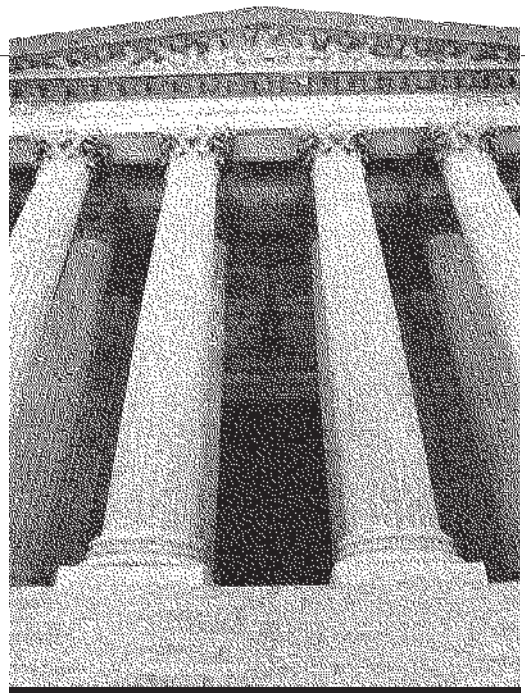

THE DEBATE

Net-Zero by 2050: How Should We Achieve a Carbon-Free U.S. Economy?

President Biden has called for the United States to achieve net-zero greenhouse gas emissions by 2050, with interim targets of 50-52 percent reduction by 2030 and an entirely carbon-free power sector by 2035.

Just two years prior, ELI Press published *Legal Pathways to Deep Decarbonization in the United States,* a compendium of over a thousand legal options for the United States to rapidly reduce emissions. This "legal playbook" outlines many of the actions needed to achieve the president's ambitious climate action goals.

All but eliminating the use of fossil fuels will require transitioning the nation's vehicle fleets from internal combustion engines to electric motors; heating buildings with electricity rather than oil or gas; slashing industrial emissions; and eliminating the use of coal and perhaps natural gas to generate electricity. The demand for electricity would soar while most existing supplies would be cut. Biden wants to achieve this transformation in the context of racial equity and good-paying union jobs. This is a huge undertaking, requiring excellent governance going forward.

While *Legal Pathways* serves as a useful starting point for discussions on achieving net-zero emissions, by no means is it exhaustive. We invite back one of the book's editors, Michael Gerrard, along with three other expert commentators, to weigh in on Biden's goals.

We are asking these experts, What policy mix would be the best at achieving the administration's many and diverse goals? What tools do we have at hand? What tools do we need to create — and how?

Many policies have been proposed — carbon taxes, cap and trade, technology or performance standards, research and development, carbon capture and sequestration, public works programs, planting forests. There are no doubt other approaches as well. Which make sense in the quest to efficiently and equitably reach a zero-carbon future and achieve the president's other climate change goals?

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Rachel Fakhry
Senior Policy Analyst
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"The federal government must take the lead — both the president (who has stepped up) and Congress (for which we are still waiting)"

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"The power sector should partner with the administration and local communities to consider EJ issues in energy infrastructure"

Roger Martella
Vice President, Chief Sustainability Officer
General Electric

Unlocking Opportunity With Policy

By Rachel Fakhry

The new U.S. Nationally Determined Contribution for 2030 under the Paris Agreement puts America firmly back into the global climate Olympics. An ambitious target commensurate with the urgency of the climate crisis, it is set to trigger seismic shifts away from our dependency on health and climate-damaging fossil fuels toward a more resilient, prosperous, and equitable U.S. economy.

In fact, an ambitious NDC is aligned with what improves Americans' lives. It weds economic growth and the creation of millions of good paying jobs with markedly improved public health, a healthy natural world for our enjoyment, and the avoidance of more destructive extreme weather events. And several rigorous studies, one of which I led for the Natural Resources Defense Council, have demonstrated that it can be met at a modest fraction of our GDP: clean energy technologies are now affordable and reliable enough to replace many of our fossil fuel-reliant assets – oil-guzzling cars, coal-fired power plants, and so forth — for either a modest cost premium or substantial savings.

