


Guide to Purchasing Green Power

Renewable Electricity, Renewable Energy Certificates, and On-Site Renewable Generation

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

EPA GREEN POWER PARTNERSHIP

WORLD RESOURCES INSTITUTE

CRS center for resource solutions

NREL NATIONAL RENEWABLE ENERGY LABORATORY

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TABLE OF CONTENTS

Summary

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Summary

Today, the diverse array of energy resources used to create electricity can produce very different environmental impacts. In the United States, power generation is still the nation's single largest source of industrial air pollution and is a major contributor to greenhouse gas emissions, despite advances in pollution controls over the last 30 years[1].

Electricity generated from renewable resources such as solar, wind, geothermal, some forms of hydropower, and biomass has proven to be an increasingly attractive choice for electricity consumers. This Guide to Purchasing Green Power focuses on voluntary purchases of electricity generated from these renewable resources. It is intended for businesses and other organizations that want to diversify their electricity supply and reduce the environmental impact of their electricity use. Although renewable resources can also be used for heating and cooling needs or for transportation, this guide does not address those applications.

Green power purchases are attractive to electricity consumers because they allow organizations and individuals to use renewable electricity that is above and beyond what is required by public policy mandates such as the renewable portfolio standards adopted by 29 states and the District of Columbia. Purchases of green power can approach or even exceed 100 percent of an organization's electricity use. Green power purchases have and continue to play an important role in driving the development of new renewable energy projects in the United States (see Figure S-1) and are expected to be an important driver for the overall market for the foreseeable future.

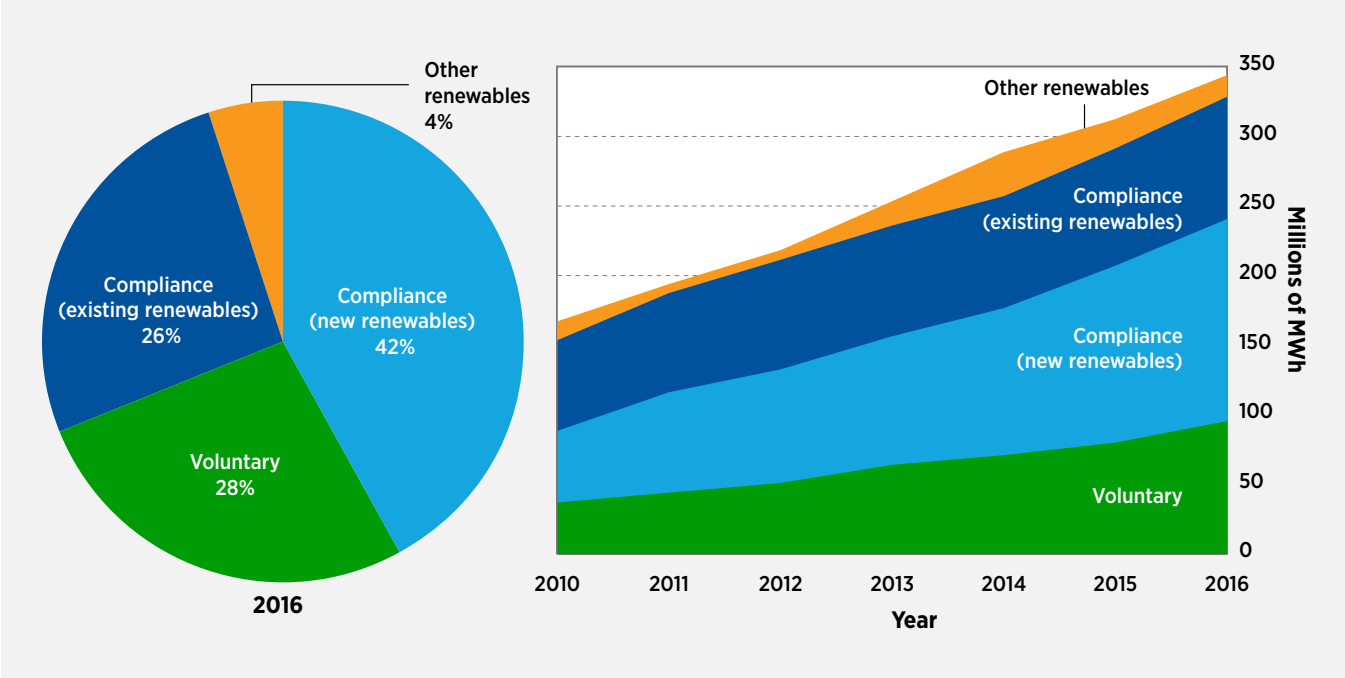
A wide range of organizations purchase green power, including federal, state and local governments; universities; businesses; nonprofit organizations; and individual consumers. By purchasing green power, these organizations are helping protect the environment, meeting their own financial goals, enhancing stakeholder relations and contributing to the development of domestic energy resources. In 2016, renewable electricity generation in the United States (excluding hydropower) approached 342 million megawatt-hours (342 billion kilowatt-hours)—enough to meet the annual electricity needs of over 31 million average U.S. homes.

Green power is an effective part of a strategic energy management plan. Successful energy management plans consider options such as energy efficiency, load management, power purchases, self-generation and non-electric (thermal) energy needs. As with any investment portfolio, the best mix of these options depends on the organization's goals, the cost of various alternatives, and external market conditions.

Over the past 15 years, the market has developed a variety of offerings for electricity consumers, allowing them to purchase green power from renewable sources in verified transactions. The market has gained a wealth of experience with voluntary procurement methods, including physical power purchase agreements, green tariffs and financial power purchase agreement contracts, and self-generation, either on-site or off-site. This latest revision to the Guide to Purchasing Green Power provides an overview and key details on each of these procurement methods.

[1] U.S. Environmental Protection Agency. (2015). Sources of greenhouse gas emissions. Retrieved from https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions.

Figure S-1. Demand Drivers for Renewable Energy[2]



Note: Compliance (new renewables) represents the amount of voluntary sales driven by state programs or policies that require regulated entities to procure RECs from "new" projects, while compliance (existing renewables) are based on sales from existing renewables which account for 26%. Voluntary market sales represent over 27% of all U.S. non-hydro renewable energy sales in 2016. Other renewables include utility renewable energy purchasing beyond RPS requirements and on-site generation.

While voluntary purchases of green power are becoming more common in today's electricity markets, these markets offer many choices. This guide is intended to provide guidance to organizations that have decided to purchase or invest in green power, as well as organizations that are still considering the merits of green power.

The Guide to Purchasing Green Power addresses the following commonly asked questions:

- What is renewable energy and green power? (p. 3)
- What is the importance of product certification and verification? (p. 5)
- What benefits will my green power purchase bring? (p. 6)
- What is the cost of green power? (p. 12)
- What are the options for purchasing green power? (p. 17)
- How should an organization choose a green power product? (p. 27)
- What are the best ways to buy green power? (p. 37)
- What are the steps for installing on-site renewable generation? (p. 47)
- How do I measure and account for emissions? (p. 54)
- How do I communicate my green power purchase to stakeholders? (p. 55)

[2] O'Shaughnessy, E., Heeter, J., Cook, J., and Volpi, C. (2017). *Status and Trends in the U.S. Voluntary Green Power Market (2016 data)*. National Renewable Energy Laboratory. https://www.nrel.gov/docs/fy18osti/70174.pdf.

CHAPTER

1

Introduction

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This Guide to Purchasing Green Power is intended for organizations that are considering the merits of green power procurement options, as well as those that have decided to purchase green power and want help doing so. The guide was written for a broad audience, including businesses, government agencies, universities and other organizations that want to diversify their energy supply and reduce the environmental impact of their electricity use. Although it is intended primarily for non-residential electricity consumers, residential consumers may also find many of the best practices, processes and guidance on purchasing green power applicable to their purchasing decisions, including more specific information in Appendix C.

First published in 2004, and previously revised in 2010, this new version of the Guide to Purchasing Green Power provides an overview of green power markets and describes the necessary steps to procure green power. This revision represents a major update to the guide and includes new market information and terminology, updated statistics, new case studies, information on evolving purchasing methods, an updated additional resources section, and new resources for federal agencies and the private sector to use when planning self-generation renewable projects or purchasing green power.

This chapter summarizes the guide to help readers find the information they need.

Chapter 2 defines green power, clarifies the role of renewable energy certificates (RECs), explains the importance of independent certification and verification of green power, and describes the role of REC tracking systems.

Chapter 3 summarizes the benefits and costs of purchasing green power.

Chapter 4 describes options for purchasing green power products: utility and retail provider options (including green tariffs), direct purchase options (both physical and financial power purchase agreements), community choice aggregation and unbundled RECs; and on-site or off-site self-generation of renewable electricity.

Chapter 5 outlines the preparations necessary for buying green power: setting goals, identifying the key decision-makers, gathering energy data, and choosing specific green power options based on availability and feasibility.

Chapter 6 discusses the process of contracting for renewable electricity: developing screening criteria, collecting product information, drawing up a procurement plan and evaluating the purchase.

Chapter 7 describes the steps for owning and operating self-generation: screening the technologies best suited to the purchaser's site, obtaining technical and financial resources and assistance, creating a project plan, anticipating possible barriers, and installing and operating the on-site generation system.

Chapter 8 explores ways to maximize the benefits of buying green power, particularly through greenhouse gas accounting and reporting, promotion to stakeholders both inside and outside the organization, and making accurate claims about the environmental benefits associated with a green power purchase.

Chapter 9 summarizes the key concepts and learning insights of Chapters 2 through 8.

Chapter 10 offers a list of resources for more information about all aspects of green power. Because electricity from renewable resources may be generated in a variety of ways, many institutions are working to facilitate the development of green power markets. Several of these organizations' programs—the U.S. Department of Energy's Federal Energy Management Program, the U.S. Environmental Protection Agency's Green Power Partnership, the Green Power Market Development Group of the World Resources Institute, the Center for Resource Solutions, and the National Renewable Energy Laboratory—collaborated together to write this purchasing guide.

The guide also includes a glossary of terms commonly used in the green power field.

Finally, **Appendix A**, Green Power Considerations for Federal Agencies discusses considerations specific to federal agencies that buy green power, particularly the procurement regulations that cover federal acquisition of green power. **Appendix B**, Commercial Solar Financing Options provides a snapshot of the current commercial solar financing arena and an overview of existing financing mechanisms. **Appendix C**, provides green power purchasing guidance for residential consumers

CHAPTER

2

Introducing Green Power

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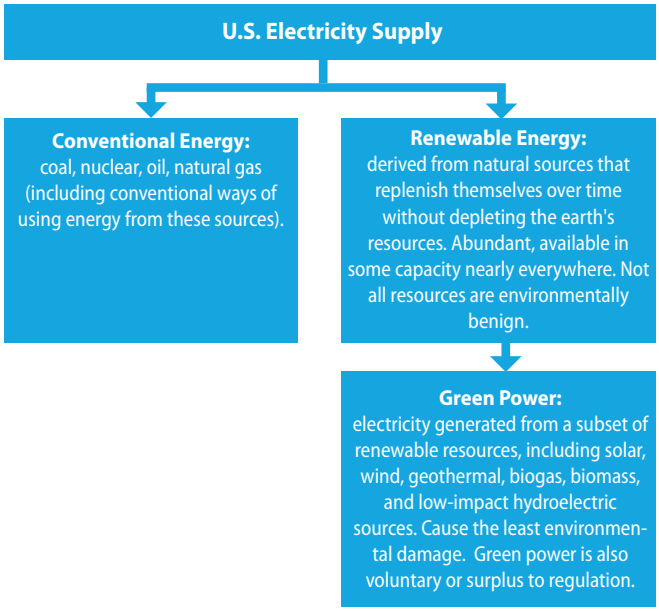
DOCUMENT MAP

What is Green Power?

The term green power can be used in several different ways. In this guide, green power refers specifically to electricity supplied from a subset of renewable resources that provide the highest environmental benefit. Green Power is also defined as renewable electricity that goes above and beyond what is otherwise required by mandate or requirement – green power is also voluntary or surplus to regulation. Renewable energy is supplied by natural resources that replenish themselves over short periods of time without being depleted. Green power is a subset of renewable energy and represents those renewable energy resources that provide the highest environmental benefit, such as:

- Solar
- Wind
- Geothermal (the earth's heat)
- Biogas
- Biomass (some forms of plant and waste material)
- Low-impact hydroelectric resources

Figure 2-1. Green Power as a Subset of the U.S. Electricity Sector



Green power generally does not include some resources that are often considered as renewable energy including large hydropower and municipal solid waste.

Green Power and Related Terms

The U.S. energy supply includes a variety of energy resources. Inclusion of specific resources in certain definitions for clean or renewable energy is often driven by other factors beyond the environmental profile of the resource. Green power is viewed by the market as a subset of renewable energy which is shown in Figure 2-1. Green power, as described by EPA's Green Power Partnership, is a term that includes only electricity generated from this subset of renewable resources. Readers should keep in mind that the resources associated with renewable energy or green power vary depending on the source or program. For more discussion on the definition of green power, please refer to the websites of the organizations that collaborated on this guide, listed at the beginning of Chapter 10, Resources for Additional Information.

Introduction to Renewable Energy Certificates

Due to the physical nature of electricity and the way it moves across the shared electric grid, it is difficult for consumers (or utilities) to know precisely the source or origin of the electricity they consume, even with onsite projects. The electricity coming through the utility grid can be generated from many different sources and is essentially mixed together prior to consumption. Historically, these generation sources were not tracked from the generator to consumer.

As states and organizations began developing targets for renewable electricity, a separate system of renewable energy certificates (RECs) was therefore developed to track generation delivered to the grid to meet consumer demand. RECs solve the problem of identification, allocation and ownership of renewable energy across a shared

electric grid. Each REC represents 1 megawatt-hour (MWh) of electricity generated and conveys the environmental and social attributes of the generated electricity to consumers.

State or regional electronic tracking systems issue RECs to generators that have registered with and report verified generation to the tracking system. The RECs issued are tradable legal instruments that are used to verify ownership of the attributes of the energy generation from the point of generation to the point of use. The REC owner has the right to claim the attributes of the renewable electricity.

What is a REC?

A renewable energy certificate (REC) is a tradable market instrument that represents the generation of 1 mega-watt-hour (MWh) of electricity from a renewable energy source.

This Chapter introduces the REC and its role as the track-ing and accounting instrument for generation and use of renewable energy.

Chapter 4 reviews RECs and green power product options. The Chapter identifies that RECs are a core instrument to all green power supply options as well as a stand alone supply option unto itself."

States first created RECs to track compliance with mandatory renewable energy targets for electricity suppliers (also known as state renewable portfolio standards), and in some cases to verify electricity supplier statements to consumers about fuel mix and environmental impacts of their electricity. Voluntary or non-regulatory markets and programs invariably require RECs as proof of green power purchases, and the Federal Trade Commission has issued environmental marketing guidelines that require ownership of RECs to substantiate commercial renewable energy claims. This substantiated claims guidance extends not only to those who claim to be using renewable energy, but also to those who claim to be selling renewable energy, such as renewable energy project developers.

Although there are differences in state definitions of RECs for compliance purposes, state rules and voluntary market norms generally agree that the REC instrument provides a legal basis for making green power and other environmental claims. As such, RECs provide an essential accounting and tracking function in renewable energy and green power claims.

In support of such claims, RECs convey information about each megawatt-hour of electricity generated and consumed: not only whether it is renewable or green but also other details such as the type of fuel or resource used to generate the electricity, air emissions created during generation, generator capacity, location and year the generator began operation, month or quarter when the electricity on which the REC is based was generated, and other characteristics associated with the generator and generation. These descriptive characteristics are usually referred to as "attributes," and are important to documenting environmental claims and determining eligibility for programs or financial incentives.

In addition to being essential to substantiate environmental claims, RECs help avoid double counting and claiming of the same generation attributes by more than one party. RECs must include all relevant information on the generation of their underlying green power including location, fuel type and month or quarter of generation. They must be tied to 1 MWh of actual green power generation no matter how large or small the facility is or where the facility is located relative to the consumer.

If the generator is not registered with a REC tracking system, and therefore RECs are not formally issued within a tracking system, the generator nevertheless creates RECs or energy attributes with every megawatt-hour generated. These RECs or energy attributes may be conveyed to another party by way of a contract. Generation must still be measured and generator attributes verified. Without benefit of a tracking system, verification of ownership would be proven through an independent chain-of-custody contract audit.[1]

[1] This is also true in the case of self-generation where the consumer of the energy owns the generator that is not registered with a REC tracking system. The consumer-owner of the generator may make green power usage claims based on the attributes of the generator, but the records of the generator and its output should be documented and verifiable.

Introduction to the Voluntary Market

The voluntary market provides consumer choices, particularly the ability to choose green power. States can set their own renewable energy goals and may mandate that utilities supply a specified percentage of their electricity to customers from renewable energy resources. Utility customers in these markets purchase and receive renewable energy as part of their standard electricity service without any proactive measures on their part. This buying and selling of renewable electricity that simply meets a mandate and occurs because of mandated utility purchases is known as the "compliance market." In contrast, consumers who choose to purchase renewable electricity above and beyond any minimum amounts that their state requires, as well as above and beyond what is available through their standard electricity service in states that do not have renewable energy mandates, participate in what is known as the "voluntary market."

Helping Consumers Identify Green Power

Case Study: The Green-e program, administered by the nonprofit Center for Resource Solutions, uses its stakeholder-driven eligibility criteria to certify and verify renewable energy products. Green-e has coordinated the development of market-based, consensus definitions for environmentally preferable renewable electricity and RECs. Further details about third-party certification are available in Chapter 10.

When consumers choose to purchase green power above and beyond what is required or otherwise available, they do so because they want to make a difference that goes beyond what would have otherwise occurred through a mandate or as part of business as usual. These voluntary actions help increase the aggregate demand for renewable electricity, and over time influence the way electricity is generated.

In the United States, RECs are the instrument used in compliance markets to verify that utilities are procuring and delivering renewable energy in compliance with the state mandate and in the voluntary market to verify that voluntary purchasers are using green power in excess of the renewable electricity that otherwise would have been used to meet state mandates. Voluntary and mandatory markets work alongside each other to create demand for renewable energy. Renewable energy generation represented by RECs that is sold to a regulated entity to meet a mandate should not also be claimed as a voluntary purchase, as this would double count the use and aggregated impact of the renewable electricity.

Certification and Verification

The voluntary green power market is shaped by the dynamics of supply and demand with little regulatory oversight. As a result, one major concern is ensuring that green power purchasers receive what they paid for and that RECs are not claimed by more than one customer or buyer. It also can be difficult for consumers alone to substantiate claims made about the quality and characteristics of green power products. To address these concerns, a best practice is for consumers to purchase green power products that are certified and verified by an independent third party.

Third-party certification programs set minimum quality standards for green power products and can provide credibility and confirmation of the product's environmental value. Certification allows customers to confidently state that the purchased green power product has met the specific environmental and consumer protection standards adopted by the certifying organization. A key aspect of certification is verification. Verification helps ensure that there is a traceable pathway back to a known generator and that no other consumers can lay claim to the attributes from the same megawatt-hour of generation. The verification process includes an audit to ensure that claims regarding environmental and non-energy benefits associated with the purchase are accurate.

Tracking Systems

Certificate tracking systems account for RECs and ensure that RECs are only held by one organization. These tracking systems issue RECs based on verified generation, track ownership as RECs are sold and purchased, and track REC retirements as the RECs are claimed or used by the organizations that own them. Tracking systems assign a unique identification number to each REC to ensure that only one REC is issued for each megawatt-hour of generation reported, thereby minimizing double issuance. In this way, REC tracking systems, together with certification, facilitate and simplify the verification of green power purchases and claims for consumers.

While not all green power purchases are processed through certificate tracking systems (e.g. RECs can also be created and transacted in bilateral contracts without benefit of a tracking system), consumers may wish to purchase green power substantiated with RECs that are specifically issued and tracked in such systems to gain confidence in the standardization, enforceability and transparency of their green power purchases. The transfer of renewable attributes through bilateral contracts can be verified and traced based on attestations that accompany the contracted attributes. Attestations help ensure that only a single entity can legally claim the renewable attributes at a time. For more details about third-party certification and verification, and certificate tracking systems, see Chapters 6 and 10.

CHAPTER

3

The Benefits and Costs of Green Power

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DOCUMENT MAP

Green power can offer organizations a variety of environmental, economic and stakeholder relations benefits. Green power purchases can also support the development of domestic renewable energy, which creates jobs, promotes resource diversity and provides grid resilience. This chapter is intended to help buyers understand the benefits and costs associated with purchasing green power. The focus here is on the universal benefits and costs that are synonymous with all forms of green power. Chapter 4 compares the specific benefits and costs associated with different green power supply options.

The Benefits

Green power provides benefits both directly and indirectly to the buyer. The benefits listed here are grouped into four categories:

- Environmental benefits
- Economic benefits to the purchasing organization
- Stakeholder relations
- Development of domestic energy resources

Environmental Benefits

Reduce organizational carbon footprint. Organizations that purchase low- or zero-emissions green power may claim to be reducing indirect (or Scope 2) emissions associated with purchased electricity—emissions that are owned and are the direct responsibility of the utility or other owner of the generating facility, but that are the indirect responsibility of the consumers of the electricity produced. Although consumers cannot directly control the generating facility that produces their electricity, they can influence the generator indirectly through their demand side choices. This is especially useful if the organization is accounting for its emissions through an inventory using the Greenhouse Gas (GHG) Protocol Corporate Reporting Standard.

Reduce air pollution. Conventional electricity generation from fossil fuels is one of the single largest industrial sources of air pollution (for sulfur dioxide, nitrogen oxides, mercury and certain types of particulate matter) in the United States.[1,2] The emissions from conventional electricity generation contribute to a number of serious environmental problems. Green power generates fewer emissions than conventional power, helping to protect human health and the environment. According to a study by the Lawrence Berkeley National Laboratory and the National Renewable Energy Laboratory, emission reductions from each megawatt-hour of new renewable generation produced health and environmental benefits ranging from $26 to $101 per megawatt-hour (MWh).[3]

Reduce water environmental impacts. Most green power technologies do not consume water and have a negligible impact on local aquatic ecosystems.[4] Conventional power generation often requires water for fuel extraction, steam production and power plant cooling. The release of spent cooling water increases the temperature of local water resources, which can alter aquatic ecosystems. In contrast, most green power systems do not consume water or release it into the environment. A joint study by two national laboratories found that adding new renewable electricity

[1] U.S. Environmental Protection Agency. (n.d.). Air pollutants emissions trends data: Average annual emissions. Retrieved from https://www.epa.gov/air-emissions-inventories/air-pollutant-emissions-trends-data

[2] U.S. Environmental Protection Agency. (n.d.). Mercury and Air Toxics Standards: Cleaner Power Plants. Retrieved from https://www.epa.gov/mats/cleaner-power-plants

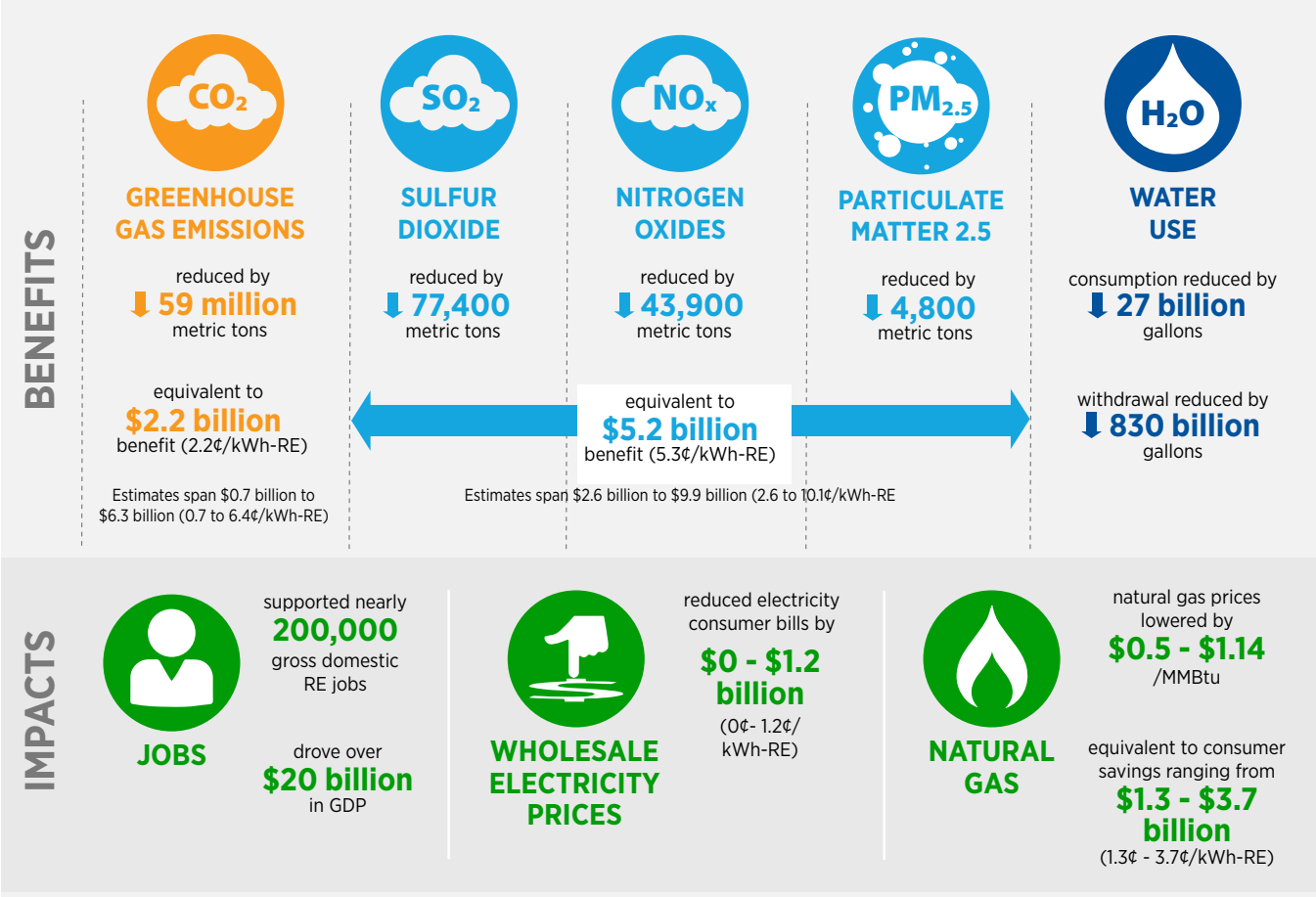
[3] Wiser, R., Barbose, G., Heeter, J., Mai, T., Bird, L., Bolinger, M., Carpenter, A., Heath, G., Keyser, D., Macknick, J., Mills, A., and Millstein, D. (2016). A retrospective analysis of the benefits and impacts of U.S. renewable portfolio standards. Lawrence Berkeley National Laboratory and National Renewable Energy Laboratory. (Publication No. NREL/TP-6A20-65005). Retrieved from http://www.nrel.gov/docs/fy16osti/65005.pdf

[4] International Energy Agency. (2012). World energy outlook 2012 (pp. 501-511). OECD/IEA. Retrieved from http://www.iea.org/publications/freepublications/publication/WEO2012_free.pdf

to the grid resulted in water savings equivalent to 8,420 gallons of withdrawal and 270 gallons of consumption for each megawatt-hour produced.[5]

Emissions and water benefits of renewable electricity generation for state renewable portfolio standard (RPS) programs through 2013 were examined in a recent Lawrence Berkeley National Laboratory study, with results shown in Figure 3-1.

