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2024 Aspen Winter Energy Forum Report

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Table of Contents

Forward

2023 was yet another contradictory year for the energy transition. On the one hand, investment in clean energy reached a record $1.8 trillion and annual deployment of renewable energy increased by nearly 50 percent to an estimated 510 gigawatts.[1] On the other hand, annual carbon dioxide emissions continued to rise due to increased consumption of oil, gas, and coal.[2] The common denominator is a global economy that continues to require more energy. And the result is a global economy that is emitting more carbon than it ever has.

As we gathered in Aspen this February, we began by taking stock of the energy transition: where are we now, and where are we headed? We know that immense changes to the global energy system are already underway. An overwhelming number of scenarios indicate that renewable energy will continue to boom over the coming decade. Models also predict that coal will begin to lose its place within the global energy system. But the picture is less clear in other areas. The debate over the timing of peak oil demand remains divisive. Scenarios for natural gas also range widely, with some reputable sources predicting more, rather than less, demand for gas. However, almost all scenarios agree on one conclusion: the world's current trajectory is insufficient to keep global warming below 1.5°C, and perhaps even 2.0°C, above pre-industrial levels.

The Aspen Winter Energy Forum seeks to accelerate the energy transition by focusing on the nexus of finance, policy, technology, and markets. All four areas are critical for the energy transition, but face tremendous challenges. Policy often receives the most attention, with many arguing that more aggressive national targets, incentive schemes, and implementation plans are required to achieve the goals of the Paris Agreement. But technology and markets are equally important; while these areas can be spurred by policy, they can also jump ahead of it. And breakthroughs are urgently needed. The International Energy Agency (IEA) estimates that 35 percent of the emissions reductions needed to reach net zero by 2050 must come from new technologies.[3] Reaching net zero will likewise require an estimated $4.5 trillion in clean energy finance every year from now to 2030, well above the current allocation of $1.8 trillion.[4]

While we do not pretend to have all the answers, we know that promising solutions already exist, and that these need to be further identified, implemented, and scaled. For example, frameworks have already been introduced for policy that can expedite permitting in communities that are ready and willing to build clean energy infrastructure.[5] Technologies like artificial intelligence (AI), nuclear energy, and carbon capture, utilization, and storage (CCUS) all can and will play a role in reaching net zero, although each carries unique risks that must be carefully managed. Green banks, government purchasing, and public funding can mobilize private capital. Models exist: the Connecticut Green Bank has

1 https://www.bloomberg.com/news/articles/2024-01-30/china-leads-global-clean-energy-spending-which-record-1-8-trillion-in-2023
https://www.iea.org/reports/renewables-2023/executive-summary

2 https://globalcarbonbudget.org/fossil-co2-emissions-at-record-high-in-2023/

3 https://www.iea.org/reports/net-zero-roadmap-a-global-pathway-to-keep-the-15-0c-goal-in-reach/executive-summary

4 https://iea.blob.core.windows.net/assets/9a698da4-4002-4e53-8ef3-631d8971bf84/NetZeroRoadmap_AGlobalPathwaytoKeepthe1.5CGoalinReach-2023Update.pdf

5 https://www.aspeninstitute.org/wp-content/uploads/2021/06/Building-Cleaner-Faster-Final-Report.pdf

mobilized an estimated $6.70 per dollar of public capital; the General Services Administration is helping move markets with its Buy Green Initiative; and the Environmental Protection Agency's Greenhouse Gas Reduction Fund has set aside $27 billion to serve as a multiplier for private investment.[6]

Each year, the Aspen Institute's Energy & Environment program gathers leaders across the energy industry to tackle the most difficult questions facing the energy transition. The discussions this February included topics such as transmission, load growth, building decarbonization, artificial intelligence, carbon accounting, and the future of environmental groups. Together, participants grappled with an array of crucial questions. How can we build a much larger electric system to both serve new loads and to do so with carbon-free resources, while ensuring reliability, affordability, and getting new generation on the grid faster? What are the main challenges to decarbonizing the built environment, and what financial mechanisms are needed to overcome them? How can AI deliver more value with a corresponding reduction in the environmental impact of the systems that enable it? What is the purpose of greenhouse gas accounting, disclosure, and goal-setting/leadership programs, and are they still fit to purpose to drive and scale private sector capital for the energy transition? Are environmental NGOs still playing an optimized role in seeking new policies and influencing private sector actions? Is it time to rethink the future of climate philanthropy or are we on the right track?

Large questions like these do not often result in clean, easy answers. But they do lead to discussions that can unearth themes of what is occurring across the energy ecosystem, and what we may be missing. Our discussions this year helped us reach four key conclusions:

1. **Major assumptions in climate models present large downside risk, but are not currently fully accounted for.** These factors, ranging from raw material availability to geopolitical stability, are major sources of friction and tension. We must further integrate such variables into climate models and proactively work to ensure that they enable, rather than impede, the energy transition. A key consideration that we discussed is the imperative to build a grid capable of handling more load and more clean energy.

2. **We now find ourselves in an unparalleled moment of "speed and scale".** Decades of technological innovations, cost declines, and climate advocacy, paired with new legislation like the Inflation Reduction Act and Bipartisan Infrastructure Law, have catapulted the energy transition into a new stage. Implementation is the order of the day, and we must now focus on getting things built and scaled.

3. **As we seek to accelerate the energy transition, we also need to carefully balance difficult tradeoffs.** The challenge of balancing cost, security, access, and environment remains as crucial as ever. Energy must be affordable, reliable, accessible, and clean. Balancing these considerations will shape how we approach fossil fuel decommissioning and artificial intelligence. The role of institutions, like nongovernmental organizations, and mechanisms, like carbon accounting, will also require careful weighing of their purpose, impact, limitations, and alternatives.

