Energy & Environmental Business Strategy

The Role of Corporate Energy Procurement in Grid Decarbonization:

Defining Next Generation Procurement Goals and Strategies

Prepared by **Green Strategies, Inc**. in Conjunction with

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and the

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ABSTRACT

By adopting and implementing aggressive renewable energy goals, leading companies have enabled the development of multiple gigawatts (GW) of new renewable generation capacity and demonstrated the ability of corporate buyers to reshape the energy landscape. From 2014 to 2018, large companies announced transactions with off-site renewable energy projects representing over 15 GW of capacity – equal to around one-quarter of all such new renewable generation capacity installed across the country in that same period. This is a great success story.

To achieve mid-century targets for limiting global warming, experts indicate that the U.S. electric grid must achieve full decarbonization by 2050 (if not sooner) - an immense challenge given the current reliance on fossil generators and given the likely future demands for generation arising from the electrification of other sectors. The fastest and most certain pathway to a decarbonized grid is one that utilizes a broad portfolio of zero-carbon resources that can provide firm and dispatchable power to complement intermittent generation. Large energy buyers can accelerate this urgently needed transition to a zero-carbon grid with a new generation of procurement targets and practices. A next generation of goals would prioritize *all* zero-carbon electricity options, including *but not limited to* wind and solar, and involve an expanded range of procurement objectives and activities that seek to maximize the carbon impact of procurement and reduce a buyer's consumption of grid-supplied fossil generation at more times and at more locations.

In this paper, we explore how a "next generation" of corporate electricity procurement strategies and goals could accelerate grid decarbonization to meet science-driven targets. Our analysis covers: A) the imperative of a zero-carbon grid and how a pathway that prioritizes a broad portfolio of zero-carbon generation best aligns with reaching that goal; B) the achievements – and shortcomings – of current corporate renewable energy procurement efforts; C) the possible elements and objectives of next generation corporate procurement strategies; D) example transaction structures for next generation corporate procurements and the potential barriers those transactions might find in today's marketplace; and E) other challenges corporate buyers might face in adopting and executing next generation goals.

In a companion report, *The Role of Corporate Energy Procurement in Grid Decarbonization: The Stakeholder Landscape*, we assess how various stakeholders that influence corporate goals related to energy and climate could respond to the adoption of new next generation goals.

Contents

A. The Need for a Decarbonized Grid by Mid-Century and How Such Decarbonization is Best Achieved through a Portfolio of Zero-Carbon Resources

The Paris Climate Agreement calls for holding the increase in average global temperature to 2°C, but it also encourages the global community to pursue efforts to limit the average increase to only 1.5°C, given that this level of warming would significantly reduce the risks and impacts of climate change. In 2018, the Intergovernmental Panel on Climate Change (IPCC) affirmed these climate objectives in publishing, *Global Warming of 1.5°C,* a special report assessing pathways for limiting global average temperate increase to 1.5°C. It found that in "model pathways with no or limited overshoot of 1.5°C, global net anthropogenic CO2 emissions decline by about 45% from 2010 levels by 2030 (40–60% interquartile range), reaching net zero around 2050 (2045–2055 interquartile range)."[1] In recognition of the scientific consensus, policymakers and other stakeholders are adopting policies and goals to achieve near or full economy-wide decarbonization around mid-century.

In the United States and other countries, economy-wide decarbonization puts a premium on full and rapid decarbonization of the electric grid - for at least two reasons. First, other sectors, such as heavy industry, will likely take longer to decarbonize; while a challenge, the electric grid is lower-hanging fruit. Second, economy-wide decarbonization will require the electrification of some currently non-electrified sectors and processes. The National Renewable Energy Laboratory (NREL) projects that widespread electrification (in transportation, buildings, and industry) could increase 2050 U.S. electricity consumption by between 20% and 38%,[2] underscoring the need to decarbonize the grid.

There are different possible pathways to the decarbonized grid we need. All pathways will feature a high-level of variable, intermittent renewable generation and a growing role for energy storage, but to maintain a reliable grid that matches customer demand with generation on a near instantaneous basis - particularly when intermittent generation or adequate stored energy is not available - a decarbonized grid will likely require significant contributions from firm and dispatchable[a] generation. Today, fossil generators (without carbon capture and storage (CCS)) provide much of the grid's firm and dispatchable capacity, but due to our climate imperative, they cannot be relied upon to serve this role for much longer. Firm and dispatchable *zero-carbon resources* must take their place. Already, hydro and nuclear generation provide firming capabilities, but more zero-carbon generation, most likely drawn from a broader range of zero-carbon technologies, will be needed.

1. Review of The NorthBridge Group Analysis

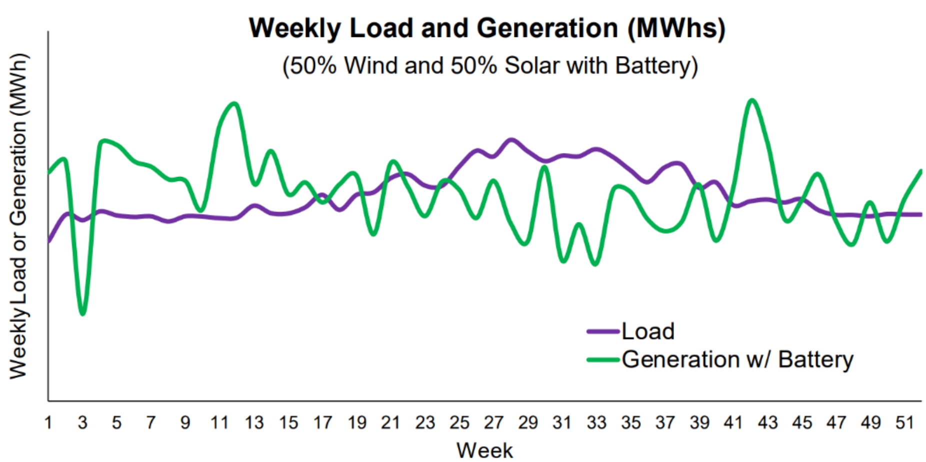
Our partner in this project, The NorthBridge Group, has completed an in-depth modeling and analytical study of the impacts of current – and potentially new – corporate procurement strategies. We highlight their results here.

Many buyers have adopted 100% renewable electricity commitments, defined as purchasing an amount of renewable generation equal to the electricity they consume. Buyers undertake different approaches to purchasing sufficient renewable generation to meet their goals, but many buyers have focused on purchases of intermittent wind and solar generation. To better understand how purchases of

[a] Existing energy storage technologies provide firm and dispatchable supply, but only for relatively short periods of time, possibly multiple hours. Experts anticipate the need for energy storage capabilities for longer periods of time, possibly on a monthly or seasonal basis.

intermittent renewable generation align with deep decarbonization objectives, NorthBridge first compares the profile of a buyer's electricity consumption over the course of a year (using the load profiles of a big box store and a commercial building) to the annual profile(s) of intermittent renewable generators that generate sufficient output over the course of the year to match 100% of the buyers consumption (fulfilling a buyer's 100% renewable goal if the buyer purchases all of the output).[b] NorthBridge assesses how well different combinations of wind and solar generation (100% wind, 100% solar, 50% wind and 50% solar), with and without battery storage, match the timing of the buyer's consumption. While these generators ultimately provide sufficient generation to equal a buyer's annual consumption, their output, due to the intermittency of the underlying wind and solar resources, is not necessarily timed with the consumption of the buyer.

Figure 1



Credit: The NorthBridge Group

This analysis reveals that over the course of a year there are significant time periods of "deficit" (the buyer's load exceeding available output from the specific generators it contracts with to meet its 100% goal) and "surplus"[c] (available output from those same generators exceeding a buyer's load) (Figure 1). Deficits primarily occur when the wind is not blowing, or the sun is not shining. There are daily deficits, of course, but the output of intermittent generators also varies by seasons. For instance, the average daily output of solar generator is higher during the summer than during the winter. For wind generators, the situation may be reversed. During the periods of deficit, the electric grid (and thus the buyer) relies on a portfolio of generators to meet demand, including fossil generators.