Figure 3-1. Environmental Benefits and Impacts of New Renewable Electricity as Evaluated to Meet 2013 RPS Compliance[6]



Note: This study evaluated a subset of the potential benefits and impacts of state RPS policies. We distinguish impacts from benefits because we do not estimate or claim any net social benefit from the impacts assessed here. We do not assess all potential benefits and impacts, for example land use and wildlife impacts, or job losses in the fossil industry. We also do not address the costs of state RPS programs, as that was the subject of an earlier study (Heeter et al. 2014).

Economic Benefits to Purchasing Organization

Reduced economic costs of green power projects. Technological innovations have led to dramatic declines in the cost of wind and solar technologies since 2000. These cost decreases have stimulated demand, contributing to higher sales volumes and larger economies of scale, which has further reduced production costs. This has allowed green

[5] Wiser et al., op. cit. Withdrawals are defined as the amount of water removed or diverted from a water source for use, while consumption refers to the amount of water that is evaporated, transpired, incorporated into products or crops, or otherwise removed from the immediate water environment.

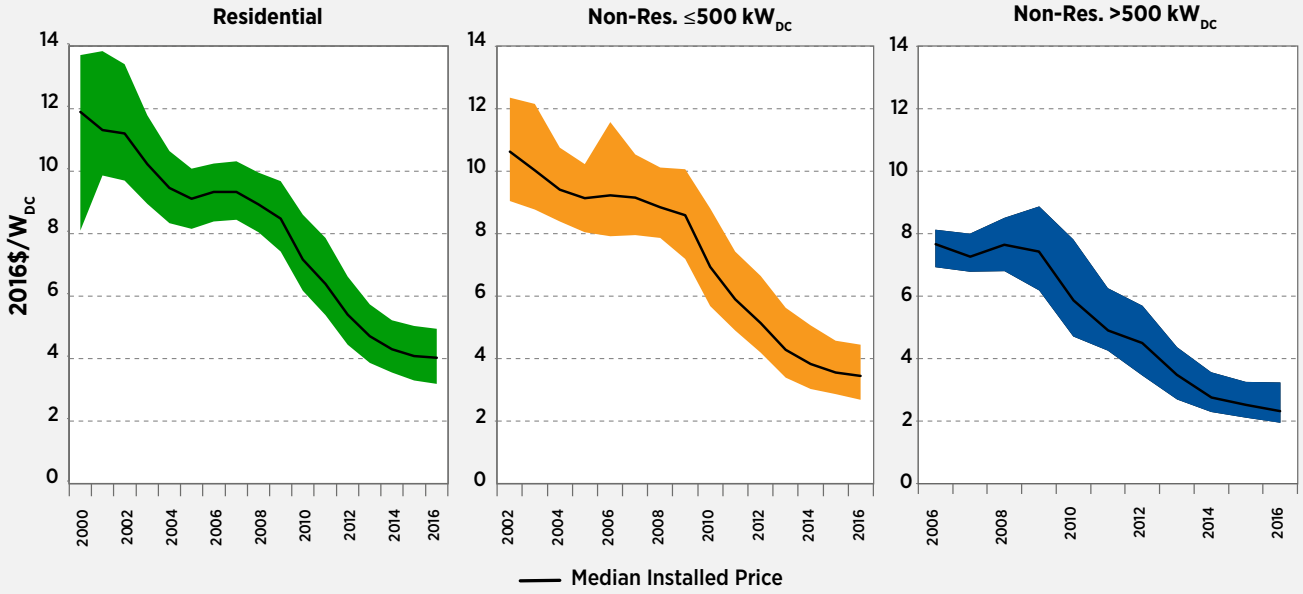
[6] Wiser et al., op. Cit.

power to become more affordable to more organizations. To illustrate the recent cost reductions, Figure 3-2 shows that the installed cost of solar has decreased from $8- $12/watt in 2000 to $2-$4/watt in 2016. Similar dramatic cost reductions have been seen for wind technologies. In some situations, wind and solar are now cost-competitive with conventional energy.

Manage electricity prices. Organizations can procure green power through long-term contracts to safeguard against expected electricity prices increases by locking in fixed costs for their electricity and the associated renewable attributes for several years at a time.

Mitigate fuel supply disruptions. Disruptions in fuel supply can hinder business processes and profitability. Green power resources can reduce the impact of fuel supply disruptions to power plants caused by transportation difficulties, accidents or natural disasters by lowering demand for fuels that are delivered by rail or pipeline. In addition, on-site self-generation or third-party owned generation, coupled with storage, can improve electricity supply reliability and resilience in response to local power outages.

Figure 3-2. Cost of Installed Solar[7]



Note: Solid lines represent median prices, while shaded areas show 20th-to-80th percentile range. See Table 4-1 for annual samples sizes. Summary statistics shown only if at least 20 observations are available for a given year and customer segment.

[7] Barbose, G., Darghouth, N., Millstein, D., LaCommare, K., DiSanti, N., and Widiss, R. (2017). *Tracking the Sun 10: The installed price of residential and non-residential photovoltaic systems in the United States* (p. 15). Lawrence Berkeley National Laboratory and U.S. Department of Energy SunShot. Retrieved from https://emp.lbl.gov/sites/default/files/tracking_the_sun_10_report.pdf.

Case Study: Stabilizing Electricity Price with a Physical PPA

In 2014, George Washington University (GW), American University (AU) and George Washington University Hospital (GWUH) entered into a 20-year power purchase agreement with Duke Energy Renewables for the energy from a 52-megawatt solar photovoltaic project in North Carolina. The solar energy will power more than half of GW's and AU's electricity needs and more than a third of GWUH's need. Equally important, the agreement provides fixed pricing for the solar energy at a lower total price than current power solutions and is expected to yield greater economic savings for the partners as traditional power prices are anticipated to increase at a higher rate over the same period. The project will help GW, AU and GWUH meet their climate action plan commitments without incurring additional costs.

Stakeholder Relations

Meet organizational environmental objectives. Reducing an organization's environmental impact is one of the main motivations for buying green power. This may be driven internally by employees and shareholder initiatives, and externally by a desire to improve brand image and perception of the organization among its stakeholders and customers. If an organization is interested in creating a third-party certified environmental management system (e.g., ISO-14001 certification for environmental performance) or is preparing for LEED (Leadership in Energy and Environmental Design) certification for its building or facilities, purchasing green power could be important for attaining the certification standards.

Increase brand credibility through recognized initiatives. Participating in collaborative programs improves the environmental credibility of the organization and may help in attracting new investment. Below are a few examples:

- The U.S. Environmental Protection Agency's (EPA's) Green Power Partnership is a voluntary program that encourages organizations to use green power to reduce the environmental impacts of electricity use. This partnership tracks an organization's performance in use of green power. In return for technical assistance and recognition, Partners commit to use green power for all, or a portion, of their annual electricity consumption.
- The Sustainable Purchasing Leadership Council is a nonprofit organization whose mission is to support and recognize purchasing leadership that accelerates the transition to a prosperous and sustainable future.
- RE100 is a collaborative, global initiative of influential businesses committed to attaining 100 percent renewable electricity use, with a focus on dramatically increasing corporate demand for renewable energy.
- CDP (formerly the Carbon Disclosure Project) works to improve corporate awareness through measurement and disclosure as a way to effectively manage carbon and climate change risk. CDP encourages companies and cities across the world to measure and disclose their environmental information.
- The Global Reporting Initiative (GRI) is an international, independent organization that helps businesses, governments and other organizations understand and communicate the impact of business on critical sustainability issues using the GRI Guidelines, which enable organizations to measure and understand their most critical impacts on the environment, society and the economy.
- The Center for Resource Solutions' Green-e program for renewable energy certification can help organizations purchase green power with confidence, as the program sets standards for voluntary green power and certifies retail green power products.

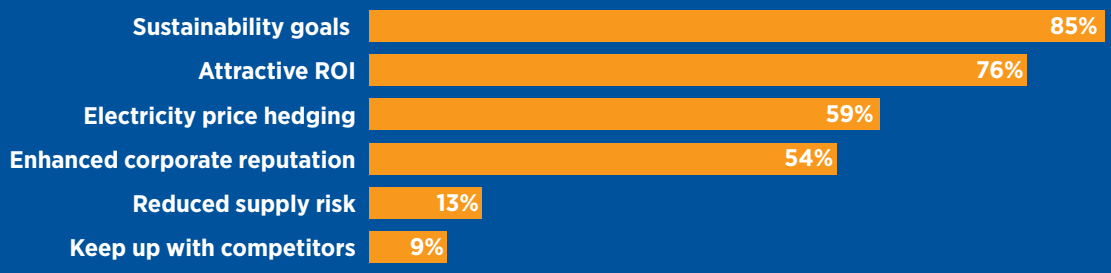
Demonstrate civic leadership. Being among the first in a community to purchase green power is a demonstration of civic leadership. It makes a statement that an organization is willing to act on its stated environmental and social goals. Committing to green power can also demonstrate a company's willingness to innovate and reduce long-term business risk. See Chapter 10, Resources for Additional Information, for details.

Generate positive publicity. Buying green power affords an opportunity for and builds on existing public recognition and public relations activities. Companies that are in the public eye benefit from being responsive to the concerns of environmentally conscious customers, shareholders, regulators and other constituents. Programs promoting green

power, such as EPA's Green Power Partnership or the Center for Resource Solutions' Green-e Program provide assistance in reaching broad audiences to convey the benefits of green power purchases.

Corporate Motives to Pursue Renewables

A 2016 survey of corporate participants on motives to pursue renewables indicates that most companies view their renewable energy purchases as part of a larger commitment to meet corporate sustainability goals. The survey results for corporate motives are shown below:



Source: O'Shaughnessy, E., Heeter, J., Liu, C., and Nobler, E. 2016. Status and trends in the U.S. voluntary green power market (2015 data). National Renewable Energy Laboratory. Retrieved from https://www.nrel.gov/docs/fy17osti/67147.pdf, p. 36, citing PWC study.

Improve employee recruitment and retention. Leadership on renewable energy may improve employee morale, productivity, retention and talent acquisition. A Tandberg-Ipsos MORI survey report of employees in 15 countries showed 80 percent of survey respondents (81 percent in the United States) preferred to work for organizations with an environmentally friendly reputation. A McKinsey survey found that company executives in the sustainability leaders' group (companies that are more adept at capturing value through sustainability) more often report that sustainability is important for attracting and retaining employees than respondents at other companies. A University of California - Los Angeles study found that for companies that voluntarily adopt green practices and standards, employees are 16 percent more productive than average.

Improve student recruitment and enrollment. In an annual survey of college applicants and their parents, the Princeton Review found that "a majority (61 percent) of respondents said having information about colleges' commitment to environmental issues would contribute 'strongly,' 'very much,' or 'somewhat' to their application/attendance decisions." Underlining the point, the Princeton Review also ranks the Top 50 Green Colleges and reports sustainability information for over 300 more schools in the Guide to Green Colleges.

Differentiate products or services. By purchasing green power, a company may be able to differentiate its products or services by offering them as "made with certified renewable energy." For example, businesses and consumer goods recognized by the Center for Resource Solutions' Green-e program can display the Green-e logo on their company websites and product packaging to indicate use of 100 percent certified green power in the manufacturing of the product.[8] Some companies also find that producing their products with green power gives them an advantage in marketing to customers who are trying to "green" their supply chains. For example, Steelcase, a furniture manufacturer, uses a scorecard to grade suppliers' performance, including a sustainability metric. One of the scorecard's listed best practices is purchasing renewable resources. Steelcase has also helped suppliers negotiate volume pricing for purchasing renewable energy certificates (RECs).

[8] Green-e certifies both renewable energy products (sold by utilities and other energy suppliers and marketers) and companies and products (consumer goods) that use or are made with certified renewable energy.

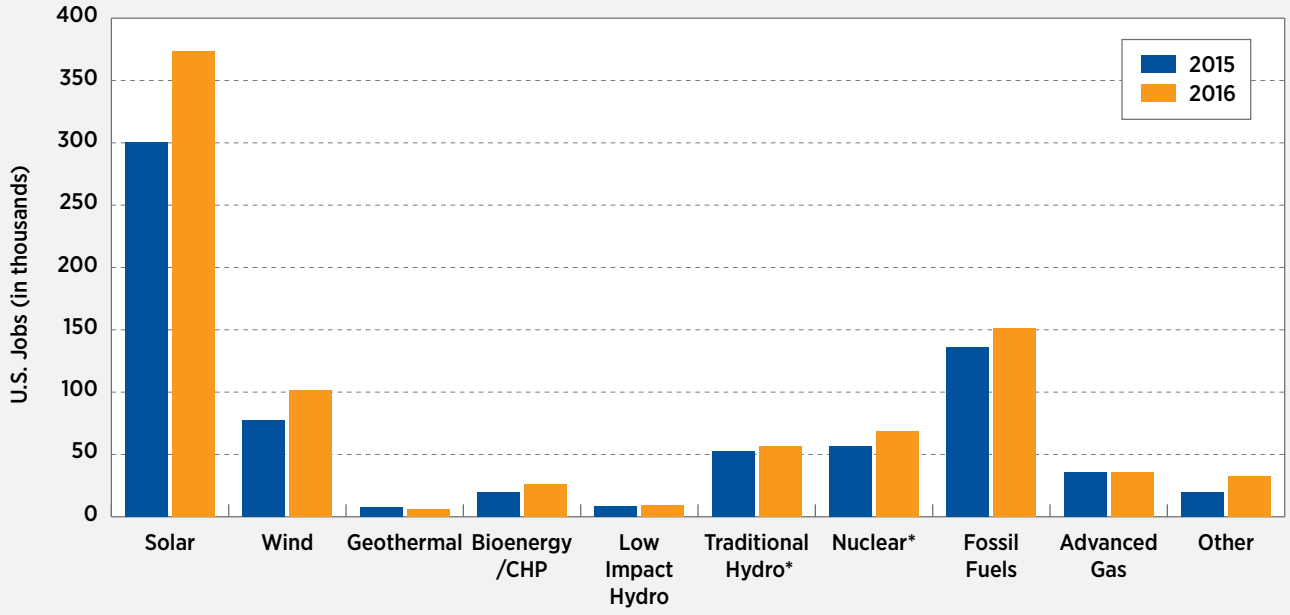
Case Study: Demonstrating Community Leadership

In 2013, Maplewood, Missouri, undertook a GHG inventory of the city as a first step in developing a GHG emissions reduction action plan. Two years later, the city's sustainability commission and city government launched the Maplewood Green Power Community Challenge to motivate local government, businesses, and citizens to install solar or purchase renewable energy certificates, with the goal of qualifying as an EPA Green Power Community. When the challenge began, the goal was to match 3 percent of the city's energy use with green energy. The residents and businesses of Maplewood showed such overwhelming support of the Green Power Challenge that they doubled the original goal and are now matching 6 percent of the community-wide total electricity use with green power. Led by the city government and the Maplewood-Richmond Heights School District, there are approximately 200 homes supporting green energy either by installing solar or participating in the local utility's Pure Power program. About 20 Maplewood businesses are purchasing RECs, installing solar, or a combination of the two. In 2016, EPA named Maplewood the Green Power Community of the Year.

Development of Domestic Energy Resources

Stimulate domestic economy. Manufacturing, installing and operating renewable technologies in the United States requires a trained energy workforce. By purchasing green power, organizations increase aggregate demand, leading to creation of high-quality, high-paying jobs that can help grow the local economy (see Figure 3-3). Renewable energy facilities can also increase the local tax base and provide income to farmers and rural communities, who can benefit through landowner lease payments. Green power generation is an important growth sector that can simultaneously boost the nation's economy and create jobs, while also meeting the nation's energy requirements with renewable domestic resources.

Figure 3-3. U.S. Jobs by Electric Power Generation Technology, Q2 2015 to Q1 2016[9]



*Note: Hydro and Nuclear increases due to resolving suppression errors in 2015.

*Note: The methodology was revised in 2016 to capture subcontractor employment in Nuclear and Traditional Hydro, employment totals are not reflective of growth year over year. Job figures in chart are only related to electric power generation and associated technologies.

[9] U.S. Department of Energy. (2017). *U.S. Energy and Employment Report*. Retrieved from https://www.energy.gov/downloads/2017-us-energy-and-employment-report.

The Costs

There are several factors that can affect green power costs; most of them depend on the choices an organization makes. These factors include the following:

- Green power product option (discussed more in Chapter 4)
- Green power supplier (e.g., competitive bid or not)
- Renewable resource and technology type (e.g., wind, solar, hydro, biomass)
- Quantity of green power purchased
- Duration and terms of contract
- Available incentives for green power
- Location of the generator or consumer

Figure 3-4 illustrates the levelized costs of renewable and fossil fuel technologies and shows that several clean energy technologies are now cost-competitive with conventional energy sources.[10] Despite this progress, the product type an organization chooses can make a big difference in cost and in how that cost is incurred. For example, even if the extra cost is low, purchasing unbundled RECs still comes at a cost premium on top of the standard electricity cost to the consumer. The same is usually true for purchases of green power from a utility.

In contrast, the competitive costs for some renewable energy technologies shown in Figure 3-4 have made self-generation and long-term contracts or direct purchasing from generators more accessible to an increasing number of organizations.

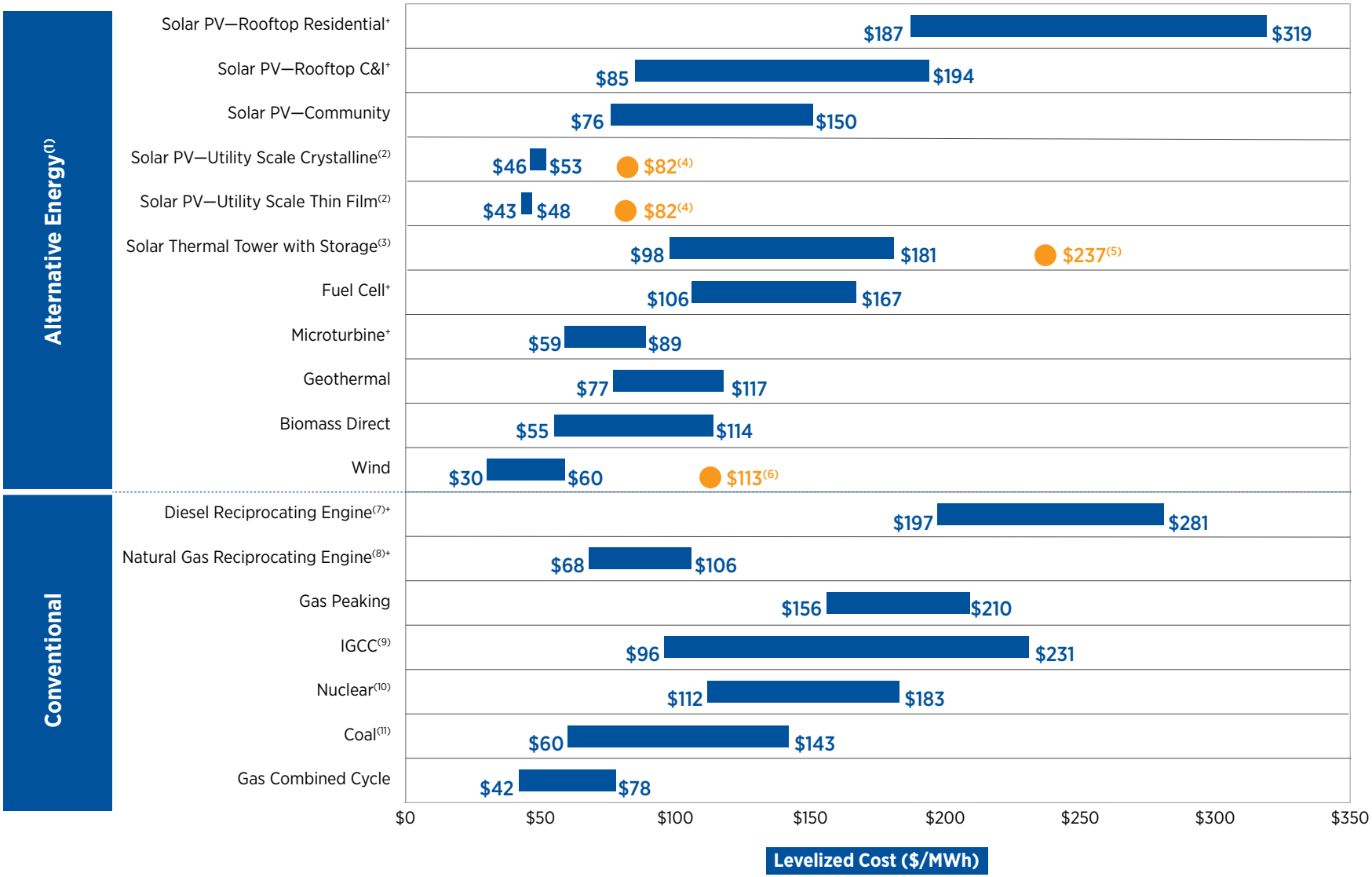
For example, while self-generation can require a major capital outlay that varies significantly depending on the size of the installation, that cost can be recovered over time through stable and, in some cases, lower ongoing operating costs.

Long-term contracting for electricity supply avoids the upfront capital cost and may also provide competitive and predictable electricity costs depending on the contract terms. In some states, solar companies will capitalize, own and install a solar project at an organization's site with a commitment from the host organization to purchase the output over a period of years. Alternatively, creditworthy large energy consumers may be good candidates for long-term contracts for off-site green power supply from the utility grid. The risk with long-term contracts is that future electricity prices may turn out to be lower than expected, and the organization is locked in to the higher price specified in the contract. Some contracts can specify which party accepts the market risk for higher electricity prices.