4. **A successful energy transition will require a people-centered approach.** Climate is often deprioritized at the polls in favor of issues like economics and security. New tactics are needed to tie the three together, and communicate opportunities, reduce tradeoffs, and make the benefits of clean energy more tangible to communities. We can continue to take steps forward by doing things like framing transmission as a growth opportunity, determining how to socialize the costs of green buildings, and empowering NGOs to identify communities that are ready to commission new projects today.

6 https://www.ctgreenbank.com/strategy-impact/
https://www.sustainability.gov/buyclean/
https://www.epa.gov/greenhouse-gas-reduction-fund

Hidden Assumptions in Climate Models | The Electric Grid

Climate modeling often requires assuming that certain parts of the energy ecosystem will cooperate and fall in line with different scenarios. But many core assumptions, particularly for low-emission scenarios, present hidden risks to the energy transition. These assumptions must be actively identified, integrated, and planned for.

Discussants at the Winter Energy Forum highlighted several key variables that can either enable or stall the road to net-zero, and therefore warrant more active consideration. For example, supply chain challenges could raise the costs and hinder the speed of the energy transition. Political swings will also have significant impacts on policy and markets, with more than half of the world headed to the polls in 2024. Similarly, geopolitics and the resilience to war, trade conflicts, and cyberattacks can influence political resolve to reduce emissions. Closer to home, the direction of permitting reform and the US workforce will dictate how much can be built, and how quickly. There was also discussion around the possibility of changes to the legal principle "Chevron Deference", which could substantially impact the trajectory of the domestic energy transition, and it is difficult to foresee the exact implications of novel legal precedents.

The future of electric grids is another variable that promises to be a key enabler, or inhibitor, of the energy transition. Grids were a major topic of conversation at the Winter Energy Forum this year. According to the IEA, delays in global grid development would mean that "global long-term temperature rise would go well above 1.5 °C, with a 40% chance of exceeding 2°C."[7] The challenge in the United States is building a grid that is both net-zero and sizably bigger than that of today.

Shifting from a primarily fossil-fuel grid to a net-zero grid was always going to be a huge challenge. There is now also need for a grid that can accommodate large increases in electricity demand. Grid planners in the US currently forecast peak demand growth of 38 GWh (gigawatt hours) through 2028.[8] And that number is likely an underestimate; in the last year, forecasts for five-year demand growth increased from 2.6 to 4.7 percent.[9] Utilities are rapidly adjusting their load projections due to surging demand from data centers and efforts to onshore manufacturing. Other variables, like new hydrogen facilities, electrification of transport, and extreme weather, are further adding to demand. Participants indicated that utilities are struggling to determine the quantity and location of new demand, as well as the different preferences of new customers.

Load growth is also driving a need for more transmission capacity. For example, a recent study by the Department of Energy found that the US must double regional transmission capacity to meet its 2035 clean energy goals.[10] The good news, according to participants, is that drastically new technologies are not necessarily required to build more transmission. But the bad news is that transmission buildout faces massive political challenges due to its high upfront costs and long timeline. Transmission lines

7 https://www.iea.org/reports/electricity-grids-and-secure-energy-transitions/executive-summary

8 https://gridstrategiesllc.com/wp-content/uploads/2023/12/National-Load-Growth-Report-2023.pdf

9 https://gridstrategiesllc.com/wp-content/uploads/2023/12/National-Load-Growth-Report-2023.pdf

10 https://www.energy.gov/sites/default/files/2023-10/National_Transmission_Needs_Study_2023.pdf

in the US and Europe took an average of 8-10 years to build from 2010-2021.[11] That timeline, which includes planning, permitting, and construction, can disincentivize elected officials from approving building more capacity since incumbents may be out of office by the time the infrastructure is built.

Grid interconnection was another major area of discussion given the current barriers to increasing transmission capacity. But Forum participants were adamant that interconnection, while important, is not a solution to the broader transmission challenge. Transmission was framed in the Forum as an "artificially scarce resource". Interconnection can be seen as the rationing of that artificially scarce resource. But transmission should not be scarce in the first place. Metaphorically, policymakers, regulated actors, and market participants need to focus both on making the pie bigger (transmission) and determining how to distribute it (interconnection).

Much higher levels of renewable capacity are also required. The US currently generates 60 percent of its electricity from fossil fuels, 21 percent from renewables, and 19 percent from nuclear energy.[12] Efforts to retire and replace coal plants (still 16 percent of electricity generation in the United States) with renewables continues to accelerate. Yet, as discussed later in this report, renewable capacity does not have the same reliability as other sources when it comes to frequency, voltage, and dispatchability. Participants also noted that the "retire and replace" approach, while crucial to getting a cleaner grid, will not help solve the challenge of load growth. Something closer to "retire, replace, *and* add" is needed, supplemented by the buildout of significantly more transmission capacity.

A major hurdle to adding more renewables is the state of the current US interconnection queue, which was a large topic of discussion in this year's Winter Energy Forum. The US currently has over 2 terawatts of energy languishing in interconnection queues, and renewables account for more than 94 percent of capacity pending in queues.[13] Unlocking that capacity will be critical to decarbonizing the grid, yet projects completed in the United States in 2022 spent an average of five years waiting for approval in the interconnection queue.[14] Queue wait times will likely only increase as the queue itself becomes larger through the continued filing of interconnection applications without a simultaneous acceleration of the process that follows. While most projects in queues are targeting operational dates in the next few years, the review process alone will likely render those timelines impossible, not to mention the time that will later be spent on permitting and construction. The crux of the interconnection challenge lies in determining how to identify, approve, and build viable projects on an accelerated timeline.