We therefore stand at a pivotal moment where we can confidently assert that unlocking this opportunity hinges on policy. The primary challenge in cutting our greenhouse gas emissions in half by the end of this decade rests in building the societal and political commitment to the transition. It will require a whole-of-government approach to drive decisive progress at the necessary nonstop pace. One bright beacon is that the federal government has all the necessary tools to deliver the pace of transformation, and many of the policy tools are familiar and have already been enacted in some form. In fact, a pile of rigorous analyses conducted ahead of the NDC announcement converged on this conclusion.

To achieve the pace of transformation, we need to pursue bold regulatory and legislative pathways that include both standards and incentives.

The Biden administration can deliver strong ambition with maximal implementation of existing administrative authority. For instance, the Environmental Protection Agency should pursue an ambitious multi-pollutant power-sector strategy under the Clean Air Act. This bears emphasis considering the overwhelming consensus that the power sector is the engine of the decarbonization of the economy in this decade and beyond as we increasingly electrify our homes and vehicles. In the transportation sector — the highest-emitting sector — EPA is expected to re-grant the waiver repealed by the Trump administration to allow states to adopt their own clean car standards. The agency should also move to quickly restore and strengthen the Obama-era clean car standards, and rapidly adopt new car and truck GHG emission standards to catalyze the transition to zero-emission vehicles. The Department of Energy has sizeable authority in accelerating the adoption of electric appliances in our homes and businesses in lieu of health-damaging gas appliances. The department must pursue appliance efficiency standards, to shift investment decisions toward high-efficiency electric options.

New, far-reaching climate and energy legislation is also critical to cut GHG emissions. Complex congressional political dynamics may complicate the passage of bold legislation. However, a series of independent studies have demonstrated that ambitious climate action would not hinge on Herculean congressional solutions, a la Obama-era Waxman-Markey legislation, but would instead be unlocked by sector-specific policy interventions, many of which already exist. In particular, a clean energy standard in the electricity sector would be game-changing and is a popular, cost-effective means of catalyzing the sector's transition away from fossil fuels. A stable and long-term tax incentive platform for the range of clean energy technologies, such as electric vehicles and high-efficiency heat pumps and batteries, would be transformational in rapidly shifting consumer choices toward clean options. Achieving the transformation envisioned by the NDC is preconditioned on the large-scale buildout of interstate electric transmission lines and ubiquitous electric vehicle charging networks; legislation must confer robust financial incentives for the buildout of this job-creating infrastructure.

Critically, social commitment to the transition to clean energy can only be achieved if the federal government makes it as much about improving Americans' lives as it is about averting a climate catastrophe. "Just transition" policies must be prioritized to meaningfully support communities adversely impacted by the decline of fossil fuel-related industries. The federal government should enact incentives for the domestic manufacturing of clean energy technology parts, and prioritize both emissions mitigation and new economic opportunities in pollution-overburdened communities and communities historically shunned from economic growth. Congress should pass President Biden's American Jobs Plan, which delivers a bold climate vision tying together the host of critical policy interventions.

Solving the climate crisis may be the challenge of our time, but it also presents an unprecedented opportunity to consciously reimagine a U.S. economy that is more prosperous, sustainable, equitable, doesn't choke its citizens in the name of progress, and does its part in avoiding a climate catastrophe.

It is high time to bring the iconic American ingenuity and leadership to bear and rise to these historic times.

Rachel Fakhry is a senior policy analyst at the Natural Resources Defense Council.

An All-of-the-Above Approach to Climate Policy

By Kelly Sims Gallagher

Tempting as it is to seek a "silver bullet" in climate policy, it doesn't exist. Policymakers must utilize a mix of regulatory, fiscal, market-based, investment, information and disclosure, education, and innovation policies to achieve a more globally competitive, low-carbon, resilient economy by mid-century. Compared with other countries, the United States has an incoherent, often contradictory approach to climate policy, and it shows. While U.S. emissions peaked in 2007, they remain 2 percent above 1990 levels. By comparison, the United Kingdom plans to achieve a 78 percent reduction below 1990 levels by 2035.

