Beyond 100% renewable: Policy and practical pathways to 24/7 renewable energy procurement

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Abstract: Corporations are increasingly shaping the future of the electric grid by pursuing 100% renewable energy goals that seek to match their annual energy consumption with an equal volume of renewable energy. The challenge of achieving a 100% renewable electricity grid, however, is not only a question of *how much* renewable energy is built, but rather whether renewables can supply electricity *when* it is needed. One emerging approach to address this challenge is "24/7" renewable energy, which requires matching a corporation's hourly energy demand with renewable energy produced in the same region and hour. This paper explores the evolution of voluntary renewable energy procurement goals, presents a practical framework for 24/7 renewable energy procurement, and suggests policy developments that would support wider adoption of a time-matched renewables procurement approach.

Keywords: 24/7 renewable energy, decarbonization, Voluntary procurement, corporate sustainability, renewables integration

Gregory Miller is a doctoral student in the interdisciplinary Energy Systems program at the University of California, Davis, and formerly worked as the sustainability manager for Georgetown University. His PhD research focuses on how commercial and industrial decarbonization strategies, such as voluntary renewable energy procurement, demand flexibility, and fuel switching, affect the integration of renewable energy into the electric grid.

1. Introduction

Over the past decade, large energy users, including corporations and cities, have assumed an active leadership role in shaping the future of the electric grid: by December 2019, 145 U.S. cities and 216 global corporations had voluntarily committed to procuring 100% of their annual energy consumption from renewable sources.[1] The Intergovernmental Panel on Climate Change (IPCC) has forecasted that renewables will need to supply at least 70-85% of global electricity consumption within the next 30 years in order to avoid global temperatures rising above 1.5°C.[2] Given that the commercial and industrial (C&I) sector consumes almost two-thirds of global end-use electricity, and that corporate procurement has already been responsible for over 12% of all utility-scale wind and solar installed in the U.S., corporate leadership is critical for a rapid and complete transition to a fully-renewable future.[3]

When a corporation says that it is "100% renewable" it generally means that it has purchased the same volume of renewable electricity as the electricity it consumes in a year, but not necessarily at the same time as it is consumed. Because electricity is delivered instantly and cannot be directly stored, operating the power grid reliably requires supply to equal demand, every second of every day. This means that the main challenge of achieving a 100% renewable electricity grid is not only a question of *how much* renewable energy is built, but rather whether renewables can supply electricity *when* society can use it.

While the current focus on simply expanding renewable energy capacity has helped jumpstart the energy transition, sustaining the transition and achieving full decarbonization will require a more sophisticated approach. In late 2016, as Google was at the cusp of achieving its 100% renewable energy procurement goal, it declared that "100% renewable is just the beginning."[4] In a 2018 white paper, Google articulated its vision for the next step beyond 100% renewable: "24x7 carbon-free energy."[5] The company makes the distinction that while it currently "matches" 100% of its annual energy consumption with an equal quantity of electricity from renewable sources, it will now seek to "power" its operations with renewable energy produced *in the same hour* and *in the same region* as it is consumed. The promise of load-matched renewables, according to Google, is "elevating carbon-free energy from being an important but limited element of the global electricity supply portfolio today, to a resource that fully powers our operations and ultimately the entire electric grid."[6]

This paper builds upon Google's vision to explore the potential policy, market, and organizational approaches that would be needed to incentivize voluntary, load-matched renewable energy procurement. This paper first traces the brief history of voluntary renewable energy procurement goals and the 24/7 approach's place in this evolution. Next, this paper explains how policies and market structures have influenced current volume-based renewable energy goals, and how they will need to change to better incentivized load-matched renewable energy goals. Finally, this paper suggests a framework for renewable energy buyers to follow in order to practically achieve a 24/7 renewable energy goal.