There was also discussion that mismatched incentives for developers and utilities are contributing to long interconnection queues. On the one hand, many projects in the queue are not economic and have overly optimistic development timelines. One participant, for example, estimated that only 15 percent of the projects in the queue are "real" and ready to move. On the other hand, participants noted that developers have reason to propose many (potentially illusory) projects. Developers face uncertainty around when, and if, their projects will be selected. They also often do not know if the project will receive its permits and whether the future electricity price will make the project economic. Uncertainty pushes developers to propose more projects. That behavior is further incentivized by low financial barriers to enter, stay in, and withdraw from the queue.

11 https://www.iea.org/data-and-statistics/charts/average-lead-times-to-build-new-electricity-grid-assets-in-europe-and-the-united-states-2010-2021

12 https://www.eia.gov/tools/faqs/faq.php?id=427&t=3

13 https://www.spglobal.com/marketintelligence/en/news-insights/research/us-interconnection-queues-analysis-2023

14 https://www.utilitydive.com/news/grid-interconnection-queue-berkeley-lab-lbnl-watt-coalition-wind-solar-renewables/647287/

Participants noted that the challenges facing the US electric grid will ultimately require a variety of solutions rather than a "silver bullet." Industry and regulators must figure out how to distribute the costs of intermittency and energy storage between generation providers, utilities, customers, or other entities. There are also major challenges around how to ensure reliability, where new demand will come from, what profile new demand will take, how to improve price certainty for developers, how to reduce interconnection queues, how to build transmission, where spare capacity exists, and other crucial questions.

Nonetheless, participants offered an array of potential solutions to different pieces of the grid puzzle. Various experts argued that grid enhancing technologies and artificial intelligence can play an important role in promoting efficiency. Most of the technology required to build smart grids is available and mature; now the focus needs to shift to deployment. Participants also agreed on the need to enhance the US workforce, from public servants reviewing projects to construction workers building new transmission lines and generation capacity. Other areas had wide consensus on principles, but a range of opinions on potential solutions. For example, participants agreed that utilities should move from a reactive approach to a more proactive approach on transmission. Solutions could include strengthening mechanisms for anticipatory investments or providing utilities with a first right of refusal on new transmission capacity.

Participants also agreed on the urgent need to reduce interconnection queues. **Two proposed ideas to achieve that objective were increasing financial commitments for generation projects in the queue and shifting from a "first-come, first-served" model to a "first-ready, first served" model.** Increasing financial commitments for developers would likely lessen the number of projects on the queue and improve the overall "quality" of projects that apply for approval. Raising required project deposits and implementing withdrawal fees were highlighted as potential mechanisms. Additionally, moving to a "first-ready, first-served" model would allow projects that are demonstrably viable to move more quickly through the interconnection process. Luckily, the Federal Energy Regulatory Commission (FERC) is already intending to move forward with both of these solutions to accelerate the deployment of clean energy.[15]

15 https://www.perkinscoie.com/en/news-insights/ferc-upholds-reforms-to-interconnection-process-but-will-reforms-be-implemented-fast-enough.html

Speed and Scale | Time for Implementation

The words "speed" and "scale" were used frequently in this year's Winter Energy Forum. Discussions centered around how to accelerate the energy transition at a "gigaton level," confirming that entrance into a new phase of the transition that will be defined by implementation. That shift has been propelled by four key factors.

First, technological and commercial innovation have made renewable energy economically competitive. Costs for utility-scale solar have dropped by over 80 percent since 2010; solar electricity is now cost-competitive with natural gas and cheaper than coal.[16] Similarly, the cost of onshore wind costs has declined significantly, while the cost of lithium-ion batteries dropped 97 percent from 1991 to 2021.[17] Participants noted that, although smart grid adoption previously stalled due to technological constraints, the technology needed to build smart grids is now readily available. Costs for clean energy technologies, particularly for technologies like battery storage and green hydrogen must still continue to come down. But, on the whole, tremendous innovation over the last three decades has already led key technologies to become economically viable. And that cost competitiveness is enabling a shift toward implementation.

Second, society's growing awareness of climate change is driving support for clean energy. Since the mid 20th century, there has been substantial progress in developing climate science and spreading awareness. Today, polls show that 67 percent of US adults believe the government should encourage wind and solar power, and 69 percent favor taking steps to become carbon neutral by 2050.[18] Opinions on climate change in the US remain divided across political lines and most US voters do not prioritize climate at the polls. Nevertheless, decades of change in American perceptions on climate are beginning to support more aggressive action.

Third, the passage of landmark climate legislation, marked by the Inflation Reduction Act (IRA) and the Infrastructure Investment and Jobs Act (IIJA), has unlocked huge public investment for clean energy in the form of tax credits, loans, and grants. But one participant described the legislation as "wrapped in ice" due to its vulnerability to political challenges that could cause legal and/or implementation challenges. These dynamics have opened a massive, but potentially politically narrowing, window of opportunity. Policymakers must continue to rapidly move legislation from words to action. The private sector must accelerate the pipeline of projects that leverage public funding, while innovating to prepare for a world without subsidies. And civil society must ensure that energy infrastructure is built quickly, responsibly, and equitably.

Lastly, the time value of carbon is contributing to the need for implementation. A ton of carbon reduced today reduces emissions by orders of magnitude more than a ton reduced in 2050. And, as the world inches closer to 1.5°C, more drastic action is needed each year. While progress on climate awareness, innovation, and legislation remain necessary, an immediate and stronger pivot to implementation is required to reach the goals of the Paris Agreement.

16 https://www.nrel.gov/news/program/2021/documenting-a-decade-of-cost-declines-for-pv-systems.html https://www.eia.gov/outlooks/aeo/electricity_generation/pdf/AEO2023_LCOE_report.pdf

17 https://spectrum.ieee.org/chart-behind-the-three-decade-collapse-of-lithium-ion-battery-costs

18 https://www.pewresearch.org/short-reads/2023/08/09/what-the-data-says-about-americans-views-of-climate-change/#:~:text=Concern%20over%20climate%20change%20has,change%20as%20a%20major%20threat.

