# PRIMER

# ACCELERATING THE DECARBONIZATION IMPACT OF ENERGY PROCUREMENT

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**A NOTE ON TERMINOLOGY** In defining next-generation energy procurement goals, large energy customers have adopted various criteria for the types of energy to procure, including renewable, carbon-free, carbon-neutral, zero-emission, etc. While each definition includes a slightly different set of resources, and can vary across organizations, they share a common goal to reduce greenhouse gas (GHG) emissions and help achieve a zero-carbon energy system. This document uses the term "carbon-free" throughout for the sake of conciseness, but these strategies are applicable to any of these goal definitions.[1]

Additionally, this document uses the terms "energy" and "electricity" interchangeably throughout to refer to the procurement of electricity, rather than other forms of energy (such as methane gas or petroleum fuels).

[1] For the purposes of this paper, "carbon-free" refers to resources which have zero GHG emissions resulting from generating electricity, including solar, wind, hydroelectric, certain kinds of geothermal, nuclear, and fossil or biomass fuels equipped with carbon capture and storage (CCS). This definition does not account for lifecycle emissions from these resources.

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Thank you to the following subject matter experts and practitioners who provided guidance and review for this primer series. Your work continues to bring us closer to a zero-carbon energy future.

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Olivier Corradi, Tomorrow
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Bruce Phillips, The NorthBridge Group
Megan Lorenzen, Salesforce
Max Scher, Salesforce
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We are grateful to several additional Clean Energy Buyers Association member contributors who shared their time and expertise with the authors.

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### ABOUT THE CLEAN ENERGY BUYERS INSTITUTE

The Clean Energy Buyers Institute (CEBI) solves the toughest market and policy barriers to achieve a carbon-free energy system. CEBI's aspiration is to achieve a 90% carbon-free U.S. electricity system by 2030 and a global community of customers driving clean energy.
To learn more about the Clean Energy Buyers Institute, visit

www.cebi.org

# OBJECTIVES OF THIS RESOURCE

**CEBI Primers are meant for members just starting their energy procurement journey, or those that want a refresher on a particular topic. Primers are one level deeper than an introductory overview and include key basics, Clean Energy Buyers Association member insights, and relevant market-based information.**

**THE PURPOSE** of the **Accelerating the Decarbonization Impact of Energy Procurement Primer** is to help energy customers understand the impact of emissions reductions decisions and the power to accelerate the transition toward a zero-carbon electric grid. This primer describes several emerging trends to enhance these impacts, and why companies are applying these strategies to guide energy-sourcing goals and decisions. Trends covered include energy procurement, emissions impact evaluation, and consumption-based thinking.

The **Accelerating the Decarbonization Impact of Energy Procurement Primer** is the first in a series of primers that the Clean Energy Buyers Institute (CEBI) will release to address the implementation of decarbonization strategies.

**INTENDED AUDIENCE** Energy customers of all types, sizes, and experience levels. Whether in the process of formulating a renewable energy goal, or having already achieved an ambitious goal, this primer will help you think about what's next on your company's clean energy journey.

**HOW SHOULD YOU USE THIS PRIMER?** The **Accelerating the Decarbonization Impact of Energy Procurement Primer** starts with an introduction to the role of energy customers in the clean energy transition and the potential impact energy procurement can have towards a carbon-free electric grid through next-generation strategies.
Information included in this Primer **should not** be interpreted as the only pathways to increase impact, rather as a starting point of strategies for energy customers to consider while setting next-level ambitious energy goals.

# THE LARGE ENERGY BUYER ROLE IN THE CLEAN ENERGY TRANSITION

## ACHIEVING A CARBON-FREE ELECTRIC GRID

In order to understand the role that energy customers, like corporations, can play in fighting climate change and accelerating the transition toward a carbon-free electricity system, it is important to first understand what is required to achieve these goals. First, minimizing further consequences of climate change requires reducing the rate of greenhouse gas (GHG) emissions into the atmosphere as rapidly as possible. Each unit of GHG reduced **now** will reduce climate impacts more than a unit of GHGs reduced **later**. [2] This can be achieved by reducing energy consumption and ensuring that energy demand is met with clean energy sources. Second, achieving zero emissions from our electric power system will require carbon-free generation to equal electric demand **at all times** and in **all places**.