These procurement or product options may allow for cost savings over the life of the project or contract. Chapter 6, Contracting for Green Power, suggests methods for minimizing green power purchase costs as part of a procurement plan.

[10] Levelized cost of electricity (LCOE) is used to compare the relative cost of energy produced by different energy-generating sources, regardless of the project's scale or operating time frame. LCOE is a calculation accounting for all of a system's expected lifetime costs (including construction, financing, fuel, maintenance, taxes, insurance and incentives), which are then divided by the system's lifetime expected power output (in kilowatt-hours). All cost and benefit estimates are adjusted for inflation and discounted to account for the time-value of money.

Figure 3-4. Levelized Cost of New Power Generation Technologies in 2016[11]



Note: Here and throughout this presentation, unless otherwise indicated, analysis assumes 60% debt at 8% interest rate and 40% equity at 12% cost for conventional and Alternative Energy generation technologies. Reflects global, illustrative costs of capital, which may be significantly higher than OECD country costs of capital. See "Unsubsidized Levelized Cost of Energy—Cost of Capital Comparison" page for additional details on cost of capital. Analysis does not reflect potential impact of recent draft rule to regulate carbon emissions under Section 111(d). See Appendix for fuel costs for each technology. + Denotes distributed generation technology. REC Prices

[11] Lazard. (2017). *Lazard's Levelized Cost of Energy Analysis—Version 10.0*. Retrieved from https://www.lazard.com/media/450337/lazard-levelized-cost-of-energy-version-110.pdf.

REC Prices

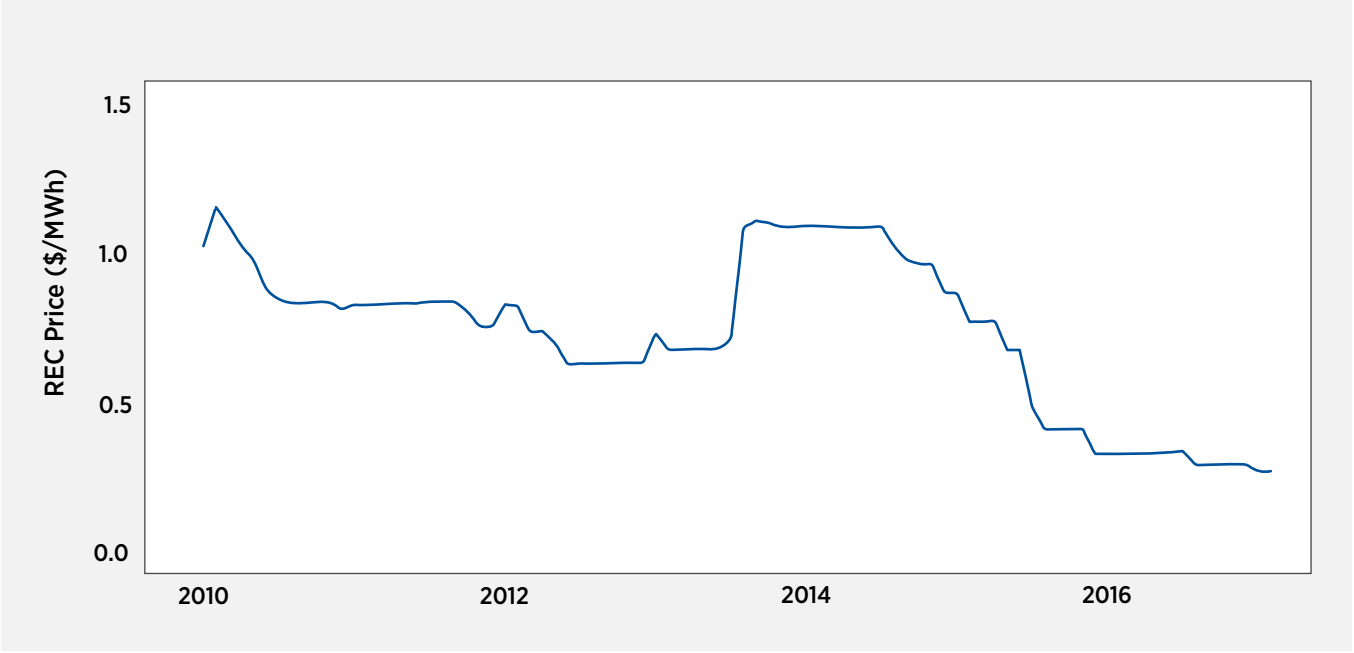
The premiums associated with green power were originally conceptualized as representing the incremental cost of the renewable resource above the utility's "avoided cost," meaning the cost of building the next power plant the utility will need, discounted to today's present value. This avoided cost can be quite low, hence, many green power products available from utilities today are offered at a price premium over the retail electricity price.

However, trading of RECs separate from electricity has led to pricing that is based more simply on the supply of and demand for RECs. In a competitive voluntary national market, RECs have become commodities, and REC supply currently exceeds demand nationally. This has driven wholesale REC prices down in recent years. Figure 3-5 below tracks the wholesale prices of wind RECs traded in voluntary markets from 2009 to 2015, as reported by REC brokers. These wholesale prices typically reflect large quantity transactions of national wind RECs. The REC price in a retail transaction may be 5-10 times higher, depending on the volume purchased, the resource type and the location of the generator.

Regional prices may also vary, especially where there is competing demand for RECs to satisfy utility mandates to acquire and supply minimum percentages of renewable energy or where specific renewable resources may not exist (i.e., low-impact hydropower).

If an organization owns the green power generating facility and keeps the RECs, there is no additional cost for RECs.[12] In certain direct or retail purchase options, the acquisition of RECs may be built into the cost of long-term contracts. Ownership of RECs in this case is the result of contract negotiation. Because the price is not reported and may not even be separately specified, there is no visibility into REC prices for such transactions.

Figure 3-5. Trends in Voluntary National Wholesale Wind REC Prices[13]



[12] In many cases, on-site generation is owned by a third-party, who (as project owner) may choose to sell the RECs to someone else. Organizations hosting on-site projects but contracting for the power should make sure the contract is explicit about which party owns the RECs if the hosting organization wishes to claim it is using green power.

[13] O'Shaughnessy, E., Heeter, J., Cook, J., and Volpi, C. (2017). *Status and Trends in the U.S. Voluntary Green Power Market (2016 data)* (p.21). National Renewable Energy Laboratory. https://www.nrel.gov/docs/fy18osti/70174.pdf.

Contracting Challenges

Purchasing green power can be challenging, depending on the supply options available and the local regulatory environment. If an organization chooses to pursue long-term contracting, for example, it will incur transaction costs stemming from soliciting and vetting bidders, negotiating contracts and obtaining legal advisory services. These types of procurements are customized agreements.

If an organization chooses to pursue generation that it owns and operates, it will need to ensure site control (if off-site), undertake engineering feasibility studies, determine equipment size and type, obtain permits, design and specify the installation, secure a vendor, and contract for installation as well as operations and maintenance. If the project is on-site, but owned by someone else, the organization hosting the project may face many of the same challenges pertaining to long-term contracts and will need to address concerns about how the installation will affect the building or the facility's operations.

Although organizations purchasing green power for the first time may need to invest extra effort to learn about the market and available options, these costs often decrease significantly over time as the buyer gains experience with the process. Following the information and strategies provided in this guide, particularly Chapter 6, should help reduce the contracting challenges faced by new purchasers of green power. In addition, sample contract templates are publicly available to help buyers avoid difficulties in signing a green power contract (see Chapter 10, Resources for Additional Information).

Public Relations Considerations

Organizations can ensure the credibility of their green power purchase by buying green power as part of a broader environmental management strategy or program, as well as by working with third-party organizations for independent auditing, certification, endorsement and minimum purchasing benchmarks.

Organizations purchasing green power can experience public relations and internal challenges, which can fall into the following categories:

- **Conceptual.** Some people may struggle to understand that the REC market instrument represents the intangible environmental attributes of generation. RECs are an inherently separate commodity and also trade separately from physical electricity. Nevertheless, RECs are the legal accounting instrument in the U.S. market for voluntary green power use and purchasing, and they are supported in GHG accounting guidance and state RPS policies. Their validity to representing the conveyance of environmental attributes of green power is also founded in case law. Educating stakeholders about how purchases of specified electricity work in electricity markets can help, and sourcing green power from projects within the organization's local electricity grid may help minimize confusion.
- **Purchase credibility.** Questions about whether an organization really receives what it claims it bought can be easily addressed through greater transparency. Example efforts to improve credibility and transparency include purchasing renewable energy that is certified and verified by third-party certification programs and use of facilities whose RECs are tracked in independent electronic tracking systems.

- **Market impact.** Some stakeholders may struggle to understand or accept the benefits of a national renewable energy market in which new development and generation of renewable energy will depend on sufficient demand. They may be concerned that purchasing green power from existing renewable facilities does not have a big enough impact on the overall supply of renewable energy due to current national levels of supply and demand of RECs. If these concerns are important to an organization, it may want to emphasize purchases from new facilities or leverage its resources to help a new renewable facility get built. This may offer added reputational benefits beyond the core renewable energy usage and emissions rate offered by all REC-based green power supply options.[14]

[14] Center for Resource Solutions. (2016). How renewable energy certificates make a difference: The impacts and benefits of buying renewable energy. Retrieved from https://resource-solutions.org/wp-content/uploads/2016/03/How-RECs-Make-a-Difference.pdf

CHAPTER

4

Green Power Product Options

To view the full Guide, visit https://www.epa.gov/greenpower/guide-purchasing-green-power

DOCUMENT MAP

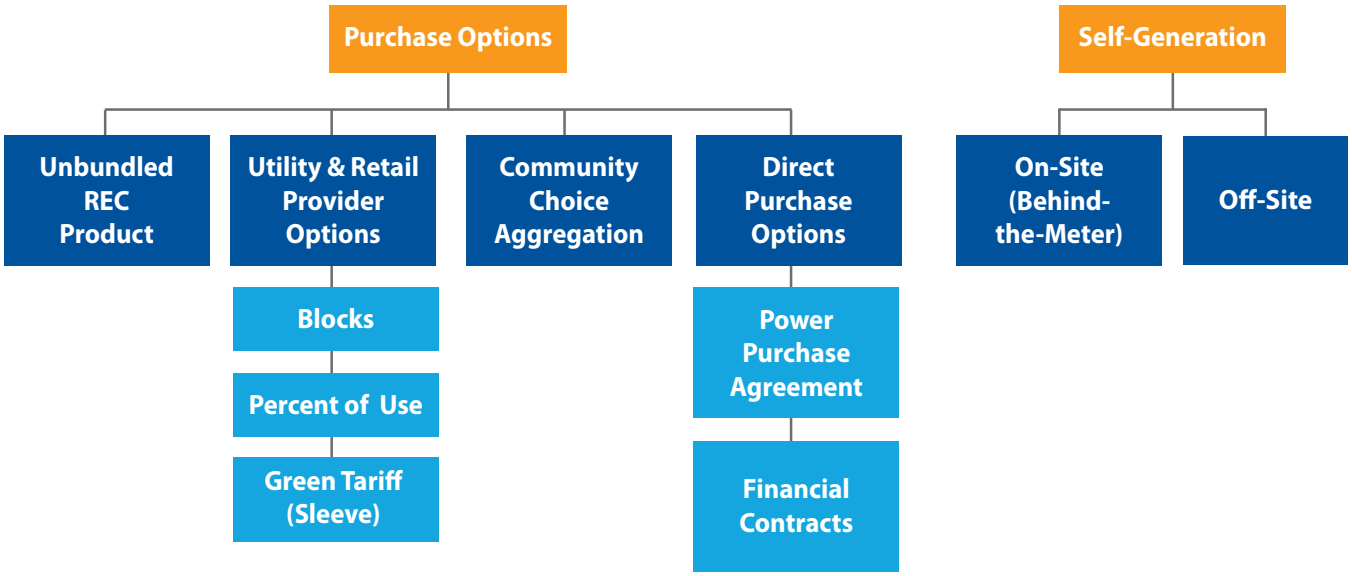
Green power can be procured in several different ways, however, all forms of green power supply and consumption include renewable energy certificates (RECs). If an organization chooses to purchase green power they may procure it from a local distribution utility, from competitive power suppliers, or directly from a renewable energy generator, depending on regulatory conditions in the state. Even in states where there are no green power retail suppliers and the utilities do not offer a green power option, any organization in the United States can buy RECs as a stand-alone product, "unbundled" from the organization's electricity purchases. For organizations considering owning or leasing green power generation facilities, the energy resources (e.g., solar, wind, biomass) available at the proposed generation site are an important initial consideration in determining a project's feasibility. Self-generation is not limited to on-site opportunities such as rooftop solar photovoltaic. Large organizations in particular might consider owning off-site generation where project siting may be more cost-effective and resource options more abundant.

The range of supply options in the market provides considerable flexibility. Organizations can consider factors such as price, long-term cost savings, generation resource type (e.g., wind versus solar), ease of procurement, the direct and indirect effect of their demand-side choices, and the location of the generating facility in their purchasing decisions. With these choices, organizations can usually find a green power product that will meet their desired goals.

Chapter 2 introduced the REC and emphasized its role as the tracking and accounting instrument for generation and use of renewable energy. As the basis for claiming and allocating the usage of renewable energy and its environmental attributes, ownership and retirement of RECs are essential with each green power option discussed in this chapter and all green power purchasing options in the United States. As discussed in more detail below, RECs are also offered as a stand-alone purchase option or product. When discussing these options and RECs in particular, it is important to clarify when one is referring to RECs as a tracking instrument essential to all green power product options, or to RECs as a stand-alone or unbundled product offering. It is also important to note that all supply options include RECs which convey ownership of the attributes and the right to claim renewable energy usage on a shared grid.

This document identifies six general green power supply options, including four types of green power purchase options and two types of self-generation options, as shown in Figure 4-1. Several of these options are described in more depth in Appendix B, Commercial Solar Financing Options.

Figure 4-1. Voluntary Green Power Supply Options



Purchase Options

Unbundled REC Products

Customers can buy green power in any quantity of megawatt-hours by purchasing RECs separately from electricity – an unbundled product option. Purchasing a standalone REC product allows organizations to effectively self-bundle the renewable energy attributes associated with the RECs with the organization's consumed physical electricity. This is in contrast to a supplier that sells a green power product that includes both the electricity and RECs bundled together, as in the case of either a retail green power product from your electricity supplier (i.e., utility) or alternatively through the direct purchase from a specified generator.

In purchasing unbundled RECs, organizations can claim receipt of the environmental attributes of the REC-generating facility (or facilities) without affecting their physical electricity purchase and delivery options. Unbundled REC purchases can be scoped to meet an organization's electricity usage over any period of time, but monthly and annual contracts have historically been the most common transaction periods. Unbundled purchases may also be arranged as a percentage of monthly or annual electricity consumption or as a long-term fixed price contract.

Unbundled products provide versatility, making renewable electricity available to all grid consumers regardless of the location of the generator or consumer on the grid. Unbundled RECs also offer purchasers the flexibility to purchase renewable energy from any provider rather than being limited to a local electricity supplier. This expanded availability and ease of participation creates a larger market that supports market efficiencies, scalability and lower transaction costs, because a single REC purchase can cover a wide operational footprint through a single transaction. Due to their ease of acquisition, unbundled REC procurements often serve as an entry point for organizations entering the green power market. As they gain experience, organizations may become more interested in other supply options, such as self-generation or direct purchase from a green power project, in order to achieve cost savings or to have a more direct impact on increasingly incremental supply. Organizations may also pursue a combination of supply options that includes unbundled RECs to cover certain parts of their operations.

Purchasing unbundled REC products provides significant flexibility but also entails net premium expenditures in addition to electricity costs incurred by the organization, so this option does not yield cost savings. Because unbundled RECs are separate from electricity purchases, they cannot help purchasers hedge against increases in future electricity costs.

Dual Purposes of Renewable Energy Certificates

A REC is a tradable certificate that represents the generation of 1 megawatt-hour (MWh) of electricity from a renewable energy source. RECs serve two distinct purposes. One is as a tracking instrument essential to all renewable energy and environmental claims. The other is as a product option that may be purchased separate from electricity.

RECs as Accounting Instruments: All green power purchases are based on the ownership of RECs, which represent the environmental attributes associated with green power. Hence, an organization's claim that it uses green power can be substantiated only through the ownership and retirement of RECs. If an organization uses electricity from a renewable resource without also owning and retiring the REC, it is not considered to be using renewable electricity. Some renewable energy projects are not formally issued RECs by a tracking system and in these cases the project still produces environmental attributes in megawatt-hour increments that must be owned in order to substantiate green power use.

RECs as a Product Option: RECs may be purchased separate from electricity ('unbundled") as a way to buy green power. Organizations that buy unbundled RECs match them to all or a portion of their electricity used and may claim to be using green power with the attributes of the RECs.

Utility Retail Options

Customers may be able to buy green power from their local electricity supplier. Green power is an optional service offered by many utilities and competitive suppliers to allow customers to support a greater level of investment in renewable energy, often by paying a premium on their electric bills. In some states where retail electric choice is permitted, customers can switch electricity service providers if their current provider does not offer a green power product.

Utility supply options involve the sale of both the RECs and electricity as a single commodity product within the same utility bill. Some utilities may buy unbundled RECs and bundle them with their electricity service as green power. In some cases, the renewable electricity generator could be owned either by the utility itself or by a third party, but the customer purchases the REC-substantiated electricity from the utility. With the first two utility product options below, the transaction process is easy, but the product is usually sold at higher cost than conventional electricity supply. The third option below demands more involvement and transactional effort, but may afford other benefits. Utility product options typically include the following:

- A block option is a fixed energy quantity, often 100 kilowatt-hours, of 100 percent renewable electricity, offered for a fixed monthly price. The price is usually expressed as a price premium above the price of conventional power. Customers usually can sign up for as many blocks as they desire.
- Percentage of monthly use is an approach whereby customers may choose green power in an amount based on a fixed percentage of their monthly electricity use. In practice, this usually results in the purchase of blended green and conventional power, unless the customer chooses 100 percent green power. This is typically priced as a premium on a "cents per kilowatt-hour" basis over the standard rate. The monthly cost for these products varies with use and the percentage of green power chosen.
- A green tariff describes an arrangement by which regulators authorize a utility to negotiate a long-term contract for green power with an individual large customer. The traditional green tariff form is sometimes called a "sleeve" because it is a contract within a contract: the utility enters into a long-term contract with a third-party green power generator, and in turn contracts with the customer to purchase the RECs and electricity. Green tariffs can take several forms under a green tariff arrangement with the utility, renewable generator and green tariff customer taking different roles relative to each other in the transaction.

  In "sleeve" contracts, the utility provides the balancing power, distribution infrastructure and transactional services to the customer served by the green tariff. In this way, the utility meets its customer demands and retains revenue, while the customer can access green power without regulatory and transactional constraints.

  Some utilities have begun using a new form of green tariff, where the utility procures the long-term contract with the third party green power generator and allows multiple large customers to sign up for just a slice of the larger project. With these products, customers all have the same commercial terms and do not negotiate as many complexities.

  In states where retail access to generators is not authorized, green tariffs are an effective way for utilities to facilitate renewable electricity purchases for their customers. Usually, the utility is required to recover all costs of the long-term contract with the third party green power generator from the purchasing customer, to ensure that other utility customers do not bear any of the costs (or share the benefits) of the long-term contract.

Community Choice Aggregation (CCA)

A CCA is formed in accordance with a state policy that enables local governments to aggregate electricity demand within their jurisdictions and contract for electricity supply (often renewable energy) to serve that demand. Meanwhile, the existing electric utility maintains transmission and distribution services. CCAs are not authorized in all

states. As of this writing, they are authorized in California, Illinois, Massachusetts, New Jersey, New York, Ohio and Rhode Island.

The CCA often sources local renewable energy generation, contributing to the support of local employment and economic development. Depending on the renewable sources, aggregated demand and state incentives, the electricity rates of the CCA may add or remove net expenditures to an organization's electricity bill. In most cases, all customers in the CCA community participate by default, unless they choose to "opt out" of the program. Local governments periodically reassess CCA costs and benefits and can either modify or stop offering CCA contracts altogether. Hence, it is important to note that the availability of CCAs in the long-term is unknown and decisions regarding the green power itself are out of the control of the electricity consumer. Some CCAs have also been known to buy renewable power that traditionally has not been desired by the voluntary green power market.

Case Study: Engaging a Utility One-on-One to Achieve an Organization's Specification

Google has worked with its local utilities to negotiate customized one-on-one renewable off-takes, resulting in the purchase of 48 MW of wind energy from the Grand River Dam Authority (GRDA) for Google's Oklahoma data center, and up to 407 MW of wind from MidAmerican Energy for its Iowa data center facilities. Instead of Google buying energy directly (via a power purchase agreement (PPA)) from the developer who built the wind farm, the utilities enter into PPAs with local wind farms, and Google has agreed to a long-term purchase agreement with the utilities—essentially, a PPA within a PPA, or a sleeve contract. This approach places responsibility for integrating the output from the wind farms on the utility. The agreement calls for Google to pay GRDA a premium for the renewable energy.

Direct Purchase Options

In some states, organizations can contract directly with a specific third-party owned generator to obtain green power. Direct purchase options include both physical power purchase agreements (PPAs) and financial PPAs. Both types of arrangements offer an organization a tangible and clear association with a specific renewable energy facility.

Physical PPA. PPAs are long-term contracts (often 10 to 20 years, but sometimes longer or shorter) between the organization purchasing renewable electricity and a party that generates that electricity. The renewable energy generator can be on-site or off-site, but the buyer must be located in the same power market to allow for physical delivery of electricity. The contract specifies the electricity price (generally a long-term rate with a price escalation clause), the schedule for the delivery of electricity, and the transfer of RECs from the generator (seller) to the purchaser. The purchaser must ensure the RECs are included in the PPA for the electricity to be considered renewable and to substantiate green power use and environmental claims.

Physical PPAs are not available in all markets due to state regulations. In states without retail access, end-use consumers are not allowed to purchase directly from green power generators. Also, solar installers may be reluctant to offer third-party ownership and solar PPAs in states that do not shield them from regulation as a utility. Purchasing organizations will need to determine from state utility regulators whether PPAs with non-utility owners are an option. The benefit of PPAs are that they require little capital investment on the part of the purchasing organization, offer certainty of electricity cost and allow for the accrual of savings often within the first year.

It should be acknowledged that physical PPAs also present risks to the purchaser because they are a bet that future electricity prices will be higher than the PPA negotiated price. If electricity prices go lower than expected, the purchaser will forgo savings. Organizations could find that they are stuck with a PPA price that exceeds what others are paying. The underlying assumptions that go into determining the PPA price are often key to whether it will offer savings to the purchaser organization.

Financial PPA. A financial PPA, also known as a virtual PPA (VPPA) because the energy is not delivered to the buyer, is a long-term contract in which a generator and purchaser agree on a reference electricity settlement price (the "strike price," which may include an escalator rate). The electricity generated by the project is sold into a wholesale regional power market where the generator is located rather than delivered to the buyer, and therefore the buyer's consumption of electricity can occur in a different power market than where the renewable energy generator is located, including in a traditionally regulated retail electricity market.

In a financial PPA, any difference between the settlement price and the wholesale market price is balanced by both transacting parties over the life of the contract. On a monthly basis, if the generator earns more from the wholesale market than the strike price, it pays the extra revenue to the purchaser; if the generator earns less than the strike price, the purchaser makes up the difference to the generator. Hence, this option is also referred to as a contract for differences.

The financial PPA is a hedge for both parties, ensuring fixed revenue to the seller and fixed costs to the buyer. As a green power purchase option, a financial PPA of necessity must convey RECs to the buyer. In essence, a financial PPA is a hedge against rising electricity prices combined with an unbundled REC contract, where the cost of RECs varies depending on the difference between the wholesale market price and the agreed upon settlement price. In order for the contract to have a hedge value, there must be correlation between the wholesale market where the renewable energy project sells its electricity and the retail market where the buyer consumes their electricity.

As with a physical PPA, a financial PPA does not protect the buyer against the risk of lower retail electricity prices. (Similarly, the seller is protected against lower wholesale market prices, but would miss out on extra revenue from higher retail electricity prices.)

Some of the advantages of financial PPAs are as follows:

- Organizations may be able to obtain long-term cost stability even when they are located in states that do not allow retail choice and they lack authorization to transact physical PPAs in the market where they operate.
- The organization entering a financial PPA can continue to purchase electricity at retail from its usual supplier.
- If the financial PPA is undertaken with a project under development, it may support a strong claim of directly adding new green power capacity and can be used by the developer to help secure project financing.

