DC Moves

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1. Introduction

I frequently post papers on moves that California (my home state) is making to mitigate climate change. However if California is the only government doing this, mankind will lose this war. I am happy to report on some new efforts that the U.S. Federal Government is making to reduce the amount of greenhouse gas (GHG) our economy is emitting. This paper will report on these.

The main effort is a bill that was recently passed by both houses of congress. This bill, the "Inflation Reduction Act of 2022," is awaiting President Biden's signature as I am finalizing this post. This certainly doesn't sound like a climate-focused bill, but a large percentage of the spending mandated by the bill is focused on incentivizing individuals and corporations to "do the right thing" relative to the climate. The bill's name has more to do with public relations and congressional sausage-making than descriptions of its impact. This paper will review the impact of this bill on GHG reduction.

The problem is that not all segments of the Federal Government fully understand the importance of these efforts. I'm sure that many of my readers have heard in the news that the Federal Supreme Court struck down some elements of the Clean Power Plan, the Obama Era regulations intended to moderate the amount of GHG power plants are emitting. The good news is that when I researched this ruling, I found that the elements that were struck down were very specific to the methodology used in the Clean Power Plan, and will just require a different path. Possible paths will be reviewed in this post.

2. Inflation Reduction Act Climate Impact

I found a good article from NBC that identifies this bill's primary impact on climate change:

More clean energy, less dirty energy, new punishments for methane leaks and billions of dollars for communities most in need of climate-related help — those are the provisions that have environmentalists celebrating what they see as a monumental step for U.S. climate action.[1]

Senate Democrats on Sunday (Aug 7) passed a sweeping bill (known as the Inflation Reduction Act) that includes hundreds of billions of dollars to fight climate change.

The package calls for major spending to tackle the climate crisis, in addition to extending health care coverage and reducing the deficit. On top of tax credits to provide incentives for electric vehicles and clean energy, the bill aims to expand renewable energy production and fund the development of technologies to remove carbon dioxide from the atmosphere.

[1] Denise Chow, NBC News via MSN, "5 ways the Inflation Reduction Act will fight climate change," Aug 9, 2022, https://www.msn.com/en-us/news/us/5-ways-the-inflation-reduction-act-will-fight-climate-change/ar-AA10tJme

While the climate part of the legislation was significantly pared down from the Biden administration's original ambitions in the Build Back Better Act, experts say that the bill will be the largest investment to address global warming in U.S. history and that it will reduce the country's greenhouse gas emissions.

Dan Lashof, the U.S. director of the World Resources Institute, a Washington-based nonprofit research group, called the bill "transformative," adding that it was the culmination of decades of work to enact meaningful climate legislation.

"It would be hard to overstate what a pivotal moment this was with the Senate," he said at a news briefing Monday.

From cutting emissions to helping the U.S. economy make the transition away from fossil fuels, here are five ways the Inflation Reduction Act will actually fight climate change.

***It includes huge investments in clean energy:** The bill would devote $369 billion over 10 years for electric vehicle and clean energy tax breaks, a measure that Lashof said would establish clean energy as the most cost-effective option for Americans.*

"If you look at the incentives across electric vehicles, electricity production from wind, solar and clean hydrogen, carbon removal — it really establishes an economic framework that makes clean energy the choice," he said.

The tax credits, which are designed to help pivot industry and consumers to renewable energy systems, include incentives for electric appliances, heat pumps and other technologies to increase energy efficiency in homes.

Consumers would also be eligible for $7,500 tax credits for buying new electric vehicles and $4,000 credits for used electric vehicles…

***It will keep climate goals within reach:** Climate experts say the bill will reduce U.S. emissions by about 40% below 2005 levels by 2030, an important step toward staving off the worst consequences of global warming.*

President Joe Biden had set a goal of reducing greenhouse gas emissions in the country by at least 50% by the end of the decade. A preliminary estimate by the Rhodium Group, an independent research and data firm that tracks such targets, found that Biden's goal could be achievable with the Inflation Reduction Act and other measures at the federal, state and local levels.