2. The Evolution of voluntary renewables procurement

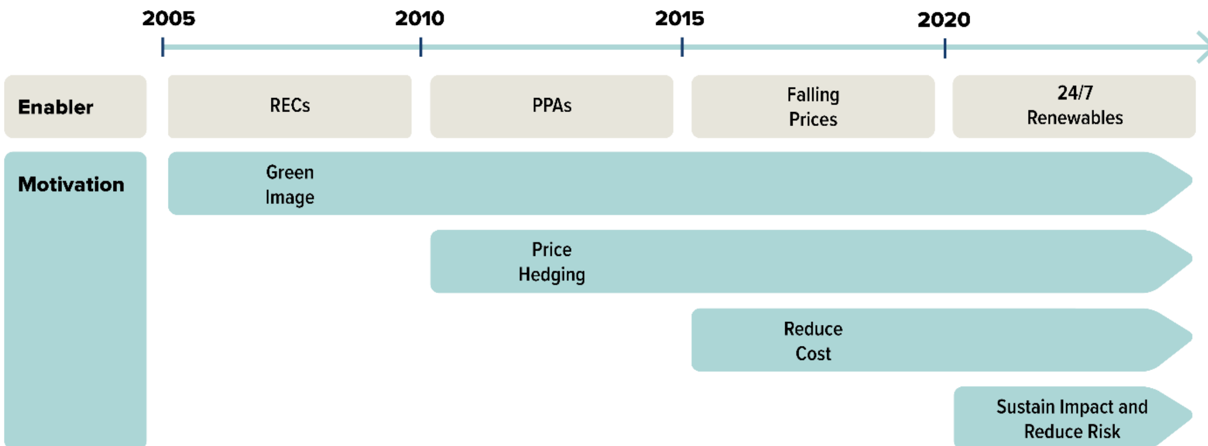

Figure 1. The evolution of corporate renewable energy procurement trends.

2.1 Greening their image with unbundled RECs

The motivations for, and sophistication of, voluntary renewable energy procurement have evolved continuously over the past decade, as illustrated in Fig. 1. Starting in the mid-2000s, corporations, driven by intensifying corporate social responsibility and sustainability concerns, started to seek out ways to green the impact of their operations. At that time, solar was not yet cost competitive with conventional electricity supply and contract instruments such as power purchase agreements (PPAs) were not yet widely tested, so the primary mechanism for corporations to buy renewable energy was through unbundled renewable energy certificates for wind power.

A renewable energy certificate (REC) is a market instrument that represents 1 megawatt-hour (MWh) of electricity generated by a renewable generator. RECs were first developed to track compliance with renewable portfolio standard legislation, but a "voluntary market" has also developed for non-utility buyers to track who owned the marketing rights to the green electricity. The owner of a renewable generator, whether a solar field or wind farm, can sell their RECs bundled with the electricity they generate, a product known as "green power," or the RECs can be stripped from the underlying electricity and sold "unbundled." Each unbundled REC essentially grants its owner the marketing right to call a MWh of electricity that they purchased from a non-renewable source "renewable."

The concept was that demand for unbundled, voluntary RECs would help spur the construction of additional renewable energy on the grid, and that the price paid for the RECs would add a value stream for renewable energy developers to finance new projects. Because the purchase of unbundled RECs represented a premium on top of the price that buyers were already paying for electricity—about $5 per MWh in 2008—demand for these RECs remained relatively low until prices dropped under $1 per MWh in 2010, where they have stayed through 2017.[7]

Although these low REC prices made them accessible to more buyers—the number of customers for voluntary RECs nearly quadrupled from 2008 to 2012—it also called into question the additionality, and thus impact, of these investments.[8] When combined with the fact that the average length of most unbundled REC contracts was under 5 years, this low cost meant that a company's investment in RECs became immaterial to the project financing of new renewable projects.[9] A 2013 study published in *Energy Policy* found that "the investment decisions of wind power project developers in the United States are unlikely to have been altered by the voluntary REC market," and that consequently, "the claims […] that voluntary market RECs result in additional wind power projects lack credibility."[10]