Financial PPAs also have some risks:

- If the strike price is consistently above the wholesale market price, the purchasing organization will be constantly making up for the generator's generation revenue losses.
- If the parties are located in different regions, it is important that the retail price the buyer pays for electricity is influenced in the same direction as the movement in wholesale market prices that the seller receives. Stated another way, the price of electricity in the wholesale market where the renewable generator is located and the retail electricity price of the organization's operational use of electricity must have a high degree of price correlation for the purchasing organization to realize an economic hedge.
- Even if the parties are located within the same region, if the region uses locational marginal pricing to value energy depending on supply and congestion, the parties may face different prices depending on each parties' sub regional locational marginal pricing. Again, it is easier to agree on a strike price when the prices that both parties face move in parallel.
- There is a difference in value to the grid between energy delivered by the generator to its nearest node and energy that is delivered to a transactional market hub. It is often desirable that the purchasing organization negotiate the strike price at the hub to remove the cost and risks associated with power delivery.

From the purchasing organization's perspective, the keys to a satisfactory financial PPA are to:

- Make sure both parties to the financial PPA face the same wholesale electricity markets so that the retail price paid by the buyer is correlated with the movement of wholesale market prices where the generator is located.
- Understand that a low strike price benefits the purchaser because any revenue from energy sales earned by the generator must be paid to the purchasing organization.
- Evaluate carefully all assumptions in determining future prices. This requires an understanding of how the wholesale electricity market operates, as well as the expertise to develop realistic expectations about future wholesale prices.

- Diligently negotiate the price and allocation of the risks associated with power delivery because the organization is not receiving the power directly.
- Be aware that if the wholesale price falls, that benefit will not be available to the purchasing organization because it will have to pay the difference between the low market price and the agreed upon strike price, while competitors in that market may be getting lower electricity prices. It is a choice between paying the same as everyone else (regardless of price volatility) and hedging against rising electricity prices.

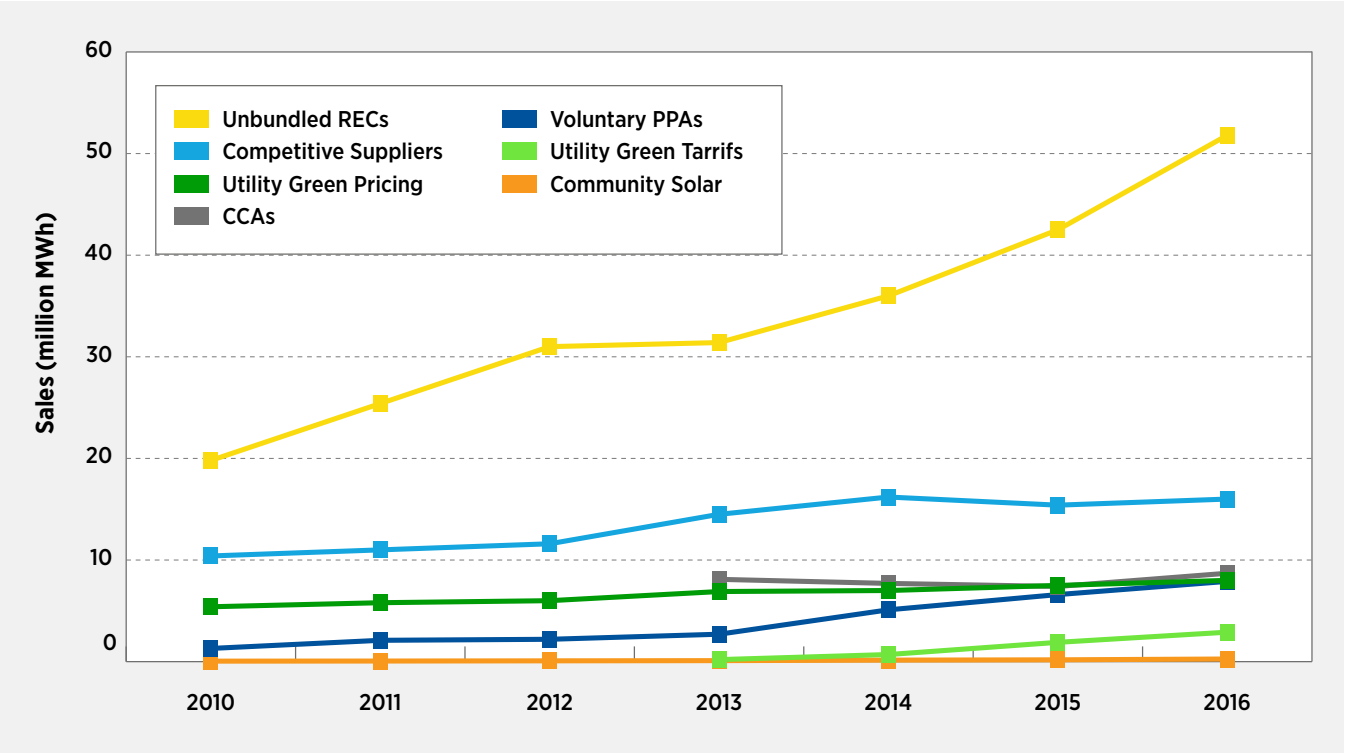
Table 4-1 breaks down the sales of green power by the four major green power purchasing types in 2016. These sales do not include self-generation options, which are discussed in the following section. Of the several different green power purchasing options, unbundled REC products are the most popular voluntary market sales option. Figure 4-2 shows the use of these options over the past several years in terms of total sales volume. It is important again to reinforce that all these supply options involve a REC to substantiate the options as green power.

Table 4-1. Voluntary Green Power Sales in 2016 (MWh)[1]

Options for Purchasing Green Power	
Unbundled REC Products	51,800,000
Utility Retail Options	26,989,000
Community Choice Aggregation	8,378,000
Direct Purchase Options	8,149,000
Total	**95,450,000**

[1] O'Shaughnessy, E., Heeter, J., Cook, J., and Volpi, C. (2017). *Status and trends in the U.S. voluntary green power market (2016 data).* National Renewable Energy Laboratory. Retrieved from https://www.nrel.gov/docs/fy18osti/70174.pdf

Figure 4-2. Green Power Sales from 2010 to 2016[2]



Self-Generation Options

In addition to purchasing green power, organizations can own or lease and generate green power either on-site at their own facilities (behind the meter) or at an off-site location.

Green power technologies for self-generation include solar photovoltaics, wind power, fuel cells and electricity storage that use renewable fuels. Large facilities sited near a municipal landfill or sewage treatment plant may be able to use recovered methane gas for on-site electricity and/or heat production. The following describes each of these and additional options in more detail:

- **Solar.** Solar photovoltaic (PV) systems can be scaled to almost any size from a few kilowatts up to many megawatts. PV systems may either be ground-mounted or rooftop-installed on schools, homes, community facilities and commercial buildings. They can be integrated into a building, displacing other building material costs, such as those for roofing shingles or car park shading.
- **Wind.** Wind turbines vary in height and blade sweep, with individual turbines having the ability to generate from hundreds of kilowatts up to several megawatts in capacity. Wind turbines may be best-suited for off-site applications. On-site installations are usually only possible in nonurban areas and often require zoning permits to exceed 35-foot height restrictions (a tower for a 250-kilowatt turbine is 130 feet high, with a blade sweep of 98 feet). Such installations usually require approximately 1 acre of land per turbine and wind speeds that minimally average 15 mph at a 150-foot height. In addition, placing turbines in urban areas is inadvisable because nearby buildings may create wind turbulence that can disrupt the turbines' performance.

[2] O'Shaughnessy, E., Heeter, J., Cook, J., and Volpi, C. (2017). *Status and Trends in the U.S. Voluntary Green Power Market (2016 data)*. National Renewable Energy Laboratory. https://www.nrel.gov/docs/fy18osti/70174.pdf.

- **Fuel cells and electricity storage technologies.** Fuel cells are another way of producing power. Some fuel cell technologies emit essentially no air pollution through the conversion of the fuel into electricity, but the electricity they produce cannot be considered green power unless they operate on a renewable energy-produced fuel source, such as landfill gas or hydrogen derived from PV or wind power. Fuel cells are similar to other electricity storage technologies in this respect.
- **Landfill and wastewater methane gas.** Methane gas derived from landfills or anerobic digesters at wastewater treatment plants, livestock or agricultural operations, or organics (e.g., food waste) management facilities can be used to generate electricity. The methane gas is converted to electricity using an internal combustion engine, gas turbine, direct combustion boiler and steam turbine generator set, microturbine, or other power conversion technologies. Most methane gas projects produce from 0.1 to 4 megawatts (MW) of electrical output with many landfill methane projects generating in the 5-20 MW range and some as large as 50 MW.
- **Biomass**. Biomass is plant material burned in a boiler to drive a steam turbine to produce electricity. Biomass systems can also be good for producing combined heat and power at facilities with large thermal loads. Biomass projects are best suited to locations with abundant biomass resources (often using waste products from the forest industry or agriculture). Although biomass is considered a renewable resource, it may have air emissions impacts. Furthermore, not all biomass is eligible under voluntary market certification standards. Buyers of biomass-based green power should consult with program administrators and third-party certification programs to determine criteria for eligible biomass resources.

Case Study: Reducing the Cost of Green Power through Virtual Net Metering

It pays to know and take advantage of state financial and regulatory incentives. Some states allow virtual (or remote) net metering, where the renewable generator is off-site but the output can nevertheless be credited against the customer's electricity bill through an accounting reconciliation. Some states offer group net metering, where multiple owners can share in the billing credits from a single off-site project. In Massachusetts, municipalities and other governmental entities can receive billing credits for an off-site installation they don't own if they are the "host customer," meaning they are assigned 100 percent of the output. UMass-Boston is using this virtual net-metering rule to purchase the output from a 3.9-MW solar installation at Boston Business Park, home to several warehousing and distribution companies. The PV array is owned by Altus Power America, which sells the energy produced to UMass-Boston through a net-metering credit purchase agreement. UMass-Boston will avoid up to $5 million in energy costs over the next 20 years. The electricity is not considered self-generated because the university does not own the solar project.

Self-generation of green power can occur on-site (within the organization's facilities at the point of consumption) or off-site. Under both scenarios, the organization must retain ownership of the RECs in order to claim the use of renewable electricity.

On-site Generation

On-site renewable generation is a visible demonstration of the organization's environmental commitment. Generating power on-site also offers control over electricity expenditures. However, even though the project is on-site and providing electricity to the owner, the organization must either retain and retire the RECs to claim that it is using renewable electricity from the on-site project or replace any self-generated RECs that are sold, in order to claim that it is simply using renewable electricity based on the replacement REC attributes. (See REC Arbitrage on pp. 4-11)

In many states, excess electricity generated from on-site renewable generators may be sold back to the grid at the same price at which power is bought (or at the price of wholesale power), through a policy option called net metering. Net metering is a cost recovery policy that helps improve the financial return for qualifying on-site renewable power systems, although net metering is often limited to smaller behind-the-meter installations. For example, the state of California limits on-site generation systems to 1 MW (or up to 10 MW for up to three biogas digesters) and the total aggregate generation of all net-metered systems' capacity may not produce more than 5 percent of a utility's peak demand.

If energy storage is incorporated into on-site system design (and energy storage technology costs are declining), on-site renewable generation can serve critical loads when power from the grid is interrupted, as well as when the renewable resource is not available. This ability to operate independently of the power grid can be a great advantage and contribute to project economics where grid stand-by or demand charges may be high.

REC Arbitrage

The price of RECs may vary depending on market dynamics, such as supply and demand, and market policies, such as renewable energy mandates with which utilities must comply. If there is a significant discrepancy between REC prices in the voluntary and compliance markets, an organization may be able to leverage these differences to its financial advantage by selling its eligible renewable energy project's RECs for a higher price in a compliance market and purchasing replacement RECs from another renewable project at a lower price. This is commonly referred to as REC arbitrage (also a REC swap).

This opportunity could arise in the case of self-generation, as well as where an organization purchases power directly from a generator, as in a PPA. In either case, the REC owner has the choice to keep the RECs or sell them into a compliance market where the REC value is greater. However, if the organization sells the RECs and buys replacement RECs, it would have to claim the attributes of the replacement RECs rather than the attributes of the generator that supplied the energy.

For more information on REC arbitrage please see the U.S. EPA's guidance document titled "Renewable Energy Certificate (REC) Arbitrage." https://www.epa.gov/greenpower/renewable-energy-certificate-rec-arbitrage

Off-site Generation

Under certain circumstances, organizations may prefer to own renewable electricity technologies off-site, away from their own facilities. If the off-site generation is owned by the consuming organization, the RECs produced can be retired by the organization and used to substantiate green power use claims. Similar to owned on-site generation, the organization can sell those RECs for additional revenue; however, doing so would negate the organization's ability to claim it is using green power, unless replacement RECs are purchased.

An organization may find advantages in owning off-site generation rather than on-site generation:

- **Resource availability.** Off-site generation projects might perform more favorably and produce more electricity due to the site's renewable resource characteristics. The organization could own a renewable generator in an area with better access to renewable resources, thereby maximizing the return on investment.
- **Better match to green power needs.** Land may be more available and cheaper off-site, allowing a larger generating project that more closely matches the organization's need for green power.
- **Easier permitting and regulation.** Regulations and permitting laws could be more flexible in some cases for an off-site electricity generation site. Zoning and safety laws with respect to proximity to other buildings and development are some of the key factors that could restrict on-site power generation at an organization's facility.
- **Utility benefits.** Locating a generation facility elsewhere on the grid may provide benefits to utility operations. In some cases, the utility may provide incentives to locate generation in specific areas to help solve reliability or congestion issues.
- **Economic benefits.** Organizations may choose off-site generation options in areas where they can sell the power at higher prices, where renewable incentives are stronger, or where there is greater opportunity for REC arbitrage.

Shared Renewables

Shared renewables projects, such as community solar, are an emerging off-site generation option that may allow an organization to purchase a share of a renewable energy system within its utility service area. For organizations that have rooftops unsuitable for self-generation and have cash flow or institutional constraints that prohibit ownership

of renewable power equipment, shared renewables (particularly solar and wind) give access to the benefits of owning renewable power at a more affordable upfront cost. The organization will typically receive utility bill credits and possibly the associated RECs produced from its share of the shared project output. Shared renewables may be implemented in a variety of ways, however, including arrangements where the consumer purchases, rather than owns, a share of the output. Also, some utilities offer green power retail options under the "community" or "shared" renewables nomenclature. Not all shared renewables options necessarily provide RECs to their participants. Therefore, an organization should carefully review the contractual terms, and perhaps the policy landscape, before investing in the project. If an organization does not receive the RECs associated with the shared renewables project, then it cannot claim to be receiving or using green power. Similarly, it is deceptive for shared renewable energy providers to sell generation or generating credits from their project as "green power" or "renewable energy" if the project owner does not convey the associated RECs to the project shareholders.

Green Power Supply Options Summary

Table 4-2 summarizes the seven main options for procuring green power, including both renewable purchasing options and self-generation options. The table compares each option based on the parameters of capital investment cost, terms of commitment and transaction complexity.

Table 4-2. Summary of Supply Options[3]

Supply Option	Unbundled REC Products	Utility Supply Options	Community Choice Aggregation	Physical Power Purchase Agreements	Financial PPAs / Contract for Differences	On-site Self Generation	Off-site Self Generation
Upfront Capital Investment	None	None	None	None	None	$$-$$$	$$-$$$$
Ongoing Expenditures Relative to Incumbent Electricity Option	Cost premium	Cost premium; tariff may offer savings	Varies	Cost savings over life of contract	Cost savings over life of contract	Cost savings over life of project	Cost savings over life of project
Term of Commitment	Varies; significant flexibility	Monthly; multiyear for green tariff	Consumer opt-out provision	Multiyear	Multiyear	Operational life of installed technology	Operational life of installed technology
Transaction Complexity	✪	✪	✪	✪✪✪	✪✪✪✪✪	✪✪✪	✪✪✪✪
Transaction Includes	RECs only	RECs + Electricity	RECs + Electricity	RECs + Electricity delivery + fixed cost of electricity	RECs + Hedge against downside price risk	RECs* + Electricity + Generator	RECs* + Generator + Revenue from electricity sales

*Many smaller renewable energy projects are not formally issued RECs from regional tracking systems, but nonetheless still generate environmental attributes.

[3] Note that Shared Renewables are not included in Table 4-2, as they may be offered under several different supply options.

CHAPTER

5

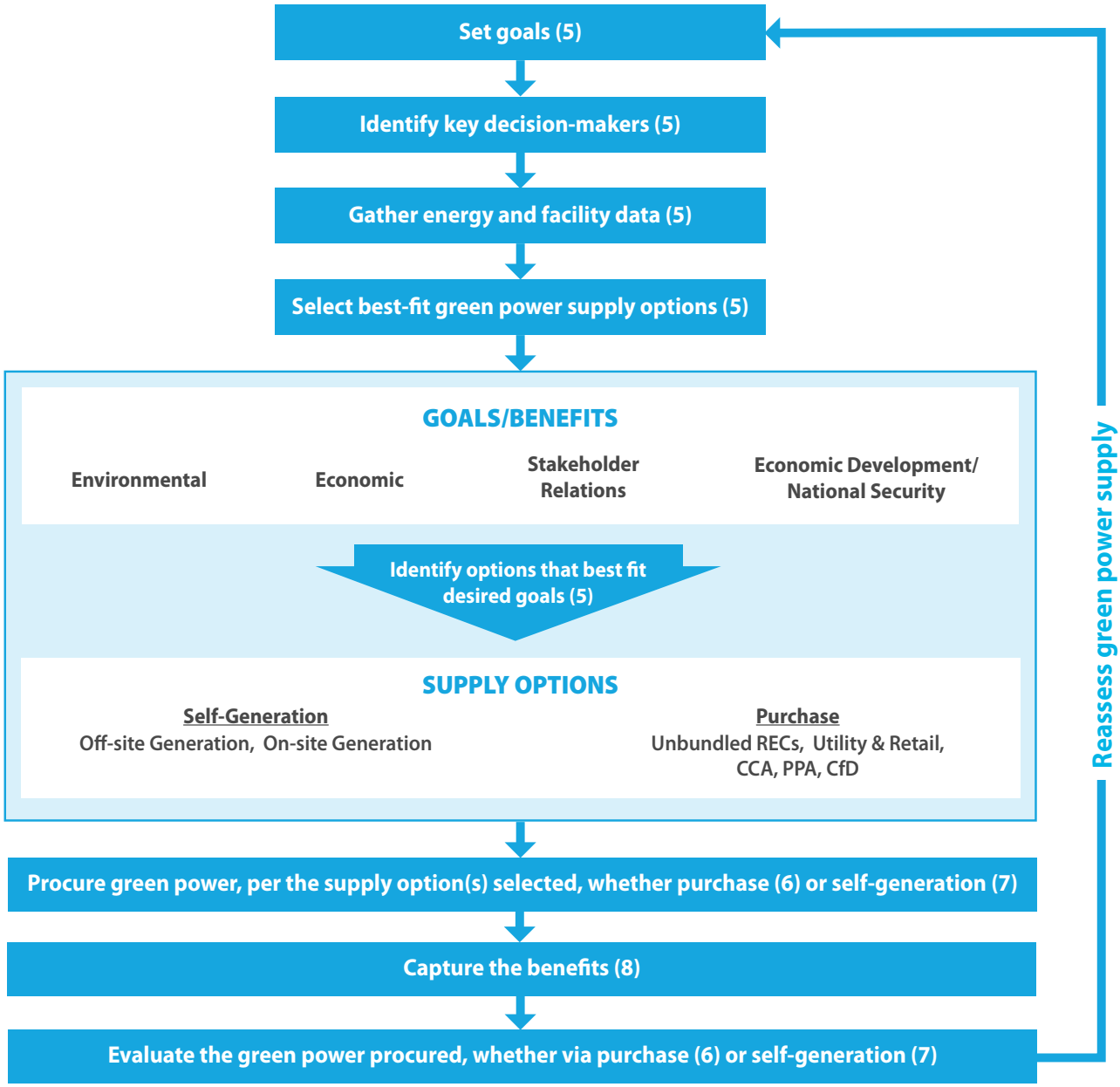
Using Organizational Goals to Guide Green Power Purchases

To view the full Guide, visit https://www.epa.gov/greenpower/guide-purchasing-green-power

DOCUMENT MAP

Determining an organization's renewable energy goals is the first step to selecting the appropriate green power supply option(s). Using key decision-makers' goals to guide the process will help an organization successfully select a green power purchase. Gathering energy use data for each facility will help the organization understand the amount of renewable energy that must be purchased to meet its goals. Knowing each facility's total energy use will also provide the basis to evaluate whether self-generation is a viable option. Once these steps are completed, an organization can develop a green power procurement strategy that aligns the available supply options with its goals. This process is illustrated in Figure 5-1 and further explained below.

Figure 5-1. Steps for Selecting Green Power Supply Options Based on Organization Goals



Note: Numbers in the figure refer to chapter numbers where more information can be found.

Setting Goals

Questions to consider

Clear goals are critical to purchasing the best-fit green power option, identifying metrics that will help evaluate progress and communicating a plan for green power within and outside an organization. At a minimum, the organization should consider the following questions when setting goals:

- Why is the organization considering purchasing green power? What does the organization hope to get from it?
- What selection criteria are important to the organization?
- Does the organization have significant experience and expertise with energy procurement and management, or is it a passive electricity consumer looking to choose a unique energy product and provider for the first time?
- What selection criteria are most important (e.g. visibility, resource type, independent certification and verification, low cost and low involvement)?

Motivation of organization and types of goals

An organization's goals will be driven by its motivations for purchasing green power. The questions above will serve to bring management objectives and stakeholder inputs into the process of establishing an organization's overall energy and environmental goals. Some examples of goals are shown below:

- Achieve 100 percent green power use by 2030. Reduce emission footprint by 50 percent by 2020.
- Supply 50 percent of electricity use from on-site generation and the remainder from green power purchases.
- Add 10 megawatts of new green power capacity to serve electricity needs.
- Lower electricity costs by 10 percent compared to 2017 baseline, by 2025.
- Mitigate purchased electricity price increases.
- Hedge against electricity price volatility (if exposed to the wholesale market).
- Establish predictable electricity cost budgets through 2030.
- Increase reliability and security of supply for specific facilities or processes.
- Build brand recognition for specific products that can be marketed as "Made with Renewable Energy."
- Increase shareholder satisfaction by reducing emission risk or liability.
- Take visible actions in the community to demonstrate civic leadership and environmental commitment.
- Qualify as part of a green supply chain serving a larger business.

These sample energy and environmental goals fit into the four broad categories of green power benefits highlighted earlier in Chapter 3: environmental, economic, stakeholder relations and development of domestic energy resources.

Once the organization's goals are established, it is important that the organization document and communicate them to the public. These actions will help the organization ensure that there is internal agreement and awareness of the main motivations for purchasing green power, inform stakeholders (customers, business associates and the local community) of the organization's objectives, provide justification the organization can use to support its pursuit of green power as time passes, evaluate progress toward achieving green power goals, and adapt those goals over time. Organizations that clearly document and communicate these goals inspire and sustain the structural change that is needed to achieve those goals. Those goals and motivations will ultimately inform which green power supply option (see Chapter 4) is best.

Identifying Key Decision-Makers

The organization must identify key decision-makers who can approve the purchase of green power on a sustained basis over time, as well as the implementers who will assess the gathered energy, facility and energy market data to identify feasible options and obtain support from the organization and its stakeholders for green power purchases.

Importance of having a champion

The people in an organization who are interested in green power may be high-level decision-makers (such as senior C-level executives) as well as staff from departments such as the following:

- Purchasing
- Facilities/energy management
- Environmental health and safety
- Legal
- Corporate relations
- Marketing

A high-level green power champion is often critical to achieving green power goals, particularly because these decisions stretch across departments. This champion can help align the interests of the other key decision-makers and garner support from other important stakeholders.

Knowing key decision-makers

All of the interests and concerns of key decision-makers must be addressed early in the planning process. Not doing so may lead to disagreements later in the process. The list below identifies potentially influential C-level executives who may need to be involved in the decision to purchase green power.