Across scenarios, the time periods of deficit and surplus relative to a buyer's load are significant, equaling between 25% and 60% of the buyer's annual consumption. Periods of deficit alone equal

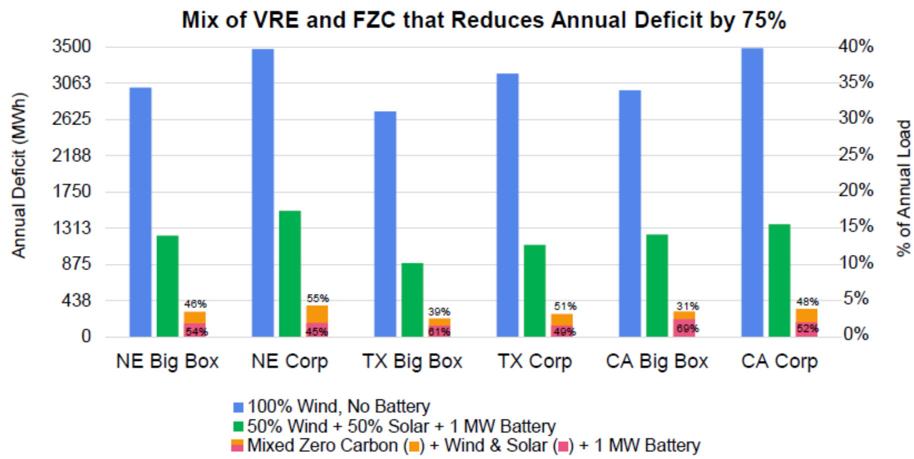
[b] NorthBridge assumes a buyer procures intermittent renewable generation from the same regional grid as its load. Its scenarios involve buyer loads in New England (ISO-NE), California (CAISO), and Texas (ERCOT).

[c] Producing generation that is surplus to corporate load is not necessarily good. Most U.S. electric grids can accommodate such excess generation today, utilizing it to meet the demand of other buyers. But as the penetration of intermittent renewables has increased in recent years, the operators of some regional electric systems have needed to curtail renewable generation in hours when total system generation exceeds total system load. As more intermittent renewable generation is built in the future, curtailment may become more widespread. Among other impacts, this depresses market prices for energy, sometimes close to or below zero. This could stress the economics of new intermittent renewables as developers struggle to justify investment in new capacity that is expected to generate output in hours with very low market prices and perhaps be curtailed.

between around 10% and 30% of a buyer's total consumption. Even with the use of battery storage, the periods of surplus and deficit remain relatively high. Even under scenarios assuming battery storage with *ten times* the capacity of buyer load, significant periods of surplus and deficit remain.

NorthBridge then examines alternative approaches of meeting a buyer's load with a mix of intermittent renewables and firm and dispatchable zero-carbon resources. NorthBridge finds that generation portfolios involving between 30% to 50% firm and dispatchable zero-carbon generation reduce the time periods of deficit by at least 75% (Figure 2).

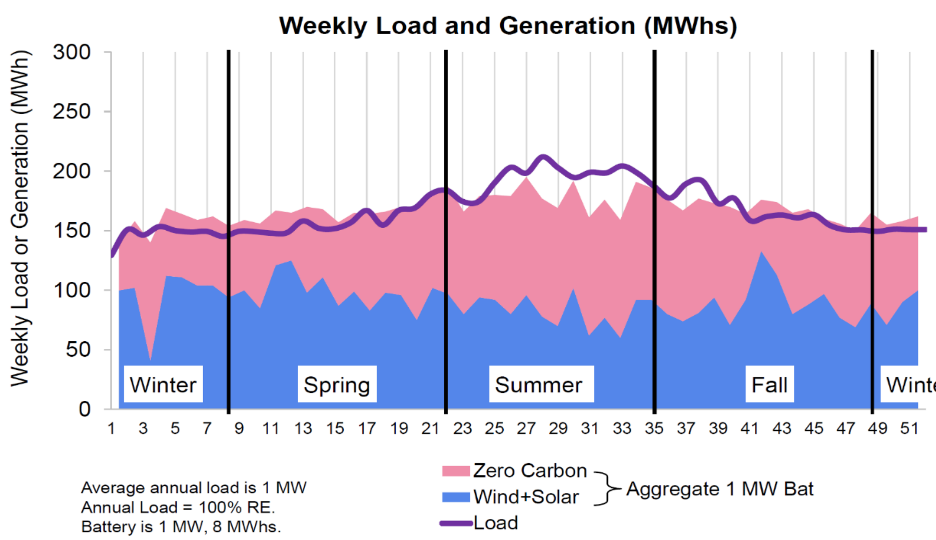
Figure 2



Credit: The NorthBridge Group

The NorthBridge analysis demonstrates how the combination of intermittent renewable and zero-carbon generation offers an annual generation profile that much more closely matches when a buyer is consuming electricity (Figure 3). As such, these resources can complement each other, solving much of the deficit challenges and reducing the need for an overbuild of intermittent renewable capacity that would be needed to better match a buyer's actual consumption.

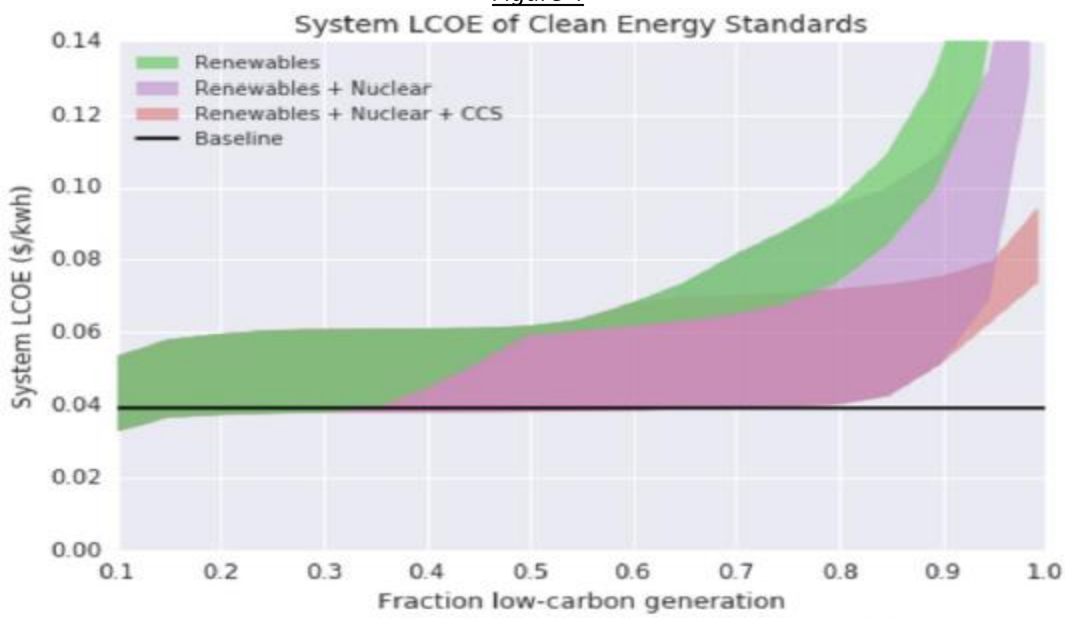
Figure 3



Credit: The NorthBridge Group

From its own analysis and a review of other literature (Figure 4), NorthBridge demonstrates that from a system (grid) level perspective, a 100% intermittent renewable (plus storage) pathway for grid decarbonization faces significant challenges. This is due to several factors. As the capacity of intermittent generation increases (and generation cannot be utilized elsewhere to meet demand), the potential for price suppression and curtailment increases, making the continued deployment of intermittent capacity through market forces alone more difficult. Integrating increasing amounts of battery storage also faces a similar challenge. If battery storage is used to cover the demand not met by intermittent generation, deploying additional units of battery storage lowers the average utilization of a given unit, decreasing the share of unit cost covered by revenue. A system with that relies also heavily on intermittent renewable generation faces rising costs due to the need for backup capacity, balancing services, and new transmission capacity. In comparison, a system that relies on a combination of firm and dispatchable zero-carbon resources in addition to intermittent generation is less costly.

Figure 4



Source: Analyzing Energy Technologies and Policies Using DOSCOE; Platt, Pritchard, Bryant, Google Inc. 2017

Credit: The NorthBridge Group

For buyers, the takeaways of this analysis are that intermittent renewable generation is not available for significant portions of the year when a buyer is consuming (particularly on a seasonal basis). This results in buyers relying heavily on the underlying grid mix, which often has a significant fossil fuel component, to meet their demand. Even with the addition of battery storage, the mismatch is only reduced somewhat, while the cost of a renewables-plus-storage-only pathway becomes more expensive. In contrast, adding zero-carbon generation resources into the mix reduces periods of mismatch with load, as well as the system-level costs of decarbonization. Buyer contracting practices focused on a mix of zero-carbon resources could send better price signals to the market to retain and develop zero-carbon resources, while helping to decrease costs and increase the likelihood of successful and timely grid decarbonization.