It's important to set forth some principles for American climate policymaking. First, American policies must be predictable and durable so that private firms and individuals can make informed decisions about their investments. This will require bipartisanship so that policies don't sharply zigzag depending on which political party is in office. Ideally, new climate legislation will be developed and passed with Republican, independent, and Democratic support because we must stop vacillating if we are to take advantage of the genuine economic opportunity in a low-carbon transition. The United States must be a real contender in the race for low-carbon markets around the world.

The economic transition must also be taken seriously. For workers who rely on carbon-intensive industries, vague assurances of clean energy jobs are hardly reassuring. It is not so simple for a parent to pick up and move to another town or state because a new job happens to be there. Moreover, many local towns, counties, and even states rely heavily on tax revenue from certain types of industry. If the local school or hospital depends on royalties to provide its services, then new sources of revenue must be found. Planning for the transition must thus begin now, town by town, city by city, county by county, and state by state. A recent National Academy of Sciences study on accelerating decarbonization called for the establishment of a new National Transition Corporation together with a National Transition Taskforce, regional planning offices, and a net-zero transition office in every state capital.

This transition must be genuinely fair and requires a new social compact. Fairness needs to be considered, among other dimensions, in terms of race, income, age, gender, and geography. Certain communities are much more vulnerable to climate change itself and others are vulnerable to the economic transition to a low-carbon economy. Others are fortunate to live in less risky places or to already be employed in a clean, low-carbon industry. Those more fortunate must recognize that they have a responsibility to help those at risk.

We need to be disciplined in our approach to climate policy. We need to set goals, performance metrics, and budgets and stick to them. Net zero by 2050 means we have 29 years to get from the 5,769 million metric tons in 2019 to no net emissions. We need a carbon budget and we need to hold ourselves accountable to it, just as most American families live within their own household financial budgets. An independent body should be established to track progress against our goals and recommend revisions to policy as needed. Congress needs to appropriate sufficient financial resources to achieve our goals.

Let's invest wisely and efficiently. Every public dollar invested and new policy announced should get the most bang for the buck in terms of economic gain, climate mitigation, and resiliency. Let's stop siting new infrastructure in flood-prone areas. Let's rebuild houses, schools, and hospitals to be energy efficient and low carbon. Integrating distributed renewables and battery storage cannot only help reduce emissions but can provide power after strong hurricanes when the grid is down. We need an American infrastructure or development bank so that we can ensure that financing is available for all communities to invest in low-carbon, resilient infrastructure.

Finally, we must recognize that climate policy is really economic, labor, and social policy. The U.S. competitive position in low-carbon technologies and industries has eroded, and American firms and workers are not economically benefiting as they should from the global energy transition. China is doing a better job than the United States in domestically deploying and exporting renewable energy technology, building new nuclear capacity, and launching a thriving electric car industry.

America must invest in innovation and construct a market-based industrial policy that supports U.S. firms and labor while holding them accountable for performance. Public and private investments in research, development, and demonstration must be greatly increased, commensurate with the scale of the challenge of climate mitigation and resilience. Just as important is investment in our human capital so that we have the people to invent the new technologies, the entrepreneurs who can bring the ideas to reality, the workforce that can manufacture advanced technologies, and the government officials who can devise and execute smart policy.

Kelly Sims Gallagher is professor and director of the Climate Policy Lab at The Fletcher School, Tufts University.

Legal Pathways to Biden's Climate Goals

By Michael B. Gerrard

Achieving President Biden's goal of net-zero greenhouse gas emissions by 2050, with interim targets of being halfway there by 2030 and having entirely clean electricity by 2035, is possible with law and technologies that already exist or can be readily imagined. In the process, many more jobs would be created than lost, and aspects of the environment beyond climate change would be greatly improved. But it is a massive undertaking.