- Chief Executive Officer (CEO) – The CEO is the integrator of the organization's growth, management and environmental objectives, and a key decision maker in approving green power purchasing options.
- Chief Financial Officer (CFO) – Because buying green power is ultimately a financial decision, it is important to have the CFO involved in and supportive of the decision.
- Chief Operating Officer (COO) – The COO may have overall responsibility for assessing the organization's emissions footprint and for determining the feasibility of different green power options, including whether to purchase or self-generate.
- Chief Marketing Officer (CMO) – The CMO leverages the green power activities of the organization to build the brand or the relationship with key target stakeholders.
- Chief Commercial Officer (CCO) – The CCO aligns green power procurement with the organization's commercial strategy and development.
- Chief Sustainability Officer (CSO) – The CSO is often charged with driving the environmental business actions of the organization and often possesses the decision-making power to move green power decisions forward

In addition, other departments may also be involved with the purchase of green power if such a decision aligns with their responsibilities. Facilities/energy management staff might be interested in how procuring green power could improve the efficient operation of facilities. Human resources might be interested in corporate sustainability efforts that may boost employee morale or attract better talent. Sustainability officers naturally have an interest in environ-

mental beneficial purchases. In some cases, all else being equal, decision makers will support green power if they can be convinced that it will not have a detrimental impact on their responsibilities.

Strategies for coordination with key decision-makers

Designating a contact person who can draw on experts from throughout the organization is an important step. Additionally, this primary contact can form and lead a cross-functional team to develop and implement a green power plan. The departments that are ultimately chosen to participate will depend on the type of green power supply options being considered. However, all departments that are relevant to the green power purchase decision should be identified and consulted early in the process. It also is important to involve senior management in planning and decision-making. Some organizations further involve their employees (or students, in the case of educational institutions) in selecting green power products.

A simple matrix like the one shown in Table 5-1 below is a useful tool for identifying high-level staff who have the most influence on an organization's decision to purchase green power. As Table 5-1 shows, gauging each stakeholder's level of interest and relative influence within the organization helps determine who must be on board with the decision. A stakeholder's influence within the organization can come in many forms: ability to influence or make a purchasing decision, to implement the purchase after it is made, to unlock financial and staff resources, and to evaluate legal and financial risks. Those that have high interest and high influence will need more frequent updates and consultations on progress towards the goal.

Table 5-1. Matrix for Internal Stakeholder Analysis

	Level of Interest: Low	**Level of Interest: High**
Level of Influence: Low	Monitor (Minimal Effort) e.g., Human Resources, CCO	Keep Informed (Supporters) e.g., COO, Facilities Mgt., Environmental Compliance
Level of Influence: High	Keep Satisfied (High Effort) e.g., CFO, CMO, Legal, Board Members	Key Players (Champions) e.g., CEO, Sustainbility Officers

Note: Assignment of individual decision-makers to different quadrants in Table 5-1 may vary depending on organization and leadership structure.

Gathering Energy and Facility Data

Obtaining reliable energy use data is important for developing goal metrics since total energy use is the denominator of any "percent green power" goal. Gathering energy use data is also a good way to focus attention on energy management and opportunities for efficiency. Gathering energy and facility data is important whether the organization is interested in purchasing green power or pursuing on-site or off-site self-generation.

Evaluating facility opportunities

Organizations may wish to organize data on renewable energy possibilities by building. As a preliminary step, organizations considering on-site generation can conduct a renewable energy survey of their properties to consider the following:

- Do the buildings have flat roofs or south-facing roofs with good solar access?
- Is the site windy enough to consider on-site wind, and is there enough acreage to install it?
- Are there other unique renewable energy opportunities either on or adjacent to the site (e.g., a sustainable source of methane gas that could be converted to energy, or feedstock for biogas digester)?

Later, these opportunities can be evaluated more rigorously if self-generation is consistent with the organization's goals.

Electricity use data collection

The organization should measure its facilities' energy use, including electricity and thermal, over at least the last two years to make an informed decision about its supply options. Annual electricity use can be calculated from the utility bills for each facility or business unit and for the entire organization. These data will help:

1. Evaluate the organization's energy performance and compare to local, state and national level energy use patterns and trends.
2. Determine the amount of green power that must be purchased or self-generated to match the organization's goals.
3. Evaluate the environmental impacts (e.g., GHG emissions) of the organization's current electricity use.[1]

The ENERGY STAR Portfolio Manager® tool can aid in comparing the organization's building energy usage with that of similar buildings nationwide while normalizing for other variables that influence energy use patterns.[2] Portfolio Manager also allows users to track electric demand, which is an important financial consideration and one that may guide the choice of a green power product. Portfolio Manager also facilitates the tracking of green power use allocated across a building portfolio.

Each organization should study its energy consumption data from the past few years, to evaluate variation and patterns in energy consumption on a seasonal, monthly and daily basis. Adjustments should be made for known acquisition or divestiture of assets. Monthly electricity consumption data are the most important, while peak demand and interval-meter data, if available, are useful in interpreting demand charges and tracking variation in energy usage with time. These detailed data can also help with selecting green power options that have the desired impact on the organization's energy use patterns.

Building ownership status

An organization's ownership of its building or facilities may also have implications for electricity use data collection. An organization that does not own or operate its building may pay for its electricity as part of an aggregate leasing cost and may not receive a separate bill. In such cases, the organization would need to estimate its electricity use by

[1] For guidance on how to conduct a GHG emissions inventory, see: Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard. World Resources Institute and World Business Council for Sustainable Development, March 2004. Available at http://www.ghgprotocol.org/standards/corporate-standard. Also Greenhouse Gas Protocol, Scope 2 Guidance. World Resources Institute, 2015. Available at http://www.ghgprotocol.org/scope_2_guidance.

[2] ENERGY STAR. (n.d.). Use Portfolio Manager. Retrieved from https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager

calculating the floor area of the facility in question and applying a national average electricity intensity use factor on a kilowatt-hour per square foot basis for that particular building type. A best practice is to be transparent about how the organization calculates electricity use when actual consumption figures are unavailable.

Case Study: Riding in the Slipstream of a Bigger Deal

Large corporations are leading the charge in direct renewable electricity purchasing, but medium-sized firms can benefit from power purchase agreements (PPAs) as well. Tech giant Amazon.com contracted to purchase about 90 percent of a new 253-MW wind farm in Texas. This was followed by Boston data storage firm Iron Mountain Inc., which contracted with the wind farm for the remaining 10 percent of output, sufficient to power all of its Texas operations—more than 75 facilities in total—as well as operations across additional states, providing long-term rate stability and allowing Iron Mountain to save $1.5 million annually. The purchase will cover about 30 percent of Iron Mountain's North American electricity footprint.

Other data collection considerations

Other relevant information to collect may include a general assessment of the energy market in which the organization operates, the organization's existing energy efficiency and sustainability efforts, and available resources. For example:

- Existing energy consumption and cost reduction objectives, and their effects on the procurement strategy for green power.
- Resources (time, staff, financial) that can be set aside for procuring green power, both in the short and long term.
- Electricity cost and rate information where the organization's facilities are located.
- Whether the organization operates facilities in a regulated or restructured energy market.
- Available incentives for self-generation, such as state or utility financial incentives. To identify available incentives, consult the Database of State Incentives for Renewables and Efficiency at http://www.dsireusa.org.

Choosing Green Power Options

Using goals to guide supply option choices

The next step is to determine the green power solutions that meet the organization's goals, factoring in the preferences of key decision-makers along with the energy use and other gathered data. For example, an organization that wants to manage fuel price risk might be more interested in entering into a physical or financial power purchase agreement (PPA). An organization that finds the reliability of its power supply to be most important might be more interested in on-site renewable generation coupled with storage. Likewise, organizations with facilities in multiple locations must determine whether to procure green power from one supplier for all of their operations, or whether to procure green power from different suppliers for each site based on a unique green power supply option that might be available to only specific sites. Selecting just one supplier tends to minimize transaction costs and the complexity associated with multiple contracts, while selecting a unique supplier for each site might maximize utility bill savings if some sites have access to less expensive green power products than others.

All green power product options are covered in more detail in Chapter 4. The section below identifies how well each green power supply option generally aligns with common organizational goals. It is important to note that ownership of renewable energy certificates (RECs) is required to substantiate an organization's environmental claims regardless

of the green power product option selected. Also, each option may be structured or designed differently to provide different benefits and have different impacts. Shared renewables may be offered in several different purchase options.

- **Self-generation options.** The initial high capital expenditure for self-generation is often recovered over the green power project's lifetime by avoided utility electricity costs, avoided purchases of RECs and financial incentives offered by utilities and government agencies. Self-generation can also serve as a financial hedge against rising electricity prices and volatile REC prices as self-generation locks the generator into a known electricity and REC cost over the life of the project.
  - **On-site generation.** Due to siting constraints, most on-site self-generation options are limited to solar photovoltaics and, in a few cases, biomass or wind. On-site green power generation can provide a visual demonstration of an organization's commitment to achieving environmental goals.
  - **Off-site generation.** Off-site options can potentially meet the organization's goals more effectively as they may be able to scale and generate more power while encountering fewer constraints than on-site generation. Off-site options may also qualify for various state or federal financial incentives.
- **Purchase options.** If self-generation is not a viable option due to limitations such as resource siting, capital financing, human resources and technical expertise, organizations can meet their environmental goals by purchasing green power. The type of energy market (regulated or restructured) can also determine the green power product options available.
  - **Unbundled RECs.** Unbundled RECs are the most prevalent and flexible product option used in the market. They are accessible to all organizations, as they avoid the challenges of siting, capital financing, complex transactions and technical expertise, but they add cost on top of electricity expenses since the organization is buying RECs in addition to paying for its conventional electricity use. Unbundled RECs can be sourced locally or nationwide, from a variety of different project types and sizes, from both new and older projects, and through long-term and short-term agreements. Purchasing an unbundled REC product that sources from a small group of local, new projects with a long-term purchase agreement may have similar environmental benefits to on-site self-generation or local PPA options.
  - **Utility retail products.** Off-the-shelf products, such as fixed blocks of green power or percent-of-use choices, allow organizations to buy small to large quantities of green power at very low transactional costs, but as with unbundled RECs, usually add incremental cost on top of electricity expenses. Different utility products will be structured differently in terms of where projects are located, the size and types of projects used, the age of projects used, and the length of the purchase terms. Some utilities combine unbundled RECs with their own electricity service, essentially offering a credible green power option through a single billing.
  - **Utility green tariffs.** Organizations can sometimes procure electricity and RECs through green tariffs, often referred to as a "sleeve" contract, through their utilities. Green tariffs in most cases offer a fixed price for green power, which provides predictability for budgeting, and may provide cost savings depending on the tariff negotiated. Green tariffs are available in a limited number of states at this time, but are the focus of continued interest by larger electricity consumers.
  - **Community choice aggregation (CCA).** CCAs allow certain jurisdictions (such as a municipality or county jurisdictions) to aggregate electricity consumers and procure electricity on their behalf from suppliers other than the local utility. The purpose may be to offer electricity at a price lower than the local utility, or to offer a product with more green power than is available from the utility. CCAs can therefore provide economic benefits and environmental benefits at a very low transaction cost to organizations within the CCA jurisdiction. Although participation is easy, electricity consumers have little to no control over the type of supply secured by the CCA on their behalf (the same is true for utility retail product suppliers). The type of green power purchased by some CCAs can change frequently and may not meet national voluntary consumer quality standards. CCAs are currently authorized in only a few states.

- **Physical PPAs.** Physical PPAs for green power convey RECs and deliver power to the purchaser, usually via the shared grid. PPAs are long-term contracts that provide price stability and, potentially, financial savings in some regions where conventional electricity prices are high. Substantial purchases may provide branding and marketing opportunities even though the renewable project is owned by someone else. Depending on the market where the facility receiving the green power is located, PPAs may be signed for both on-site and off-site generation options.
- **Financial PPAs.** Financial PPAs enable organizations to enter into an agreement with a third party that combines a downside electricity price hedge with an unbundled REC contract. Financial PPAs (also known as virtual PPAs or contracts for differences) do not include the delivery of physical power to the electricity consumer. Similar to physical PPAs, financial PPAs provide potential dollar savings and branding opportunities for the purchasing organization.

Organizations may have multiple goals related to green power procurement, and there are usually multiple options available to satisfy these goals. Table 5-2 illustrates how the various options are likely to satisfy some typical organizational goals.

Table 5-2. Alignment of Options and Goals

	Goals/ Options	Environmental: Make green power claims; reduce emission footprint	Economic: Mitigate electricity price rises; ensure predictable budget	Stakeholder relations: Respond to environmental concerns and interests	Direct or indirect impact on new supply	Considerations
Self-Generation	**On-site**	Yes; generates green power; must keep RECs	Yes; depends on the levelized cost of electricity over project life, project size relative to load	Yes; direct project involvement shows commitment; size matters for emissions footprint mitigation	Direct impact on new supply	Mostly solar; policy risk falls on owner; often net-metering dependent; size might not provide enough green power
	Off-site	Yes; generates green power; must keep RECs	Yes; ownership provides power sales revenue at market clearing price	Yes; branded renewable energy generators yield public awareness; larger projects offer greater benefits	Direct impact on new supply	Off-site may mean larger projects, which require Orgs. with access to capital and expertise; may require managing and integrating generation
	Shared Renewables	Yes, if RECs convey to participant	Yes; share of ownership provides power at known cost through bill credit	Maybe; RECs must be retired; often RECs do not convey to participants	May result in direct or indirect impact on new supply	Mostly solar; driven by state policy; may involve penalties for participant exit

	Goals/ Options	Environmental: Make green power claims; reduce emission footprint	Economic: Mitigate electricity price rises; ensure predictable budget	Stakeholder relations: Respond to environmental concerns and interests	Direct or indirect impact on new supply	Considerations
Purchased Product Options	**Unbundled RECs**	Yes	No; REC purchases are in addition to electricity costs and require two separate billings	Yes, but may vary depending on stakeholder interests	Most often an indirect impact on new supply; depends on contract design	Easy to purchase larger amounts too; cost is often additional to electricity cost; can limit transaction costs and barriers to engagement
	Utility Supply	Yes; utility must retire RECs on consumers' behalf	No, for off-the-shelf products that charge green premium; involves a single billing.	Yes; may vary depending on stakeholder interests; RECs must be retired	Most often an indirect impact on new supply; depends on utility program design	Easy purchase; cost is additional to electricity cost.
	Utility Green Tariff	Yes, tariff must transfer to or retire RECs on customer's behalf	Yes, for green tariff, depends on negotiation	Yes; RECs must be retired on customer's behalf	May directly impact new supply	Green tariff is similar to PPA, but with utility rather than generator
	CCA	Yes; CCA must retire RECs on consumers' behalf	Varies depending on wholesale supply costs (market conditions)	Yes; RECs must be retired on customer's behalf	Generally, an indirect impact on new supply; depends on CCA design	Must take what CCA offers; limited flexibility
	Physical PPA	Yes; RECs must convey to consumer	Yes; depends on negotiated price	Yes; RECs must be included	Power purchase and REC contract offers a direct impact on new supply	Requires good credit rating, large load requirement, ability to agree to long-term contract
	Financial PPA	Yes; RECs must convey to consumer	Yes; depends on negotiated settlement price and wholesale-to-retail market correlation	Yes; RECs must be included	Financial PPA coupled with unbundled REC contract offers a direct impact on new supply	Requires deep understanding of wholesale markets and future price movements

CHAPTER

6

Contracting for Green Power

To view the full Guide, visit https://www.epa.gov/greenpower/guide-purchasing-green-power

DOCUMENT MAP

To select a green power supplier and product, purchasers should start by developing specific criteria for assessing their options. These criteria can be ranked based on the goals identified early in the process (see Chapter 5).

Developing Criteria for Screening Green Power Suppliers and Products

Criteria for Screening Suppliers

- **Reputation.** A supplier's reputation is built on how well it honors its commitments, how easy it is to work with, who its customers are and how well it is viewed by the industry. Assessing a supplier's reputation should entail obtaining references and conducting a review of energy industry literature. It may be also helpful to connect with environmental groups who might have information about the supplier.
- **Certification.** Certification provides important assurances related to the credibility of the seller and the sale of green power products. Retail green power suppliers, renewable energy certificate marketers, and projects selling directly to consumers may sell certified green power products.
- **Financial strength and credit.** To research the financial health of a power supplier, purchasers should look at its annual reports, Securities and Exchange Commission filings and bond ratings.[1]
- **Location.** If buying green power from a local supplier, purchasers should ask where the supplier sources its renewable generation. Public utility commissions' websites often have contact information for registered retail suppliers.
- **Product choice.** Some suppliers offer several green power products that vary in the percentage of renewable power and mix of resources. In such cases, buyers may be able to change their product options in the future without having to search for a new supplier and negotiate a new contract.
- **Environmental performance.** Assessing a supplier's environmental performance can be useful. Review the supplier's annual financial, environmental, or corporate social responsibility reports; its other electricity product offerings; and other business activities.

These criteria may apply to all types of purchase options, including direct purchase options from generators. In direct purchase cases, organizations may want to consider the generating company's experience in building new projects of similar size and financial arrangement and its history of operation and maintenance. The next chapter discusses other criteria that may apply to self-generation projects.

Criteria for Renewable Electricity Products

- **Price.** When considering price, organizations should make sure they are comparing apples to apples. Differing prices might reflect different types of products. For example, renewable electricity products might quote total price per kilowatt-hour for electricity that includes the green attributes (e.g., RECs), which can be compared to the standard electricity price, but other product options, such as unbundled RECs and many utility green pricing products, quote only the incremental cost of green power, which must be added to standard electricity rates. Furthermore, prices for long-term contracts might be fixed or escalate over time, or they can be tied to a variable price index such as the wholesale price of electricity. Finally, the purchase of some utility green power

[1] SEC filings may be found at: https://www.sec.gov/edgar/searchedgar/companysearch.html.
Moody's bond ratings may be found at: https://www.moodys.com/page/lookuparating.aspx

products might offer an exemption from variable fuel charges or environmental taxes, which should be factored into the ultimate price.

- **Risk.** Different purchasing options allocate the risk of price volatility, equipment failure, non-performance and other potential issues in different ways. Risks can differ by geography and market. It is important to understand the risks associated with each purchasing option and how they might impact price over time.
- **Percentage of renewable energy.** Green power product resource mixes can range from 1 to 100 percent renewable power. Organizations can therefore calculate the percentage of their electricity use served by renewable power whether they are buying unbundled RECs or RECs bundled with electricity.
- **Incremental impact.** Voluntary buyers want their purchases to make a difference. To do so, their renewable electricity use must go beyond what otherwise would have been available through the standard electricity mix or beyond what is required or mandated by law, sometimes referred to as "regulatory surplus." Voluntary buyers should ensure that the green power purchased voluntarily is not also used by the electricity supplier to meet a compliance obligation—thus ensuring that the voluntary purchase is incremental or surplus to any requirement imposed on renewable energy suppliers. Voluntary buyers demonstrate that their green power use is incremental or surplus to regulation buy owning and retaining renewable energy certificates. By retaining ownership of renewable energy certificates, a voluntary consumer denies their use for compliance mandates or requirements by a regulated entity.
- **Percentage of "new" renewable sources.** Many organizations look for opportunities to support new generation. "New" renewable resources can be defined in different ways, however. Programs such as the U.S. Environmental Protection Agency's (EPA's) Green Power Partnership and Green-e define "new" as any renewable power generation that both meets specific environmental criteria and began operation within the last 15 years.[2] These purchases help create the aggregate demand necessary for constructing additional renewable resources while giving projects time to recover their capital costs. Some organizations want to have a more immediate, direct impact on supply by entering into long-term contracts with a project still under development. Their purchase contract may help the new project obtain financing and get built, however not all organizations are large or creditworthy enough to support project finance.
- **Renewable energy/resource type.** Purchasers may have different preferences for the kind of resource(s) used in green power products. Wind and solar are usually the most environmentally preferred energy sources, although even these are not without controversy. Some stakeholders are concerned that hydropower dams may alter river habitats and fish populations, but the impacts are site-specific. Biomass facilities may have air emissions impacts. Geothermal energy has limited environmental impacts, which can vary depending on the type of technology used. It is also important to check the environmental characteristics of any nonrenewable generation resources included in the product, as they will contribute to the overall environmental impact of the power purchased. Ultimately consumers should be concerned with whether their purchase of green power conveys the legal right to the environmental attributes of the resource, by way of owning and retiring the associated REC instruments.
- **Renewable energy resources also have different associated costs.** For instance, a green power product generated from a low-wind resource in one part of the country will generally be more expensive than a similar wind product generated in regions with higher wind speeds. See Chapter 3 for more on resource costs.
- **Length of contract.** Longer-term contracts, especially with new projects in development, are often attractive to buyers. Sellers may be willing to offer a discount in exchange for stable revenue that enables them to finance the project. The longer term of the contract offers greater price stability to the buyer and a greater leadership opportunity if it supports a new renewable energy project. Long-term contracts come with their own risks, however, if the buyer misjudges the future market price direction and ends up paying more than the actual market

[2] U.S. Environmental Protection Agency. (n.d.). Green power partnership: What is green power? Retrieved from https://www.epa.gov/greenpower/what-green-power

price. Technology costs could continue to fall, making shorter-term or smaller contracts attractive, as they leave future options open. Also, long-term contracts may be beyond the reach of buyers that represent a credit risk, or that are too small to justify the transaction and legal costs.

- **Third-party certification and verification.** A green power product can be certified and verified by an independent third party. A wide range of product options may be certified, including unbundled RECs, retail utility products, community choice aggregation programs, power purchase agreements with generators, and on-site generation. Such certification can provide credibility to the product and confirm the product's environmental value. By purchasing a product that has met specific environmental and consumer protection guidelines adopted by the certifying entity, organizations will be better positioned to address stakeholder questions about purchase quality and credibility. Regional REC tracking systems are not an equivalent replacement or substitute for third-party certification. Visit http://www.green-e.org for more information about certification and verification.
- **Location of generation.** Where the generation occurs may matter to purchasing organizations for several reasons. Some may prefer to buy locally (e.g., in-state) because the generating project is more visible, has a more direct economic influence, or creates a better story for local stakeholders. Others may prefer to buy in-state renewable generation to contribute local environmental benefits.

  Location can also matter from the perspective of organizations preparing greenhouse gas (GHG) inventories. Although GHG emissions are global in impact, purchasing local non-emitting generation might lower the average emissions from the local electric grid. Long-term, this could be beneficial in an organization's Scope 2 location-based emissions calculation. If the organization intends to report avoided emissions (an option under Scope 2 accounting), it might choose to purchase from a region (not necessarily local) with high emissions because purchasing from this region could likely displace more emissions. For more information on GHG inventories please see Chapter 8.
- **Specific generation facility.** Some green power options are for power generation at a specific site, such as a nearby wind farm, rather than a mix of generation from different resources. These products, such as the annual output of one particular wind turbine, are sometimes preferred by customers because such products offer a closer sense of connection between a purchase and a specific environmentally beneficial facility. Some buyers will capitalize on this through naming or branding the facility, reserving the opportunity to provide tours, and other methods of reinforcing their connection to the project with their stakeholders.
- **Product complexity.** Different product and procurement options require different levels of effort and due diligence. For example, direct engagement with a project owner can involve lengthy negotiations and significant transaction costs relative to an off-the-shelf product from a retail electricity supplier. Financial PPAs or physical PPAs may require additional research on wholesale market prices, legal and accounting advice, and reporting if the contracts are regulated as a financial product.

The Role of Product Certification

One of the major concerns with buying green power is ensuring that organizations get what they pay for. It can be difficult to substantiate claims made about the quantity and characteristics of the product purchased. It is also important to ensure that two organizations are not claiming to have purchased the same green power (e.g., megawatt-hours) and are not double counting the same green power benefits (e.g., zero emissions electricity). Moreover, organizations may be unable to ensure public acceptance of their purchase and avoid criticism from external stakeholders without independently verified information about the product. Third-party certification addresses these concerns by setting standards for green power products in the following areas:

- Minimum levels of environmentally acceptable renewable resources
- Overall environmental impact
- Conduct for suppliers, including oversight of supplier advertising claims and regular reporting to the certifying entity

Third-party certification usually also requires independent verification by an auditor to document that green power sellers have generated or purchased enough renewable energy to match their sales commitments. Regional REC tracking systems are not an equivalent replacement or substitute for third-party certification.

Collecting Product Information

A good starting point for collecting information about specific green power options is the suppliers themselves. The Green-e list of certified products is another way to get started (see Chapter 10 under Finding Green Power Products). Purchasers should be sure to collect enough information to answer the decision criteria listed earlier, and to collect information consistently across suppliers and among products to facilitate comparison. A good way to find consistent information is through an exploratory letter or a request for information (RFI), listing individual criteria and addressed to specific suppliers.