Corporate leaders took note and started to adjust their strategy. Walmart, in its 2014 *Approach to Renewable Energy*, stated: "We want to do more than just shift around ownership (and marketing rights) of existing renewable energy, so we have made a decision that under normal circumstances, we prefer not to simply offset our non-renewable power by purchasing standalone renewable energy credits (RECs) or other certificates. While REC purchasing may allow us to more quickly say we are supplied by 100% renewable energy, it provides less certainty about the change we're making in the world."[11]

2.2 Hedging prices and cutting costs with VPPAs

Companies like Walmart had the opportunity to cost-effectively pivot their renewable strategy around this time due to the combination of a dramatic drop in the levelized cost of solar in 2011 and the emergence of a new contracting structure for procuring renewable energy: the virtual power purchase agreement.[12] Bilateral, physical power purchase agreements (PPAs), which require the buyer to monetize the generated electrons by selling them into the wholesale electricity market, had existed as a contract instrument for all types of electricity generation for decades. A virtual PPA is a financial instrument similar to a contract for differences or fixed-for-floating swap, in which the generator exchanges its variable cash flow from selling its electricity into the spot market for a fixed cash flow paid by the buyer.[13]

For corporations, improving their sustainability image remained important, as it helped market their products and recruit and retain young talent, but the virtual PPA introduced an additional motivation by mitigating price risk. By signing long-term PPAs at a fixed price, a corporation's ability to hedge volatile and increasing electricity costs became an additional motivation for increasing renewable energy procurement, especially for energy-intensive industries.

As renewable energy costs continued to drop throughout the 2010s, renewable energy PPAs started to become cheaper than generation delivered by their utility, eliminating any "green" cost premium. For companies with large energy bills, the ability to procure cheaper energy (that happened to be renewable), became a further motivation to sign renewable energy contracts. Google's stated reasoning for its renewable energy goals reflects these multiple motivations: "we strive to lead on climate change as a business imperative; we are a large electricity consumer that seeks to minimize our environmental footprint; and we are a growing business that prizes the cost-effectiveness and financial certainty of renewable power sources."[14]

2.3 The growing pressure to sustain impact and reduce risk

Since the mid-2010s, declaring 100% renewable energy goals (on an annual basis) has become the benchmark for leadership in corporate sustainability. The emerging 24/7 renewable energy vision suggests that voluntary procurement of renewable energy is at the cusp of another evolution. Just as a desire for greater impact helped spur the shift from unbundled RECs to PPAs, a better understanding of the long-run impacts of corporate procurement on the electric grid is spurring a shift toward 24/7 renewable energy.

Whether called "24x7 carbon-free energy" or "100x100 renewable energy" (100% renewable energy, 100% of the time), greater attention to load-matched renewable energy procurement is being driven by an improved understanding of the influence of voluntary procurement on electricity markets and the need to manage the resulting risks.[15] Taylor Sloane of Fluence Energy, an energy storage provider, argues that "Procuring only renewable energy on a net basis is not a scalable solution to create a sustainable renewable energy market where everyone can achieve 100% renewable energy. Corporate renewable buyers should also consider how their procurement decision impacts the rest of the electric grid."[16] In a 2018 interview on Greentech Media's "The Interchange" podcast, Brian Janous, the General Manager of Energy for Microsoft, recognized that "we are altering the market as we continue to develop more and more renewables," and that ultimately "a core value for us as a company is that we're going to leave a positive legacy with what we build."[17]

Voluntary renewables procurement that does not coincide with the buyer's demand increases both the short- and long-term costs of grid-scale renewable energy generation. Periods of over- and under-supply cause market-destabilizing swings in energy prices, periods of negative pricing (during which grid operators must pay adjacent energy markets to take the energy), and the need to invest in costly storage and transmission upgrades to move the energy.[18] Procuring mismatched renewable energy allows the buyer to benefit from cheap, fixed prices, while passing the costs and volatility on to other ratepayers. Each renewable energy buyer has the best knowledge of, and control over, its internal costs and operational flexibility, and thus is the best-informed market participant to invest in cost-effective, load-matched supply (or supply-matched demand flexibility).