"If Congress passes this package, additional action from executive agencies and subnational actors can put the US's target of cutting emissions in half by 2030 within reach," the report said…

***It aims to curb methane emissions:** While the bill is being hailed as a historic breakthrough, it does include some concessions that resulted from hard-fought negotiations with Sen. Joe Manchin, D-W.Va. Senate Democrats agreed to include new oil drilling leases in the Gulf of Mexico and off Alaska.*

Still, the measure would introduce a fee that would penalize fossil fuel companies for excess methane emissions from drilling oil and gas.

Methane is a potent greenhouse gas that is released into the atmosphere when coal, oil and natural gas are mined and transported. Microbes can also emit methane in low-oxygen environments.

Emissions of methane have been responsible for about 30 percent of global warming since preindustrial times, according to the U.N. Environment Program.

It emphasizes environmental justice: *The climate bill earmarks $60 billion for environmental justice initiatives in disadvantaged communities that are disproportionately affected by climate change. That includes $3 billion in grants to promote clean and accessible transportation and $1 billion for clean buses, garbage trucks and other heavy-duty vehicles.*

The provisions would help front-line communities deal with air pollution and other important public health issues, said Christina DeConcini, the World Resource Institute's director of government affairs…

The bill also includes funding for rural communities and communities with fossil fuel-based economies to make the transition to clean energy.

It sends an important message to international partners: *Experts agreed that the Inflation Reduction Act will play an important role in signaling to the global community that the U.S. is serious about doing its part to fight climate change.*

The measure not only will help the country catch up to aggressive climate measures introduced in places like the European Union; it could spur other countries to act.

In about four months, leaders from around the world will gather in Egypt for the U.N. Climate Change Conference to accelerate efforts to reduce emissions, implement adaptations and negotiate financing. The climate provisions in the Inflation Reduction Act could help send a message ahead of the meeting that the U.S. is ready to step up, said Nisha Krishnan, an expert on climate resilience at the World Resources Institute.

The bill will essentially put the U.S. in "a much better place to actually encourage these countries to stand by their existing commitments, but also to raise their ambitions," Krishnan said.

Author's comment: I have seen many recent articles that have said that many EVs will not qualify for part or all of the tax credits. I believe that this is being overblown. See the next subsection.

2.1. Limitation on EV Tax Credits

One of the reason that the Inflation Act of 2022 was able to pass was that it strongly supports U.S. manufacturing of EVs and their components. This is mainly done via limitations on the tax credits, for instance:

EV eligibility in this new bill depends on using key components made in North America. It stipulates that 50% of the battery parts and 40% of the minerals have to come from U.S. shores or a country with which we have free trade agreements, and must be done so by

December 2023 and December 2024, respectively. Those figures will go up by 10% each year of the program.[2]

Other limitations restrict who can receive the credits, and for what EVs:

Eligible autos include cars with a manufacturer suggested retail price (MSRP) under $55,000 and up to $80,000 for SUVs and trucks. Those filing taxes as head of household/single filers have an income cap of $150,000, while couples are maxed out at $300,000, further pushing the middle class into purchases of EVs. The other great part is that the new Act removes the previous requirement that the only EVs eligible had to be from manufacturers that have not yet reached sales of 200,000 models. That means Tesla and GM have skin in the game again.

The largest EV Manufacturer (with over 50% of total sales) is Tesla, and they manufacture in the U.S. in the Fremont, CA Mothership, and near Austin, (in Gigafactory TX). They also have a major battery factory near Reno, NV (Gigafactory I).

Manufacturers with rising EV-volume include Ford, Chevy and VW, all manufacture EVs in the U.S., and all have, or are building new battery plants in the U.S. Also Tesla is adding a second major battery plant at Gigafactory-TX, and has a smaller battery plant in near the Mothership factory. It appears (from the limited information that I have) that there will be plenty of EVs that qualify for these tax credits.

Also a large majority of the other major manufacturers that produce EVs (like Nissan, Hyundai / Kia, Volvo and BMW) and sell these in the U.S. also have factories in the U.S. that produce vehicles. Even if they currently don't produce EVs there, they can make adjustments.