Balancing Tradeoffs | The Grid, AI, Climate Accounting, and NGOs

Pursuing the energy transition at speed and scale requires balancing competing priorities and making difficult tradeoffs. Conversation at this year's Winter Energy Forum focused in particular on tensions in four areas: the grid, AI, climate accounting, and the role of nongovernmental organizations.

The Electric Grid

One of the fundamental challenges of the energy transition is the tension between cost, security, and environment. The electric grid's main mandate has historically been to provide electricity that is affordable, reliable, and accessible. Now, there is an additional mandate to ensure that electricity is clean. But those variables lie in a delicate balance, as Europe learned following Russia's invasion of Ukraine. Today, one of the main questions facing US policymakers, utilities, and consumers is the role of coal and gas on the electric grid.

Participants at the Winter Energy Forum resoundingly agreed that firm, dispatchable capacity is key for the grid. Renewables must be scaled while simultaneously ensuring the continued provision of reliable and affordable electricity. If reliability or affordability is placed in jeopardy or sacrificed, the energy transition could face political backlash. For better or worse, renewables require a baseline level of fossil fuels as firm capacity, at least for now.

The implications are different for coal and gas. Participants noted that coal must be replaced as quickly as possible yet continues to be needed in the near term. Coal retirements were a central point of debate. While all agreed that retirements need to accelerate, some argued that in select instances, 1–2-year plant extensions could provide strategic advantages, and may be preferable to building natural gas facilities with long lifespans. Participants also stated the need for a strategy to decommission coal plants in a way that ensures reliability for those that do exist. There are currently few incentives to invest in a plant slated for retirement. That causes problems, as reliability declines without investment and maintenance. While coal must rapidly be decommissioned, policy and market solutions are needed to ensure that existing plants operate reliably up until their anticipated retirement.

Gas was also a major topic of discussion. Participants spoke about the need for natural gas in the near term due to its value for grid stability and its ability to replace coal. Gas is a cost-effective option and utilities understand how it works. However, constructing more gas capacity, particularly for liquified natural gas (LNG), will make it difficult to achieve long-term climate goals. Gas-fired plants have a typical lifespan of 30-40 years.[19] The decision to build new gas capacity therefore introduces a tension between near- and long-term energy priorities. Some Forum participants speculated that an electric grid with 10-20 percent gas in the long term may be a pragmatic target to reach a grid that is both low-carbon and reliable. Gas's potential role stems from the need for firm dispatchable capacity and the lower emission footprint of gas relative to other fossil fuels like coal. The seemingly sticky role of gas in the energy system means that carbon capture and utilization will be key to reducing gas-related emissions.

19 https://www.bloomberg.com/news/features/2021-05-21/lifespan-of-new-u-s-gas-plants-exceeds-net-zero-climate-goals

Artificial Intelligence

Artificial intelligence (AI) is both one of the largest challenges and opportunities facing the energy industry. Forum participants had much to say on the topic, and offered various suggestions to ensure that AI is a net-positive force for the energy transition.

The rise of AI is projected to drive a substantial increase in demand for electricity. McKinsey estimates that data center demand for power will grow from 17 gigawatts in 2022 to 35 gigawatts by 2030, while the IEA predicts that data centers will move from 4 percent of US power demand in 2022 to 6 percent by 2026.[20] Additionally, data centers are often large water consumers and producers of e-waste. Participants also pointed out that the location and level of power demand from AI remains highly unpredictable or otherwise difficult to foresee, complicating planning for utilities and regulators.

However, AI also has significant upside for the energy transition. According to BCG, AI could deliver insights that help unlock 5-10 percent global emission reductions by 2030.[21] Forum participants were cautiously optimistic about AI's potential benefits.

Conversation around the upside for AI outlined three main categories of value. First, AI can deliver major improvements in optimization. One participant noted that AI can cut costs by half in certain categories for utilities, while also boosting energy efficiency in buildings. Second, AI can help with the discovery of new sustainability solutions. The Department of Energy, for example, is currently using large language models to create subsurface data maps and enhance critical mineral discoveries. And third, AI has the potential to empower the workforce, accelerating processes like permitting and interconnection review. If harnessed correctly, AI can also drive other areas of progress for the energy transition. For example, as tech companies with aggressive decarbonization targets purchase energy for data centers, they could create a demand pull for clean energy. Another opportunity could emerge through the direct use of AI itself, as predictive analytics from AI models could mitigate the effects of extreme weather events.

Forum participants offered a series of recommendations to reduce the threats and capitalize on the benefits of AI. **A series of these recommendations centered on lowering AI's energy footprint. Suggestions included making algorithms more efficient; designing, incentivizing, and deploying energy-efficient chips; promoting centralization to build scale at large data centers; and locating data centers next to low-carbon grids.** The good news is that AI energy efficiency has precedent. According to the IEA, energy efficiency ensured that power demand from data centers grew slower than demand for data center services over the last decade.[22]

Another set of suggestions at the Winter Energy Forum focused on maximizing the benefits of AI. Data standardization was highlighted as a key enabler; participants noted that AI only works with good data, which is oftentimes lacking for important segments of power demand like buildings. Other recommendations focused on the workforce. Widespread education and AI training is required to put technology into people's hands and unlock productivity gains. Utilities were depicted by participants as "AI curious," but lacking the training and familiarity to accelerate deployment. There was broad consensus among Forum participants that AI should primarily focus on augmentation and freeing up the time of employees to boost productivity, rather than on replacing jobs. However, it was noted that job replacement may occur in select cases, such as at call centers. Lastly, participants recommended that regulators should increase and mandate transparency on data center energy usage.