Any organization with an energy procurement goal that seeks to mitigate climate change and help bring a carbon-free electric grid to fruition must consider four questions:

Impact Question 01
How much carbon-free energy should I procure?

Impact Question 03
Which generation projects should I prioritize to maximize short-term emission reductions?

Impact Question 02
Where should this carbon-free energy be located and when should it generate energy?

Impact Question 04
Beyond procurement, what actions can I take to ensure I am actually consuming carbon-free energy at all times in all locations?

**Ultimately, the goal of these impact questions is to**

**01.** **accelerate the pace at which the electric grid transitions to carbon-free electricity,**

**02.** **achieve the greatest emission reductions as soon as possible, and**

**03.** **to actually achieve a fully-carbon-free electric grid for all of society by mid-century.**

[2] https://link.springer.com/article/10.1007/s11367-012-0436-5

## CARBON IMPACT OF LARGE BUYER ENERGY PROCUREMENT

The commercial and industrial (C&I) sector consumes nearly two-thirds of global end-use electricity, so the type of electricity that the sector chooses to procure and consume can have a significant impact on shaping the future mix of resources on the electric grid.[3] To date, 242 global companies have committed to purchasing 100% renewable energy, equivalent to 228 Terawatt-hours (TWh) of renewable energy production.[4] In the United States, corporations have added over 26 GW of new renewable capacity to the electric grid since 2014.[5]

Existing renewable energy purchasing goals have been successful at adding renewable capacity to the electric grid, but have only addressed the first of the three impact questions introduced above. The next-generation strategies introduced in this document can help energy customers expand the impact of their procurement beyond adding carbon-free energy capacity to the electric grid to maximize emissions reductions and accelerate the carbon-free transition of the electric grid.

[3] IRENA, "Corporate Sourcing of Renewables: Market and Industry Trends - REmade Index 2018" (Abu Dhabi: International Renewable Energy Agency, 2018)

[4] RE100 Annual Report

[5] CEBA Deal Tracker

# NEXT-GENERATION STRATEGIES

Increasing emission reduction potential can be achieved by layering additional strategies on top of existing commitments and procurement practices. Some of the strategies that energy customers are already adopting include time-coincident procurement, emissions impact evaluation, and consumption-based evaluation. Time-coincident procurement focuses on purchasing renewable energy that produces when and where a company consumes electricity. Emissions impact evaluation can help buyers prioritize transactions that reduce the greatest amount of emissions. Consumption-based evaluation encourages buyers to utilize demand-side solutions and public policy engagement to ensure that the energy consumed from the grid comes from carbon-free sources.

## TIME-COINCIDENT ENERGY PROCUREMENT

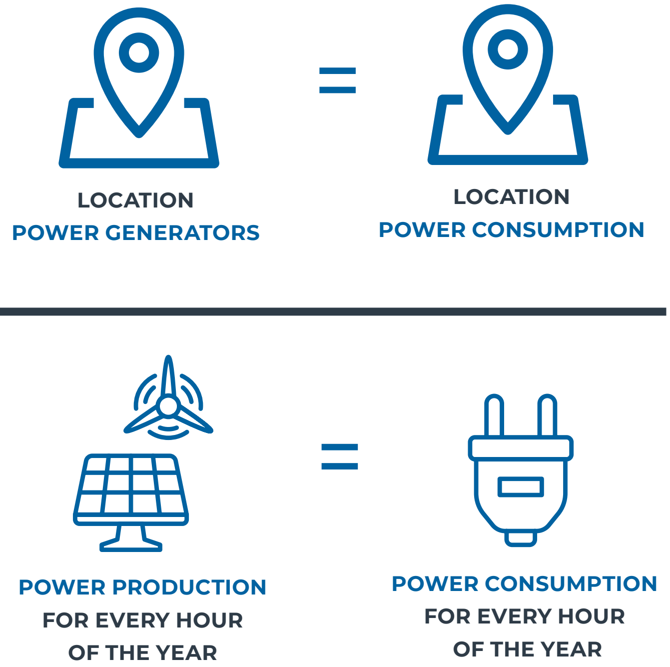
The concept of time-coincident procurement was introduced to the renewable energy market in a 2018 white paper by Google.[6] The concept as introduced by Google, was to power all of its operations with carbon-free energy **in all places, at all times**.[7] Whether a company is aiming for 100% carbon-free energy or 25% renewable energy, this strategy means two things: the power generators from which a buyer procures energy should be located in the same region as they consume that energy, and that their production for every hour of the year should match the buyer's consumption as closely as possible.