The nature of this task was spelled out in detail in a prescient report, *Pathways to Deep Decarbonization in the United States*, issued in 2014 and 2015 by the Sustainable Development Solutions Network and the Institute of Sustainable Development and International Relations. Much of the same team, led again by Jim Williams, prepared an updated version in 2020 as part of the Zero Carbon Action Project.

Based on the 2014/2015 reports, in late 2015 John Dernbach and I began work on an edited volume that the Environmental Law Institute published in 2019, *Legal Pathways to Deep Decarbonization in the United States*. It analyzed how federal, state, and local law and private governance need to change for the United States to achieve goals that are very similar to those that the Biden campaign would announce a year later.

Five pillars underlie this effort.

Electricity decarbonization. In generating electricity, we need to eliminate all use of coal and almost all use of gas unless it is coupled with carbon capture and sequestration, or comes from biological sources. This will require a massive program to build new solar (both utility-scale and rooftop) and wind (both onshore and offshore) facilities, as well as more geothermal, hydropower, and other non-fossil technologies. The existing nuclear fleet needs to keep running as long as it can operate safely. A comparably massive program of new transmission lines is needed to bring the power from these new sources to where it is needed, coupled with storage to fill in the gaps when there is no wind or sun. According to the Zero Carbon Action Project, that will require 3,000 gigawatts of new generation by 2050 — an average of 100 gigawatts a year. (One good-sized nuclear power plant generates about one gigawatt.)

Energy efficiency. We need a 40 percent reduction in per capita energy demand. This would mostly come from improvements in the efficiency of appliances, buildings, and all manner of industrial operations.

Electrification. Most uses that now rely on fossil fuels need to switch to electricity. The biggest sector here is transport. This means that all new cars and SUVs need to be electric by about 2035, with trucks and buses not far behind (unless hydrogen or other technologies do the job). Electricity needs to be used instead of oil and natural gas to heat buildings and water; all new buildings need to be all-electric, and over time older buildings need to be converted. The added electricity demand that all this will create (even after aggressive energy efficiency programs) is one reason we need so much new generation and transmission.

Carbon capture and removal. It is difficult to abate the emissions from certain industrial operations, such as making cement and steel. For these, and for any remaining natural gas power plants, we need to capture the carbon dioxide before it leaves the stack, and either use or sequester it. We also need to remove large amounts of the carbon dioxide that is already in the atmosphere. Some of this can be achieved by planting more trees and better managing forests. Some can be done through improved agricultural practices, which will also reduce methane emissions. Beyond that, we need various technologies now being developed to draw carbon dioxide from the atmosphere.

Non-CO_2 pollutants. Carbon dioxide is not the only pollutant that contributes to climate change. Methane, fluorinated gases, nitrous oxide, and black carbon are also important, and each can be drastically reduced.

All of this will require a great deal of new infrastructure. President Biden's American Jobs Plan, if enacted by Congress, would be an important move in that direction.

Congress has not passed a major new environmental law since 1990. The partisan paralysis since then has been a major obstacle to progress in the fight against climate change (and many other things). There are several items Congress could enact that would greatly assist in meeting the 2050 goals. These include an economy-wide carbon pricing system; a clean electricity standard; stricter command-and-control regulations of air pollution; more subsidies for clean energy; and elimination of subsidies for fossil fuels. None of these would do the whole job, but any would greatly help.

Meanwhile, many states, cities, and corporations are making great efforts. But the federal government must take the lead — both the president (who has stepped up) and Congress (for which we are still waiting).

Michael B. Gerrard is a professor of environmental and energy law at Columbia Law School, and faculty director of the Sabin Center for Climate Change Law.

The Pathway Forward for the Power Sector

By Roger Martella

When it comes to achieving President Biden's goal of a 50-plus percent reduction in greenhouse gas emissions by 2030, not all sectors are created equal. Although the president has not set sector targets, basic math teaches that because 50 percent is an average, some will see more ambitious targets in the upcoming decade.