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20 https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/investing-in-the-rising-data-center-economy
https://www.washingtonpost.com/business/2024/03/07/ai-data-centers-power/

21 https://web-assets.bcg.com/72/cf/b609ac3d4ac6829bae6fa88b8329/bcg-accelerating-climate-action-with-ai-nov-2023-rev.pdf

22 https://www.iea.org/energy-system/buildings/data-centres-and-data-transmission-networks#tracking

Carbon Accounting and Corporate Disclosure

Since the early 2000s, the number of companies calculating carbon footprints and publicly disclosing information related to climate and sustainability has increased substantially. More than 75 percent of the S&P 500 publicly disclose such information and companies representing more than a third of global market capitalization have or are in the process of setting "science-based targets". Participants noted that accounting and disclosure help inform investor decisions, provide transparency for employees and customers, and track progress against net-zero targets. Despite their various benefits, accounting and disclosure systems are also beginning to cause tough questions in boardrooms and policy circles.

Participants outlined several key questions that are playing out within companies. Is it the duty of CEOs to focus on climate change? How can companies manage the risk of greenwashing litigation, even despite good intentions? Who within companies is responsible for disclosures? How can accountants avoid double counting between Scope 1, 2, and 3 emissions? And what constitutes a reasonable effort on accounting for, disclosing, and reducing Scope 3 emissions? One participant noted that when it comes to Scope 3, "everyone seems lost".

Participants also mentioned the tension between harmonization and customizability. Carbon accounting and corporate disclosure must be comprehensive to mean anything, and must be harmonized to allow for comparability. Yet, there also needs to be a certain level of flexibility and customizability to accommodate different industries, available data, internal resources, operating models, and other considerations. Things seem to be moving in the right direction, led by work at the International Sustainability and Standards Board, although the potential for fragmentation still exists. There was also discussion among participants of an attributional versus consequential approach to accounting. An attributional approach to accounting examines the inventory of emissions within a specific system and firm boundaries, while a consequential approach seeks to quantify the net change in emissions (irrespective of any boundaries) due to a specific decision. A consequential approach can often be preferable when it comes to evaluating the holistic effects that a decision can have on emissions. However, it was noted that consequential accounting is also more difficult to account for and standardize.

Lastly, a significant part of the discussion at the Winter Energy Forum focused on the shift of accounting and disclosure systems from voluntary to mandatory. The move toward mandatory disclosures has accelerated as government entities like the European Union, California, and the US Securities and Exchange Commission (SEC) adopt mandatory disclosures. Participants were split on the efficacy of such mandates. Some believed that there should be a third option on the table — regulations — that would be far more efficient since they could directly lead to standardization, widespread collection of data, and obligations to meet firm targets. The question participants posed is that, in the absence of regulations, is mandatory accounting and disclosure a good alternative, or just a proxy war for regulation? The SEC's new rule will be interesting within this context. It certainly has potential to boost transparency, but will face pushback if it fails to balance legitimate corporate, design, and policy concerns.

The Role of Environmental Nongovernmental Organizations (eNGOs)

Environmental NGOs (eNGOs) are currently operating with a dual mandate. On the one hand, these organizations and their funders are increasingly focused on solving the climate crisis by accelerating deployment of clean energy technologies. At the same time, environmental NGOs have historically served a critical role in society as a brake, rather than a pedal, for industrial and energy development. The question is: how can the eNGO community strike an adequate balance of preventing bad things and enabling good things from a climate perspective?

Addressing this question of balance, and its inherent tensions, is a key challenge for eNGOs and the larger philanthropic community. Environmental NGOs have historically protected the climate by opposing projects. But eNGOs must confront conventional orthodoxies; preserving climate now requires a mix of blocking or

slowing certain projects while accelerating others. Participants suggested that eNGOs can begin to solve these questions by having a deeper conversation about their values and the hierarchy of those values. The eNGO community should also remember that it is not a monolith; different eNGOs will have different, but complementary, priorities, roles, and purposes in society.

Participants in the Winter Energy Forum offered a variety of different recommendations for the eNGO community. Some of these recommendations focused on accelerating climate action. Some participants recommended that eNGOs should continue to invest in political advocacy, clean energy deployment, and financing clean energy technologies through the "valley of death" to commercialization. Ideally, these investments should all search for a "multiplier effect" that ensures limited funds unlock public and private capital.

Some participants also recommended that other types of eNGOs should play where they are strongest — working in communities and for communities. Participants agreed that eNGOs must strive to maintain trust at all costs since that is the unique value-add of nonprofits relative to the public and private sector. However, maintaining trust does not mean discouraging deployment. To the contrary, eNGOs can play an important role in facilitating deployment by, for instance, leading tribal consultation, identifying communities that are ready to build clean energy projects, and educating communities about the energy transition. Other eNGOs may be suited to play a different role by continuing to set accountability via mechanisms like the Greenhouse Gas Protocol, Climate Disclosure System, and Science Based Targets Initiative. And eNGOs must continue to strictly monitor harmful projects and ensure that they do not move forward. **Perhaps the best summary of the conversation at the Forum is that the eNGO community can serve as a brake "and" a pedal, rather than having to choose between being one "or" the other.** That means the eNGO community must focus on not only being synergistic with the public and private sector, but also with itself, distributing its focus on the many challenges ahead.

A People-Centered Energy Transition | Winning Hearts and Minds

The energy transition will not succeed unless it is designed for, and by, everyday people. Participants at the Forum frequently mentioned the need to win the "hearts and minds" of Americans. Without that, implementation of the energy transition at speed and scale, and US climate goals writ large, are unachievable. Yet winning hearts and minds is a challenging process that requires patience, solutions, and substance.

Part of a people-centered energy transition has to do with the question of cost. Participants outlined that a central challenge for funding grid infrastructure is determining who pays for it, and convincing politicians and voters to invest in large upfront costs. As mentioned earlier, transmission projects can often span 8-10 years. Various participants pointed out that over the long run, the economic costs of building transmission are heavily outweighed by the economic benefits. But it was noted that the long-term view is difficult to communicate to voters and politicians, who often fixate on the initial costs rather than the long-term economic opportunity.