As the grid continues to integrate more variable renewable energy sources, it becomes more challenging for grid operators to reliably balance supply and demand at all times. Adding too much of a single type of resource at one time (like solar) can lead to issues when all of that resource disappears at once (e.g. when the sun sets) and there is no other carbon-free resource available to supply the grid. This requires other generators, which are often fossil-fueled, to remain on the grid to provide power during these periods. Since most generation is scheduled on an hourly basis on the grid, procuring energy that more closely aligns with the hours when an organization consumes energy helps avoid these balancing issues and the need for fossil generation to remain on the grid.

Procuring energy when and where an energy buyer uses it is partially about being a responsible user of the grid, and not exacerbating mismatches in supply and demand through procurement practices. Time-coincident procurement can help advance a more equitable energy transition by ensuring that procurement decisions are not shifting renewable energy integration costs onto other users of the grid.

*Procuring* 100% time-coincident carbon-free energy does not necessarily mean that an energy buyer is *consuming* 100% time-coincident carbon-free energy, however, it does accelerate the transformation of the electricity system that will be

[6] https://storage.googleapis.com/gweb-sustainability.appspot.com/pdf/24x7-carbon-free-energy-data-centers.pdf
[7] Google defined carbon-free to include renewables, biomass, nuclear, and fossil fuel with carbon capture and storage