Among those sectors generating higher expectations is the power sector. Observers see emissions from power easier to abate by 2030 relative to transportation, industry, and agriculture. Thus, much attention is focused on the technology, innovation, policy, and law to drive deeper decarbonization of power.

The pathway for power begins with where it's come from. The International Energy Agency provides a starting point: in the 14 years between 2005 (the Biden baseline) and 2019, emissions from the sector declined 31 percent. To meet the president's *average* goal, the sector has 19 percent to go, but expectations are to over-perform.

To achieve deeper decarbonization beyond 50 percent by 2030, three developments must align.

First, accelerating renewables is the most immediate priority, but challenges must be addressed. For example, while the next generation of offshore wind technology is ready to be installed, regulatory delays have stalled deployment. Here, the Biden administration in a short time has worked to address permit bottlenecks and approved the first full-scale offshore wind project, Vineyard Wind. But to succeed on this timeline will require more regulatory resources and streamlining. The administration, Congress, industry and stakeholder will have to work closely together to properly define tax incentives, fiscal stimulus, and tariff policies to ensure investments will lead to measurable benefits.

Second, natural gas is key to any solution. The numbers speak for themselves: between 2005 and 2019, emissions went down steeply while natural gas use doubled to 38 percent of the nation's generation. Looking forward, the gas sector similarly can help reduce emissions by strictly controlling methane. The country can also switch from coal to natural gas, providing a baseload that serves as a force multiplier for more renewables. Under the IEA's projections, power emission reductions will surpass 50 percent and reach 53 percent (vs. 2005) while gas grows to 42 percent of generation in 2030. Looking beyond this scenario, more switching from coal to gas can drive emissions down further, at least 65 percent, with reductions of 70-plus percent with more renewables.

Third, reducing emissions is not enough. The grid is confronting growing risks in extreme weather events, increasing demand, more variable energy, and cyber security. Modernizing the grid, including physical infrastructure and digital upgrades, to make it more resilient while reducing emissions are mutually achievable goals.

Although power can over-perform this decade, innovation is the most important element of longer-term success. Innovating breakthrough technologies such as carbon capture and sequestration, hydrogen as a fuel, and small modular nuclear reactors will be key to realizing the next tier of decarbonization goals while ensuring a resilient energy ecosystem.

At the outset, there is reason for optimism about the success of these goals regardless of legal regimes. The IEA scenario above shows the power sector realized significant reductions during an era without comprehensive regulation. This is due to innovation, corporate social responsibility initiatives, subnational regulations including renewable energy standards, and the impact of NGOs.

Having said that, well designed law and policy can bring more certainty to outcomes. With a closely divided Congress, piecemeal approaches are more likely than a comprehensive package for climate generally or power specifically. On the Hill, it will be key for Congress to create the right reforms for streamlining renewable approvals while creating financial incentives for renewables, grid improvements, and breakthrough technologies and pilot projects. These concepts warrant bipartisan support.

The Environmental Protection Agency is likely to complement this approach with a focus on emissions from new and existing coal plants and gas turbines. Regulatory efforts to focus on technology-based standards "inside the fenceline" will help avoid the legal controversies and delays of the Clean Power Plan.

There are also other policy and legislative proposals, including clean energy standards and carbon prices. These warrant study for creating ground-up solutions that can be more efficient than piecemeal approaches. While proposals differ in design and details, key to success will be technology-neutral policies that focus on achieving emission reduction goals and letting technology and innovation achieve those goals, as opposed to prejudging technologies at the outset of these paths to deep decarbonization.

Finally, the Biden administration has been right to elevate the role of environmental justice, focused on ensuring that disadvantaged and disproportionately impacted communities avoid harms *and* realize benefits from clean energy opportunities. The power sector should partner with the administration and local communities to consider EJ issues in the siting and permitting of energy facilities and infrastructure, as well as opportunities to develop jobs and to ensure affordable and reliable electricity for all communities.

Roger Martella is vice president, chief sustainability officer, at General Electric. The opinions are the author's and not any employer.