B. Corporate Renewable Procurement to Date and the Adoption of 100% Renewable Purchasing Goals

1. How Corporate Demand Has Driven the Deployment of Renewable Generation Capacity

Over the last decade, numerous large corporate commercial and industrial (C&I) electricity buyers have procured renewable energy. The Renewable Energy Buyers Alliance (REBA) estimates that corporate transactions for offsite renewable electricity in the United States between 2014 and 2018 involved 15.46 GW of capacity.[3] In comparison, within the same time period, approximately 60 GW of wind and solar capacity were installed.[4] In 2019, REBA estimates that buyers executed transactions involving an estimated 9.3 GW of capacity.[5]

Different buyers presumably have different motivations in seeking renewable electricity – such as reducing expense uncertainty with fixed-price contracts and hedging against the price volatility of generation from commodity fossil fuels but nearly all leading renewable energy buyers see their procurements as a way of reducing their carbon footprints, advancing sustainability goals, and driving positive change.

Corporate buyer demand for renewable electricity has had a transformative effect in growing the marketplace for renewables. Initially, the growth in renewable energy deployment was largely a result of two types of impactful top-down public policies: federal and state tax incentives and state-level mandates (e.g., renewable portfolio standards (RPSs)). Corporate demand has provided a third driver for the expansion of the renewables sector. Corporate demand has spurred electricity suppliers and utilities to quickly develop new renewable resources and to offer new and more innovative and competitive products to meet that demand. As renewables have scaled from all three of these drivers, costs have fallen dramatically, accelerating even more deployment. Corporate demand has also signaled to the broader public that renewable technologies are both technologically and commercially viable.

Large companies continue to adopt renewable electricity goals and make commitments to advance renewable electricity. The Corporate Renewable Energy Buyers' Principles initiative reports that it launched in 2014 with 12 original signatory companies with electricity demand of 8.4 million megawatt-hours (MWh), but its signatories have now expanded to 78 companies with 69 million MWh of demand.[6] As of October 2019, over 190 companies participate in the RE100 initiative, having made public commitments to 100% renewable energy.[d] REBA, a membership organization of large corporate buyers and renewable energy project developers, aims to facilitate the development of 60 GW of new renewable energy around the world by 2025.[7]

2. Corporate Renewable Electricity Commitments Are Typically "Purchasing Goals"

Most corporate buyer goals and commitments center on the "purchase" of renewable electricity. Under such an approach, a company sets a renewable energy goal (typically expressed as a percentage of the electricity it consumes in its operations) and then seeks to purchase renewable electricity and/or a

[d] RE100 notes that it currently has 194 participating companies. http://there100.org/going-100

quantity of attribute certificates.[e,f] A company meets its goal by matching, for a given year, its ownership of renewable energy certificates (RECs) with its targeted percentage of load consumption.

A company might use one or more of the following methods to purchase renewable electricity and/or RECs:

- The use of on-site renewables such as rooftop solar;
- The purchase of renewable energy produced by an off-site installation owned and operated by a third party and delivered to the buyer via a direct line with no grid transfers;
- The purchase of off-site renewable electricity "bundled" with RECs through transactions with renewable generators or competitive retail suppliers or under utility-offered tariffs;[g]
- The purchase of RECs "unbundled" from the underlying generation or RECs transferred to the buyer by a generator with whom the buyer enters into a financial transaction such as a contract for differences or "virtual power purchase agreement" (VPPA).[h]

To date, several companies have announced the achievement of their 100% renewable energy goals. For example, in 2017, Google announced that it had met its purchasing goal,[8] in large part from contracting with the project developers of over 2.6 gigawatts of wind and solar capacity. In 2018, Apple announced that it is "now globally powered by 100 percent renewable energy" and that its current and planned portfolio of renewables transactions would reach over 1.4 gigawatts across 11 countries.[9] In 2019, Unilever announced that it had "achieve[d] 100% renewable electricity across five continents."[10] In 2019, Proctor & Gamble announced it had achieved "purchasing 100% renewable electricity" in the United States, Canada, and Western Europe (equal over 70% of its total global electricity purchasing).[11]

3. How Renewable Electricity Purchasing Goals Do and Do Not Impact the Grid, Buyer Electricity Consumption, and Carbon Emissions

The following section discusses the varying impact of buyer purchasing goals and different buyer mechanisms to achieve purchasing goals on the electric grid, the portfolio of generation resources that serve a buyer at its retail points of load, and carbon emissions. Understanding these impacts is important in assessing how buyer purchasing goal approaches serve deep decarbonization objectives.

- **Purchasing goals add renewable generation to the grid, but the grid still requires complementary generation resources.** Grid operators rely on a broad portfolio of generators to continually meet demand and reliably manage the grid on a 365/24/7 basis. Intermittent renewable generation provides zero-carbon electrons to the grid but, as noted in the NorthBridge analysis, is not available at all times of the day - and its availability also varies considerably month-to-month and season-to-season. To accommodate the intermittency of renewable generation and maintain reliability, grid operators utilize

[e] Attribute certificates are a commodity representing the environmental attributes of generation distinct from the underlying electrons. In North America, these certificates are called Renewable Energy Certificates (RECs). A REC represents one MWh of renewable generation.
[f] Companies might also include additional objectives as part of their goals, such as committing to purchase from only new renewable generation projects or prioritizing purchases from the same grid as their load. These additional objectives are discussed later in the report.
[g] RECs can either be owned by the buyer or retired on the buyer's behalf.
[h] There is some disagreement as to whether a company can "add" renewable electricity consumed as part of its underlying grid mix to the total of renewable electricity/RECs procured via transactions.

firm, dispatchable generation resources to provide adequate generation supply. These resources may include fossil (natural gas, coal), carbon-free (nuclear, hydroelectric), or energy storage assets.

- **A buyer's renewable electricity purchasing may or may not impact the buyer's *consumption* of the grid's underlying mix of fossil and other generation or the buyer's own grid.** Even buyers that meet 100% renewable purchasing goals continue to rely on a given electric grid's portfolio of generation to meet much of their demand for electricity at their places of load.[i] This is most clear for a buyer utilizing unbundled RECs or a buyer whose purchase of renewable electricity does not involve physical delivery. Even a buyer with a contracted and delivered source of intermittent renewable generation consumes grid mix energy when their contracted renewable generation is not available.[j] Under prevailing accounting and reporting regimes, a buyer can claim "100% renewable use" while still consuming fossil generation from the grid.[k]

  Owing to challenges in securing renewable generation where their loads are located, buyers often transact for the purchase of renewable electricity (and attribute certificates) from a different grid region than the place of the load against which the renewable purchase is "applied". In that case, the renewable purchase may have little to no impact on the carbon intensity of the buyer's local grid.[l]

- **Renewable electricity purchases have varying impact on carbon emissions.** Renewable electricity buyers often prioritize using their buying power to support the development of new renewable generation capacity with the expectation that new renewable generation helps in reducing the carbon intensity of a given grid, but the level of actual carbon impact can vary considerably. When new renewable generation is added to a heavily carbon-intensive grid or a grid with fossil generation on the margin, that new capacity is likely to directly displace fossil generation and thus reduce emissions. On the other hand, in a grid region with a lot of existing renewable or other zero-carbon generation or a grid with renewable generation on the margin, new renewable capacity might have little if any additional decarbonization impact. Indeed, as renewable deployment grows, the addition of each new unit of renewable capacity may have diminishing returns in reducing fossil emissions. The quantity of renewable generation a buyer purchases is not always a direct proxy for carbon impact.

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[i] On-site renewable generation *does* directly displace grid consumption.

[j] In seeking to match 100% of their consumption with renewables purchasing, buyers must maximize the purchase of renewable electricity when it is available, irrespective of whether generation matches the buyer's load at any given moment. Certain buyers may contract with renewable generators for offtake that far exceeds their load at given times in order to cover their load when generation is not available and possibly to apply against loads for which it cannot secure renewable generation.