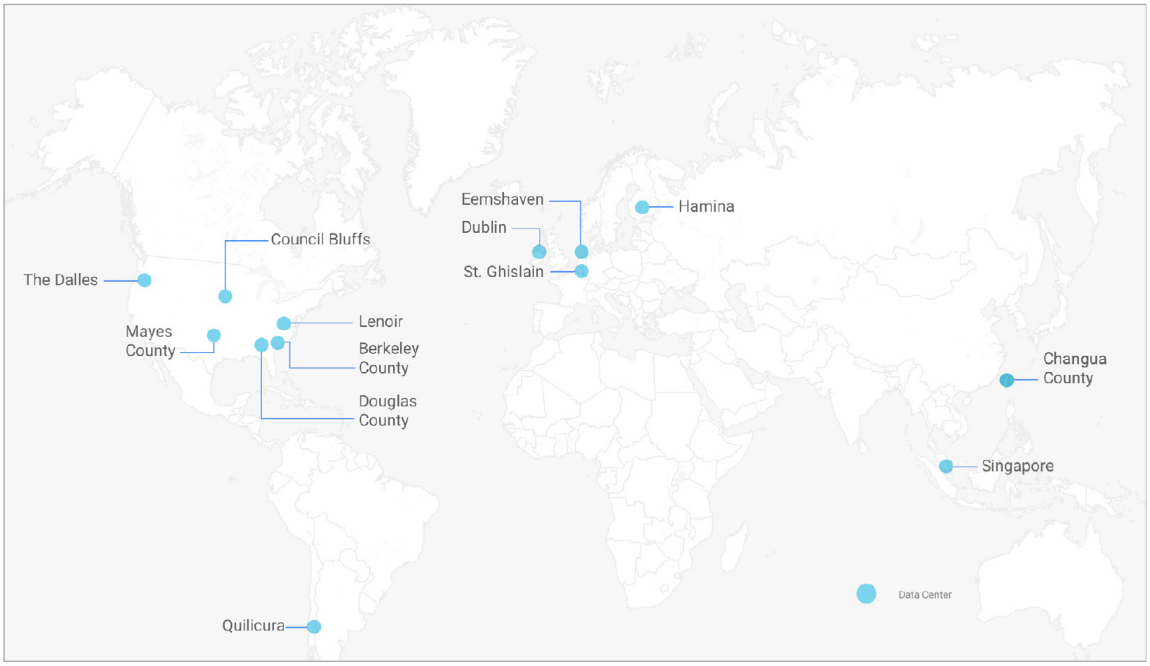

required for all of society to consume electricity that is carbon-free.

While specific approaches to implementing a ime-coincident energy procurement goal will be discussed in the next primer in this series, one of the major questions is whether it will cost more than procuring non-time coincident energy. The short answer is that it depends when and where an energy buyer consumes electricity. Some energy customers may be able to achieve this goal through a well-planned mix of low-cost solar, wind, hydro, and storage. Other energy customers may need to also consider technologies such as geothermal or offshore wind to match their load, or over-procure energy in some hours so that it is available in others. Companies can also implement cost-effective demand-side strategies, such as efficiency or load shifting to maximize the cost-effectiveness of this strategy. In addition, time-coincident procurement may mitigate certain risks that could lead to higher or more volatile costs in the future.

**THE CONCEPT AS INTRODUCED BY GOOGLE, WAS TO POWER ALL OF ITS OPERATIONS WITH CARBON-FREE ENERGY IN ALL PLACES, AT ALL TIMES**

**100%** $CO_2$ free energy

# CEBA MEMBER HIGHLIGHT: GOOGLE'S 24/7 STRATEGY




Google's data center fleet as of 2017

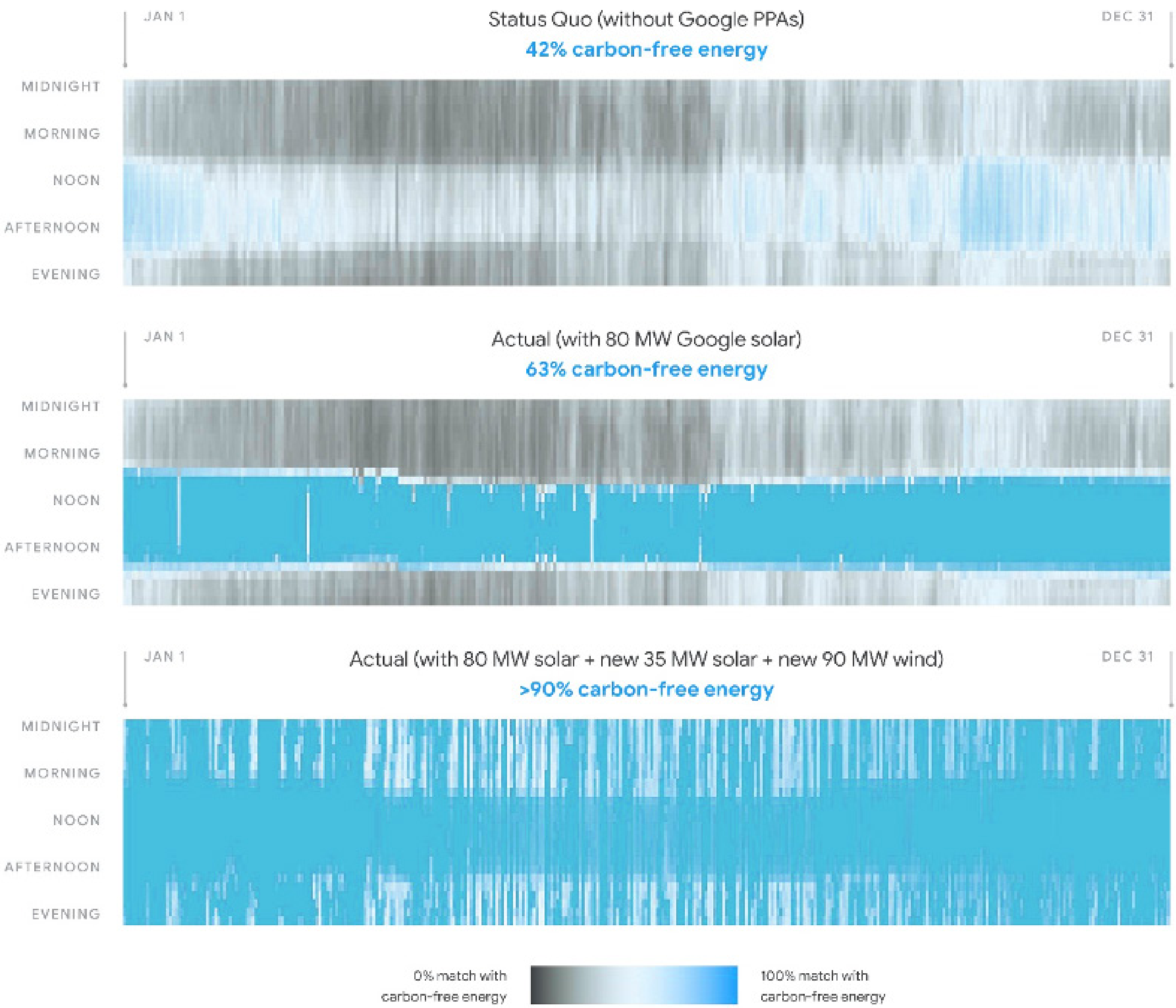
In September of 2020, Google announced that it aims to operate all of its data centers on 24/7 carbon-free energy by 2030.