Given the 20-25-year contract length of many existing corporate PPAs, the mismatched PPAs that corporations are signing today could end up being a liability as the grid continues to transform. In addition to concerns about impact, this evolving risk profile is a further incentive for corporations to rethink their strategy. Shape risk, also known as covariance risk, is the primary concern, as it is exacerbated when project output does not correlate with the buyer's consumption.[19] With increasing penetrations of a single type of renewables—primarily solar—wholesale market prices are driven down or even negative by the glut of solar production in the middle of the day, which reduces the value of the PPA. In addition, if there is not enough systemwide load to absorb this solar energy, solar operators may be forced to curtail their production, reducing the overall quantity of RECs that the offtaker can retire and use to make progress toward their renewable energy goals.

3. The role of policy and market design in renewable energy goals

Policy and markets have played an important role in shaping the approach to voluntary renewable energy procurement. To date, these policies have focused primarily on market access and ensuring that renewable energy claims are not being double counted. To incentivize widespread adoption of load-matched renewable energy procurement, current market rules and structure must evolve to recognize the time-based value of renewable energy supply.

3.1 Consumer choice and market access

Consumer choice laws are a necessity to allow energy users to access energy markets and directly procure renewable energy. Global corporations may have operations in energy markets, such as much of Asia and the Southeastern U.S., that do not allow consumer choice and direct procurement of renewable energy. Without consumer choice, powering a facility with 24/7 renewable energy is a non-starter unless the incumbent utility is willing to offer a product that delivers that service. While some utilities have attempted to offer a load-matched renewables product (such as Dominion Virginia Power's proposed "Continuous Renewable Generation" tariff), most utility "100% renewable" options are no more than unbundled RECs offered at a cost premium.

3.2 GHG accounting standards

Current greenhouse gas accounting protocols, such as the "GHG Protocol Corporate Accounting and Reporting Standard," have an influential effect on how companies approach and report their renewable energy purchases. The accounting guidance for "scope 2 emissions," or emissions from purchased electricity, allows for market instruments such as RECs to be counted as a zero-emissions attribute for any electricity consumed in the same reporting year, thus allowing companies to report zero market-based scope 2 emissions if the quantity of RECs they retire equals the annual quantity of electricity consumed. Previous research has found that using annual emissions data for a constant load would overestimate the emissions reductions from purchasing solar power by over 50%.[20] Updating the protocols to include guidance on, if not prefer, hourly accounting of scope 2 emissions would help make corporate sustainability teams more familiar with this concept and allow them to quantitatively measure the benefits of load-matched renewable energy procurement in their reporting.

3.3 Renewable energy marketing claims

How can consumers tell if a company advertising "100% renewably powered" goods and services is powered by 24/7 renewable energy or simply buying unbundled RECs? To ensure fair treatment of marketing claims, the rules governing how companies can market and report their renewable energy and decarbonization claims require an update. The Federal Trade Commission has published specific guidelines for renewable energy claims to help avoid any "unfair or deceptive acts or practices in or affecting commerce," as prohibited by Section 5 of the FTC Act.[21] These guides currently allow a marketer to claim the use of renewable energy if they have "matched such non-renewable energy use with renewable energy certificates." This FTC guide does not currently well-define specifically what it means to "match" energy use with RECs, or on what timescale, but it implied that this would be on an annual basis. Reworking these "green guides" to better define that renewable energy claims must be matched on an hourly basis would force companies to procure load-matched renewables if they want to market their operations as "100% renewable."