[k] A relatively clear example of how a renewable energy purchase may not change a buyer's consumption at its load is the virtual power purchase agreement (VPPA). A VPPA is a common mechanism utilized by electricity buyers in pursuit of purchase goals whereby a buyer enters into an agreement with a developer that guarantees a certain price for the output of a renewable project that the generator sells into a competitive wholesale market, which enables the generator to finance and build a generation project. The buyer receives RECs and payments from the generator if the wholesale price received by the generator exceeds the agreed upon strike price and the developer receives a payment from the buyer if the wholesale price is less. The structure is helpful for both parties and adds renewable generation to the grid where the new renewable generation is added. If that is not where the buyer's load is, however, then the buyer's consumption at its place of load is unchanged.

[l] The term "grid" is subject to different interpretations. "Grid" could mean NERC region, RTO/ISO, balancing authority, utility service area, or distribution system. As discussed below, narrowing the geographic definition of "grid" creates greater challenges in procurement but also could lead to greater impact.

- **Existing reporting regimes and best practices allow buyers to report 100% renewable "use", even if a buyer continues to consume carbon-intensive electricity and even if their renewable purchases yield relatively little incremental emissions reduction.** Greenhouse gas (GHG) reporting regimes allow companies to account for renewable energy purchases when reporting their greenhouse gas emissions.[m] Under prevailing reporting regimes, claims of renewable electricity use are mostly demonstrated through RECs (either owned by the buyer or retired on its behalf).[n] A buyer can apply RECs (which are measured in MWh) against its actual electricity consumption (also measured in MWh) within a given year. Since a REC represents an "emissions factor" of zero carbon per MWh, the owner of that REC can treat a corresponding MWh of their consumption (regardless of the actual emissions factor of the electricity they consumed) as zero. If a company's total number of MWh represented by RECs equals the total MWh of its load, it can claim to be using "100% renewable electricity" and report the total GHGs represented by its electricity use as zero.[o] Again, the *delivery and consumption* of renewables at a buyer's end-use location is not required, and a buyer's report need not reflect the carbon emissions associated with the grid electricity consumption left unchanged by its purchases of renewables and/or attributes. And again, the attributes used to offset a buyer's load are all counted equally regardless of the actual grid decarbonization impact of the underlying MWh of renewable generation (See Section E, below).

C. Next Generation Electricity Procurement Goals: Going Beyond 100% Renewable Electricity Purchasing to Further Accelerating Grid Decarbonization with Goals Focusing on All Sources of Zero-Carbon Electricity

Even as corporate electricity buyers pursue and even reach renewable electricity purchasing goals, many are looking to do more. For example, some companies have begun to share their procurement power and expertise to help suppliers and even customers secure renewable electricity.[p] Other companies are considering a "next generation" of goals, with new levels of ambition for using their buying power to have even greater impact. In addition to corporate buyers, states and electric utilities are currently all exploring what pathways are available to them for meeting long-term decarbonization objectives.

In October 2018, Google published a white paper, *"Moving toward 24x7 Carbon-Free Energy at Google Data Centers: Progress and Insights."*[12] Google signaled that achieving its initial renewable purchasing goals was just a first step and that its future procurement efforts will consider how to better match its consumption of energy with zero-carbon electricity:

> *Reaching our 100% renewable energy purchasing goal was an important milestone, and we will continue to increase our purchases of renewable energy as our operations grow. However, it is also just the beginning. It represents a head start toward achieving a much greater, longer-term challenge:* ***sourcing carbon-free energy for our operations on a***

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[m] Most companies utilize the World Resources Institute (WRI) and the World Business Council for Sustainable Development's Greenhouse Gas Reporting Protocol ("the Protocol") to estimate their GHG emissions. Other initiatives, such as the Carbon Disclosure Project (CDP) and RE100, in turn direct participating corporates to use the Protocol. Emissions accounting and the Protocol are discussed in greater depth in Section E.3.

[n] A buyer could also demonstrate renewable use through a contract with a renewable generator.

[o] For GHG accounting purposes, it does not matter whether or not RECs were associated with new or existing RE generation.

[p] While not covered in this report, many companies are also engaging in public policy advocacy to accelerate decarbonization.

> ***24x7 basis**. Meeting this challenge requires sourcing enough carbon-free energy to match our electricity consumption in all places, at all times. Such an approach looks markedly different from the status quo, which, despite our large-scale procurement of renewables, still involves carbon-based power.*[13]

In the white paper, Google also compared its own consumption at specific load centers to when electricity was being generated either by renewable projects that Google had contracted with or from the grid. This analysis highlighted times when Google still relies on carbon-intensive electricity from the grid despite extensive RE purchases. Google explains:

> *Achieving 24x7 carbon-free energy will be no easy feat. It will require innovations across policy, technology, and business models . . . Google will continue to promote electricity market reforms that unlock access to carbon-free power around the world. We'll also need vigorous development and deployment of emerging technologies — such as energy storage, advanced nuclear, and carbon capture and storage — that boost the availability of carbon free energy around the clock.*

There are, of course, differing points of view about the need to focus on "carbon-free energy" beyond renewables. There are a myriad of academic papers and advocate statements arguing that we *can* decarbonize the grid with wind, solar, and storage primarily. We think this is the wrong question – and one that confuses "means" with "ends". The end goal is a decarbonized grid, and the weight of authority (discussed above) demonstrates that the fastest, surest, most politically feasible, and least expensive pathways to that end goal involve a full mix of zero-carbon resources.

The idea that the rapid and deep decarbonization of the grid can best come from a portfolio of renewable and non-renewable generation is gaining traction beyond corporate buyers. For example, several U.S. states recently extended their RPSs, while simultaneously adopting long-term deep decarbonization targets. Most of these states increased their near-term RPS targets, but allow a broader portfolio of zero-carbon resources to meet the longer-term target:

- *California*: 60% of retail sales met by renewables by 2030; 100% of all retail electricity sales met by zero-carbon resources by 2045.[14]
- *Nevada*: 50% of retail sales met by renewables by 2030; 100% of retail sales met by zero-carbon resources by 2050.[15]
- *New Mexico*: 50% of retail sales met by renewables by 2030 and 80% met by renewables by 2040; 100% of retail electric sales from zero-carbon resources by 2045.[16]
- *New York*: 70% of retail sales met by renewables by 2030; 100% of retail sales met by zero-emission resources by 2040.[17]
- *Washington*: 100% of retail sales met by carbon-neutral sources (meaning 80% met by carbon-free resources and up to 20% of sales covered by unbundled REC purchases or alternative compliance payments) by 2030; 100% of sales met by carbon-free resources by 2045.[18]

In addition, in 2020, the New Jersey Board of Public Utilities released an updated Energy Master Plan at the direction of Gov. Phil Murphy.[19] The Plan identifies a 100% "clean power" by 2050 target (not yet adopted through legislation) that encourages the state to rely on existing nuclear generation and renewable resources to achieve power sector decarbonization.

Many of the largest U.S. electric utilities also have recently adopted long-term goals to decrease their reliance on fossil generation and to increase their reliance on zero-carbon generation.

- In 2019, *Xcel Energy* announced a goal to reduce its carbon emissions by 80% of 2005 levels by 2035. By 2050, Xcel aspires to provide all customers with 100% carbon-free electricity.[20] In a white paper to explain its strategy, Xcel highlights:[21]

  > *To fulfill this aspiration, we will continue to increase renewable energy sources on our system, as well as technologies that enable renewable integration. We will need new carbon-free dispatchable technologies — technologies not yet commercially available at the cost and scale needed to achieve our 2050 aspiration. Because of this, there needs to be significant research and development to ensure we have these technologies to deploy in the coming decades.*

- In April 2019, *Southern Company* announced a 2030 goal of reducing carbon emissions by 50% compared to a 2007 baseline and a goal to achieve low- to no-carbon emissions by 2050.[22]

- In September 2019, *Duke Energy* announced a target to reduce carbon emissions by at least 50% by 2030 and to attain net-zero emissions by 2050. Like Xcel, Duke Energy indicates that it "expects it can achieve significant reductions in carbon emissions by 2050 with the technology that exists today. Getting to net-zero emissions will require innovation and new technologies."[23]

- In September 2019, *DTE Energy* announced a 2050 goal to achieve net-zero carbon emissions in its electricity company. DTE indicated that achieving this goal "will require further advancements in technology, such as carbon capture, large-scale storage, and modular nuclear facilities."[24]