2.2. Climate Goals

Regarding the impact of "**It will keep climate goals within reach"** above, *energy and climate modelers have now scrutinized its 725 pages and concluded the 40% claim is about on target. They plugged major provisions, including subsidies for renewable energy and tax cuts for electric vehicles, as well as controversial incentives for the fossil fuel industry, into their models. Three models now agree that if the bill's provisions are carried out, U.S. greenhouse gas emissions would fall by perhaps 40% by 2030, although only part of that stems from the bill alone. One model also finds that the renewable energy subsidies will likely create 1.5 million jobs and prevent thousands of premature deaths from air pollution, especially in disadvantaged communities.*[3]

"It's a historic step, no doubt about it," says Marshall Shepherd, an atmospheric scientist at the University of Georgia and former head of the American Meteorological Society. "It really does a lot to enhance the transition to a renewable energy economy."

U.S. emissions have been falling by about 1% per year since 2005, when they peaked, largely because of replacing coal power with wind and solar, as well as natural gas, and

[2] Selena Fragassi, Yahoo Finance, "EV Tax Credit in Inflation Reduction Act Very Limiting: 'Most Vehicles Immediately Ineligible,' Aug 11, 2022, https://finance.yahoo.com/news/ev-tax-credit-inflation-reduction-180848085.html

[3] Erik Stokstad, Science, Aug 5, 2022 Issue, "Ambitious bill leads to 40% cut in emissions, models show," https://www.science.org/content/article/surprise-climate-bill-will-meet-ambitious-goal-40-cut-us-emissions-energy-models#:~:text=Two%20such%20models%20conclude%20that%20if%20the%20bill,part%20of%20that%20stems%20from%20the%20bill%20alone

rising fuel economy in light cars. But this pace is nowhere near fast enough to meet President Joe Biden's goal of a 50% to 52% cut in emissions by 2030 relative to 2005…

Biden's major effort had been the Build Back Better Act, which would have invested $560 billion in cutting greenhouse gases but died in the Senate after Manchin objected. The smaller new bill, called the Inflation Reduction Act of 2022, preserves much of the bang for clean energy, says energy systems expert Jesse Jenkins of Princeton University's Rapid Energy Policy Evaluation and Analysis Toolkit Project, which runs one of the models. "I think [Senate staff] did a miraculous job," he says. In particular, the bill provides subsidies to expand renewable energy and lure consumers to buy electric vehicles, solar panels, and climate-friendly home heat pumps.

To evaluate the climate impacts of the legislation, Jenkins and other modelers simulate the entire U.S. energy system from the smallest electric vehicles to nuclear plants and add the proposed policies to see how they impact CO_2 emissions. Scientists also fold in results from other models that focus on factors such as the impact of agricultural policies on two other causes of greenhouse warming: methane emissions from livestock and nitrous oxide released from fertilized fields. Modelers put everything together to forecast emissions trends, says modeler Ben King of Rhodium, an independent research firm.

Just a day after the bill was released, Rhodium posted preliminary estimates on its website. The topline result: a 31% to 44% reduction in greenhouse gas emissions from 2005. Compared with current policies, that's an additional drop of 7 to 9 percentage points. Variables such as the price of natural gas account for much of the uncertainty: If gas prices drop, utilities might favor gas over renewable power, slowing the decline in carbon emissions.

This week, the think tank Energy Innovation narrowed the range, forecasting emissions reductions of 38% to 41%, with 13% to 17% from the bill alone. And the Princeton model estimated about a 42% reduction, with 15% from the bill itself.

All the analyses find the two most important factors driving down emissions are clean electricity tax credits—which the bill provides for at least a decade—and expanded tax credits for both new and used electric vehicles. The subsidies will help utilities install more capacity from wind farms and solar panels and help keep nuclear power plants financially viable as they face competition from cheap natural gas. Previous analyses had also pointed to green electricity generation and transportation as crucial to reducing emissions (Science, 27 May, p. 922).

Models can have difficulty predicting human behavior, cautions economist Meredith Fowlie of UC Berkeley. "I wouldn't believe any one projected number, but [key] models agree in a qualitative sense that this is going to bend the trajectory," she says.

Other provisions of the proposed bill could eventually lead to further CO_2 reductions, such as investment in technologies that directly remove carbon from the atmosphere and capture it from fossil fuel plants.