Since 2017, Google has matched its global electricity consumption with purchases of renewable energy around the world on an annual basis. Google aims to source carbon-free energy to match its electricity consumption in every hour of the day, on every grid where it operates through its new commitment. Reaching this goal will require new strategies and technologies, such as developing new approaches for buying clean energy, driving innovation in technology, and advocating for policies to decarbonize electricity grids. More detail on Google's goal and approach can be found in its 2020 white paper, **24/7 by 2030: Realizing a Carbon-free Future.**

Google has already pursued a number of strategies to match more of its hourly electricity consumption with carbon-free energy, including buying power from multiple renewable generation sources in a given region. For example, at Google's data center in Chile, the overall content of the electricity grid was 42% carbon-free in 2019. In 2016, Google signed a power purchase agreement (PPA) for 80 megawatts (MW) of solar photovoltaic (PV), which increased the data center's hourly carbon-free energy match to 63%. In 2019, Google announced two additional PPAs in Chile for 35 MW of solar PV and 90 MW of wind power. Once these PPAs come online, Google's hourly carbon-free energy match in the country will exceed 90%. By pursuing multi-technology deals, companies sourcing clean energy can ensure that they are covering more of hourly consumption with clean energy and more effectively contribute to decarbonizing electricity grids.

### Impact of combining carbon-free technologies

Without Google's renewables purchases, just under half our energy use in Chile would be matched with carbon-free sources on an hourly basis (top). By signing an 80 MW solar PPA in 2015, we boosted our performance, matching 63% of our data center consumption with carbon-free electricity on an hourly basis (middle) in 2019. Because the wind blows at different times than the sun shines, our most recent, blended purchase (35 MW solar + 90 MW wind) will fill in gaps in our carbon-free energy supply, helping us match our data center with more than 90% carbon-free energy on an hourly basis (bottom).



# EVALUATING EMISSIONS IMPACT

Adding new renewable energy capacity to the grid has long been one of the standard criteria for evaluating the impact of energy procurement, but it does not necessarily translate to carbon impact.