- In January 2020, *Arizona Public Service (APS)* announced a goal to deliver 100% "clean, carbon-free" electricity to customers by 2050, along with a 2030 goal to use a resource mix that involves 65% clean energy and 45% renewable energy. APS notes that it is already 50% carbon-free owing to solar and nuclear resources in its current generation mix.[25] APS has already planned investments in large-scale energy storage to pair with its solar resources and "expects technological advances to eliminate the need to supplement renewable energy with even low-emitting carbon resources like natural gas in order to maintain reliable service around the clock at reasonable prices"[26]

- In February 2020, *Consumers Energy* announced a 2040 goal to achieve net-zero carbon emissions. Consumers specifies that it plans to "eliminate coal, boost renewable fuel sources and help customers reduce energy use and waste", but that it "also may offset further emissions through strategies such as carbon sequestration, landfill methane capture or large-scale tree planting. And that it will continue to explore new technology and policy solutions to reach the net-zero goal."[27]

Additional utilities have set long-term net-zero emission or 100% carbon-free electricity goals in line with state policy mandates.[28]

1. What Next Generation Corporate Electricity Procurement Goals Might Entail

As they have led on scaling renewable energy, corporate buyers could help drive the transition to a fully decarbonized grid with next generation goals that go beyond 100% renewable purchasing goals. Buyers could define and adopt goals centered around the realization of a fully decarbonized grid. Once the grid is fully decarbonized, all buyers will be *consuming* zero-carbon electricity on a 365/24/7 basis- at all points of load.[q] The question becomes how buyers can accelerate this future through new approaches to procurement.

Under such goals, electricity buyers could:

- Increase the ambition of their electricity procurement strategies, prioritizing overall carbon impact[r] and seeking to reduce their reliance on carbon-intensive electricity in more locations and at more times.
- Increase the utilization and viability of zero-carbon generation -- particularly firm and dispatchable resources that can meet stricter time and location-matching priorities (discussed below).
- Provide direction to markets and to utilities and their regulators in the development of generation portfolios by signaling demand for "anything but fossil" (without CCS) resources.
- Support the deployment of new emerging zero-carbon technologies.

The adoption of next generation goals does not necessarily mean the abandonment of 100% renewable purchasing goals. A buyer could maintain a 100% renewable purchasing goal, while simultaneously adopting a new set of priorities and procurement strategies that further accelerate the decarbonization of the grid by prioritizing the consumption of 100% zero-carbon electricity.

a. Seeking Generation from a Portfolio of Firm, Dispatchable, Zero-Carbon Resources

Most first generation electricity procurement goals have been limited to purchasing renewables. Sometimes goals explicitly limit themselves to wind and solar, but even for ones that do not, buyers often in practice only consider wind and solar. A fully decarbonized grid, however, will likely include a combination of intermittent renewables and zero-carbon firm and dispatchable generation that could be provided by non-intermittent renewables (including hydropower, geothermal, and biomass), storage, and other non-emitting resources (e.g., nuclear, fossil with CCS). Buyer demand across the full zero-carbon portfolio can accelerate that future, and next generation goals could explicitly include such an expansive view.

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[q] This report focuses primarily on off-site generation that a buyer consumes, but a buyer could also address its end-use consumption through options such as on-site renewables and energy storage. Of course, a key element of decarbonizing load is to first reduce it with efficiency and other forms of demand-side management.

[r] New tools and new analytic capabilities are likely needed to enable companies to better understand the carbon impacts of their procurement. Developing such tools may not be easy, as data regarding a buyer's load and grid carbon intensity at given times and locations is not always readily available (see longer discussion below).

b. Rethinking "Additionality"

Many electricity buyers currently prioritize "additionality" for individual renewable energy purchases. Many define "additionality" as facilitating the development of *new* renewable generation capacity through their procurement efforts.[s] While there are a number of reasons one might favor new renewable generation (employment impacts, for example), the goal of getting to a fully decarbonized grid should remain central. Under a next generation of goals, buyers perhaps could focus not just on the addition of new renewable energy capacity but also on how their procurement approaches – in addition to delivering carbon impact by displacing carbon-emitting generation (as just noted) – could deliver broader incremental carbon *impact* in other ways.

Such impacts could include:

- **Enabling the development of new zero-carbon generation resources**: In addition to new renewable capacity, companies could seek the deployment of new non-renewable zero-carbon generation capacity (such as fossil energy with carbon capture or next generation nuclear) when it is ready for market. The same type of purchasing transactions that enable new renewable generation (such as PPAs) could be used to bring to market the new non-renewable zero-carbon generation resources that will likely be needed for long-term grid decarbonization.

- **Contributing to the extension of existing zero-carbon generators:** In several U.S. regions, the retirement of zero-carbon resources – most notably large nuclear generators – prior to the end of their safe and useful lives could set back progress on grid decarbonization. In a 2018 report, the Union of Concerned Scientists estimated that "losing the at-risk plants early could result in a cumulative 4 to 6 percent increase in US power sector carbon emissions by 2035 (0.7 billion to 1.25 billion metric tons) from burning more natural gas and coal. This pathway would make it more difficult for the United States to achieve deep cuts in carbon emissions."[29] Some non-renewable zero-carbon generation today may be selling electrons into the market at prices that do not cover operating costs – but unlike renewable generation that is "paid" for both electrons and attributes (RECs) in the (non-compliance) market, non-renewable zero-carbon generators do not receive value for their carbon-free attributes (other than in limited policy-created markets). New buyer demand for the electrons and attributes of such resources can help extend the lifespan of such resources and avoid backwards steps on the decarbonization pathway.[t]

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[s] Buyer activities that are not usually considered additional include procuring from existing generation projects or from projects developed due to regulatory mandate. As the list of U.S. states adopting long-term renewable or zero-carbon goals continues to grow, electricity buyers may have difficulty distinguishing their activities from those happening due to regulatory mandate.

[t] As an illustrative example, consider a 1,000 MW nuclear plant with an operating cost (fuel, operations & maintenance, and ongoing capital additions) of $40/MWh located in a power market where it is receiving $35/MWh in energy and capacity revenues. It still dispatches and produces energy up to the full amount of its capacity since its variable costs are close to zero, but revenues are not enough to cover its fixed costs of operation. Because of that, the owner intends to shut it down at the end of its next fuel cycle, say in one year. If it shuts down, the lost generation would be replaced by a mix of gas and coal generation, increasing system carbon emissions. If the operator were to receive a payment from a buyer or a policy for emissions attributes equal to $5/MWh or more, its operating deficit would be erased ($35 minus $40), and its operating life would be extended beyond the end of its next fuel cycle, say for another 5 or 10 years. The extended life of the plant would provide the market with another 1,000 MW of generation for that 5- or 10-year period, avoiding the gas and coal generation and the associated carbon emissions.

- **Accelerating the systemic decarbonization of the grid:** As discussed above, buyer demand has led to significant new deployment of renewables, both in competitive markets (where buyers can engage developers directly to finance and bring online new wind and solar generation) and in regulated markets (through concerted work with utilities and regulators).[u] Similarly, strong market signals and concerted action from buyers in favor of a full suite of zero-carbon generation could accelerate the decarbonization of the grid. Early-mover buyer transactions for zero-carbon energy (such as those discussed in Section E *below*) may by themselves have limited impact on the overall grid, particularly if suppliers can simply move generation from one customer to another to meet such demand. It could be argued, though, that first-mover corporate wind and solar deals led to others, and the cumulative impact of corporate demand has yielded systemic impact. Likewise, as more and more buyers seek to consume zero-carbon energy at all places and at all times – and to execute transactions and demand options that further those objectives – the marketplace will respond. Cumulative buyer demand for non-emitting generation can accelerate the clean energy future.

c. Closer Matching of Zero-Carbon Generation and Consumption Timeframes

The very nature of intermittent renewables (and many of the types of transaction structures used by buyers to procure them) means that during time periods when those intermittent renewables are unavailable, buyers typically must consume a mix of generation resources from the grid. These mismatches between renewables supply and demand are most pronounced on a seasonal basis but also occur down to a daily or even hourly basis. Yet so long as a buyer's procurement goals are measured and assessed on an annual basis, those mismatches are not an obstacle. The flip side of this, however, is that such renewable purchasing goals do not directly seek to displace any underlying fossil generation that is being consumed during these times of mismatch.

