Climate Here and There: Part 2, U.S. Perspective

By John Benson

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1. Introduction

Just as I had completed what ended up being part one of this two-part series (described and linked below), I came across two really good articles regarding a similar goal, but for the U.S. as a whole. The first article was in Time magazine and the second in my weekly web issue of Science. Both of these are referenced in the body of this paper.

Climate, Here and There, Pt 1, California SB 100 Progress: *This paper is a summary of a report on our progress meeting the goals of the 100 Percent Clean Energy Act of 2018. This is a landmark policy that establishes a target for renewable and zero-carbon resources to supply 100 percent of retail sales and electricity procured to serve all state agencies by 2045, and also increases the state's Renewables Portfolio Standard (RPS) to 60 percent of retail sales by December 31, 2030.*

https://energycentral.com/c/cp/climate-here-and-there-pt-1-california-sb-100-progress

2. Denial to Coalition

An article from Time, referenced below, was the best summary I've seen of the World's evolution to a powerful alliance that is capable of addressing climate change.

To understand how we got here, it's helpful to look back to a remarkable coincidence of history. Climate change entered public consciousness at the same time that, in the U.S., the zeitgeist turned against government's playing a robust role in society. In 1988, when then NASA scientist James Hansen offered his now famous warning that the planet was already warming as a result of human activity, American voters had spent eight years hearing President Ronald Reagan tell them that government lay at the root of society's problems.[1]

So it's perhaps no wonder that in the decades that followed, government attempts to tackle a new problem, unprecedented in scope and scale, encountered roadblocks. That effort began in earnest in 1992 as heads of government from around the world gathered in Rio de Janeiro to inaugurate a new U.N. framework to address climate change. Every year since, with the pandemic-related exception of 2020, countries have met to hash out solutions to the problem. But in the first two decades of talks, a comprehensive solution failed to break through. In the U.S., the lagging climate policy can in large part be attributed to the then pervasive free-market ideology, which dictated that businesses exist to make a profit. From the 1990s and into the new century, fossil-fuel companies as well as heavy industry spent millions denying the existence of the problem and funding organizations that opposed climate rules. Other firms remained on the sidelines of an issue that seemed unrelated to their core business. The results in the political arena were clear. President Bill Clinton tried to pass an energy tax in Congress, but a concerted lobbying effort from manufacturers and the energy industry doomed the plan. President George W. Bush publicly questioned the science of climate change and

[1] Justin Worland, "Climate goes Private," April 26 / May 2 issue, article starts on page 48. To order a copy of this issue call 800-843-8463.

appointed executives from the oil and gas industry to senior positions in his Administration. Obama pursued comprehensive climate legislation that would have capped companies' emissions in 2009; the legislation failed to make it to the floor of the Senate after a prominent group of businesses condemned it.

But around that time, many business leaders began to feel pressure to do something on climate for the first time. Prioritizing environmental, social, and corporate governance concerns in investing, or ESG for short, had risen from a niche idea in the early 1990s to a mainstream approach to investment two decades later. At that point, a growing flow of reports from financial institutions warned of the economic consequence of inaction. And key voices in the business community-from Michael Bloomberg to Bill Gates-took the message on the road, telling CEOs to take climate change seriously. From 2012 to 2014 the value of investment in the U.S. earmarked for funds that took into account ESG issues close to doubled, to nearly $7 trillion, according to data from the U.S. SIF Foundation, a nonprofit that advocates for sustainable investment strategies…

The most important private-sector push came from the institutional investors at the center of the global economy, who control trillions of dollars in assets and are invested in every sector and essentially every publicly traded firm. When you own a little bit of everything, the scenarios portending climate-driven economic decline are terrifying. "We're too big to just take all of our hundreds of billions and try to find a nice safe place for that money," Anne Simpson, then director of board governance and sustainability at CalPERS, California's $500 billion state pension fund, told me in 2019. "We're exposed to these systemic risks, so we have to fix things."

With the U.S. government on the sidelines, these investors joined together to send a signal. When French President Emmanuel Macron hosted a climate summit in Paris in December 2017, he brought together investors controlling $68 trillion in assets to launch Climate Action 100+. In the beginning, members of this consortium used their status as high-profile investors to push emission reductions in 100 publicly traded companies through one-on- one engagements with high-level executives.