The bill also includes some climate-unfriendly provisions, apparently added at Manchin's request. It requires the federal government to offer several lease sales of offshore oil and gas resources, with more on the table if public lands are opened to renewable energy efforts like wind farms. The leases could boost oil and gas production from federal lands by an extra 50 million tons per year in 2030, according to Energy

Innovation. Overall, however, climate wins out, analysts say: For each additional ton of CO_2 from fossil fuels, other provisions of the bill would reduce emissions by 24 tons.

3. Supreme Court Ruling on the Clean Power Plan

As threats from climate change become more urgent, the US Supreme Court has responded by erecting a new roadblock to effective climate policy. Last month, it struck down the Clean Power Plan, the Obama administration's never-implemented regulation of greenhouse gas emissions from existing power plants. The ruling [West Virginia v. Environmental Protection Agency (EPA)] is a blow to climate action and could signal the court's hostility to a wide range of future regulations within and beyond the climate and environmental sphere, including those related to consumer protection and worker safety. Although the immediate effects on US climate policy aren't pervasive, EPA now needs to evaluate the emissions-reduction potential and legal risks of alternative regulatory approaches for the power sector.[4]

The court's decision didn't question EPA's authority to regulate greenhouse gas emissions under the Clean Air Act. Similarly, it didn't limit authority to regulate greenhouse gas emissions from existing power plants under section 111(d) of the Clean Air Act—the provision used in the Clean Power Plan. The direct impact of the decision is relatively narrow, foreclosing only one approach to power sector climate regulation. This leaves EPA with other options.

The court objected to the Clean Power Plan's reliance on "generation shifting," a partial shift in electricity production from coal to natural gas, which generates fewer emissions, and from coal and natural gas to renewables, which produce no emissions. According to the court, the Clean Air Act didn't authorize EPA to base its standard on this technique. Climate regulations for other sectors, including transportation, oil and gas, and manufacturing, are likely to be source specific, and therefore unaffected by this decision.

With generation shifting now off the table, EPA must choose the "best system of emission reduction" under the relevant provision in the Clean Air Act. This system must be "adequately demonstrated," which means that it cannot be too speculative. And the agency must "take into account the cost of achieving such reduction," which means that costs cannot be excessive. EPA could consider basing the "system" on technologies such as carbon capture and storage (CCS). It could also consider requiring the combustion of coal simultaneously with natural gas at coal plants (cofiring), which reduces emissions by replacing some coal with natural gas.

CCS, which captures and stores carbon dioxide before it is released into the atmosphere, will lead to the greatest emission reductions among the options remaining. Thus, EPA is compelled to adopt it as long as other statutory requirements are met. In 2017, a document filed in a federal litigation on greenhouse gas standards strongly argued that the technology was "adequately demonstrated," and there have since been further technological developments. The process is costly but the 2021 infrastructure bill provides substantial subsidies for its use, and more federal money is possible through future congressional action. EPA will need to evaluate whether the funding sufficiently lowers the effective cost of CCS. Because some states have higher subsidies for this

[4] Richard L. Revesz, Science, July 29 Issue – Editorial "How will EPA regulate the power sector?" https://www.science.org/doi/10.1126/science.ade0779

technology than others, EPA could divide the power sector into regions and require CCS in states with larger subsidies.

Should EPA conclude that the costs of universal CCS are excessive, it could require power plants with multiple contiguous generating units to partially adopt CCS. For example, EPA standards could require plants with three or more contiguous units to use CCS at one-third of the units. This technique, called "bubbling," is a common regulatory tool upheld by the Supreme Court. EPA could also evaluate whether the statute permits this approach for noncontiguous sources.

As an alternative, the agency could require that coal plants cofire with natural gas. Because many coal plants have already adopted cofiring, it is clearly "adequately demonstrated" and doesn't require that "coal plants…become natural gas plants"—which the Supreme Court indicated would be problematic. If EPA were concerned about the legality of an across-the board cofiring standard, the agency could restrict this requirement to a subcategory of the industry that already uses cofiring and set standards for other sources using a different approach.

Generation shifting would have reduced emissions at the lowest cost through a cap-and-trade program or related regime, but that's no longer possible. Unfortunately, other regulatory approaches for the power sector will be more costly or less effective. Moreover, these regulations, as well as other regulations in the climate change and environmental sectors, may be slowed or stalled on other grounds. The fallout from the Supreme Court's decision across the economy is likely to have only just begun.