Next generation strategies could include buyers seeking closer matching of zero-carbon generation and consumption timeframes. While an aspirational goal could be to "consume zero-carbon power at all times", a buyer could begin by seeking to more closely match consumption on a seasonal or monthly basis, perhaps by targeting certain days of the year or certain hours of the day when mismatch is greatest. Meeting time-matched goals will likely require buyers to procure dispatchable zero-carbon resources. As Google explains in its recent 24x7 white paper, "we'll need new energy contracting approaches that focus on providing firm low-carbon electricity 24x7, likely through a combination of multiple generation sources or the adoption of energy storage."[30] A buyer could, for example, ask a competitive retail supplier or a regulated utility for a product or tariff structure that provides zero-carbon electricity at times that match its load consumption over a designated time period.

In many markets today, buyers will likely find that there are inadequate existing zero-carbon resources or other challenges to the development of such products. As discussed above, though, increased buyer demand will drive innovation in product offerings and create market and regulatory-based pressures to move the generation mix away from emitting resources toward more zero-carbon generation that could be more closely time-matched to load.

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[u] For example, corporate buyers have asked Dominion Energy to give a higher priority to renewables in its Integrated Resource Plan. https://www.ceres.org/sites/default/files/VA%20Data%20Center%20IRP%20Letter%E2%80%93Spring%202019%20Final.pdf

d. Greater Focus on the Location of Zero-Carbon Procurement and Consumption

Under their purchasing goal strategies, electricity buyers have had several choices regarding where they do their sourcing. Certain buyers are maximizing on-site solar opportunities, simultaneously deploying energy storage, energy efficiency, and other load management strategies (shifting load or utilizing demand response) to minimize total consumption and reliance on grid-supplied electricity. Other buyers have turned to off-site transactions. Some companies prioritize procuring renewable energy within the same region (potentially the same RTO/ISO territory or utility service area) as their load, but others seek to procure renewables wherever they are most cost-effective and then apply their purchases against their loads in other regions. In such cases, their procurement choices may not impact their local grid's portfolio of generation.

Given that a fully decarbonized electric grid will feature the use of zero-carbon generation in all locations, a next generation strategy could include greater emphasis on adding zero-carbon generation to a buyer's local grid as part of an ultimate goal of "consuming zero-carbon at all locations". Pledging to secure zero-carbon generation from a narrower geographic boundary in relation to load – e.g., same NERC region, RTO/ISO market, balancing authority, or utility service territory – means that a buyer is focusing its impact on the local grid – as part of the effort to achieve fully decarbonized grids in all locations.

This is not to say, however, that locationally "mismatched" procurement cannot also have important carbon impact; a fully decarbonized electric grid will feature the use of zero-carbon generation in all locations. Enabling new generation, whether intermittent renewables or firm and dispatchable zero-carbon resources, on grids that remain heavily carbon-intensive does have important impact on that targeted grid and could have greater carbon impact than a buyer securing renewables on the same grid where its load is located. But this need not be an "either or" choice. Seeking zero-carbon supply in places of load can be complementary to procurements targeted in fossil-intensive regions where the buyer does not have load. To ultimately get to a zero-carbon everywhere outcome, both approaches may be needed, and both are pieces of a next generation procurement approach focused squarely on grid decarbonization impact.

D. Procurement Options and Procurement Challenges in Meeting Next Generation Goals

Today, an electricity buyer attempting to fulfill a next generation goal focused on zero-carbon consumption would face a range of challenges. Few, if any, load serving entities (LSEs), whether competitive retail suppliers or vertically regulated utilities, currently offer retail products/tariffs that would meet a buyer's desire for zero-carbon supply on a firm, load-matching, and perhaps locally sourced basis. A shift to zero-carbon, time-matched, and location-tied "consumption" goals will require changes to current procurement tools and to market design and practices (see Section E for in-depth discussion). Meeting these new goals will also require changes to the generation mix, since in many places, adequate zero-carbon (renewable and non-renewable) generation may not be available. While this is a current challenge, it also represents the structural transformation (*impact*) that next generation procurement goals can help achieve: over time, the generation mix will conform to demand and accelerate the transition to a zero-carbon electricity sector.

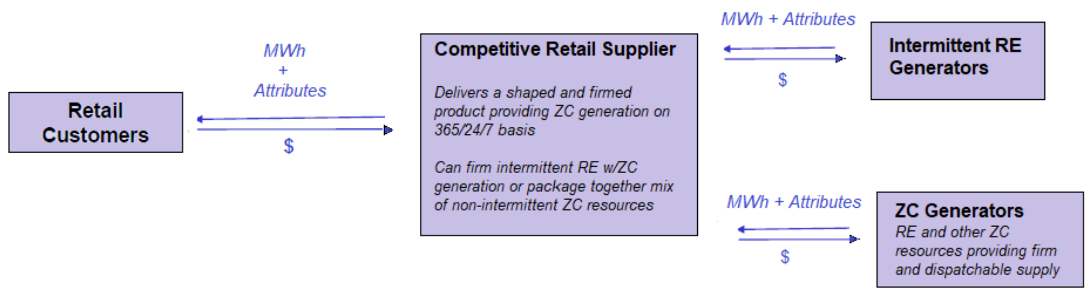
1. Review of Existing Buyer Procurement Options and Potential Adaptations to Meet Next Generation Goals

The following sections discuss how existing mechanisms currently used by buyers to secure renewable energy could be adapted to accommodate next generation goals. These sections also identify additional considerations and potential challenges in utilizing these mechanisms to achieve new objectives.

a. Competitive Retail Supplier Product

DESCRIPTION	CONSIDERATIONS/CHANGES FOR NEXT GENERATION GOALS
Market Structure: Retail competition. **Mechanism**: A buyer asks a competitive retail supplier to provide a firmed/shaped product that provides zero-carbon generation to match its load, potentially on a 365/24/7 basis or on a shorter time interval. Energy and attributes go to the buyer.	• Supplier ability to secure zero-carbon generation resources that meet customer demand for time- and/or location-matching. • Extent to which a supplier would procure from existing zero-carbon resources.

<u>Model Outline</u>



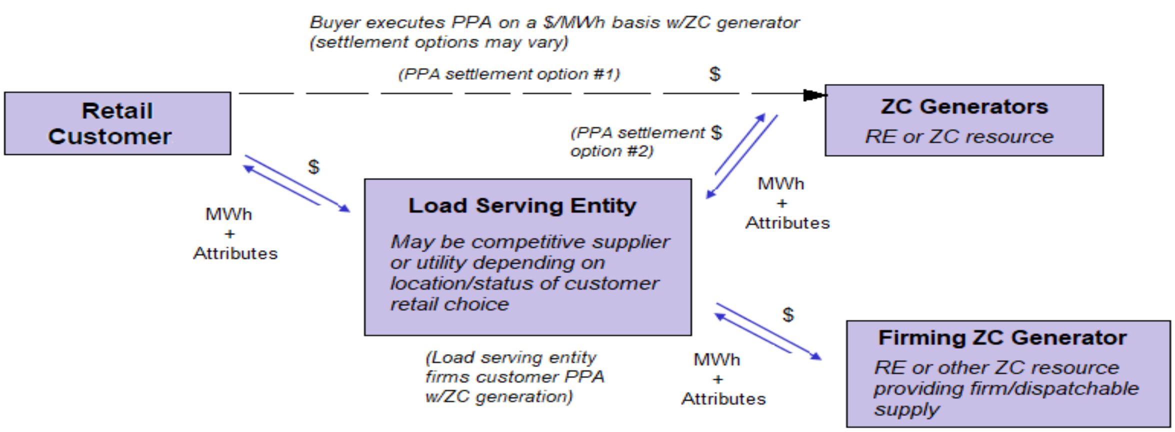
In U.S. locations with retail choice,[v] retail suppliers compete for customers and offer differentiated retail products that combine one or more sources of generation to meet the customer's preferences. Under next generation goals, customers could work with competitive retail suppliers to secure zero-carbon generation resources that meet time and location-based criteria. Under this model, the interval for firming/matching consumption with zero-carbon resources could be on a season-to-season, month-to-month, week-to-week, day-to-day, or hour-to-hour basis. It seems likely that competitive retail suppliers would rely heavily on existing resources to meet customer demand, but that reliance may decrease if customer demand leads to the development of new zero-carbon resources.