In many states, competing electricity suppliers are required to provide an electricity label—analogous to a list of food ingredients or nutrition label—that provides information in a standard format and makes product comparisons easier. This information is generally available directly from the supplier or from the state's public utility commission (see Figure 6-1 for an example). Third-party certifiers, such as Green-e, also require standardized product content labels and provide product content information on their websites.

For direct purchase options, it can be challenging to find suitable new generation projects under development that fit the purchasing organization's objectives. Each resource type has its own trade press (e.g., North American Windpower, Solar Industry Magazine[3]) that reports on new projects in the works, so following these media sources can be informative.

Self-generation options are discussed in more depth in Chapter 7, Planning a Self-Generation Renewable Project.

After collecting data from suppliers, the next step is estimating the full cost over time of the chosen green power option and calculating relevant financial metrics to present to decision-makers. As mentioned above, the organization should take care to compare apples to apples, as well as measure goals that are of value to the organization. For help finding cost data, contact the potential suppliers or do additional research using the sources listed in Chapter 10, Resources for Additional Information.

Figure 6-1. SAMPLE Environmental Disclosure Label

Energy Source (Fuel Mix)	**Residual Mix - Year: 20XX**	**Fuel %**
	Nuclear	35.22%
	Coal	31.00%
	Gas	26.01%
	Import Mix	5.89%
	Solar	1.22%
	Oil	0.60%
	Hydro	0.06%
	Total	100.00%

Air Emissions	**Emission Type**	**Lbs. per MWH**	**Relative to State Average**
	Nitrogen Oxides (NO_X)	0.123	98%
	Sulfur Dioxide (SO_2)	1.2345	110%
	Carbon Dioxide (CO_2)	987.6543	108%
	CO_2 is a greenhous gas which may contribute to global climate change. SO_2 and NO_X released into the atmosphere react to form acid rain. NO_X also react to form ground level ozone, an unhealthful component of "smog."		

[3] North American Windpower: http://nawindpower.com/. Solar Industry Magazine: http://solarindustrymag.com/.

Creating a Procurement Plan

A procurement plan documents the purchaser's decisions and addresses possible challenges in buying green power. A procurement plan can also help convince others in the organization that purchasing green power fits the overall corporate strategy.

The main audience for the procurement plan is the managers who need to support the purchase decision. Their support should be secured as early in the process as possible. As soon as the green power project team can show the costs and benefits of purchasing green power to the organization, it should present the information to management. Managers may ask about the products the organization would buy, their cost and their benefits and the risks relative to different parties involved in the transaction. The procurement plan should compare the green power opportunity to what the organization is currently buying or using for power. The project team may also want to describe to what extent and how peer organizations are purchasing green power.

Besides providing the information management needs to make a decision, a procurement plan can also help overcome resistance to green power within the organization. Some organizations have outdated perceptions of the reliability of renewable energy technologies, misunderstandings about using a variable resource, worries about the cost, misperceptions of the role and importance of RECs, or different perspectives on certain product types. As part of the procurement process, the project team will need to educate others about these topics and the benefits of green power. The organizations that sponsored this guidebook can provide helpful information to overcome these misconceptions.

The scope and detail of the procurement plan will depend on the organization's needs and requirements, but it should address the following:

Scope of Procurement

The plan should list the facilities for which green power will be procured, because the quantity of electricity used in those facilities now and in the future will guide the size and timing of the purchase. Some organizations start out with a single facility and over time expand to cover their national footprint. The plan should propose the amount of power that to be purchased (as a fixed quantity, a fixed dollar amount, or a percentage of total power use). If this procurement is a trial that may lead to additional purchases in the future, the plan should spell out the criteria that will be used to judge the trial's success. The plan should describe whatever is known at this point about future procurement phases. For example, some organizations may start out with an unbundled REC purchase that is easy and straightforward and then, as they gain experience and learn more about available green power options, choose to pursue other supply options such as direct project engagement.

As described earlier, although long-term contracts offer price stability benefits and may help finance a new project, these benefits must also be weighed against the risk of changing market conditions. Therefore, some organizations consider a portfolio approach for their procurement. Much as a standard energy procurement strategy seeks to balance risk over time by considering a variety of suppliers, contract lengths and generation sources, a green power strategy can also benefit from a portfolio approach. Considering a range of purchasing styles and locking in smaller purchases or taking advantage of scaled larger purchases over time can be helpful in light of the rapid changes ongoing in the sector. Organizations operating in a range of geographies will also need to consider how to prioritize each market or how to aggregate purchases for these different facilities. For example, some organizations may prioritize facilities by cost-effectiveness or favorable policy climates, while others may prioritize by impact on greenhouse gas emissions reductions. Still others prioritize their iconic locations, such as the headquarters or customer-facing operations, first.

Expected Benefits

Keeping in mind the general benefits of purchasing green power, the plan should list the particular environmental, economic and stakeholder benefits expected from buying green power for the organization. Wherever possible, these benefits should be linked to the organization's goals, such as greenhouse gas reductions, electricity price hedging or enhanced branding.

Financial Considerations

The procurement plan should also discuss cost and risk. Cost has traditionally been the primary concern with green power, but there are an increasing number of emerging products and financing models for purchasing green power that can result in a net economic benefit or risk reduction over the long-term. Negotiating the right supply contract can have a big effect on the financial costs and benefits of buying green power.

Strategies to Manage the Cost of Green Power

- **Seek a fixed-price contract.** Because it requires no fuel (and hence its cost is predictable), renewable energy may be available at a fixed price without any future fuel-cost adjustments. Organizations should check with potential green power suppliers, particularly if the organization is considering a utility retail option, to see whether green power customers are exempted from fuel-cost adjustments.
- **Buy green power for only part of the organization's electricity use.** Green power does not have to be used for all electricity consumption. For example, an organization might buy green power for just 5 or 10 percent of its electricity use, or for certain production or a specific product line or part of operations. Buying 10 percent green power may add less than 1 percent to the organization's electricity costs and sometimes may cost less and save money. Alternatively, some lower-percentage renewable electricity products cost less because they contain less than 100 percent green power.
- **Make a longer-term purchase.** Organizations should consider the term of commitment alongside the quantity and cost of green power purchased. A short-term contract (typically less than three years) might offer greater flexibility in the future but might cost more. Direct project engagement options such as physical and financial PPAs, utility green tariffs, and self-generation involve longer-term commitments (e.g., 10+ years). The security of a long-term commitment can reduce risk to the supplier, allowing it to offer a lower price than under a shorter contract, and can offer price predictability to the purchasing organization. See Chapter 10 for more resources on PPAs, including contract price escalators and options for buyouts. Ultimately, the right contract length depends on the organization's goals and selection criteria.
- **Consider a financial PPA.** A financial PPA allows buyers to lock in stable green power prices and sellers to lock in stable revenues by agreeing to pay the difference between the actual power price and an agreed upon settle-

Case Study: Financial PPA with Renewables

Yahoo has stabilized its energy budget while helping a new wind farm get built. In 2015, the digital information company entered into a financial PPA with a wind farm that was under development in Kansas. The wind farm sells the electricity into the regional wholesale market at spot market prices, while Yahoo's nationally scattered data centers continue to purchase electricity from their local suppliers. The contract is structured as a contract for differences under which the parties agreed to a guaranteed settlement price for the sale of the project's electricity into the market over the duration of the contract. If the electricity sales income received by the wind farm is greater than the agreed settlement price, the wind farm pays Yahoo the difference between the income and the guaranteed price. Conversely, if the electricity sales income is less than the guaranteed price, then Yahoo pays the wind farm the difference. In the event of higher wholesale electricity market prices, the long-term fixed price provides savings to Yahoo and a guaranteed revenue stream for the wind farm. If electricity market prices are lower that the agreed-upon price, however, Yahoo may miss the opportunity for savings. For more understanding of the risks and benefits of financial PPAs, see Chapter 4, Green Power Product Options.

ment or "strike price." It is an effective way for both parties to manage price risk, but financial PPAs are relatively complex procurements, generally only available to the largest, most creditworthy organizations, and may have accounting implications that some organizations consider onerous. For example, financial PPAs can be viewed as a type of financial derivative or swap transaction that may be regulated by the U.S. Commodity Futures Trading Commission. Such transactions require specialized knowledge about Financial Accounting Standards Board rules. See Chapter 4 for a fuller discussion of financial PPAs. Some additional resources are referenced in Chapter 10, but organizations should seek legal and accounting advice for the most current information.

- **Offset the cost with savings from energy efficiency.** Energy efficiency is often the first step in managing energy costs. Reducing the total amount of electricity purchased helps make green power more affordable. When reviewing green power providers, organizations may find that some providers also offer energy efficiency services, with the goal of no net increase in their customers' power bills. The savings may work the other way, too. Some green power supply options can save on electricity costs, which can then be used to fund energy efficiency activities.
- **Use savings from competitive choices.** In states with restructured electricity markets, competitive choices of either green power or commodity electricity can lead to savings on energy costs, which can be used to buy green power. Alternatively, the extra cost of green power can be limited to the amount of savings resulting from competition. Switching to less expensive conventional power can also mean dirtier power, so organizations should ask the electricity supplier for information about the emissions from its product and make sure those emissions do not erode the benefits of the green power bought with the savings.
- **Specify a price cap.** For example, an organization might say in its request to suppliers, "We want our cost of energy to be at or below 5 cents per kilowatt-hour." A drawback of this approach is that suppliers are likely to bid at or near the specified price cap. But if the organization is interested mainly in other aspects of green power, such as environmental benefits or hedge value, this can be a good approach. Even if a price cap is not the most important consideration, it is a good idea to decide on the highest price the organization is willing to pay for green power, as part of its internal procurement planning.

Procurement Methods

Organizations can purchase green power in several different ways, depending on the product options available and the organization's procurement rules. Generally, the greater the load the buyer can bundle together in one purchase, the more attractive it will be to a supplier. Simply put, a large purchase can result in a lower price per unit and transactional efficiencies for both buyer and supplier.

The following explains typical ways to buy green power. Federal agencies must work within the procurement rules applicable to the federal government, which are explained further in Appendix A, Green Power Considerations for Federal Agencies.

- **Call several sellers.** A buyer can keep the procurement process simple by calling a few green power providers—either REC marketers, utilities, or other electricity providers available to them. An off-the-shelf product may meet its needs. If the organization wants something different, it can ask for an informal proposal. After a discussion, the organization may be ready to negotiate directly with one of the suppliers about product definition, certification, price and terms. If the organization is planning a large purchase, the suppliers might be willing to tailor something to the buyer's needs.
- **Negotiate with the utility.** Buying power is simple, though the choices may be limited if the organization is served by a single utility in a regulated market. If the local utility offers green power, the organization can collect information by visiting the utility's website and calling to discuss its interest. If the utility does not offer green power and the organization is a large, highly visible customer, it may be able to encourage the utility to offer a green tariff or an integrated energy efficiency and renewable energy package tailored to the organization's green power goals.

- **Request proposals.** Large companies and especially public institutions often issue a formal solicitation or request for proposals (RFP). This practice is also recommended for direct project engagement options such as PPAs and self-generation. An RFP requires more time and effort for preparation, evaluation and negotiation but might be more suitable for a large purchase and when many green power options are available. With an RFP, it is important to understand the organization's own objectives and communicate them clearly in the solicitation. Third-party certification and verification can be specified in the RFP evaluation criteria.

  RFPs can be as simple as a letter sent to selected suppliers describing the organization's objectives and asking for a bid. RFPs can also be more formal, casting a wider net through a broadly advertised solicitation. The latter requires more effort to prepare and evaluate responses.

  A two-step process is possible, in which the organization first issues an RFI and, based on the responses, sends a more detailed RFP to those suppliers that meet its general requirements. The RFI would be broadcast to a larger audience, not only to find out who meets the buyer's qualifications, but also to gauge the amount of interest. Screening qualifications would emphasize experience and would vary according to the type of product option under consideration. For example, an RFI for a green electricity supplier might ask for the total load served, number of similar customers served, how long the supplier has been in the green power market and how many complaints have been made about the supplier to the public utilities commission. A buyer considering a PPA might want to know the number and size of projects developed previously, how long each project was in development, the developer's financial strength, and experience obtaining financing for similar projects.

  For large purchases, RFPs may be addressed to renewable power generators (wholesale) as well as retail suppliers. Buying directly from generators might lower the cost but will likely require a longer-term purchase commitment. Organizations will still need to work with a retail supplier to integrate the wholesale contracts, so active engagement with a preferred retail supplier will be important.

Using an RFP versus an RFI

An RFI may be a productive way to engage suppliers about innovative, new purchasing strategies. Suppliers might not want to respond to an RFP if the request is not "cookie cutter," as they know significant negotiations would be required once the winner is selected that could require changes to their costs while locking them into a pricing commitment. Organizations can ensure broad participation and validate interest from the market about new purchasing ideas with an RFI. Based on the results of the RFI, organizations can either proceed directly to negotiating with a particular vendor or refine their procurement goals in order to issue a detailed RFP that will have a better chance of multiple qualified bidders.

EPA's Green Power Partnership offers assistance to partners putting together a green power purchase RFP. For example, the Partnership can provide examples of publicly available RFIs or RFPs.

Contract Considerations

There are many issues that must be covered in green power contracts; those mentioned here are just a few. See Chapter 10 for more resources on power purchase agreements.

- **Environmental attribute ownership.** RECs embody the environmental attributes of generation. They are essential to verifying ownership and the right to claim environmental attributes. It cannot be overemphasized that RECs, as a tracking instrument, must be conveyed to the buyer who claims to consume green power, regardless of the product option chosen or how green power is procured, including in the case of on-site self-generation and physical PPAs. If the RECs are owned by the project owner and not conveyed to the electricity consumer, the consuming organization must purchase replacement RECs, and the green power claim must be based on the replacement RECs. See the text box on REC Arbitrage in Chapter 4.

  Organizations should make sure that the green power they purchase is not also counted by utilities for compliance with regulatory requirements such as renewable portfolio standards, and RECs used for regulatory compliance claims should also not be sold to voluntary consumers. Utilizing tracking systems and third-party

certified products can help ensure that RECs are not claimed by more than one party. To avoid potential double claims on environmental benefits, contracts should be explicit about what environmental attributes are included with the sale, that the purchase conveys exclusive rights to the attributes, and that they are not being used for any mandate or regulatory requirement. For more information, see Chapter 2 on renewable energy certificates and tracking systems.

- **Evaluate contract price escalators.** Some contract prices for delivered power are flat for the life of the contract, but they may start off higher than the utility rate at the beginning with the expectation that the utility rate will rise. Other contracts may escalate the price annually by a fixed percentage, leveling off after a specific year. Still others may index the contract price, offering power at a fixed discount to the local utility rate. Organizations need to figure out what is best for them.
- **Consider options for PPA buyouts.** Some contracts, particularly for electricity from solar projects, may allow the purchasing organization to buy the generator after the original developer/owner has obtained any tax benefits that may be available (e.g., the federal investment tax credit). This approach reduces the investment capital required and removes the hassle of build-to-own in the first place. If interested in this approach, and if it is available, the organization should agree on the basis for determining the buyout price.
- **Termination clauses.** Some contracts will define early termination fees and penalties. Fully understanding how these might constrain future decisions for the company is an important part of risk evaluation.
- **Transfer of ownership.** Generation assets may be sold to a third party, in which case the buyer of the asset will be responsible for fulfilling the terms of the PPA. The contract should specify under what circumstances such transfers will be allowed and whether the PPA off-taker has a say in the transfer.
- **Date of operation.** If the organization is counting on a new generator being operational by a certain date, it should negotiate and specify in the contract when the power must become available and describe penalties or remedies if full operation does not occur by the specified date.
- **Interruptions in operation.** The generator should be required to notify the purchasing organization of any malfunction or interruption in supply and be required to make timely, routine and necessary repairs to resume service.
- **Default, remedies and damages.** The contract should specify what constitutes default and how default may be remedied.

Special Considerations for Procuring Green Power

- **Green power initiatives.** Organizations should be aware of purchasing groups, campaigns and initiatives supporting green power, along with opportunities to capitalize on their environmental commitment. These include the U.S Environmental Protection Agency's Green Power Partnership, RE100, Sustainable Purchasing Leadership Council, the World Wildlife Fund and World Resources Institute's Corporate Renewable Energy Buyers' Principles, and others. By joining forces with other like-minded organizations, green power purchasers can leverage their influence on the market and potentially on public policy. More information can be found in Chapter 10.
- **GHG Protocol Scope 2 Guidance.** Any organization that wishes to report its emissions to its stakeholders or to a GHG

Case Study: Procuring On-site Generation through a Solar PPA

Amphitheater Public Schools, the school district serving Tucson, Arizona, entered into a solar PPA for a 9.3-MW solar generation project located across 25 school sites and support facilities. The project was completed in 2016 and is expected to generate more than 60 percent of the district's electricity needs in the first year of operation. The project required no upfront capital investment from the school district. Instead the developer owns and operates the solar power system, and the district will purchase the electricity generated by the solar panels under a 25-year solar services agreement. The project will result in an expected savings of $11 million to $23 million in energy cost savings over the term of the agreement.

emissions registry should know about the Corporate Standard for emissions accounting, specifically the Scope 2 Guidance on how organizations should measure emissions from purchased or acquired electricity, steam, heat and cooling (called "Scope 2 emissions"). The guidance includes requirements for accounting for emissions from energy contracts and RECs in greenhouse gas inventories, how to calculate emissions using the location-based method and the market-based method (using tradable instruments such as RECs), quality criteria that all tradable instruments must meet to be considered a reliable data source for the market-based method; and recommendations for transparently disclosing information about energy purchases and use.

Evaluating the Purchase

Once the green power purchase has been implemented, it is important to collect information and evaluate how well the purchase achieved the organization's goals. Areas of evaluation could include:

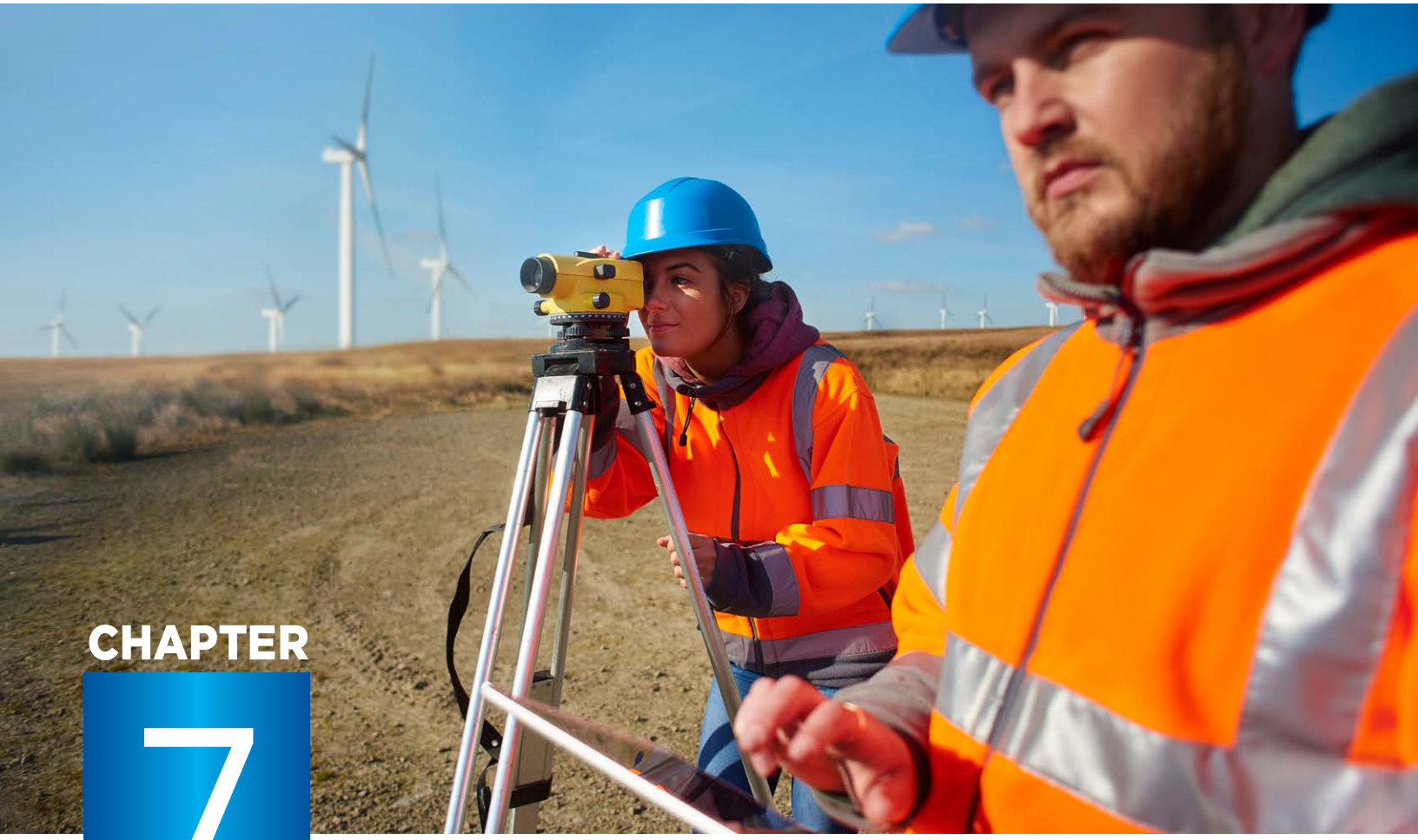
- How well the procurement process worked.
- Whether the vendors delivered what was expected.
- Whether the green power purchase is meeting the metrics described in the procurement plan, producing savings or providing an economic hedge against rising electricity prices.
- How well the organization promoted its green power commitment.
- How well the organization educated employees about the green power commitment and actions.

Whether the green power purchase is helping the organization meet its corporate or institutional goals related to environmental improvement and sustainability.

REC Tracking Systems

A tracking system is an electronic database that is used to track the ownership of RECs or megawatt-hours of electricity, much like an online bank account. A tracking system issues a uniquely numbered certificate for each megawatt-hour of electricity generated by a generation facility registered in the system, tracks the ownership of certificates as they are traded between tracking system account holders, and retires the certificates once they are used or claims are made based on their attributes or characteristics. Because each REC has a unique identification number and can only be in one owner's account at any time, a tracking system reduces ownership disputes and the potential for double counting.

RECs in a tracking system can be used to verify compliance with a renewable portfolio standard, to help create environmental disclosure labels, and to substantiate voluntary green power or environmental claims. Tracking systems are not substitutes for product certification and verification, as tracking systems only monitor wholesale transactions and do not provide assurances related to sales, supply, claims, and state policies affecting benefits; individual retail green power customers do not generally hold accounts in tracking systems unless they make very large purchases. See Chapter 10 for details.



CHAPTER

7

Planning a Self-Generation Renewable Project

To view the full Guide, visit https://www.epa.gov/greenpower/guide-purchasing-green-power

DOCUMENT MAP

An alternative to purchasing or contracting for green power is self-generation, meaning that the organization owns the generating facilities. Self-generation equipment can be located on-site where the power is consumed, or an organization may own a generation facility that is located off-site where a larger or more cost-effective installation is possible.

Depending on the size of the project, installing self-generation can be a longer process than purchasing green power because installation requires more external coordination with the organization's utility, local governments and contractors. For this reason, it is helpful to enlist outside technical expertise and not underestimate the time needed to get a self-generation project up and running. The following steps, along with the information listed in Chapter 10, Resources for Additional Information, can help organizations that are considering self-generation options.

Screening the Options

Based on the steps taken at the very beginning of the green power process (Chapter 5, Using Organizational Goals to Guide Green Power Purchasing), an organization should have an understanding of its energy needs and the renewable resources available, whether located at the organization's facilities or off-site.

The next step is to perform a screening analysis to determine the options that are best suited to the site. The U.S. Department of Energy has resource maps, data and other information on solar, wind, biomass and hydropower at https://energy.gov/eere/office-energy-efficiency-renewable-energy. The National Renewable Energy Laboratory has several energy analysis models and tools to help evaluate renewable resource potential. Private developers also offer resource assessment tools.

Whether to self-generate from a project located on-site (sometimes referred to as customer-sited) or off-site (sometimes referred to as grid-sited) is a major decision for an organization to consider. On-site self-generation at the organization's facility is a common choice among green power users for the following reasons:

- On-site self-generation is convenient if the site is already under the organization's control.
- It provides a visible statement of the organization's commitment to renewable energy.
- Solar photovoltaic (PV) panels are modular and can be easily adapted to the site (roof or ground-mounted).

If on-site self-generation is not an option, or the renewable resource is insufficient at the site, organizations might consider off-site self-generation elsewhere on the grid.