Energy costs are even more challenging. While many Americans support clean energy, they prioritize affordable energy. Participants noted that rising energy costs can cause political opposition to the energy transition, and that affordability must be a key pillar of the transition. This came up in discussions around New York City's Local Law 97. The law sets carbon standards for buildings, which account for approximately two-thirds of emissions in New York City. Local Law 97 seeks to reduce emissions from large buildings by 40 percent by 2030 and to reach net zero by 2050.[23] These targets are critical for reducing the city's emissions. But more than 10,000 buildings that are anticipated to be in violation of regulations by 2030; on average, buildings will require around $1 million to reach compliance. For many buildings, reaching compliance requires deadweight losses (i.e., more costs than savings). That then poses a huge question of who pays? Is it the public sector, private entities, or rent payers? If the costs fall on the rent payer, policies like Local Law 97 could face large political opposition despite their important benefit for climate. **As one participant noted, the social license of the energy transition will depend on the average citizen's zone of tolerance for cost.**

Deployment also requires creating stronger incentives for local communities. A central problem for the energy transition is that benefits from clean energy technologies are often diffused globally, but costs are concentrated locally. For example, lithium used in electric vehicles helps decarbonize the global economy, but the environmental costs of a lithium mine are all directly shouldered by the communities living next to that mine. Forum participants cited a similar challenge for overhead transmission lines. Owners of the land on which transmission lines pass may get some rents, but adjacent landowners just get a bad view. While wider society will benefit from more transmission, a small number of individuals face specific costs. That increases local opposition and complicates permitting. The Department of Energy and Federal Energy Regulatory Commission are working on these challenges, but they are proving difficult to solve.

23 https://www.nyc.gov/site/sustainablebuildings/ll97/local-law-97.page

Forum participants noted that there could be a feedback loop between the deployment of clean energy and grassroots support for the energy transition. Workforce challenges were mentioned frequently throughout the Forum. A larger and better-prepared workforce is needed to deploy clean energy technologies. Yet a hidden opportunity also exists: as it grows, the new clean energy workforce might become a key advocate for the energy transition. This concept is a central component of the Inflation Reduction Act, which has sought to place clean energy jobs in communities that have historically been "left behind". Participants implied that such an approach could be expanded into other areas of the energy transition. For example, rather than simply seeking to place a data center on tribal lands, companies might simultaneously ensure that tribal communities have the opportunity to receive training and access to AI. Communities must be offered a path to participate in clean energy through active involvement in decision-making, deployment, and management. That principle could unearth a key value proposition for the energy transition: replacing the historically extractive model of fossil fuels with an inclusive, community-led, and sustainable model of clean energy.

Participant List

*__Rohit Aggarwala__, Commissioner, New York City Department of Environmental Protection
__Doug Arent__, Executive Director, Strategic Public Private Partnerships, National Renewable Energy Laboratory
__Nana Menya Ayensu__, Special Assistant to the President on Climate Policy, Finance, and Innovation, The White House
__Roger Ballentine__, President, Green Strategies, Inc.
*__Miranda Ballentine__, Former Founding CEO, Clean Energy Buyers Alliance.
__Leonardo Banchik__, Investment Director, Voyager Ventures
*__Manish Bapna__, President & Chief Executive Officer, Natural Resources Defense Council
__Paul Bauman__, Senior Advisor, Rodel Foundation
__Keith Benes__, Senior Fellow, U.S. Department of Energy
__Jeff Bladen__, Global Director of Energy, Meta Platforms, Inc.
__Jim Connaughton__, Chairperson, Nautilus Data Technologies
__Amanda Peterson__ Corio, Global Head, Data Center Energy, Google LLC
__Jon Creyts__, Chief Executive Officer, Rocky Mountain Institute
__Kyle Danish__, Partner, Van Ness Feldman, LLP
__Allen Davis__, Business Development Executive, Battelle
__Tyler Denton__, Deputy Director, The Aspen Institute Congressional Program
*__Abigail Dillen__, President, Earthjustice
__Ali Douraghy__, Director, Climate & Energy Research, Google LLC
__Kerry Duggan__, Founder & Chief Executive Officer, SustainabiliD
__Martin Durbin__, Senior Vice President, Policy, U.S. Chamber of Commerce
__Courtney Durham Shane__, Senior Officer, Climate Mitigation, The Pew Charitable Trusts
__Katie Dykes__, Commissioner, Connecticut, Department of Energy & Environmental Protection
*__Juliet Eilperin__, Deputy Editor, Climate & Environment Department, The Washington Post
__Ken Elser__, Director, Technology and Technical Services, Wells Fargo and Company
__Rachel Fakhry__, Policy Director of Emerging Technologies, Natural Resources Defense Council
__Miles Farmer__, Legal Advisor to Commissioner Allison Clements, Federal Energy Regulatory Commission
__Emily Sanford Fisher__, Executive Vice President, Clean Energy & General Counsel, Edison Electric Institute
__Michael Fitzpatrick__, Partner, Brunswick Group
__Anna Foglesong__, Managing Director, Clean Grid Initiative
__Peter Freed__, Director of Energy Strategy, Meta Platforms, Inc.
__Stefan Gerlicz__, Director, Sustainability, Netflix, Inc.
__Rob Gramlich,__ President, Grid Strategies LLC
__Lindsey Baxter Griffith__, Senior Director, United States, Clean Air Task Force
__Bryan Hannegan__, President and Chief Executive Officer, Holy Cross Energy
__Jeremy Harrell__, Chief Strategy Officer, ClearPath
__Karl Hausker__, Senior Fellow, Climate Program, World Resource Institute
*__Franz Hochstrasser__, Co-Founder and Chief Executive Officer, Raise Green, Inc.
__Blake Houghton__, Partner, McKinsey & Company
__Betty Moy Huber__, Partner, Latham & Watkins LLP
*__Bert Hunter__, Executive Vice President and Chief Investment Officer, Connecticut Green Bank