"All of this made for a reorganization of the politics of climate;' says Laurence Tubiana, a key framer of the Paris Agreement who now heads the European Climate Foundation. "It has now crystallized into something new: a strong coalition between business, financial institutions, investors, and governments."

3. Reducing U.S. Emissions 50% by 2030

We report on a six-model inter-comparison of potential actions to reach the US target of at least 50% GHG reductions by 2030. This analysis helps identify which findings are more robust or uncertain given different model structures and input assumptions. Models highlight the central roles of clean electricity and electrification, the large scale of deployment needed relative to historical levels and scenarios with only current policies, and a range of benefits from near-term action.[2]

The US pledge reflects a much more stringent 2030 target than has been previously analyzed. The existing literature has primarily focused on the actions needed to achieve

[2] John Bistline, Electric Power Research Institute, Nikit Abhyankar, Lawrence Berkeley National Laboratory, et al (note that all authors and their affiliations are linked on the webpage linked at the end of this reference), "Actions for reducing US emissions at least 50% by 2030," May 27, Science, https://www.science.org/doi/10.1126/science.abn0661

longer-term deep decarbonization goals in the 2050 time frame and has provided less detailed analysis of pathways in the next decade, a gap addressed by several recent studies. The six models in those studies (the basis of this comparison) are among the most widely applied and detailed models of the US energy system, which make them well-suited to provide information for policy-makers and other stakeholders on concrete actions to support nearer-term targets Some models use a top-down approach to identify least-cost emission reduction actions, whereas others use a bottom-up, sector-specific suite of measures and incentives to reflect policy proposals. Comparing the scenarios modeled here with ones that represent current policies and technological trends indicates the magnitude of implementation gaps that need to be closed through strengthened policies and incentives in the years until 2030. Insights from this modeling may be relevant for other countries, suggesting initial steps they can take toward more sustainable, affordable, reliable, and equitable clean energy transitions...

3.1. Robust Actions, On Target

Although specific sectoral contributions vary, all models studied indicate that most GHG reductions by 2030 come from the power and transportation sectors, which account for 69 to 89% of reductions (see figure on page 5 below). A highly consistent finding is the large role of the electric power sector in accelerating change through direct emissions reductions, primarily through fuel switching, and through end-use electrification to reduce fossil fuel use and emissions in transport, industry, and buildings. Direct CO_2 reductions from the power sector account for 48 to 66% of total 2030 reductions across models.

All sectors are involved in reaching the 2030 target, including enhancing the land sink and reducing non-CO_2 GHG emissions. Some sectors have lower cost reductions available and are assumed to be able to move more quickly (e.g., electrification of light-duty vehicles), whereas others need to be set up early to make deeper reductions feasible and affordable in later decades…

Energy efficiency (broadly conceived as reductions in energy use per unit of service demand or economic activity), cleaner electricity, and rapid electrification are key pillars for both near- and long-term emissions reductions, though models differ on how fast change can occur in each sector and the relative roles of these factors in reducing 2030 emissions…

In the power sector, the average annual additions of wind and solar capacity increase by two to seven times their historical levels in the last decade to meet the 2030 target... Another model-consistent finding is that coal capacity retirements meet or exceed historical levels, which lead to ~90 to 100% reductions in coal generation by 2030. Half of the participating models also deploy gas with carbon capture and sequestration (CCS) by 2030, increasing from 0 GW today to 0 to 70 GW by 2030. These transformations exceed the pace … projected to occur with current federal and state policies.

Author's Note: An alternative for CCS is to start deploying cleaner fuel in lieu of geologically sourced natural gas. This would probably either be biomethane (a.k.a. renewable natural gas) or hydrogen.[3]

Despite broad agreement on the need for substantial power sector decarbonization, models differ in the degree of investment in various low-carbon technologies. Key differences include the level of electrification, share of electricity generated by renewables, ratio of wind to solar builds, extent of new gas capacity builds (to replace

[3] Energy Central, "Reasonable Transition," Section 2, https://energycentral.com/c/gn/reasonable-transition

retiring coal capacity and balance renewables), role of emerging technologies (e.g., CCS), and extent of infrastructure buildout (e.g., transmission). Variations in investment mixes across models are due to a combination of differences in input assumptions and model structure such as temporal resolution, capital costs of generation options, electricity demand, constraints on technological choice sets, and various policy measures applied to achieve the target reduction level.

