carbon, energy efficiency – were in fact counterproductive economically and in terms of job creation in many industries;
- Incredibly, Trump has been targeting for closure the voluntary Energy Star efficiency program that saves U.S. consumers \$34 billion a year in electricity costs, to take just one example;⁴⁶

- But regulations like the National Environmental Policy Act that can slow down permitting of critical infrastructure and clean energy build outs must be reformed to promote expansion of clean energy.

BUILDING ON EXISTING POLICIES THAT WORK, NOT RADICAL CHANGE

These common-sense but ambitious proposals build on existing tax, government procurement and clean energy investment policies to drive production through the private sector, but put a new emphasis on manufacturing as well as deployment of low-emissions technologies.

While these policies will drive government and private sector investment into low-emissions, clean energy manufacturing, they specifically do not include the more extreme elements that have been part of some Green New Deal proposals.

For example, these proposals do not involve guaranteed government jobs for all or direct incomes for all Americans. Nor do they include bans on internal combustion engine cars by 2030, or immediate bans on shale oil and gas development, or ending all fossil energy use by 2030, all of which would be detrimental to U.S. auto and energy industry competitiveness and job creation during the recovery and for years to come. And in the near-term, policies like carbon taxes that may harm a manufacturing recovery should be avoided. Carefully constructed carbon taxes, however, should be considered over time once the economy has recovered if needed to further stimulate clean technology adoption and reduce greenhouse gas emissions.

Yet the US clean energy manufacturing opportunity is vast. Unprecedented reductions in renewable energy costs have made

renewables cheaper than fossil energy in many U.S. and global markets. For example, solar prices have fallen 80% in 10 years, wind is 60% cheaper than a decade ago, and LED lighting is 95% less expensive than just five years ago. Even so, various subsidies for fossil energy and systemic “grandfathering” advantages have made turning over incumbent energy products more difficult, and should be eliminated.

In the crucial realm of climate change policy and cutting U.S. and global greenhouse gas emissions, it is clear that some of the policies enacted in the 2009 stimulus like clean tax credits helped expand renewable energy quickly and reduced American emissions, along with the displacement of coal with natural gas. Under Obama, U.S. greenhouse gas emissions fell by 10% between 2008 and 2016, the largest reduction of any major economy in the world during that period — even as the overall US economy has grown by more than 14% over the same period.⁴⁷ It is worth noting that this low-emissions, strong-growth economy occurred even though several of Obama’s major climate policy initiatives—specifically cap and trade carbon pricing legislation and the subsequent Clean Power Plan regulations—never became law.

A far more robust buildout of clean energy infrastructure, manufacturing and deployment like that envisioned here can cut emissions more deeply and set in place a more advanced technology energy economy. Such investments can drive emissions far lower while outcompeting our industrial competitors, and indeed exporting low emissions technologies.

Crucially, these investments have the opportunity to unite Americans behind a muscular, clean energy technology and

manufacturing-led emissions-cutting climate policy, rather than relying solely on regulatory or tax-raising policies that have proven politically divisive.

Such price reductions and efficiency improvements in new technologies can become a competitive advantage for the US energy economy in transition. The U.S. has an opportunity to create price reductions like these in other clean energy manufacturing sectors, gaining increased share of the \$10 trillion clean energy manufacturing market.

AN HISTORIC BIPARTISAN BARGAIN—OR A BIDEN OPPORTUNITY?

So, what are the chances of a clean manufacturing bipartisan bargain in a major infrastructure bill this year? Is a truly comprehensive economic stimulus and infrastructure bill possible in 2020 at all?

For the moment at least, President Trump claims support, and House Speaker Nancy Pelosi and many others in Congress still seem determined to try. But Mitch McConnell is already pouring cold water on the idea even as it is still just a spark igniting between the President and Pelosi.

At the beginning of April, McConnell said that he's "not going to allow this to be an opportunity for the Democrats to achieve unrelated policy items that they would not otherwise be able to pass."⁴⁸ (This is rhetorical claptrap from McConnell, as economic stimulus can hardly be considered "unrelated" in helping the nation's economy back on its feet.)

McConnell's imperious demands on April 11 that Democrats simply accept his \$250 billion small business relief bill with no changes at all also suggest that bipartisan action on a true stimulus

package will not be nearly as easy as the initial relief bills.⁴⁹ During relief bill negotiations in late April in which Democrats were pressing for funding desperately hard-hit states and localities, astonishingly McConnell suggested that some states should consider bankruptcy.

Yet other Senate Republicans still hope an infrastructure bill will emerge, although their conception seems more constricted than that of President Trump.

"Roads, bridges, tunnels – that has to be part of that," said Senator John Barrasso, the Wyoming Republican who chairs the Environment and Public Works Committee. A bipartisan \$287 billion highway bill has already cleared committee with support from senior Committee Democrat Senator Tom Carper.