The actual amount of absolute emissions reduced by building a renewable energy project can differ based on where a project is located and when it generates electricity. For example, take two hypothetical solar projects being considered in California and the Midwest. If built in California, the solar plant would likely displace generation from natural gas power plants and other solar generators, while in the Midwest, the solar plant would likely displace generation from coal. All else being equal, the Midwest solar plant would actually reduce more emissions since it is displacing generation from a carbon intensive energy source, the coal power plant. Likewise, if considering between a wind and solar project in the same region, the wind, which generates primarily at night, might reduce more emissions than the solar if more carbon intensive power plants generally operate overnight rather than during the day. [8]

While time-coincident procurement eliminates the demand signal for fossil generation at certain times of day and sends a demand signal for carbon-free electricity in the market, two projects that are each time-coincident with demand can have different short-term impacts on emissions reductions. Time-coincident procurement paired with the evaluation of emissions impact can help ensure reduction of emissions as quickly as possible in the short term, while supporting energy customers in successful, long-term integration of renewable energy into the grid.

Current GHG accounting protocols do not provide accurate information on the actual emissions impact of energy procurement. The main emissions metric that most companies track is scope 2, market-based emissions from annual GHG inventory. [9] However, this accounting treatment treats all zero-emission sources of energy equally, no matter where they are located or when they produce energy.

By shifting to metrics besides annual, market-based emissions inventory, an organization can make better decisions about the absolute emissions impacts of their decisions. But what metrics should be used?

In theory, ***marginal*** emissions factors should be used to measure the emissions that are displaced from a new energy project. Marginal in this case refers to the fact that generators are typically operated in order from lowest variable cost to highest variable cost. If a new renewable generator, which typically has zero variable cost, is built, all other things held equal, it will displace emissions from the highest-cost marginal generator. It is the emissions from marginal generators that would be compared to assess the emissions reduction impact of the new project. However, information about these marginal generators is typically confidential, so marginal emissions factors have to be modeled and estimated

[8] This example assumes that building a new generator will displace existing generation, which may not be the case if energy demand in the region is increasing at the same time. Additionally, sometimes even if a new renewable generator competes with an existing fossil generator for existing demand, the renewable generator will be curtailed if the fossil generator cannot be turned down due to physical or market constraints.
[9] For those unfamiliar with GHG accounting terminology, *scope 2* emissions primarily refers to emissions from purchased electricity (as compared to scope [1] emissions that you might directly emit onsite from burning fossil fuels in your buildings or vehicles). *Market-based* emissions refer to emissions from energy that you procure through contractual instruments, rather than emissions from the energy that you actually consume. The following section will address the distinction between procured and consumed energy.
[10] Several examples of these data sources include ElectricityMap by Tomorrow and Carbonara by Singularity Energy. Some utilities and grid operators are also beginning to make historical and real-time emissions data available. In addition, the U.S. EPA is currently developing historical hourly average emissions factors to complement its eGRID database, and the U.S. EIA has a "Electricity Grid Monitor" that provides near real-time information about the mix of generation fuels on each grid.

often using proprietary methods that are not transparent. Emerging research suggests that various estimates of marginal emissions factors provide contradictory signals about when the grid is cleaner or dirtier, which could lead to decisions that do not have an optimal emissions reduction impact.

Annual average emissions factors, such as those used in corporate GHG inventories, are also not very helpful in decision-making. As more variable renewable sources that produce power at certain times of day are added to electric grids around the world, average emissions at different times of day can significantly differ from the annual average. However, data to calculate hourly average emissions factors are widely available, and an increasing number of organizations are starting to provide historical, real-time, and forecasted hourly average emissions factors based on open data and transparent methods.[10] While hourly average emission factors do not represent emissions from the marginal generator, they would likely represent the marginal impact of long-term decisions, such as 10 to 20 year power purchase agreements. Using hourly average emissions with the location-based accounting method can help companies understand their consumption-based emissions footprint, and the impact of time-coincident energy procurement.