3.4 Tracking hourly renewable energy transactions

If regulations and accounting standards are to require hourly accounting, or that RECs be retired against load occurring in the same hour, there needs to be a simple and verifiable way for corporations to track the renewable energy attributes that they own on an hourly basis. One proposed concept is "T-RECs," or Time-matched Renewable Energy Certificates.[22] Currently, each REC is stamped with information such as the renewable fuel type, the location of the generator, and the vintage (year that the energy was generated) but they include no timestamp or information about the hour and day that the energy was produced. Currently, a 2019 vintage REC (i.e. any MWh of renewable energy that was certified to have been produced in 2019) can be retired with any MWh of electricity consumed in 2019. While companies could theoretically access hourly production data from renewable generators from which they purchase energy, RECs are the underlying mechanism for validating marketing claims and GHG accounting, so this information would ultimately need to be built into the RECs themselves. Implementation of hourly REC attributes would need to be led by the various renewable energy tracking systems or registries who are responsible for creating RECs, such as APX or M-RETS. Since these "T-RECs" would need to be retired against load occurring in a specific hour, there might be a need for a complementary certificate system for tracking and verifying hourly load.

3.5 Improving price signals

In contrast to Google's market-driving approach to 24/7 renewable procurement, Microsoft offers a competing, market-responsive approach to optimizing their time-based impact on the electric grid. "Am I as an individual consumer best positioned to determine how to integrate that resource or match my load to that resource? Is it better left to the market?" Microsoft's Brian Janous asked during an interview on *The Interchange* podcast.[23] "While it's true I could match one to one my renewables […] I don't think that's necessarily the best outcome in the long run if say there's a controllable load out there that would offer curtailment at a marginal rate that's far less than the cost of my battery. I think the value of the grid is we can design markets that lead to the least cost and most efficient solution."

The challenge of this approach is that energy markets (or at least the ones to which commercial customers have access) do not currently offer the real-time price signals that corporations like Microsoft would need to efficiently match their load with renewables at least-cost. Giving corporations greater access to wholesale energy and ancillary services markets may be a start, but as demonstrated in California, wholesale market prices are not necessarily aligned with GHG emissions reductions.[24] Getting price signals correct can be difficult and puts a large burden on market design, especially in the face of rapidly changing grid needs. In addition, while large technology companies who have entire teams dedicated to energy procurement can follow real-time price signals, the average corporate purchaser may not have the sophistication to follow, much less respond to, real time prices.

While the greater availability of real time pricing could be part of the solution, the scale of voluntary renewables procurement ultimately requires companies to accept some level of responsibility for the impacts of their purchases, even if it is not the most internally cost-effective approach. Despite differences in vision and approach, Google's Neha Palmer agreed that well-designed markets will be important for the future evolution of voluntary procurement: "I always say I'm technology-agnostic but not cost-agnostic. […] We have to run a business and do this in a cost-effective manner."[25]

4. A Framework for 24/7 renewable energy procurement

The main practical challenge of implementing a 24/7 renewable energy strategy is managing the variability and intermittency of renewable resources. Variability refers to daily and seasonal fluctuations in the availability of renewable resources. For example, solar energy is only available during the day, and is available in greater quantities on summer days than winter days. Each renewable technology has a unique resource profile, but these fluctuations can be predicted, and thus variability can be planned for. Intermittency, on the other hand, refers to the intra-day, short term fluctuations in output that result from situations like clouds passing over the sun or sudden lulls in wind. Such intermittency is harder to predict far in advance, so it must be actively managed rather than planned for.

These dual challenges raise an important question about over what time period a 24/7 renewable energy goal should match supply with demand. In wholesale power markets, a vast majority of generation is committed on the hourly timescale in the day-ahead market based on predicted load for each hour of the next day. Any differences between these hourly load predictions and actual intra-hour demand are settled in fifteen minute and five-minute real time markets, with other fluctuations under that timescale managed directly by the system operator through frequency response and regulation. Thus, hourly-matched renewables most likely make sense for corporate buyers, since sub-hourly fluctuations can more easily be managed by grid operators in the real time and ancillary service markets.