Author's comment and additional resources: Note the above highlighted text. This text is correct, and I've written on this in past posts. See below. Note that the first source is about the XPRIZE Carbon Removal contest. Although the focus of this contest in direct air capture, most of the techniques used by the winners can be modified for generation plant stack capture, or alternatively, these can be used to offset GHG stack emissions.

New Networks Compendium: *I started writing the "New NETWORKS" series almost two years ago. Thus, it didn't surprise me recently when, that there were major developments in negative emissions technology (NET). The first was a subject I wrote about over a year ago:*

XPRIZE officially launched the $100 Million XPRIZE Carbon Removal competition. In honor of the launch, XPRIZE founder Peter H. Diamandis sat down with Elon Musk, who is funding the competition through the Musk Foundation.

The above contest has now reached a major milestone which is covered in section 2. A summary of a report on Negative Emissions Technologies and Reliable Sequestration from the National Academies of Sciences, Engineering and Medicine is contained in Section 3.

https://energycentral.com/c/ec/new-networks-compendium

Tough Love – Part 2: *In this post we will look at possible roles of government, negative emissions technology, and a brief review of an excellent book on climate change politics (Part 1 is in section 2.25).*

See section 3.1 for a recent carbon-capture technology. Note that this technology was tested in a simulated exhaust from a natural gas combined cycle plant, not a coal-fired

plant, but I would guess that it could be adapted to a coal plant with pre-treatment of the exhaust (much of which is already required to meet other regulatory requirements).

https://energycentral.com/c/ec/tough-love-%E2%80%93-part-2

4. Replacing Coal

Author's final comment: The big problem with coal-fired plants is that they are too expensive on a generated electric energy (MWh) basis compared to just about anything. They are also useless for mitigating renewable variability (vs. combined-cycle or simple-cycle gas-fueled plants) because of extremely long start-up and shut-down times. The best solution (economically) would be shut them down and replace them with renewables plus, where required to mitigate intermittent renewables, battery energy storage. However then we would need to deal with the site remediation issues, which could bankrupt the utilities that owned them.

An old saying: "A horrible ending is better than horrors without end."[5] Perhaps Senator Schumer could work with Senator Manchin to create another "surprise" bill to have the Feds make a one-time offer to assume some or all of the responsibility for funding the site remediation and other shutdown expenses?

Also, there is one and potentially two very-low carbon electric generation technologies that could replace these retired coal plants.

The first is modern Nuclear Power. Even though my home state doesn't consider this renewable, I do. Also the Inflation Reduction Act of 2022, reviewed in section 2, has strong incentives for Nuclear Power, especially when used to replace coal plants. This is reviewed by a recent AP Article:

A major economic bill headed to the president has "game-changing" incentives for the nuclear energy industry, experts say, and those tax credits are even more substantial if a facility is sited in a community where a coal plant is closing.[6]

The transformative bill provides the most spending to fight climate change by any one nation ever in a single push. Among the many things it could do nuclear energy experts say is spur more projects like one Bill Gates is planning in Kemmerer, Wyoming. Gates' company, TerraPower, plans to build an advanced, nontraditional nuclear reactor and employ workers from a local coal-fired power plant scheduled to close soon.[7]

Companies designing and building the next generation of nuclear reactors could pick one of two new tax credits available to carbon-free electricity generators, such as wind and solar. To ensure coal communities have a place in the energy transition, both tax credits include a 10-percentage point bonus for facilities sited where residents have relied on fossil fuel plants or mining— a "sizeable incentive" to locate them there,

[5] Ferdinand Baptista von Schill (6 January 1776 – 31 May 1809): a Prussian major who revolted unsuccessfully against French domination of Prussia in May 1809. Schill's rebellion ended at the Battle of Stralsund, a battle which also saw Schill's own death in action.

[6] Jennifer Mcdermott and Mary Katherine Wildeman, Associated Press, "Climate bill: Could coal communities shift to nuclear?" https://www.msn.com/en-us/news/politics/climate-bill-could-coal-communities-shift-to-nuclear/ar-AA10CLlg

[7] See "Nukes – Part 6," https://energycentral.com/c/gn/nukes-%E2%80%93-part-6

according to Matt Crozat, senior director for strategy and policy development at the Nuclear Energy Institute.