# FROM CARBON-FREE PROCUREMENT TO CARBON-FREE CONSUMPTION

Purchasing carbon-free energy does not necessarily mean consuming carbon-free energy. For example, an energy buyer using a virtual PPA, a primarily financial transaction, can procure energy from a region in which it does not have underlying demand and is not consuming any of the energy from the agreement. Even if the generator is located in the same grid region as the company, if the electricity is delivered via the grid the consumed energy is actually supplied by a mix of all of the generators that were producing energy at that moment, no matter who owns the generator or buys energy from it. [11] The only way for a company to consume 100% carbon-free energy is if the entire grid in which it is located is 100% carbon free. Although existing market and reporting structures allow carbon-free energy procurement and reporting to be decoupled from energy consumption, shifting evaluation metrics from energy purchasing to energy consumption can help drive greater impact.

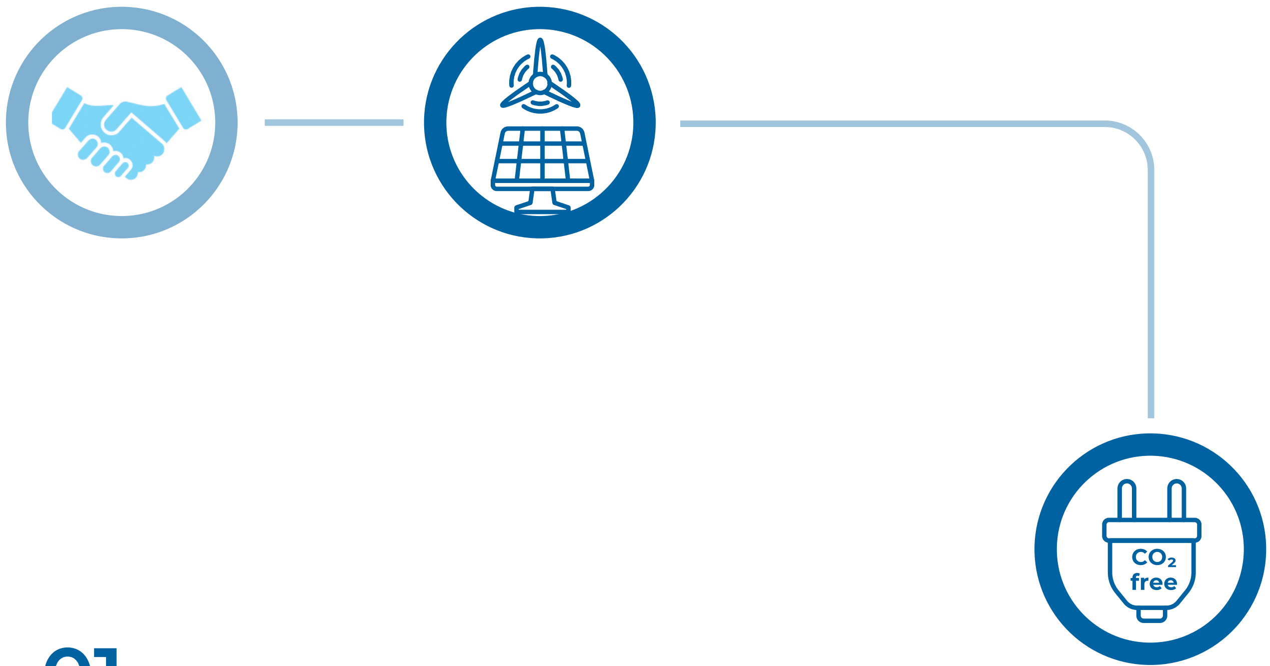
A good alternative metric to energy procurement for assessing carbon-free consumption is location-based scope 2 GHG inventory. The location-based inventory only accounts for emissions from the grid on which an organization is located and on-site carbon-free resources. Working with the sustainability department or a GHG inventory consultant to incorporate hourly average emissions factors into location-based inventory can help an organization evaluate the impact of consuming electricity at different times throughout the year.