Achieving a 24/7 renewable target will require five main approaches: understanding a company's demand patterns throughout the year, procuring a diverse portfolio of renewable technologies whose output match a company's demand profile in each region, shaping and shifting the timing of loads to match the availability of these local renewables, investing in local energy storage to balance the difference, and prioritizing action in regions where they will displace the dirtiest fuels first.

4. 1 Energy demand analysis

Powering an operation with 24/7 renewable energy will first require understanding the daily and seasonal profile of a company's demand and the characteristics of its loads. Understanding these patterns throughout the year will require access to hourly or sub-hourly interval data. Luckily,

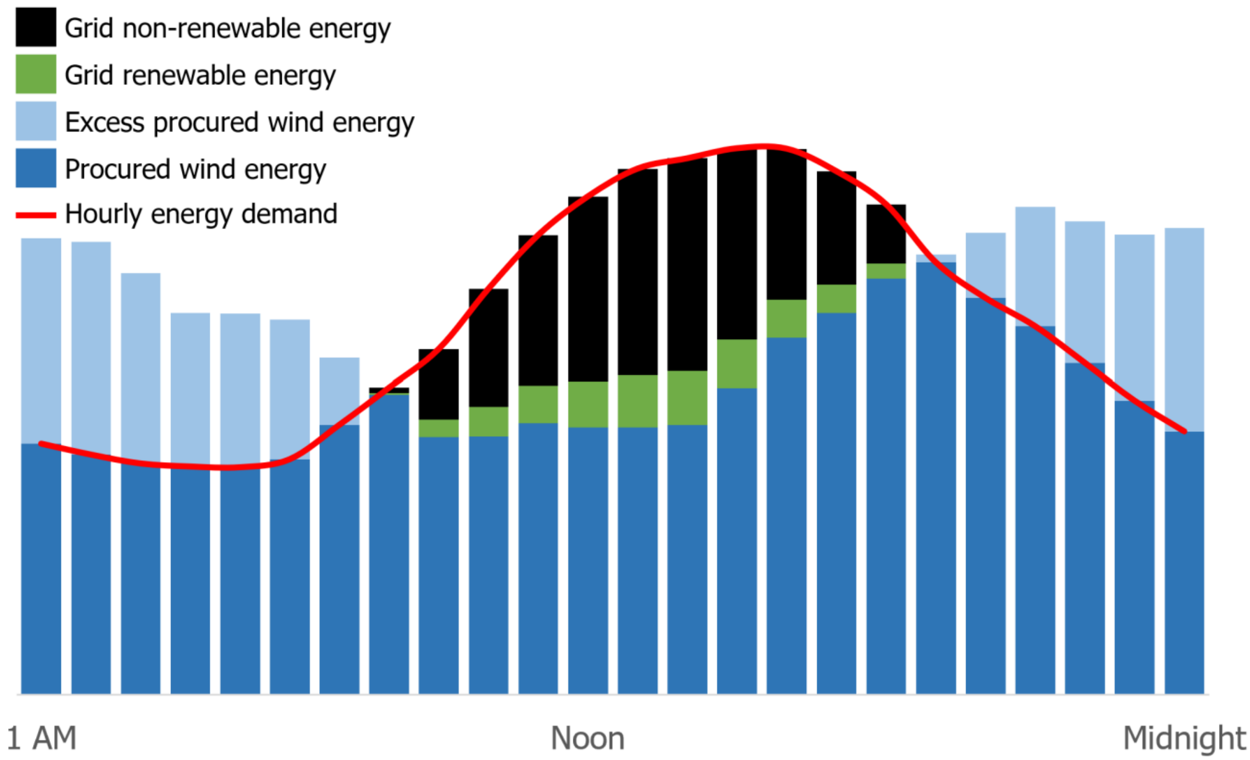

Figure 2. A hypothetical day of hourly-matched renewables. The company's procured wind energy is 100% volumetrically-matched to their demand, but only 80% matched on an hourly basis since the wind production profile does not match the demand profile of their building.