- Off-site projects can be larger (utility-scale) because more land may be available.
- Organizations can develop a project where the renewable resource is stronger and more cost-effective.
- Off-site projects may offer more opportunities for using different renewable resources since the organization would not be limited to the resource available at its facility, but the organization must control the site to be developed.

Organizations contemplating self-generation should consider whether they are prepared to include the responsibilities of owning and operating a self-generation project as part of their core business activities. Owning and operating a project means that the organization will be responsible for equipment maintenance, performance monitoring, interruptions in generation and troubleshooting. These tasks can potentially be contracted out to a service company, but someone still has to monitor the work.

Organizations developing large projects should think about their role as electricity sellers. Large projects are often connected to the transmission grid (rather than the distribution grid), which means that they must participate in the wholesale electricity market to dispose of their generation. The organization may also be responsible for ancillary services (e.g. frequency control, spinning reserves and operating reserves) required by the grid to continually balance

supply and demand. Alternatively, the organization may pay someone else to manage its electricity sales and to provide the necessary ancillary services.

As with any capital investment, organizations should assess the cost-effectiveness of a self-generation project. First, the organization needs to determine the approximate size of the project. The size can vary depending on technology, the load to be served by the project, the organization's capital budget, physical constraints at the site (such as rooftop area for PV systems or the rate of biomass fuel production), and the incumbent or alternative cost of electricity to which the cost of self-generation will be compared. A developer or utility representative can help choose the right size system based on the organization's load and site characteristics, or the organization can also use one of the software tools listed in Chapter 10, Resources for Additional Information.

At this point in the planning process, it is a good idea to consider whether energy efficiency projects should be implemented together with the renewable generation technologies being considered. Reducing the on-site load via energy efficiency may allow the project size and cost to be reduced. The organization's site-specific situation determines the appropriate efficiency measures to include.

The next step in examining cost-effectiveness is to estimate the capital cost based on the assumed size of the project. This will enable a preliminary calculation of economic feasibility. The analysis should compare the organization's current and expected future energy costs on a per kilowatt-hour basis with the levelized cost of electricity from the renewable power project over the life of the project under consideration. This screening should also include other financial assessment methods that the organization would normally use for any capital investment, such as life-cycle cost, rate of return and net present value.

Utility rate impacts should be investigated carefully. The organization should understand the different components of its electric bill and perform an analysis to determine how on-site generation will affect the demand charges, time-of-use rates and any applicable riders. Energy storage in particular, combined with self-generation, should be considered as a way to reduce electric utility demand charges. The local utility may be able to help with this determination.

The economic analysis will also be affected by whether the renewable generation will be in the form of a combined heat and power system (e.g., a system using renewable fuel, such as landfill gas and biomass). For these systems, the expected thermal utilization and associated savings will need to be considered in addition to electricity bill savings from power generation.

A further refinement to the cost feasibility screening is to consider financial incentives and hidden costs. The analysis should account for state and federal financial incentives, tax credits and production payments, such as those for net metering, which may apply. On the cost side, engineering studies, interconnection fees, insurance, operations and maintenance costs and changes to utility tariffs for distributed generation must be considered.

If the cost feasibility relies significantly on public policy, such as financial incentives, organizations should be sensitive to the risk of changes in the policy and regulatory environment. In addition, utilities are particularly concerned about the effect of self-generation on their revenues, and this may lead to policy changes and additional fees to pay for the back-up services that they provide.

The economic analysis will be affected if the organization wants to include energy storage (e.g., batteries, capacitors, flywheels). This is a separate decision, however, from the decision to install on-site generation. If energy storage is included, the additional cost and benefits of the storage system must be considered.

Obtaining Resources and Assistance

If an organization chooses to own and operate its own power system, information resources are available, many of which are outlined in Chapter 10 of this guide. Technical assistance may be available through the local utility, state energy offices, energy service providers, energy service companies, consultants, manufacturers and equipment

vendors. In addition, the U.S. Department of Energy's Federal Energy Management Program (FEMP) offers technical assistance to federal agencies. Before making a decision, the organization should consider seeking outside experts who can help with the technical, policy and financial aspects of a renewable power project, especially if it is considering a remotely sited utility-scale project that will sell electricity in the wholesale electricity market.

The financial details are usually what make or break a self-generation project, so the project team should collect information about incentives and financing options (including third-party ownership) that could make the project more cost-effective. Many states offer financial incentives specifically for customers that install qualified renewable generation systems. These incentives may take the form of direct payments (rebates or grants), competitive solicitations in which contract payments are awarded, or tax breaks (either sales or property tax exemptions). In addition, the federal government currently offers an investment tax credit and a production tax credit for certain renewable resources (although these are being reduced or phased out over time), and Modified Accelerated Cost-Recovery System (MACRS) for certain renewable energy investments.[1] The organization must ensure that the system is designed to meet the requirements of the applicable incentive programs.

Barriers may arise as a result of changing economic or policy conditions, such as the availability of tax credits, direct subsidies, or the climate for loans and project finance opportunities. Many states are reviewing how utilities compensate consumers for net excess energy fed into the grid (e.g., net-metering), and whether utilities will be allowed to impose standby charges for self-generation. The state energy office, local utility, or renewable energy equipment vendor should have information about the current status of incentive programs. Organizations should be aware that the receipt of incentives or participation in certain programs may require the relinquishment of environmental benefits (e.g., renewable energy certificates) and claims. Close attention should be paid to the terms of participation.

Finally, the organization may want to take advantage of guidance from independent programs such as The Climate Group's RE100 (companies committed to purchasing 100 percent renewable energy), the World Wildlife Fund and World Resources Institute's Corporate Renewable Energy Buyers' Principles, Rocky Mountain Institute's Business Renewables Center, and the Sustainable Purchasing Leadership Council. Some of these programs require membership to access available resources.

Case Study: Using Incentives to Finance an On-Site Generation System

The University of Washington (UW) partnered with Seattle City Light (SCL) and the Washington State Department of Commerce (DOC) to install solar panels on three residence halls. SCL's Green Up program contributed $225,000 toward the purchase of the solar panels. This contribution enabled UW to compete for the DOC Solar Grant Program, which also gave $225,000 in matching funds. Another $115,000 for the project's smart inverters was provided by another grant from the U.S. Department of Energy and the Washington DOC. In addition to the solar panels, the project will include advanced meters, communications equipment, a battery system and control center. The combined installation will act as a testbed for research on how solar energy can be combined with other demand-side resources such as battery systems, in order to provide controllable power and voltage support.

Creating a Project Plan

Once the organization has decided on a specific generation technology, it should conduct a detailed feasibility study. This study will assess the technical, regulatory and financial costs and benefits of the project. The study should be based on inputs that are as specific as possible to the organization's situation, such as resource and site conditions, specific utility rules, and quoted prices for equipment and operations and maintenance costs from vendors.

[1] For the investment tax credit, see http://programs.dsireusa.org/system/program/detail/658. For the production tax credit, see http://programs.dsireusa.org/system/program/detail/734. For MACRS, see http://programs.dsireusa.org/system/program/detail/676

Technical considerations may include how well the project output matches the organization's electricity consumption. For net metering, this has typically meant matching generation and consumption on an annual basis, but as states review net metering policies and the value of self-generation, time of use will become more important for distributed generation and how it is compensated. Organizations should compare the project's hourly and seasonal generation profile with the organization's load profile. Energy storage may be a factor in matching output to consumption and in reducing utility demand charges. For some renewable resources such as biomass, fuel availability, transportation and storage may be an issue.

As with any type of development project, the organization must secure the necessary land-use and building permits required for its construction. This should take into account space limitations, as well as fire, safety and zoning requirements. Biomass projects will likely require air permits from the local air resources control board. The project plan should account for the time and expense of acquiring these permits.

Case Study: Owning an Off-site Wind Farm

IKEA, the provider of home furnishing products, has taken bold steps by purchasing two wind farms in the United States, the 98-MW Hoopeston Wind project in Illinois, and the 165-MW Cameron Wind Farm in Texas. Both projects came online in 2015. IKEA's goal is to generate renewable energy equal to 100% of its total global energy use by 2020 and to minimize its emissions. IKEA also has 38 MW of solar capacity installed on 90% of its buildings across the United States. IKEA Group fully owns the wind farms because it wants to control its exposure to fluctuating electricity costs, but the projects were constructed and are managed by a third-party developer.

For on-site projects, the local utility will have electrical interconnection requirements, which, depending on the size of the project, may entail significant engineering studies. If the project is off-site and interconnected to the transmission or distribution grid, more significant studies and fees may be required. Other technical issues that should also be investigated include power-quality impacts for on-site generation and islanding capability (operating as a stand-alone microgrid) if there is a power outage.

If the project appears feasible, the project team can then decide on a plan to finance, build and install the renewable power system.

Procurement Strategy

Self-generation differs from power purchases. Undertaking a self-generation project means that an organization may buy, own and operate its own generation equipment, as opposed to purchasing green power supply.

An organization can handle the procurement options for self-generation in the following ways:

- **Act as the general contractor.** If the organization has design engineers on staff, they can draw up the specifications and then solicit bids for equipment and installation. This arrangement works well if the organization wants to do some of the work in-house. Keep in mind, however, that if the organization has no experience with renewable energy projects, it runs the risk of ending up with a poorly performing system.
- **Hire a qualified contractor for a turnkey project.** For an on-site project, an organization can use a request for proposals (RFP) to select an equipment manufacturer, a system designer, or a system installer to help design the project, to buy the materials, to arrange for installation and to commission the project. There are some companies (particularly in the PV industry) that are vertically integrated, from manufacturing to design and installation to operations and maintenance.

Before hiring a contractor, an organization should check with state and local jurisdictions to see what licenses are required of contractors. If the project is utility-scale and off-site, such as a wind farm, a developer with wind project experience would be very important, and it would be common for the developer to bring a partially developed project to the table.

Alternative: On-site Power Purchase Agreement

When evaluating self-generated green power, some organizations decide not to own the project because of the capital investment requirement, maintenance responsibilities, or financial returns that fall short of company standards. An alternative that many organizations consider is an on-site project developed, financed and owned by a third party. The third-party owner contracts to sell the power, or lease the equipment, to the consumer host. The deal may be structured so that the monthly payment is slightly less than the cost of electricity. See Chapter 6, Contracting for Green Power.

Relative to ownership, this approach simplifies the host's responsibilities, but it may not be available in states that only allow electricity to be sold by a qualified utility. Moreover, it is important to consider how the choice of who owns the system will affect the availability of tax credits and incentives (for instance, non-taxable entities cannot take advantage of tax credits).

As with other types of green power purchases, organizations should make sure that the contract also defines the ownership of RECs or generation attributes and therefore the rights to claim the use of renewable electricity. A host that wants to claim environmental benefits such as the use of electricity from a zero emissions resource will need to own and retire the RECs (or attributes) that are generated. See Appendix B for more on financing alternatives.

If an organization self-generates, it must retain the renewable energy certificates (RECs) to substantiate claims of renewable energy use, or for claiming reductions in its emissions footprint. But if it is a solar project in a state with high solar REC prices, it can sell the RECs and buy replacement RECs from a cheaper source to support environmental claims. See text box in Chapter 4 on REC Arbitrage.

Choosing a Vendor

When choosing a vendor, obtaining more than one bid is recommended, so the first step is to find several possible vendors for a given project. The websites for the major trade groups in this area—the Solar Energy Industries Association and the American Wind Energy Association—offer information about their members' expertise and interests. Chapter 10, Resources for Additional Information, lists more sources.

The organization should obtain comparative information from each vendor, usually through either an RFP or a request for information as described in Chapter 6, Contracting for Green Power. An RFP is appropriate if the organization already has a detailed system design and simply wants a vendor to implement that design. An RFI is better for comparing vendors' qualifications and experience and should be used to select a vendor to design and implement the project. Because the design of self-generation projects is site-specific, and because design details are often resolved differently by different vendors, the RFI approach often leads to a project best tailored to an organization's needs. For more insights and resources see also https://www.epa.gov/repowertoolbox.

Some factors to consider when choosing a provider for implementing a self-generation project include:

- **Experience.** The vendor's experience and familiarity with the type of project the organization is considering is extremely important. Also determine the vendor's experience with interconnection issues (if the project will be connected to the grid). A quick way to judge a vendor's experience is the length of time it has been in business and the number of similar projects it has installed.
- **Performance history.** It is very important to check references from previous customers, preferably for projects similar to the one the organization is considering. Another important factor is whether there are any judgments or liens against the vendor, which would indicate problems with previous projects.
- **Licenses and certification.** To be eligible for state incentives, some states require that the project be installed by a licensed contractor, whereas other states certify installers that have received the relevant training. As with any other capital project, licenses and certifications are an indicator of a contractor's qualifications.
- **Liability and professional insurance.** If any problems arise with the project during installation or operation, it is important that the contractor have adequate insurance to protect the owner/organization from liability. The contractor should also be responsible for any problems with interconnecting to the grid.

Installing and Operating a Renewable Generation Project

Once the organization's generation project has been designed, it is time to put the contracts in place and begin construction. As with any capital project, it is important to stay involved during the construction to resolve any problems that might arise.

When the construction has been completed, the project team should monitor and verify the system's energy performance. Does everything work as planned? What is the actual energy production? If it is not as projected, what can be done to improve performance? Information about performance is useful in communicating the benefits of the project to internal and external audiences.

Measurement and validation generally proceed in two steps. The first is the post-construction evaluation (or commissioning), in which a contractor's work is inspected and the project is tested to make sure that it meets regulatory and design specifications. The second step is monitoring and verifying the project's performance over a longer period, such as the first year of operation (although continuous monitoring is necessary to catch any performance problems that arise). It is important to plan for this stage at the early phases of the project, in order to design a useful data acquisition system. Economic analysis is also required, since how the system is operating relative to time-of-use rates and demand charges can sometimes be different than originally assumed.

Finally, all renewable power projects require periodic maintenance to perform as intended. Self-generation projects require scheduled maintenance and replacement of critical equipment components. Project owners should plan for replacement of key system components such as inverters that convert direct current to alternating current. Organizations should discuss the frequency and cost of such replacements with equipment vendors. Additionally, the organization must decide whether its staff has the expertise and time to operate and maintain the equipment, or whether it should contract with the equipment vendor or a service company.

Organizations that own generating projects should plan for equipment end-of-life removal and disposal, and, if applicable, site restoration. Large projects may be permitted only if funds are set aside for this purpose.

CHAPTER

8

Capturing the Benefits of the Purchase

To view the full Guide, visit https://www.epa.gov/greenpower/guide-purchasing-green-power

DOCUMENT MAP

There are many potential benefits to purchasing green power: environmental, economic, stakeholder relations and development of domestic energy resources. Some of them may be benefits internal to your organization, such as price stability or predictability, cost savings, or increased reliability, which are intrinsic to the purchase itself. Others may be satisfying organizational goals for 100 percent renewable energy, reducing the organization's emissions footprint, or enhancing employee satisfaction, which require the organization to be more proactive in communicating results.

For some of these accomplishments, an organization may want to measure and record its accomplishments in a registry or corporate annual report, or through a third-party group campaign or initiative. Companies may also seek recognition for their actions as part of branding, public relations, or product differentiation—and to contribute publicly to the momentum around purchasing green power. In all cases, an organization must own the renewable energy certificates (RECs) to substantiate its green power claims and to take credit for the benefits of its green power purchases. This chapter addresses several ways to capture the environmental and stakeholder relations benefits: emissions inventories, emission reductions, building certification, promotion of purchases and best practices in advancing public claims about environmental benefits.

The Environmental Benefits

The environmental benefits stemming from an organization's purchase of green power depend on a number of factors, including the quantity of zero-emissions energy purchased and consumed. As a start, organizations should compare the amount of green power purchased or generated and consumed to the full amount of energy used across their facilities. Percentage of green power use is the basis of many environmental claims, and organizations must be able to substantiate and document these claims.

Value of Emissions Inventories

Concerns about climate change have prompted many organizations to complete an emissions inventory. An inventory is a detailed quantitative calculation of emissions by source and type of greenhouse gas, usually expressed in metric tons of carbon dioxide equivalent ($MTCO_2e$).

An inventory serves many purposes, including the following:

- Identifying opportunities for reducing and managing emissions.
- Participating in reporting programs and reduction initiatives.
- Documenting an organization's emission reductions as a basis for promoting these actions to customers and other stakeholders.

An inventory also allows organizations to record their emission information in a formal registry. Several emissions registry programs have been established to record emissions inventories, including The Climate Registry (TCR), CDP (formerly the Carbon Disclosure Project), and Wisconsin's Voluntary Emissions Reduction Registry. The U.S. Environmental Protection Agency's (EPA's) Center for Corporate Climate Leadership provides resources and guidance on preparing a corporate emissions inventory.[1] Most registries will refer the prospective user to the Greenhouse Gas (GHG) Protocol at www.ghgprotocol.org for guidance on how to calculate emissions that will be reported in the registry. Although methods may be based on the GHG Protocol, many registries have their own reporting rules and requirements.

[1] U.S. Environmental Protection Agency. (n.d.). EPA Center for Corporate Climate Leadership greenhouse gas inventory guidance. Retrieved from https://www.epa.gov/climateleadership/center-corporate-climate-leadership-greenhouse-gas-inventory-guidance

Accounting for Emissions

The GHG Protocol, supported by the World Resources Institute (WRI) and the World Business Council for Sustainable Development, works with organizations around the globe to create accounting and reporting platforms for greenhouse gas emissions. It has established comprehensive and standardized frameworks for measuring and managing emissions. The GHG Protocol is the world's most widely used emissions accounting standard for companies.

In particular, the GHG Protocol Corporate Standard provides requirements and guidance for companies and other organizations preparing an organization-level emissions inventory.[2] This standard and supplemental reporting protocols have been adopted by the largest emissions inventory platforms in the world, including CDP and TCR. The idea is that an emissions inventory is a strong basis for setting emission reduction goals and for measuring progress toward those goals.

Capturing the benefits of emission reductions entails creating an inventory and reporting the organization's emissions, usually in a public registry. If the organization does not want to create a comprehensive emissions inventory, it may simply report that it is purchasing low- or zero-emissions green power (see environmental claims best practice below).

Avoided Emissions Claims

When an organization buys and uses green power, the renewable generation affects the operation of other generators on the grid and may reduce emissions. While avoided emissions are conveyed by RECs, organizations must exercise care when making avoided emissions claims because the RECs or generation attributes do not convey tons of emissions reductions. Also, the owner of each generating source that is affected by the organization's use of green power is ultimately responsible for its direct emissions and has the right to claim any resulting tons of direct emissions reductions. There are circumstances, however, where an organization may optionally report its avoided indirect emissions impact under its greenhouse gas inventory. Organizations should understand these subtleties before making avoided emissions claims. See the Scope 2 Guidance referenced in Chapter 10 for more information. The authoring organizations of this document are available to help organization better understand making avoided emissions claims.

The GHG Protocol provides guidance for accounting for direct emissions (called Scope 1) that are under the direct control of the reporting organization; indirect emissions (called Scope 2) resulting from the organization's purchase of electricity, steam and heat; and other indirect emissions (called Scope 3), which are emissions from the organization's supply chain.

An organization that owns or controls electricity generation facilities is directly responsible for the emissions, and if it creates an emissions inventory, would report those emissions as Scope 1 emissions. If it sells that electricity and its environmental attributes (or the attributes alone) for use by someone else, the purchaser of the electricity and attributes becomes indirectly responsible for those emissions and would report them as Scope 2 emissions. An organization can use zero emissions REC-based green power in place of fossil-fired generation that emits emissions to reduce its Scope 2 emissions responsibility, i.e., its footprint.[3]

Per the Scope 2 Guidance, organizations in a market where electricity supplier or product choices are available must report emissions calculated using two different methods. The location-based method calculates emissions using average emission factors from the grid region(s) where an organization's operations take place, regardless of any direct purchases or contractual agreements an organization may use to purchase green power. The location-based method can show an organization's "business-as-usual" scenario, absent any specific choices of energy supply. It can also show location-specific risks associated with conventional power use, such as air pollution from coal combustion. The market-based method calculates emissions using emission factors that reflect any specific energy choices an organization makes or any contractual agreements it uses to purchase power (e.g., unbundled RECs, power purchase agreements (PPAs), or differentiated utility products). An organization will account for its reduced Scope 2 emissions from green power purchases as part of the market-based method. Regardless of the green power procurement

[2] Greenhouse Gas Protocol. (n.d.). Corporate standard. Retrieved from http://ghgprotocol.org/corporate-standard

[3] The GHG Protocol Scope 2 Guidance explains how to account for green power purchases correctly. Greenhouse Gas Protocol. (2015). Scope 2 guidance. Retrieved from http://www.ghgprotocol.org/scope_2_guidance

option used, each purchase must include the renewable attributes of the energy purchased including the emissions factor of renewable source of generation - as reflected in RECs - in order to be claimed in the market-based Scope 2 figure.

Green Buildings Certification

Renewable energy purchases and on-site generation may earn building owners credit toward a variety of green building standards. For example, the U.S. Green Building Council runs the Leadership in Energy and Environmental Design (LEED) certification program, which recognizes buildings that generate or purchase renewable energy for a certain amount of their electricity use, awarding credit proportional to generation and purchase amount. For purchased renewable energy, LEED requires that renewables meet the Green-e standard, or equivalent.

Case Study: Using Green Power for Promotion and Branding

Church & Dwight features the Green-e logo on a number of products and brands, including Arm & Hammer, Vitafusion, Lil Critters, and First Response. The Green-e logo represents that these products have been made at manufacturing plants that purchase renewable energy to match 100% of the facilities' annual electricity load. Church & Dwight continues to explore ways to utilize renewable energy for their operations. In addition to other environmental initiatives, the company has committed to achieving carbon neutral status by the end of 2025.

Promoting the Organization's Purchase

Environmental responsibility has become a major factor in the purchasing decisions of many consumers. Purchasing green power, reducing one's emissions footprint and publicly promoting those purchases and emission reductions can improve an organization's brand and increase the level of trust among environmentally conscious customers. Promotion can motivate an organization's employees by showing them that sustainability is more than a buzzword and that the organization is willing to walk the talk. Promoting green power purchases positions an organization as a market leader and amplifies the environmental impact beyond the organization by influencing customers, suppliers and policymakers.

Internal Promotion

One of the benefits of buying green power is improving employee morale. It is also important to maintain internal support for purchasing green power. To achieve these goals, companies and organizations often choose to promote their purchase or installation internally using the following methods:

- **Include "energy" or "sustainability" news in internal publications.** Internal publications, such as newsletters or online employee portals, are valuable ways of communicating information to an organization's employees, stakeholders and affiliates. They also help support the organization's mission, growth and development.
- **Establish a staff adoption and recognition program.** Such a program encourages employees to buy green power for their home electricity use through an organization-wide program. A staff adoption program should create incentives, provide information, set milestones for staff purchases over time and recognize individual achievements.
- **Identify ways to measure increased customer attraction and retention from green power purchases.** Many customers prefer doing business with companies that take visible action to protect the environment. Organizations might consider performing surveys of customers to gauge the importance of the organization's green power purchase to them. They should communicate the results to management to show the bottom line impact of green power purchases and ensure continued commitment.

RECs are Not Offsets

Organizations should take care not to confuse RECs with project offsets. This confusion may arise because RECs and project offsets are both tradable instruments commonly used in U.S. energy markets to account for GHG emissions. However, RECs and project offsets serve different purposes and represent different claims.

- A REC is measured in megawatt-hours and represents the environmental attributes (including emissions from the generating facility) associated with the generation of 1 megawatt-hour of renewable electricity. The organization that purchases REC-based electricity can claim use of zero or low emissions (depending on the actual emissions at the generating facility) electricity, as part of its indirect, or Scope 2, emissions accounting, but RECs are not a basis for claiming global, or Scope 1, direct emission reductions.
- A project offset is measured in metric tons of carbon dioxide equivalent ($MTCO_2e$) and represents a direct reduction of global GHG emissions that can compensate for or offset emissions made elsewhere. Project offsets may be created from a variety of actions not necessarily related to energy production, such as energy efficiency or changes in land use. While a project offset allows its owner to claim direct global emissions reductions, offsets do not support claims of renewable energy use.

For more information regarding the differences between RECs and Project Offsets please see EPA's white paper titled "Offsets and RECs: What's the Difference?" https://www.epa.gov/greenpower/offsets-and-recs-whats-difference.