Focus on the timing of energy consumption opens up a new toolbox to reduce carbon impact: demand-side resources. Leveraging energy efficiency to reduce consumption and emissions can be a powerful tool when emissions are the highest or shaping demand by scheduling energy-intensive processes when emissions are the lowest. On-site energy storage can also be operated to charge at low emissions times and discharge when emissions are high. Shaping a demand profile based on emissions impact sends a market signal for carbon-free resources, and helps to drastically decrease demand for fossil generation. It can be more cost effective to shift or reduce demand at a certain time of day rather than procure a new generation resource that is able to supply energy during that time. Pairing a focus on consumption with time-coincident procurement allows both supply- and demand-side energy solutions to compete on the merits of their cost effectiveness and reduces the cost of achieving a time-coincident goal.

Decarbonizing the entire grid will require the collective effort of energy consumers, utilities, regulators, market operators, and policymakers. As large consumers and

**Purchasing carbon-free energy does not necessarily mean consuming carbon-free energy.**

[11] However, an onsite behind the meter project, such as a solar array on your roof, will directly feed all of these electrons into your facility.




**01.** EMPOWERING CONSUMERS TO CHOOSE THE SOURCE OF THEIR ENERGY

**02.** ENCOURAGING COMPETITIVE MARKETS THAT DRIVE AFFORDABLE CLEAN ENERGY

**03.** RESEARCH AND DEVELOPMENT OF NEXT-GENERATION GRID TECHNOLOGIES

**04.** PUSHING UTILITIES TOWARD MORE AMBITIOUS GOALS AND CLEANER ENERGY PRODUCTS

**05.** ENABLING MORE TRANSPARENT, ACCURATE, AND TIMELY ACCESS TO DATA AND INFORMATION ON CLEAN ENERGY SUPPLY AND CONSUMPTION

**06.** ENSURING THAT GREEN MARKETING RULES ALLOW ORGANIZATIONS TO CLEARLY AND ACCURATELY COMMUNICATE THE POSITIVE ATTRIBUTES OF THEIR ENERGY

Companies can advance public policy reforms by adopting a time-coincident procurement goal in several ways. First, adopting these goals signals demand for the types of policy reforms needed to enable carbon-free grids. Second, by becoming more responsible grid users and understanding the challenges that utilities face in balancing the grid, companies can open the door to deeper collaboration with utilities. Finally, companies can lead by example, showing utilities, regulators, and policymakers what is possible where the policy environment is supportive.

# INTEGRATING NEXT-GENERATION STRATEGIES INTO EXISTING GOALS

Adopting next-generation procurement strategies does not require abandoning existing procurement goals, instead these strategies can be layered on top of an existing goal to enhance its impact moving forward. Revisiting the four impact questions, we can see how each of these strategies can be layered to help an energy buyer maximize the carbon impact of a energy decarbonization strategy:

**IMPACT QUESTION 01**

**How much carbon-free energy should I procure?**
Existing procurement goals, such as those established through RE100, can help an energy buyer understand how much carbon-free energy to procure.

**IMPACT QUESTION 02**

**Where should this carbon-free energy be located and when should it generate energy?**
Applying the time-coincident procurement strategy can help an energy buyer understand the technological and geographic mix of the portfolio that will be needed to achieve procurement goals.

**IMPACT QUESTION 03**

**Which generation projects should I prioritize to maximize short-term emission reductions?**
Along the way, emissions impact evaluation can help an energy buyer prioritize procurement of specific resources and shape an energy demand signal.

**IMPACT QUESTION 04**

**Beyond procurement, what actions can I take to ensure I am actually consuming carbon-free energy at all times in all locations?**
Recognizing that it will not be possible for an energy buyer to actually consume 100% carbon-free electricity until the entire electric grid is decarbonized can provide new opportunities to engage in public policy to for the benefit of all users of the electric grid.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Part 02 of the Accelerating the Decarbonization Impact of Energy Procurement Primer will delve deeper into implementation of decarbonization strategies, including a discussion of specific transactional mechanisms, analytical tools, risk mitigation strategies, and metrics.


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