advanced metering infrastructure, which collects such data, is becoming more widespread. Any submetering data or inventory of various energy loads (e.g. lighting, HVAC, servers, machinery, vehicle chargers) can help a company understand what drives these patterns within their facilities. A corporation's initial analysis of its hourly energy demand may reveal that its existing renewable energy portfolio does not efficiently match on an hourly basis, as illustrated in Fig. 2. The following strategies, however, can start to address this mismatch.

4.2 Renewables portfolio diversification

Once a company understands its demand profile, it can begin to assess which renewable resources are available to match their demand. Achieving a 24/7 renewable energy goal with a single type of resource is unlikely; it will require a geographically and technologically diverse portfolio of renewables. Diversity is important to address both the variability and intermittency of renewables. Geographic diversity can help reduce the risks posed by intermittency, as a cloud passing over a single solar farm is unlikely to simultaneously affect the output of a solar farm in another location. Geographic diversity can also affect the supply profile of a single type of technology itself: the generation profile of a wind turbine will look different depending on whether it is offshore, on a mountain, or in an open plain.

While geographic diversity can be helpful, it is important to procure renewable resources within the same grid region as the loads to which they will be matched. While much of the grid is interconnected, if the renewable generator is located too far away or in another balancing area, it is possible that its output will not electrically contribute to reducing a company's net load due to transmission congestion or local constraints on the grid. Onsite resources, such as rooftop solar or biodigesters, provide the most surety of impact if they are directly wired to the facility, but it is unlikely that a large energy user can meet all its demand with onsite renewable energy.

Technological diversity can help overcome the challenges of variability, since different renewable resources have different, and sometimes complementing, supply profiles. To date, almost all voluntary power purchase agreements in the U.S. are for wind and solar.[26] While wind and solar offer some level of complementary supply profiles—solar energy is most available during the day while wind typically blows the strongest at night—there are many other renewable technologies available to create a load-matched renewable portfolio. For example, after teaming with Cube Hydro on a project, solar developer Sol Systems described how "the pairing of one solar plant with one run-of-river hydro plant was very simple and remarkably — though not completely — effective in matching the customer's load."[27] On the supply side, there are many resources with diverse supply profiles that could be included in a corporate renewable energy portfolio: onshore and offshore wind, fixed and tracking solar PV, small hydro, geothermal, tidal, and wave energy. Google's approach achieves greater technological diversity by including additional carbon-free resources, such as nuclear and fossil generators with carbon capture and storage. Not all these technologies are currently cost-competitive, technologically mature, or available in every region, but market demand for load-matched procurement could help buy down the costs of such technologies.

4.3 Load shaping and shifting

In addition to a supply-side approach to matching their hourly load profile, corporations can meet renewables halfway, perhaps more cost-effectively, by adjusting the demand side of the equation.

A cornerstone of this demand-side approach has been, and will continue to be, energy efficiency. As Google puts it, "by minimizing our electricity needs, we have reduced the amount of carbon-free energy required to match our consumption."[28] While some forms of energy efficiency will continue to be as simple as changing out light bulbs, companies like Google and Microsoft are thinking about how to leverage big data, machine learning (ML), and artificial intelligence (AI) to achieve deeper energy efficiency.[29] One potential challenge of a 24/7 renewable approach is simply the amount of data that a company has to process and interpret on an hourly basis: "you have meter data, you have SCADA data, you have pricing points, you have hub settlements," as Neha Palmer of Google explains, "A big portion of ML and AI is getting the data into a format that's understandable."[30]