House Speaker Nancy Pelosi has outlined a \$750 billion infrastructure bill, but this may in fact sell short the opportunity for truly transformative legislation that touches not only energy and transport infrastructure, but advance communications, health care infrastructure and care delivery advances and many other areas of America's economy.

Various elements from the House Energy and Commerce Committee's Clean Future Act and a major bipartisan Senate energy bill could be included, as could important provisions from a \$1 trillion Senate Democratic infrastructure bill introduced in 2018. Even Jay Timmons head of the conservative National Association of Manufacturers is proposing a \$1 trillion infrastructure stimulus.

There is time for Congress to bring together the elements needed to produce a major

infrastructure and economic stimulus bill this year, beyond just emergency relief funding Congress has enacted so far.

In fact, attempts at a bipartisan bargain would test the truth of claims by Republicans that they really do believe that helping those whom technology has left behind as their highest economic goal, and are willing to support robust manufacturing policies that will actually be effective.

Whether Trump and the Republican Senate are capable of this is highly uncertain, to put it mildly. In late March, while General Motors was racing to retool a plant to produce ventilators desperately needed to help Covid victims, Trump falsely accused GM of dragging its feet simply to deflect attention from his own massive and myriad mis-steps in handling the coronavirus crisis.⁵⁰

Nevertheless, the auto industries and others are rapidly outpacing the imaginations of Republican policymakers, with GM and Honda just announcing a joint venture to produce more and better EVs. Advocates in the labor and environmental community, too, are clamoring for more infrastructure investment — and quickly. “Honestly, we would have liked to see [infrastructure stimulus] in this legislation because even the most shovel-ready projects take time to plan and engineer,” said Jason Walsh, executive director of the BlueGreen Alliance, which brings together major labor unions and environmental groups.

Democrats must do all they can to compel Republicans to act as a matter of economic policy and political strategy both.

While the Trump White House has seemed only focused on bailing out the oil industry centered

in red states. The natural gas industry in swing states like Pennsylvania and Ohio has received far less attention and help. Democrats should include shale gas in their plans for infrastructure upgrades, including repairing leaky natural gas pipelines which allow the release of unburned natural gas as methane hurting both the climate and industry competitiveness. Moreover, the Great Lakes states are home to huge numbers of clean energy jobs that are being lost — Pennsylvania alone has shed 6% of its clean energy employment since the crisis began.⁵¹

America must use the 2020 recovery bills and those in 2021 as well to revitalize a huge array of clean energy manufacturing—making electric cars, buses, trucks, EV charging stations, electricity storage capacity, smart grids, advanced transformers, carbon capture facilities and retrofits to natural gas and industrial plants, direct air carbon capture, advanced or modular nuclear plants and many other technologies— that taken together represent the fastest growing manufacturing sector in the global economy. More broadly, new US technology is making American products in many sectors far more competitive than in the past with the right incentives.

If we do not invest, China and other competitors will continue to dominate these industries while America’s manufacturing sector will continue to decline, hollowing out the industrial Midwest and consigning large parts of the heartland to brutal economic and social consequences.

And beyond clean manufacturing, Democrats must offer voters an even more compelling energy and economic plan going forward to show how they can help grow millions more clean-energy jobs. Specifically, Democrats must turbocharge American clean-energy job growth

through a combination of additional clean-energy business and consumer tax incentives including those outlined above. An ambitious energy and jobs infrastructure plan, with more aggressive breakthrough energy research and development investments, is the centerpiece of such an effort.

Even before the COVID-crisis, Joe Biden proposed a \$1.3 trillion clean infrastructure plan which contains many elements to boost US manufacturing. Now the economic crisis means these efforts should be expanded.⁵²

Democrats should establish a job-focused energy-technology education plan using community colleges, to help train workers especially in communities, both rural and urban, where unemployment is highest. Finally, Democrats cannot just advocate renewable energy, as important as wind and solar are. Instead, candidates need to embrace shale gas in many parts of the country, advocate for relicensing of zero-emissions nuclear plants and urge retrofits of existing polluting plants with carbon-capture technology, along with efficiency and renewables. And they must show how Trump's policies are costing workers jobs and consumers money, right now.

American clean energy manufacturing can become the modern equivalent to Franklin D. Roosevelt's "Arsenal of Democracy", winning a struggle against subsidized, undemocratic foreign competitors like China and helping America recover from the COVID crisis while also again becoming the world leader in fighting climate change.

However, Republicans may not help Democrats produce a truly ambitious infrastructure bill focused on getting the economy back on its feet and making long-term economic investments in key sectors like clean energy manufacturing.

If that proves the case, Democrats, including former Vice President Joe Biden, should then justifiably run against Trump and Congressional Republicans for stopping such a grand bargain. Then Democrats should campaign on helping jumpstart clean manufacturing as a key component of a broader economic recovery, gaining a potentially pivotal issue for the November election which will inevitably hinge on our nation's economic future.

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