[v] Connecticut, Delaware, the District of Columbia, Illinois, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, Ohio, Pennsylvania, and Texas have authorized retail choice. California, Georgia, Michigan, Oregon, and Virginia also permit retail choice to certain customers. Source: https://www.nrel.gov/docs/fy18osti/68993.pdf

b. Buyer PPA with Physical Zero-Carbon Generator(s) with Firming by Zero-Carbon Resources

DESCRIPTION	CONSIDERATIONS/CHANGES FOR NEXT GENERATION GOALS
Market Structure: Retail competition or restructured wholesale markets where states permit choice for large customers. **Provisions**: A buyer contracts with A zero-carbon generator for offtake and works with a supplier to firm its remaining demand with other zero-carbon resources. firmed by a supplier. Energy and offtake terms/attributes "delivered"/conveyed to buyer at location of load. Two options: 1) intermittent renewable PPA firmed by zero-carbon; 2) zero-carbon PPA (providing firm supply on its own or supplemented by other zero-carbon).	• Buyer ability to execute PPA limited to certain locations and market structures. • Depending on terms of PPA and generation and load profiles of PPA counterparties, ability of competitive supplier/utility to firm and shape load-serving power with zero-carbon.

Model Outline



Under the PPA model, the buyer typically negotiates with the generator on the price per unit of output ($/MWh) and term, and then a load serving entity delivers that energy to the buyer.[w] The PPA's pricing terms can convey to the buyer's retail bill (though the exact settlement structure could vary). The generator uses that PPA to finance a new-build project or to sustain the operation of an existing project. Under a next generation goal approach, a buyer could execute a PPA with an intermittent renewable

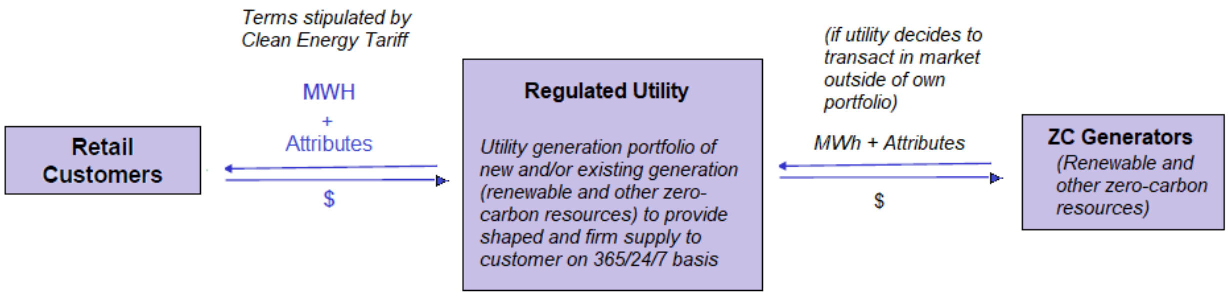
[w] The structure of PPAs can vary in terms of how they assign different responsibilities among parties (generator, buyer, a buyer's intermediary) regarding how generation is scheduled, delivered, and settled. The willingness and capability of a buyer to perform each of the responsibilities also often varies. Only a small number of relatively sophisticated electricity buyers are capable of performing these functions.

generator or other zero-carbon generator and seek to firm its PPA-secured generation with other zero-carbon resources to match its load (on an hourly or longer time-increment basis).

c. Regulated Utility "Clean Energy Tariff" for Shaped and Firmed Zero-Carbon Supply

DESCRIPTION	CONSIDERATIONS/CHANGES FOR NEXT GENERATION GOALS
Market Structure: Regulated/vertically structured utility market. **Provisions**: Utility develops new tariff structure/product offering to provide customer with mix of zero-carbon shaped and firm generation (renewable and non-renewable), as well as attributes.	• Utility ability to secure generation supply for customer on time- and/or location-matching basis. • If product secured and provided from existing resources in portfolio, limited net impact on grid, at least until demand for tariff/product scales and impacts dispatch and/or generation mix. • Need regulator support.

Model Outline



In regulated utility markets, customers seeking access to renewable generation have encouraged utilities to develop new retail tariff structures, usually termed "green tariffs",[x] to serve customer load and transmit (or retire) associated RECs. Under a next generation approach, a customer could engage its utility to develop a "clean energy tariff" or "zero-carbon energy tariff" capable of serving a customer's load with zero-carbon generation on a time-matched basis. The development of new clean energy tariffs could build off of customer and utility experiences in developing new green tariffs for renewables.

Electricity tariff structures have many design elements, which ultimately determine how much of a premium (if any) a customer is paying relative to its default rate. For example, a new tariff could be a rider that is added to a customer's default rate structure, or it could be devised as an entirely new rate structure. In addition to defining general price structure, the tariff will identify additional bill charges and credits that apply to participating customers. For example, under existing green tariffs, a customer is usually eligible for bill credits arising from a utility's avoided costs (for fuel or capacity). At the same

[x] In certain cases, utility agreements with large corporate buyers to provide access to renewables have been labeled "special contracts." Such cases share many similarities with green tariffs (a utility secures new renewable generation for select customers under terms reviewed and approved by public utilities commissions) but are often treated as distinct because they usually involve a smaller number of customers and may be authorized as one-time deals.

time, a participating customer could face charges arising from utility costs to integrate new capacity or to firm intermittent generation. Most green tariffs usually require customers to commit to participating under the tariff for a certain length of time. In the development of existing green tariffs, electricity buyers have urged utilities to develop tariff structures that are fully transparent and that only include charges and credits reasonably reflecting a utility's proven costs.

New tariff structures must also secure the approval of public utility commissions, which scrutinize the terms and provisions of all proposed tariffs. For example, many public utility commissions have been concerned by the potential for "cost shifting" under new green tariffs, defined as costs and risks incurred by the utility in securing renewable generation for a green tariff falling on the general rate base and not participating customers. Electricity buyers can play a critical role in helping utilities address commission concerns and mitigate risks.

d. Buyer VPPA with Zero-Carbon Generator with Zero-Carbon Firming

DESCRIPTION	CONSIDERATIONS/CHANGES FOR NEXT GENERATION GOALS
Market Structure: Generator located in restructured wholesale market. **Provisions**: Customer and generator agree to contract for differences based on strike price guaranteeing net offtake price for generator output (sold into market); two-way flow of payment between customer and generator based on difference between market price and strike price; "delivery" of emissions attributes to customer (via certificates if available or through contract). To further time-matching consumption objectives, under separate agreement, buyer asks a supplier to deliver zero-carbon power to firm virtual generation from VPPA counterparty.	• VPPAs frequently involve load and generation in different grid regions; local grid impact potentially minimal or non-existent. • VPPAs currently executed for new RE generation; could also be used for *new* non-RE zero-carbon generation (clear impact). • Less clear impact if executed with existing generation unless VPPA terms extend life or increase dispatch. • Challenge in making a "consumption" claim for VPPA generation.

The VPPA model has been very popular among buyers seeking to meet their renewable purchasing goals. Many buyers have applied RECs secured through deals with large wind projects against load located across the country. Given that next generation goals may involve greater efforts to reduce the carbon intensity of grids where buyer loads are located, the VPPA model could have limited use in meeting buyer demand for more narrow geographic matching.

e. Unbundled Instrument Purchases

DESCRIPTION	CONSIDERATIONS/CHANGES FOR NEXT GENERATION GOALS
Market Structure: Any. **Provisions**: Customer purchases attribute instruments associated with any zero-carbon generation unbundled from electricity.	• Limited availability of instruments. • Would need instruments beyond those used for compliance/mandatory market purposes. • Instruments would need time-based characteristics to fulfill customer desire to match load on less than annual basis. • Unclear grid impact (if sourced from existing generation, would need to show that attribute purchase extends life or increases dispatch in place of fossil). • "Removal" of attributes from generation renders that generation "brown" and underlying grid mix would need to reflect.

Many buyers rely on unbundled instrument purchases to help meet renewable purchasing goals. Under next generation goals, buyers could perhaps use unbundled attribute instruments to help achieve their goals, but it is not clear. If the attributes reflect the time and location of the underlying generation then they could be part of meeting a time and location-based goal. However, unbundled instruments still do not necessarily involve changing the generation portfolio consumed by the buyer.

2. Potential Marketplace Barriers and Challenges to Meeting Next Generation Electricity Buyer Goals

- **Ability of competitive market/vertically integrated utilities to change generation mix to meet demand** – Competitive retail suppliers and regulated utilities both maintain long-term relationships with generators in their portfolios. These suppliers might have hesitancy about quickly responding to new electricity buyer demands. Independent power producers (IPPs) may have trouble bringing new zero-carbon generation to market before sustained demand is clear. In regulated markets, utilities would need to amend existing resource plans and get regulator support. In either a competitive or regulated market, it is unclear how much additional generation is available from existing zero-carbon resources to immediately meet new buyer demand.