Beyond simply *reducing* energy, a 24/7 commitment to renewable electricity will require companies to manage *when* they use energy through load shaping and load shifting. Load shaping refers to strategic, long-term actions that affect the demand profile of a load's normal operation. This could include strategically prioritizing energy efficiency projects that reduce demand during a specific set of hours, changing the scheduling of certain operations to shift load from one time period into another, and planning new loads to best match available renewable supply. Load shifting, on the other hand, refers to short-term actions that represent a departure from typical daily operations. This could include participating in specific demand response events or making ad-hoc adjustments the schedule of operations to deal with intra-day balancing needs. This is where submeter data and an inventory of specific load types at each facility is useful, as it enables managers to understand sources of flexibility in the energy they use.

Each type of commercial and industrial facility has a unique daily and seasonal demand profile that may make it more or less challenging to power with 24/7 renewable energy than other facilities. For example, a data center has a consistently flat hourly demand profile, an office building peaks in the middle of the day and powers down at night, and an agricultural processing facility may have unpredictable seasonal loads based on a particular year's harvest. By unleashing the potential of flexibility to shape and shift loads, a corporation will be better able to cost-effectively achieve its 24/7 renewable energy goal by matching its operations to the shape of the least-cost portfolio of renewable energy supply.

4.4 Energy storage

Despite the best efforts of a company to leverage the previous strategies, there will be certain hours of net demand that cannot be reduced to zero with discrete additions of renewable supply or shaped demand. In addition, there may be unexpected deviation of supply or load from forecasted schedules that a company desires to manage. Managing these situations will be best accomplished by energy storage technologies paired with automated controls. Energy storage technologies are diverse and are primarily distinguished by the length of time they can store energy. Short-term energy storage is best for handling the intra-hour balancing needs, while longer duration storage can help address intra-day, multi-day, or even seasonal variability of renewables. Many storage technologies may still be more expensive than other supply-side or demand-side approaches to balancing, but they have the advantage of being able to arbitrage time-of-day electricity rates and earn revenue by providing ancillary grid services.

4.5 Prioritization for impact

Once a company knows *which* renewable resources it needs to procure in each location where it operates, it will still need a way of determining how to *prioritize* these investments in order to maximize their GHG mitigation impact. To stabilize climate change, we must not only minimize the *rate* of emissions by mid-century, we must also minimize the *cumulative* emissions into the atmosphere over the next three decades. This means prioritizing investments that reduce the greatest amount of emissions as soon as possible.

When a new solar plant comes online, it does not cause every other generator on the grid to slightly reduce its output; rather, most power plants will continue operating at the same level while a handful of the most expensive "marginal" generators will reduce output or completely shut off to accommodate the new, cheaper solar supply. Thus, to maximize the marginal emissions reduction of their investment, a company may want to prioritize a wind farm for their facility in Kentucky, where it is more likely to displace a coal plant, over a solar farm for their facility in California, where it would displace cleaner natural gas (or other solar farms).

While this approach seeks to minimize *long-run* emissions by smoothing the pathway to a 100% renewable electric grid and minimizing locational marginal emissions, it may not minimize *short-run* marginal emissions. In the situation shown in Fig. 2, for example, adding solar may be the easiest way to match the remaining mid-day peak that is not matched by the company's existing wind contracts, but if the dirtiest marginal fuel is burned at night, the company could displace more marginal grid emissions in the short term by investing in more wind. Quantifying the trade off between short-run and long-run marginal emissions impacts is challenging, but by taking the long view, the 24/7 renewable energy approach promises a more stable and sustainable path to achieve a renewable electricity grid.

5. Conclusion

While time-mismatched, 100% renewable energy goals have helped catalyze the early development of renewable energy, voluntary buyers must adopt time-matched, 24/7 goals if they desire to leverage their procurement to sustainably advance a grid-wide transition to 100% renewable energy. For 24/7 renewable energy to become widely adopted, however, future collaboration will be required to specify a standard that suggests practical pathways for implementation and specifies how to measure and report progress toward the goal.

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