* *Participating Virtually*

Aubrey Johnson, Vice President, Midcontinent Independent System Operator
***Katy Kale**, Deputy Administrator, United States General Services Administration
Mariah Kennedy, Director, Datacenter Energy Strategy (Global), Microsoft Corporation
Nat Keohane, President, Center for Climate and Energy Solutions
***Kelley Kizzier**, Director, Corporate Action & Markets, Bezos Earth Fund
Kate Larsen, Partner, Rhodium Group
***Louis Lazzara**, Senior Research Analyst, Energy Income Partners, LLC
Rob Leland, Director, Climate Change Security Center, Sandia National Laboratories
Nate Loewentheil, Founder and Managing Partner, Commonweal Ventures
Kathleen McGinty, Vice President and Chief Sustainability and External Relations Officer, Johnson Controls
Robin Millican, Senior Director, U.S. Policy and Advocacy, Breakthrough Energy
Sandhya Murali, Co-Founder, Solstice
Jim Murchie, Co-Founder and Chief Executive Officer, Energy Income Partners, LLC
Richard Newell, President and Chief Executive Officer, Resources for the Future
Jake Oster, Director of Energy and Environment Policy, Amazon Web Services
Katie Ott, Vice President, Sustainability and Climate Strategy, Constellation Energy
Missy Owens, Director, Global Sustainability Policy, General Motors
***Luisa Palacios**, Senior Research Scholar, Columbia University Center on Global Energy Policy
***Stephen Pantano**, Vice President, Research, Rewiring America
Jonathan Pershing, Program Director, Environment, William and Flora Hewlett Foundation
***Sarah Penndorf**, Climate Standards and Advocacy, Google LLC
***Ari Peskoe**, Director, Electricity Law Initiative, Harvard Law School
***Mark Peters**, Executive Vice President, Battelle
Rich Powell, Chief Executive Officer, ClearPath
Ida Rademacher, Vice President & Co-Executive Director, Aspen Institute Financial Security Program
***David Rich**, Deputy Director, Greenhouse Gas Protocol, World Resources Institute
***Jim Robb**, President and Chief Executive Officer, North American Electric Reliability Corporation
Kristen Sarri, Managing Director, Go Blue, LLC
Dan Schory, Chief of Staff, Infrastructure, Arnold Ventures
Karen Skelton, Senior Advisor, Office of the Secretary of Energy, U.S. Department of Energy
***Joanna Smith-Ramani,** Co-Executive Director, Aspen Institute Financial Security Program
Jon Sohn, Vice President, Government Relations, Regulatory & Environmental, Capital Power
***Andrew Steer**, President and Chief Executive Officer, Bezos Earth Fund.
David Szmigielski, Executive Director, Sustainable Finance & Advisory, Wells Fargo and Company
Ross Templeton, Political and Legislative Director, International Association of Iron Workers
***Sue Tierney**, Senior Advisor, Analysis Group
Carla Tully, Board Director, Citizens for Responsible Energy Solutions Forum
***Christie Ulman**, President, Sequoia Climate Foundation
László Varró, Vice President, Global Business Environment, Shell International B.V.
Cina Vazir, Managing Consultant, Wood Mackenzie *(Rapporteur)*
John Wagner, Laboratory Director, Idaho National Laboratory
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Agenda

Monday, February 5, 2024

Arrivals and Check-In
Opening Reception and Dinner

Tuesday, February 6, 2024

Welcome Remarks
Introduction:
Jim Connaughton, Nautilus Data Technologies
Roger Ballentine, Green Strategies, Inc.

Session 1 | Briefing Room: Reality Check on Policy and Markets

Moderated by Jim Connaughton

The good news: the last 18 months have been marked by climate progress in public policy and in private markets. Both the economic recovery from the pandemic and the global response to the energy crisis caused by the Russian invasion of Ukraine have provided a massive boost to clean energy investment (IEA). The bad news: the world is still far from achieving its stated decarbonization goals, with the reality that the global energy mix remains about 80/20 fossil v. lower emission alternatives (Statistical Review of World Energy). In this year's briefing room, we examine what is working and what is not. What do decarbonization trends look like moving forward? When it comes to policy and investment, how do we understand the gap between the money we have and the money we need?

Discussants:
Kate Larsen, Rhodium Group
Robin Millican, Breakthrough Energy
***Sue Tierney**, Analysis Group
Laszlo Varro, Shell International B.V.

Session 2 | A Zero Emission Electricity System Part 1: Interconnection

Moderated by Jim Connaughton

Following sustained, and still unresolved, attention to the twin challenges of siting and permitting of new energy, industrial, and digital infrastructure to achieve decarbonization goals, confronting the equally challenging problem of interconnection bottlenecks has emerged as the third leg of the stool to any viable solution. If one can't connect to the grid, the project is dead. There are several pieces to this puzzle: the distribution system, transmission building, RTO queues, and offshore energy. How can we move away from a reactive transmission building process, to a proactive transmission strategy, like CREZ (Competitive Renewable Energy Zones), nationwide? Why are grid enhancing technologies not being deployed more broadly in order to reduce interconnection costs? How can we leverage existing retiring connections as much as possible? Is it possible to implement less strict rules for deliverability for energy only resources, in order to get more generation on the grid, faster?