Technologies for decarbonizing end uses exhibit similarly rapid deployment. Electric vehicle (EV) shares as a fraction of new light-duty sales increase from around 4% in 2021 to 34 to 100% by 2030 with an average of 67%. The Biden administration set a 50% EV sales target by 2030, but model results suggest that EV deployment may have to exceed that level to reach the 2030 target. These shares are higher than EV shares in 2030 with current policies and incentives (16 to 77% with a 38% average). Despite rapid growth in new sales for passenger vehicles and other end-use technologies, turnover dynamics and inertia mean that the stock share and emissions impact lag new sales shares. In addition to transport, many of the roughly 150 million US households and businesses would make investments related to space heating and cooling, water heating, efficiency improvements, and appliance purchases over the next decade, leading to electricity's share of final energy across the economy to increase from 21% today to 25 to 35% by 2030.

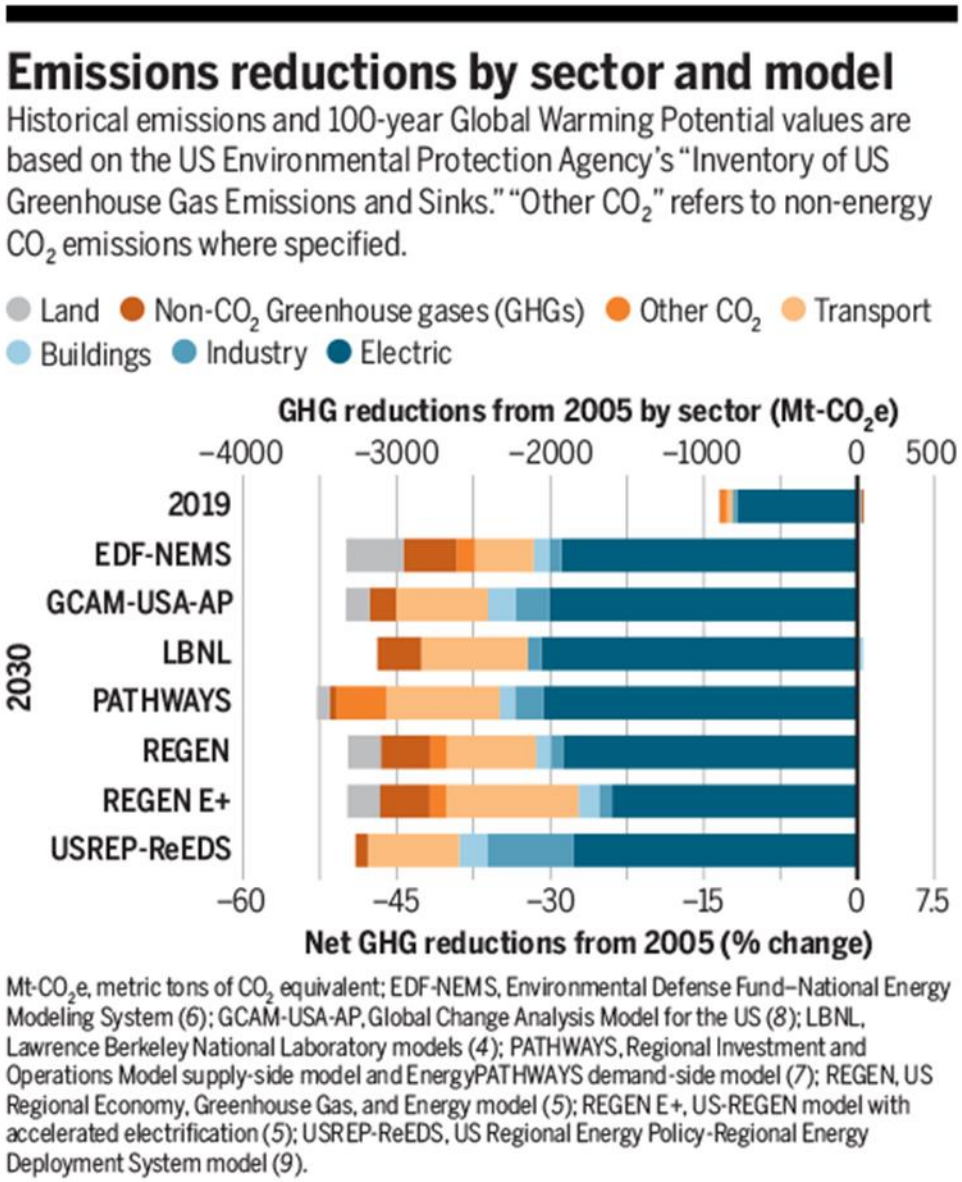
3.2. Policy and Implementation

With current policies and technological trends (i.e., model "reference" scenarios), continued electric sector emissions reductions, energy efficiency improvements, and vehicle electrification lead to 6 to 28% reductions in energy-related CO_2 emissions by 2030, falling far short of the 50% below 2005 emissions target.