- **Reliance on existing resources to meet new procurement objectives and buyer commitment to impact** – A supplier may have the ability to access existing zero-carbon generation to meet a buyer's demand for zero-carbon consumption. In that case, there may be limited near-term impact on the grid if the supplier is just shifting generation choices among customers. New zero-carbon demand, however, could increase the dispatch of an existing zero-carbon resource – at the expense of fossil generation at the margin – or could delay or avoid the premature retirement of a zero-carbon generation source. Over time, as more and more buyers seek zero-carbon consumption options, carbon-emitting generation will become disadvantaged, and market response/utility resource planning should accelerate the decarbonization of the grid.

- **Transaction complexity** – Even as the renewable electricity marketplace has matured, the number of companies transacting for renewable electricity remains relatively small. Only a handful of companies maintain energy teams with sufficient understanding and staffing to execute transactions for renewable electricity. To overcome this challenge, several advisory firms have arisen to help buyers in completing their transactions, but their services remain mostly targeted toward larger C&I companies, and smaller entities still have trouble navigating the marketplace. Next generation procurement goals seeking zero-carbon consumption could create new complexities and may present challenges not previously addressed by market players. Just as was the case in the early days of renewable procurement, first-mover buyers and willing and sophisticated suppliers will have to lead and demonstrate a new set of options and best practices to lay the groundwork for others to follow.

- **Cost and risk** – The cost of securing zero-carbon generation with desired carbon impact and/or time- and location-matching may come with a premium compared to a buyer's existing options to meet its demand. While the costs of wind and solar continue to fall, other zero-carbon technologies, particularly those with dispatchability and firming capabilities, could be more expensive when rolled into a consumption-based product. New zero-carbon generation options like modular nuclear or fossil with carbon capture will also, for some time, carry a technology risk premium for early projects. Certain large electricity buyers have been willing to pay a premium for clean electricity (and attributes), but others have not. The market will need to respond. There may, however, be other financial benefits that buyers seeking these new products might enjoy, such as protection against future carbon pricing liability.

E. Other Needed Changes and Challenges in Supporting Next Generation Procurement Efforts

In addition to securing zero-carbon generation in the marketplace, next generation buyer goals also may raise uncertainties related to data, current corporate GHG reporting methodologies, the absence of established instruments to convey emissions attributes, and challenges to demonstrating that procured electricity meets temporal and locational priorities.

1. Disclosure of Additional Data and Development of Tools to Assess Carbon Impact

Electricity buyers most likely will need to assemble more data and utilize additional analytic tools to execute on a next generation strategy prioritizing carbon impact and to secure generation that meets time- and locational-matching requirements. Buyers likely will need data to show the carbon intensity of grid electricity at given locations and at given times, the portfolio of generators being dispatched at given times, and the type of fuel providing marginal generation. The U.S. Energy Information Administration, ISO/RTOs, and utilities collect and disseminate some of relevant data, but not all pieces of data may be disclosed or be easily accessible for buyers. To overcome data challenges, certain buyers have hired vendors to model and estimate data such as the carbon intensity of the grid at designated hours. Additional tools could be developed to help buyers estimate the carbon impact of their procurement choices under different scenarios or procurement mechanisms.

2. Potential Need for New Instruments and New Attributes

Electricity buyers heavily rely on RECs to demonstrate their purchase and/or "use" of renewable electricity. Though instruments representing non-renewable zero-carbon energy attributes are *not* absolutely required to enable next generation goals and procurement (see Section E.3., below), such instruments could be useful (e.g., to avoid double-counting). Buyers are accustomed to using attribute certificates (RECs), and instruments with market value are a way to compensate generators of zero-carbon energy for the climate value they create.

New instruments – perhaps "Voluntary Zero-Carbon Energy Credits" or "Voluntary Zero-Emissions Energy Credits" (VZECs)[y] – could be created, registered, and used to convey attributes from non-renewable zero-carbon generation.[z] In some jurisdictions,[aa] the attributes of all forms of generation are already tracked and registered, but in other jurisdictions, existing registries only cover renewable generation, and information regarding non-renewable zero-carbon-generation is not formally tracked.

To facilitate next generation targets aimed at maximizing grid decarbonization, instruments would be most helpful if they included time and locational metrics. Today's instruments (RECs, primarily) do not convey these metrics with granularity. Evolving attribute instruments to convey all of this information, however, would be a challenge. Still, if the data is available, emissions attributes, as well as the time and location of zero-carbon generation, could either be verified and communicated to the buyer as part of a new attribute instrument or be conveyed in other ways (see below).

3. Issues Related to GHG Reporting

Existing GHG reporting regimes for purchased electricity ("Scope 2" under the Greenhouse Gas Protocol) were designed with traditional renewable energy procurement in mind. RECs are the main currency in Scope 2 reporting and are useful for purposes of renewable purchasing goals, which are based on a true-up of RECs and load to reach the net Scope 2 reporting number (when that number is zero, a company has achieved 100% renewable energy use).

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[y] We focus here on voluntary market instruments, to distinguish from instruments used in mandatory compliance markets, though as with RECs, a compliance instrument owned by or retired for a buyer would count.

[z] Several entities have already established instruments that convey zero-emission attributes. Under policies to provide economic support to in-state nuclear plants with declining revenue, Illinois, New York, and New Jersey have established zero-emission credits (ZECs) and adopted requirements for utilities to procure a given number of ZECs. Constellation currently markets Emissions Free Energy Certificates (EFECs) under retail products that supply carbon-free electricity to customers. These are certificates in PJM representing the emissions-free attributes of non-renewable generation. https://www.constellation.com/solutions/for-your-commercial-business/Electricity/Carbon-Free.html

[aa] The New England Power Pool Generation Information System (NEPOOL GIS) issues certificates and tracks MWh for all generators operating in the ISO-NE region and for generation imported into the region. New York's NY-GATS system similarly does so for generation within or generation imported to the NYISO grid. (https://www.nepoolgis.com/, https://www.nyserda.ny.gov/-/media/Files/Programs/NYGATS/Operating-Rules.pdf).

If non-renewable zero-carbon energy is part of company's procured portfolio, the absence of attribute certificates requires alternative reporting and calculation methods.[bb] The Greenhouse Gas Protocol seems to accommodate this pathway by allowing the use of contractually-communicated emissions attribute information,[cc] but companies and stakeholders have less experience here.

For a buyer that wants to report carbon *impact* outside of the accounting done under traditional Scope 2 methodology, things get even more difficult. Again, current REC-based Scope 2 methodologies are not particularly aligned with carbon impact, as RECs are all treated equally. A REC from a MWh of wind generated at night in West Texas is the same as a REC from a peak load solar array in Alabama, and a REC from renewables in a carbon-intensive region is the same as one from a hydro-intensive region. If a company that has achieved a 100% renewable purchasing goal (reporting *zero* Scope 2 emissions) then also contracts with a local supplier for zero-carbon firming generation at a given load site, there is no clear way to report in Scope 2 that additional clean energy consumption or its carbon impact. While infrequently used, the GHG Protocol does allow a Scope 2 reporting entity to report (separate from Scope 2) on carbon impact in terms of "avoided emissions."[dd] Potentially this could be a way for companies to "report" contributions to grid decarbonization apart from their Scope 2 bottom line numbers, but the feasibility of this route will require outreach and discussion with the entities that manage reporting regimes.

[bb] This discussion is based on the "market-based" method of Scope 2 reporting under the Protocol.
[cc] *See, GHG Protocol Scope 2 Guidance,* World Resources Institute, Section 6.5.
[dd] *See GHG Protocol Scope 2 Guidance*, Section 6.9.

[1] https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_SPM_version_report_LR.pdf
[2] https://www.nrel.gov/news/program/2018/analysis-demand-side-electrification-futures.html
[3] https://rebuyers.org/deal-tracker/
[4] Compiled from EIA data on capacity installations. For years 2014 through 2017, Electric Power Annual Table 4.6 data used (available at: https://www.eia.gov/electricity/annual/backissues.php). For 2018, capacity estimate from EIA *Today in Energy* "More than 60% of electric generating capacity installed in 2018 was fueled by natural gas" (available at: https://www.eia.gov/todayinenergy/detail.php?id=38632)
[5] https://rebuyers.org/deal-tracker/
[6] https://buyersprinciples.org/about-us/
[7] https://rebuyers.org/
[8] https://sustainability.google/projects/announcement-100/
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