That could include towns in coal-dependent West Virginia, since the state eliminated a ban on nuclear power plants this year. Or in Maryland, where the state announced a partnership in June to look at repurposing a fossil fuel site for a small nuclear reactor. Or in Montana, where lawmakers are looking at advanced nuclear reactors as a possible replacement for coal boilers.

Staffan Qvist, an expert in energy systems analysis and decarbonization strategies, has extensively researched the feasibility of replacing coal plants with emissions-free alternatives in China and Poland. He found that coal plants often make ideal sites for advanced, high-temperature nuclear reactors.

"It's a growing trend," Qvist said, "now it's being talked about everywhere." Qvist is also founder of Qvist Consulting Limited in the United Kingdom. "You have a site, you have a grid connection. You have equipment that can remain in use, and you have a workforce that could be retrained."

A design by NuScale Power is the first to be fully certified in the United States and the company is planning to begin operating a small modular reactor in 2029 at the Idaho National Laboratory. The company's chief financial officer, Chris Colbert, said former coal plants are ideal locations for advanced nuclear technology, in part because transmission lines are already in place.[8]

Colbert also said he thinks potential customers will be more interested in the company's small advanced reactors because of the incentives in the bill.

There are nearly $375 billion in climate incentives in the Inflation Reduction Act. Among them, there's a new tax credit available to any carbon-free electricity generator. That includes new advanced nuclear reactors that begin construction in 2025 or later. Existing nuclear plants that expand their output could get credit for that additional electricity production. The credit is worth at least $25 per megawatt-hour for the first decade the plant operates, according to NEI, the industry's trade association.

Or, owners of a new carbon-free electricity generator could take advantage of an investment tax credit, worth 30% of the amount they paid to build the facility.

The bill also has $700 million to produce the uranium fuel in the United States that many advanced reactors need. And there's a tax credit for existing nuclear plants worth up to $15 per megawatt hour from 2024 to 2032. That's enough of a boost that it's highly likely no nuclear plants will close during that period for economic reasons, Crozat said. There are expanded options for how the credit can be used, with direct payments for certain owners, such as municipal utilities.

The incentives are a game changer for the nuclear energy industry, said Jacopo Buongiorno, professor of nuclear science and engineering at the Massachusetts Institute of Technology. Buongiorno has studied the future of nuclear energy in a carbon-constrained world.

[8] See Nukes Part 2, https://www.energycentral.com/c/cp/nukes-part-2-little-nukes and Nukes Part 5, https://energycentral.com/c/pip/nukes-%E2%80%93-part-5

"This is really substantial," he said as he read the list of tax credits. "This should move the needle in terms of making these technologies economically viable right off the bat."

Buongiorno liked that the credits are available to many carbon-free technologies.

"It's not just nuclear, it's not just solar, it's all of the above, which is what we have been preaching as the right approach for decarbonization," he said. "You need to sort of push everybody here"….

There is also one other "renewable" electric generation technology that could possibly replace coal plants, geothermal. This would be a laughable statement until recently, because geothermal was strictly a solution in the Western U.S., and coal plants are mainly an eastern resource.

However a DOE facility is making major advancements is extending geothermal such that it is applicable just about anywhere. I just posted a paper on this a week ago, described and linked below.

Hot Rocks Part 3 – Widespread Geothermal Power: *The title of this post indicated it's the third part in this series. The first part was posted a little over a year ago, and the second this spring. This post is about Enhanced Geothermal Systems (EGS).*

The principal elements of heat, water, and permeability—when found together and in sufficient amounts—can support cost-competitive rates of geothermal energy extraction. Independent of water and permeability, thermal energy (heat) exists everywhere on Earth and increases with depth. At the most basic level, EGS are manmade geothermal reservoirs. Where the subsurface is hot but contains little permeability and/or fluid, pumping water into wells could stimulate the formation of a geothermal reservoir capable of supporting commercial rates of energy extraction.

https://energycentral.com/c/gn/hot-rocks-part-3-%E2%80%93-widespread-geothermal-power