Modeling efforts include a range of policy levers to close this gap, including clean energy tax credits, electric sector standards, end-use equipment rebates, efficiency standards, and carbon pricing. Some models rely primarily on an economy-wide GHG cap or carbon price to reach the 2030 goal, whereas others use a broader suite of options. Estimates of the marginal cost of CO_2 reductions, which reflect the cost of the last, or most expensive, ton of CO_2 reduced to meet the emission goal, provide an indicator of the level of policy stringency required to reach the target. For those studies using carbon pricing instruments, the marginal abatement cost ranges from \$36 to \$155 per ton of CO_2 in 2030 across models with an average of \$84 per ton of CO_2.

That many combinations of policies and incentives can be used to reach the 2030 target indicates that there are many pathways to halving emissions, though questions remain about which options are effective and politically durable, as well as about the roles of different actors (e.g., federal, state, and other subnational policies and their interactions).

All scenarios indicate high shares of solar and wind technologies, plant closures, and an increasing reliance on electricity as a result of electrification. These drivers suggest that the dependability of power systems (including resource adequacy, stability, and resiliency) will be an ongoing focus for planners, system operators, and policy-makers. The substantial decline in coal use also requires attention to a just transition for individuals and communities affected by these changes and their complex political economy. Additionally, given the large and rapid buildouts of resources, beyond historic levels, required to meet the 2030 target, institutional innovation will likely be needed to deploy commercial technologies at a faster pace, including expediting siting and permitting.



Actions in electricity and other sectors to meet the 2030 target are largely focused on deploying existing technologies and taking advantage of technological progress from previous decades (e.g., cost reductions and performance improvements in renewables, EVs, heat pumps), which were facilitated by policies and incentives to encourage innovation and early adoption. Continued encouragement of innovation is critical for making nascent technologies ready to scale to meet post-2030 targets. A largely decarbonized electric sector can help reduce emissions in other sectors directly through electrification and indirectly through electricity-derived fuels.

Author's Comment: "Electricity-derived fuels" are primary green hydrogen using electrolysis powered by renewable or zero-carbon electricity.

3.3. Implications

Models agree that near-term actions to reduce GHG emissions to meet the 2030 target can produce a range of benefits, and studies highlight several categories.

Magnitudes of GHG reductions are similar across models (see the above figure), though few studies explicitly monetize these benefits by multiplying these changes by the social cost of GHGs or similar approaches, which can estimate damages from rising temperatures, extreme weather events, and other climate impacts. However, one analysis reaching a 53% reduction in net GHGs by 2030 indicates annual climate benefits of ~$140 billion per year.[4] Near-term action, especially reductions of high–warming potential GHGs such as methane, can reduce the rate of worsening climate impacts and probabilities of triggering positive climate feedbacks.

Meeting the 2030 GHG target has side benefits of substantial reductions in non-CO_2 air pollutants such as sulfur dioxide (SO_2), nitrogen oxides (NOx), and particulate matter, reducing deaths and illnesses from air pollution. For instance, studies estimate the health benefits from reducing SO_2 and NOx from the power sector alone to equal tens of billions of dollars annually by 2030. Accelerated electrification can amplify the air quality benefits of electric sector decarbonization. Many 2030 target studies quantify reductions in these pollutant emissions, and some have included estimates of the value of reductions in death and illness from pollutant exposure. Individual studies discuss additional benefits that a 2030 target and associated policies could bring, including increasing jobs, encouraging technological progress and innovation, boosting international competitiveness, and improving distributional outcomes for lower-income households.

[4] R. Fakhry, S. Yeh, "The Biden Administration Must Swiftly Commit to Cutting Climate Pollution at Least 50% by 2030" (IB: 21-03-A, National Resources Defense Council, 2021), March 2021, https://www.nrdc.org/sites/default/files/2030-biden-climate-pollution-ib.pdf