* *Participating Virtually*

Discussants:
Jeff Bladen, Meta Platforms, Inc.
Miles Farmer, Federal Energy Regulatory Commission (FERC)
Anna Foglesong, Clean Grid Initiative
Aubrey Johnson, Midcontinent Independent System Operator (MISO)

Session 3 | A Zero Emission Electricity System Part 2: Managing Load Growth – and Decarbonization

Moderated by Roger Ballentine

While there has been progress in decarbonizing the grid in the U.S., it remains significantly dependent on fossil resources. Certainly progress toward meeting an ambitious 2035 target for a zero-carbon grid would be accelerated if we solved the interconnection challenge, but at least two factors make the grid decarbonization challenge particularly challenging. First, the majority of new clean energy projects trapped in interconnection queues are for variable generation and much more carbon free firm and dispatchable generation is needed to balance and complete the picture of a U.S. grid that is zero-carbon at all times and all places. Second, as daunting as it appears to decarbonize the existing grid in the next decade-plus, that is not actually the real challenge. Load growth in the U.S. is projected to grow potentially by orders of magnitude over that time frame – from electrification of new sectors, on-shoring of manufacturing, and the growth of artificial intelligence services. The true challenge, therefore, is to not just decarbonize "the" grid, but to build a much larger electric system to both serve new load and to do so with carbon-free resources. Framed in this right-sized context, what are tools, policies, technologies that can meet this challenge?

Discussants:
Emily Fisher, Edison Electric Institute (EEI)
Jim Murchie, Co-Founder, Energy Income Partners, LLC
Jake Oster, Amazon Web Services
***Jim Robb**, North American Electric Reliability Corporation (NERC)

Wednesday, February 7, 2024

Session 4 | Financing Built Environment Decarbonization

Moderated by Roger Ballentine

Buildings are responsible for 37% of global carbon emissions and 34% of energy demand (UN Environment Programme). We have long known that decarbonizing the built environment is a major requirement of meeting climate goals. Yet progress remains slow, particularly in the retrofit market. On the other hand, policy drivers are becoming stronger, preferential market valuation of "greener" buildings is emerging, and technology options across the built environment value chain have increased. What can be learned from the efforts of leading local governments and successful policies such as the 2007 lighting efficiency standard? What are the main challenges today and what needs to change to overcome them? What needs to happen for a step-change in progress?

Discussants:
***Rohit "Rit" Aggarwala**, New York City Department of Environmental Protection
***Bert Hunter**, Connecticut Green Bank
***Katy Kale**, General Services Administration
Helen Walter-Terrinoni, Trane Technologies

Session 5 | Artificial Intelligence: An Energy Problem, and Energy Solution?

Moderated by Jim Connaughton

AI is an exciting technological development for the world at large, including the potential to drive dramatic global gains in sustainable development, public health, education, energy system management, and decarbonization. At the same time, AI is an energy intensive proposition, requiring dramatic growth in digital infrastructure and associated energy generation and delivery systems. The emergence of AI therefore makes decarbonization simultaneously more urgent and more achievable. How will AI be integrated into the energy, transportation, agricultural, industrial, and municipal systems of the future? How will AI help to drive other aspects of global decarbonization? Can AI deliver increasingly more value with a corresponding reduction in the environmental impact of the systems that enable it?

Discussants:
Keith Benes, U.S. Department of Energy
Amanda Corio, Google LLC.
Mariah Kennedy, Microsoft Corporation
Blake Houghton, McKinsey

Session 6 | Carbon Accounting & Corporate Disclosure

Moderated by Roger Ballentine

Since the early 2000s, the number of companies calculating carbon footprints and publicly disclosing information related to climate and sustainability writ large has increased substantially. More than 75% of the S&P 500 publicly disclose such information through third-party platforms, and companies representing more than a third of global market capitalization have or are in the process of setting "science-based targets" pursuant to rules set by prominent environmental NGOs, which in turn require public disclosure of progress (CDP). Today, greenhouse gas accounting and disclosure systems are moving from voluntary to mandatory, with the EU, California, the Securities and Exchange Commission and other government entities adopting or planning to adopt new requirements. However, a growing segment of academics, companies, and other observers are questioning the effectiveness of incumbent accounting and disclosure systems. With mandates looming, this reexamination is raising critical questions: what is the purpose of accounting and disclosure in the climate regulatory context? If it is to incentivize and accelerate decarbonization actions by companies, how well is that working? How well can it be expected to work? Are there better alternatives? Are there other arguments for mandatory accounting and disclosure – and what are the arguments against it?

Discussants:
Martin Durbin, U.S. Chamber of Commerce
Betty Huber, Latham & Watkins LLP
Kelley Kizzier, Bezos Earth Fund
***David Rich**, World Resources Institute (WRI)

Session 7 | The Future of Environmental Groups, and Their Funders

Moderated by Jim Connaughton and Roger Ballentine

It has long been accepted that meeting the climate challenge requires both governmental policy changes and contributions from the private sector (both in response to policy and in the absence of policy drivers) – ideally working in a synergistic way that maximizes impact. While this puts policymakers and corporate leaders in the spotlight and at the forefront of efforts to decarbonize the economy, both are significantly influenced by the environmental NGO community. In many ways, the relatively well-funded environmental advocacy ecosystem sits alongside policymakers and corporations as a third center of gravity in the fight against climate change. But again, progress is maximized when forces are aligned or otherwise adequately synergistic in service of meeting mid-century climate goals. Looking at the NGO community and their philanthropic patrons, how synergistic is the environmental community today with the willing forces of change in the governmental and private sectors? Is there an adequate balance of focus on preventing bad things and enabling good things from a climate perspective? Is it time to rethink the future of climate philanthropy or are we largely on the right track?

Discussants:
***Manish Bapna**, Natural Resources Defense Council (NRDC)
Jonathan Pershing, William and Flora Hewlett Foundation
***Andrew Steer**, Bezos Earth Fund
***Christie Ulman**, Sequoia Climate Foundation

Thursday, February 8, 2024

Session 8 | Wrap Up and Reflections

Moderated by Jim Connaughton and Roger Ballentine

Forum Adjourns

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