External Promotion

Strategic external public relations maximize the positive publicity surrounding an organization's purchase of green power. In addition to the public relations benefits, the purchase can motivate additional green power purchases by the general public, the organization's customers and its supply chain, thereby extending the impact of the initial purchase. To be effective, organizations must be sure to substantiate any claims made, per Federal Trade Commission (FTC) marketing guidelines (see Chapter 10).

- **Construct a public relations plan.** Organizations may construct a plan to communicate their purchases or installations to target audiences. The plan should include strategies for using existing distribution channels such as email, social media, blogs, websites and direct mail to promote the organization and its commitment to renewable energy. An organization can create special print materials and press releases for distribution and conduct email campaigns that distinguish it as an innovative leader. Retail companies sometimes circulate special offers and coupons and even host events—such as renewable energy celebrations—at stores to attract new customers and communicate the benefits of their green power purchases.
- **Use media contacts and press.** An organization may wish to write a press release describing its purchase and circulate it to local and national media outlets. An organization can also research and contact local environmental writers and publications to encourage feature stories about the organization and its commitment to the environment.
- **Train staff to promote the organization's purchase.** Purchasers can instruct their staff about the details of the organization's purchase and the best ways to highlight it to customers in daily sales interactions. Organizations might also teach staff how to answer general questions about renewable energy. Providing presentation slides or other collateral for executives to use when speaking publicly can be effective for reaching audiences other than customers, such as investors or trade press.
- **Take advantage of all opportunities to promote the purchase.** Effective organizations use strategic business engagements and speaking events as well as existing interactions with the public to talk about the organization's environmental commitment. These opportunities might include marketing the organization's purchase on its products and encouraging its suppliers and affiliates to also buy green power. Commercial organizations can offer retail customers the opportunity to sign up for green power at point of sale, and reward them with benefits such as discounts or gift cards, merchandise or collateral products (e.g., T-shirts, hats) that tout the company as an environmental leader.

- **Work with third-party organizations.** Third-party organizations can help provide credibility to green power purchases that meet minimum purchasing benchmarks. These organizations also offer publicity channels that promote renewable energy. They can share accomplishments throughout networks of peer companies and others. Often, other green power purchasers will acknowledge or echo the initial accomplishment on social media or elsewhere. All the organizations sponsoring this guidebook help their partners and companies publicize their achievements in buying green power. Members of EPA's Green Power Partnership and those who participate in Green-e Marketplace can also use these programs' respective logos in their outreach and communication materials.
- **Participate in awards competitions.** A number of entities recognize leadership in the purchase of renewable energy through an awards program, including EPA's Green Power Partnership and the Center for Resource Solutions' Green-e program as part of the annual Renewable Energy Markets Conference. Once an organization wins such an award it can highlight the award on its website, press releases and other communication materials.

Example Claims

The FTC and RE100 have guidelines on how to market and promote green power purchases in ways that are not deceptive for consumers, with several examples of deceptive claims. These resources may be found in Chapter 10. Below are some example claims organizations might make regarding their use of renewable energy and purchases of green power.

Legitimate

- A manufacturer that self-generates half of the electricity for a manufacturing plant while also retaining the associated RECs from its onsite solar array and that also purchases additional RECs to match nonrenewable consumption for the remaining half of the plant may promote on its website that the products manufactured at this plant are manufactured using 100 percent renewable electricity.
- An owner of a local warehouse that sources 100 percent of the warehouses' energy consumption from wind energy via a PPA and maintains ownership of the wind project RECs may promote on its website and in meetings with customers that the warehouse is fully powered by wind.

Deceptive

- A retail store has a sticker on its front entrance claiming, "Powered by renewable electricity" when only half of the store's electricity use has been matched with purchased RECs.
- A commercial real estate firm advertises to prospective tenants that a building is powered by green power, when the firm has only purchased green power for the common areas and not for the tenant spaces throughout the building.
- A company enters into a PPA with a renewable energy facility for enough power to cover 100 percent of its operations and promotes to customers that it uses renewable energy, but it does not own the RECs associated with the power, which are retained by the project and sold to a compliance entity for the state's renewable portfolio standard program.

Best Practices

Making unsubstantiated and inaccurate claims about use of green power could lead to legal and financial risks while damaging an organization's reputation. Hence, it is important for organizations to make credible claims and substantiate them through REC ownership and retirement. Organizations can follow the below guidance in making environmental claims:

- **Ensure contractual right to make claims.** The ability of an organization to make claims of using green power is contingent upon its ownership of the environmental attributes associated with the electricity it consumes. In the

United States, RECs represent these environmental attributes. Thus, an organization must ensure it possesses exclusive and full rights to the RECs associated with its electricity consumption to make environmental claims. This rule applies in all cases, whether the organization owns the renewable system or is purchasing the green power from a third-party owned system through an agreement like a physical PPA, financial PPA, or utility program.

- **Ensure green power purchases do not count towards a mandate.** A long-standing consumer requirement of the voluntary market is that buyers want to know that their individual investments in and use of green power do not go towards supporting a mandate that would have otherwise occurred absent the voluntary consumer's proactive use of green power. The concept of going beyond what is mandated is sometimes referred to as "regulatory surplus." Most states prohibit electricity suppliers from counting voluntary demand towards their compliance obligations, but it is worth checking with the supplier.

  From a different perspective, some organizations may want to consider the nonvoluntary renewable energy component of their standard electricity service when setting a corporate renewable energy goal. Organizations should be aware that disaggregation of the resource components of the standard electricity supply for corporate renewable energy goal-setting purposes may not be accepted by different programs or for commercial marketing claims. For more information, please see the GHG Protocol and FTC guidance on making renewable electricity use claims.

- **Limit claims to match the scope of the purchase.** If an organization is buying green power to meet only part of its energy consumption or just for a subset of the organization, then the organization's environmental claims must also accurately reflect this scale or scope of the green power purchase.

- **Retain ownership of the RECs from self-generation supply options.** Ownership and/or operation of a renewable energy project on-site does not automatically guarantee claims to the associated RECs, unless the organization retains them. If an organization sells the RECs from its project, it must purchase replacement RECs to support its environmental claims.

- **Retire the RECs associated with green power purchases to prevent double claims.** Making an environmental claim constitutes a retirement of the REC; selling or transferring RECs after making environmental claims leads to double counting, as two different parties will claim the same environmental benefits from the green power purchase. Once the organization makes a green power purchase claim, it must retire the associated RECs (or ensure the RECs are retired on its behalf). The organization can consult with its green power supplier or tracking system representatives on the formal REC retirement options.

- **Buy certified green power to support claims.** Organizations should strive to buy green power products that are certified and verified by independent third-party entities. Certification provides credibility and affirmation of the environmental benefits associated with a green power purchase. The verification process involves auditing by an independent entity, which avoids double counting of environmental benefits while accurately accounting for the quantity and quality of the green power product. Thus, certified and verified green power products bolster credibility and substantiate the environmental claims made by an organization.

- **Limit claims to indirect emissions (Scope 2 emissions).** Organizations should be cautious when making claims related to emission reductions. Purchase of green power reduces only indirect emissions or Scope 2 emissions. Indirect emissions are based on power that an organization buys from an electricity service provider. The emissions factor from the power generator is the critical environmental attribute included in RECs. EPA advises organizations to limit their environmental claims to reduction of emissions footprint, and avoid claims of reducing total organizational emissions emitted into the atmosphere.[4]

[4] For further guidance, please refer to the GHG Protocol Scope 2 Guidance. Greenhouse Gas Protocol. (2015). Scope 2 guidance. Retrieved from http://www.ghgprotocol.org/scope_2_guidance

- **Avoid claiming emissions not included in purchases.** Organizations must limit their claims to only attributes included in the purchase of green power. Claiming emission reductions of nitrogen oxides (NOx) and sulfur oxides (SOx) might necessitate a purchase of those emission allowances independent of the REC purchase. In markets where NOx and SOx are regulated by cap and trade programs, an organization must purchase separate NOx and SOx emission allowances and retire them in order to claim the associated emission reduction. Similarly, in regions with (CO_2) cap-and-trade programs, though an organization can nevertheless claim receipt of zero-emissions RE and scope 2 reductions, an organization must ensure that allowances have been retired in order to claim avoided grid emissions.
- **Use the terms "REC" and "offset" correctly in claims.** RECs are not project offsets. Using RECs and offsets as interchangeable terms for environmental claims is not an acceptable practice. The definition of offsets can vary across greenhouse gas registries and programs. In regulated cap-and-trade programs, offsets have specific legal meaning as a noun. In voluntary markets, offsets refer to verifiable emission reductions achieved by individual projects, which demonstrate global emissions reductions beyond a baseline, and often are not even related to renewable energy. Offset instruments do not convey a renewable electricity use claim to their owner. Similarly, a REC does not convey a metric ton of global emissions reduced to its owner.
- **Be able to substantiate claims.** An organization's environmental claims must be substantiated at the time they are made. This means that the organization is able to prove, through legal ownership of generation attributes or RECs (or retirement of same on their behalf by their green power provider), its unique right to make the claim. This demonstration may be made through an audit of contracts to show chain of custody, or by purchasing RECs registered and retired in an independent and transparent REC tracking system.
- **Avoid project claims of "additionality."** Claims of additionality are often made by consumers to imply project causation and enhanced direct global emissions reduction benefits. Organizations should avoid using the terms "additionality" or "additional" in the context of green power use and renewable energy project development unless the green power project has been shown to meet offset project quality criteria for additionality. Organizations, are encouraged to make verifiable "impact" claims, when such claims are included and conveyed through their chosen supply option or purchase.
- **Follow available market guidance.** The FTC provides important market guidance for environmental claims included in labeling, advertising, promotional materials and all other forms of marketing, whether implied or stated explicitly. Organizations should be familiar with this guidance. The FTC Green Guides cover all claims on environmental attributes for a wide range products and services across all organizational sectors

Many of these best practices can be achieved by purchasing a certified product and ensuring that claims are verified by a third party. Organizations can make informed decisions on environmental claims by consulting the market guidance documents of the FTC, EPA, RE100, WRI, Center for Resource Solutions and others listed in Chapter 10.

CHAPTER

9

Conclusion

To view the full Guide, visit https://www.epa.gov/greenpower/guide-purchasing-green-power

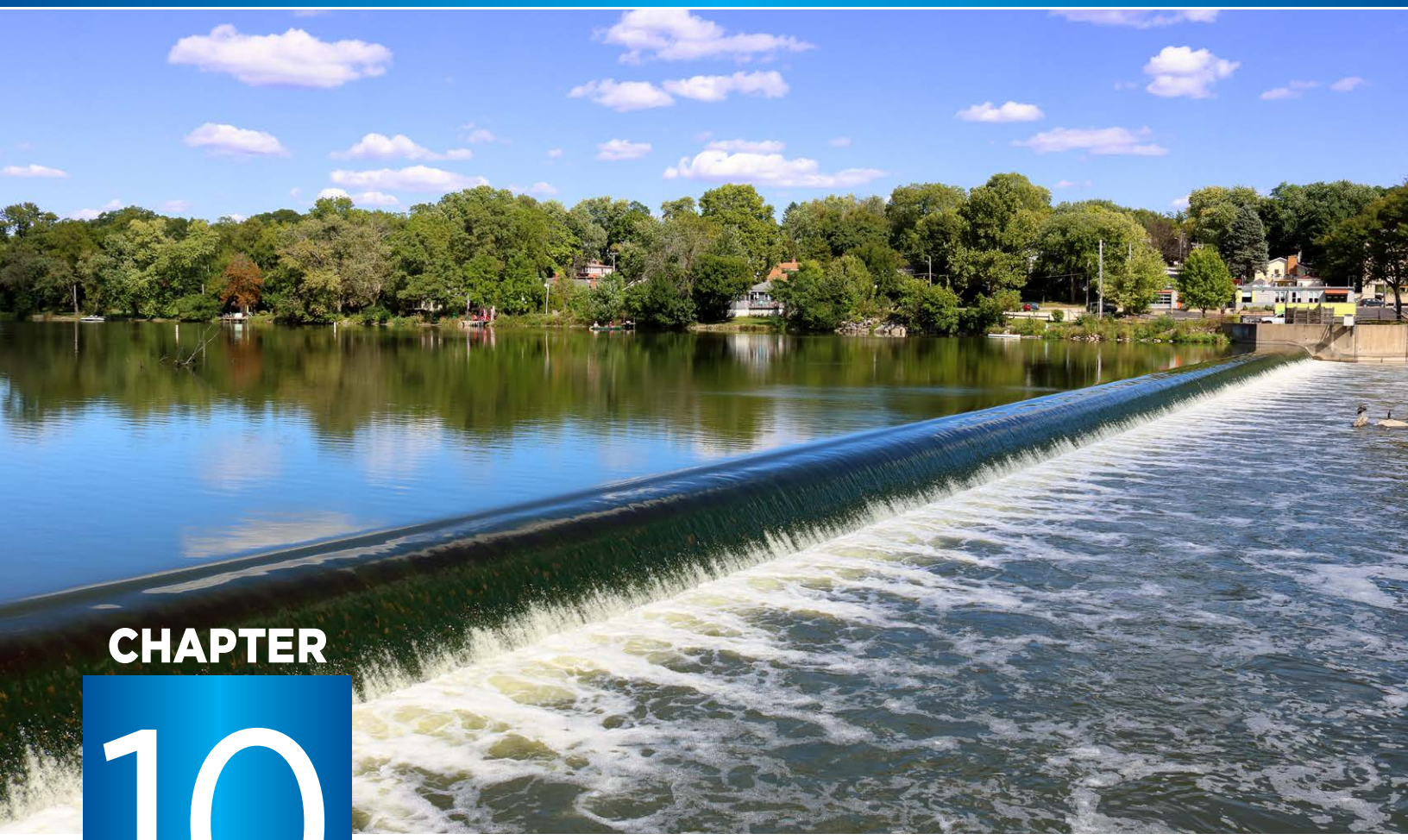
DOCUMENT MAP

Conclusion

Purchasers of electricity can have a significant impact on the way that power is produced, both now and in the future. Businesses, governments and nonprofit organizations have an unprecedented range of options for purchasing, generating and using green power. Although the rules vary from state to state, these organizations can choose how their electricity is produced, either by selecting an off-the-shelf product, by negotiating with their utility or other electricity supplier, by directly contracting with a renewable energy generator, or by participating in aggregate purchasing. Organizations that wish to purchase green power have more options now than ever before. Additionally, the decline in renewable energy equipment costs has significantly increased the economic viability of self-generation projects.

Over the past decade, renewable energy purchasing has proliferated in the United States, in part due to the voluntary green power market. As a result of this growth, project developers, utilities and businesses have gained a wealth of experience as they purchased unbundled RECs, entered power purchase agreements, or installed green power generation. Businesses in the commercial sector are principal drivers in today's markets as they use green power to realize their economic and environmental goals while improving relations with customers and shareholders.

Renewable energy technologies, a greater variety of procurement models and self-generation options are becoming mainstream, allowing organizations everywhere to support green power and reduce their environmental impact. Organizations that act in their own—and in society's—best interests can take advantage of the strategies outlined in this guide to help move the United States towards a more sustainable energy future.



CHAPTER

10

Resources for Additional Information

To view the full Guide, visit https://www.epa.gov/greenpower/guide-purchasing-green-power

DOCUMENT MAP

U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency's (EPA's) Green Power Partnership is a voluntary program that encourages organizations to buy green power as a way to reduce the environmental impacts associated with purchased electricity use. The partnership works with hundreds of partner organizations voluntarily purchasing billions of kilowatt-hours of green power annually. Partners include a wide variety of leading organizations such as Fortune 500 companies; small and medium-sized businesses; local, state and federal governments; and colleges and universities. In addition to the Green Power Partnership, EPA hosts other websites and tools that provide support for initiatives on clean power or energy efficiency.

- U.S. EPA's Green Power Partnership: www.epa.gov/greenpower
- U.S. EPA's Green Power Partnership Requirements. https://www.epa.gov/greenpower/green-power-partnership-requirements
- U.S. EPA's Green Power Leadership Awards: https://www.epa.gov/greenpower/green-power-leadership-awards
- Clean Energy: https://www.epa.gov/energy/clean-energy-programs
- Center for Corporate Climate Leadership: www.epa.gov/climateleadership
- GRID Database: www.epa.gov/climateleadership
- ENERGY STAR: www.energystar.gov
- Landfill Methane Outreach Program: www.epa.gov/lmop
- Power Profiler: https://www.epa.gov/energy/power-profiler

U.S. Department of Energy

The Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) works to strengthen the United States' energy security, environmental quality and economic vitality through public-private partnerships. It supports this goal by enhancing energy efficiency and productivity and by bringing clean, reliable and affordable energy technologies to the marketplace.

As a part of EERE, the Department of Energy's Federal Energy Management Program (FEMP) facilitates the federal government's implementation of sound, cost-effective energy management and investment practices to enhance the nation's energy security and environmental stewardship. FEMP provides project transaction services, applied technology services and decision support services. All of these services are available to federal agencies deploying renewable technologies.

- Federal Energy Management Program: https://energy.gov/eere/femp/federal-energy-management-program
- FEMP Renewable Energy Procurement: https://energy.gov/eere/femp/renewable-energy-procurement-federal-agencies

World Resources Institute

World Resources Institute (WRI) is an environmental think tank that goes beyond research to find practical ways to protect the Earth and improve people's lives. WRI's mission is to move human society to live in ways that protect the Earth's environment and its capacity to provide for the needs and aspirations of current and future generations. Its work is organized around six critical goals that the world must achieve by 2020 in order to secure a sustainable future:

- **Climate.** Protect communities and natural ecosystems from damage caused by greenhouse gas emissions, and generate opportunities for people by catalyzing a global transition to a low-carbon economy.
- **Energy.** Drive the scale-up of clean, affordable power systems throughout the world to deliver sustainable socio-economic development.
- **Food.** Ensure the world's food systems reduce their impact on the environment, drive economic opportunity and sustainably feed 9.6 billion people by 2050.
- **Forests.** Alleviate poverty, enhance food security, conserve biodiversity and mitigate climate change by reducing forest loss and restoring productivity to degraded, deforested lands.
- **Water.** Achieve a water-secure future by mapping, measuring and mitigating global water risks.
- **Sustainable Cities.** Improve quality of life in cities by developing and scaling environmentally, socially and economically sustainable urban and transport solutions.

WRI has been engaging the private sector on sustainability and clean energy for more than a decade. Beginning with the original Green Power Market Development Group, WRI has been at the forefront of expanding corporate procurement of green power. Today, WRI's Electricity Initiative convenes an action-oriented group of member companies with utilities to expand clean energy in China, India, the United States and across Southeast Asia and Latin America. The initiative drives alignment and investment in electricity markets to deliver on consumer demand for an affordable transition to clean energy. WRI is also a founding partner of the Renewable Energy Buyers Alliance.

- World Resources Institute Electricity Initiative:
  http://www.wri.org/our-work/project/electricity-initiative
- Greenhouse Gas Protocol:
  http://www.ghgprotocol.org/

Green-e Certification Programs

Center for Resource Solutions' Green-e certification program is the leading certification and verification program for renewable energy in the United States and Canada. It is a voluntary consumer-protection program that certifies superior renewable energy options offered by utilities and marketers in the voluntary renewable energy market. It is administered by Center for Resource Solutions, a nonprofit based in San Francisco. All Green e standards are stakeholder-driven, and all requirements and auditing protocols are publicly available. Green-e also works with businesses to certify renewable energy and climate commitments, verify claims, and provide accurate promotional tools. Green-e also certifies carbon offset products.

Renewable energy products that meet the Green-e standards, as well as businesses recognized by Green-e that are using certified renewable energy and products made with certified renewable energy, are identified by the Green-e logo.

The Green-e website, https://www.green-e.org, is a widely used resource that allow consumers to find certified products by state and to select the superior green power option that meets their needs.

- Center for Resource Solutions:
  https://resource-solutions.org
- Green-e:
  https://www.green-e.org

Additional Resources

The Additional Resources section is not intended to be an exhaustive list of all resources on a certain subject, but rather an introduction to a topic of interest.

Why Purchase Green Power

Business Renewables Center: A member-based platform, hosted by Rocky Mountain Institute, that aims to accelerate corporate purchasing of off-site, large-scale wind and solar energy. http://businessrenewables.org/

Climate Savers: World Wildlife Fund program encouraging businesses as leaders of the low-carbon economy. http://climatesavers.org/

Corporate Renewable Energy Buyer's Principles: An effort to communicate what buyers need from the marketplace and how much renewable energy they are seeking. http://buyersprinciples.org/

RE100: Amplifying the voice and supporting the largest companies with a goal to buy 100 percent renewable energy. http://there100.org/

Renewable Energy Buyers Alliance: A network of non-profit organizations helping companies understand the benefits of moving to renewables, connecting corporate demand to renewable energy supply, and helping utilities better understand and serve the needs of corporations. http://rebuyers.org/

Current State of Green Power Markets

Lazard. (2017). *Lazard's levelized cost of energy analysis—version 10.0.* Retrieved from https://www.lazard.com/media/450337/lazard-levelized-cost-of-energy-version-110.pdf

O'Shaughnessy, E., Heeter, J., Cook, J., and Volpi, C. (2017). *Status and trends in the U.S. voluntary green power market (2016 data)* (p. 21). National Renewable Energy Laboratory. Retrieved from https://energy.gov/eere/analysis/downloads/status-and-trends-us-voluntary-green-power-market

States with Customer Choice of Suppliers

Borenstein, S., and Bushnell, J. (2015). *The U.S. electricity industry after 20 years of restructuring.* Energy Institute at Haas. Retrieved from https://ei.haas.berkeley.edu/research/papers/WP252.pdf

U.S. Department of Energy. *A primer on electric utilities, deregulation and restructuring of U.S. electricity markets (2002).* Retrieved from http://www.pnl.gov/main/publications/external/technical_reports/PNNL-13906.pdf

Purchasing Guidance

Center for Resource Solutions. (2017). *Green-e renewable energy standard for Canada and the United States.* Version.3.1 Retrieved from https://www.green-e.org/docs/energy/Green-e%20Standard%20v3.1%20US.pdf

RE100. (2015). *The Journey to 100%*. Retrieved from http://media.virbcdn.com/files/d4/0d785368ea4e15c5-RE100briefing-reportre100websitev3.pdf

Sustainable Purchasing Leadership Council. (2016). *Principles for leadership in sustainable purchasing*, v 2.0. Retrieved from https://www.sustainablepurchasing.org/public/SPLC_Principles_for_Leadership_in_Sustainable_Purchasing_v1_0.pdf

U.S. Environmental Protection Agency. (2017). Green power partnership requirements. Retrieved from https://www.epa.gov/sites/production/files/2016-01/documents/gpp_partnership_reqs.pdf

Finding Green Power Products

Green-e. Find Green-e certified products and companies: http://www.green-e.org/certified-resources/products-companies

Making Appropriate Environmental Claims

Center for Resource Solutions. (2017). Renewable Energy Certificate (REC) Claims and Ownership. Retrieved from https://resource-solutions.org/learn/rec-claims-and-ownership/

RE100. (2016). *Making credible renewable electricity usage claims*. Retrieved from https://resource-solutions.org/document/making-credible-renewable-electricity-usage-claims/

U.S. Environmental Protection Agency. (2017). G*uide to making claims about your solar power use*. Retrieved from https://www.epa.gov/sites/production/files/2017-09/documents/gpp-guidelines-for-making-solar-claims.pd

U.S. Environmental Protection Agency. (2017). *Solar Power Use Claims Flow Chart.* Retrieved from https://www.epa.gov/sites/production/files/2017-09/documents/gpp-solar-claims-flow-diagram.pdf

U.S. Federal Trade Commission. (2017). *Guides for the use of environmental marketing claims*. Retrieved from https://www.ftc.gov/sites/default/files/attachments/press-releases/ftc-issues-revised-green-guides/green-guides.pdf

Physical Power Purchase Agreements (Physical PPAs)

Cory, K., Canavan, B., and Koenig, R. (2009). *Power purchase agreement checklist for state and local governments.* National Renewable Energy Laboratory. Retrieved from. https://financere.nrel.gov/finance/content/power-purchase-agreement-checklist-state-and-local-governments

Deloitte. (2016). Powering up the new leases standard. Retrieved from http://www.nortonrose-fulbright.com/knowledge/publications/157593/financing-projects-with-virtual-ppas

Federal Energy Management Program. Federal onsite renewable power purchase agreements: https://energy.gov/eere/femp/federal-site-renewable-power-purchase-agreements

Merry, L., and Wood, E. (2008). *The customer's guide to solar power purchase agreements.* The Rahus Institute. Retrieved from http://my.solarroadmap.com/userfiles/PPA-Customers-Guide.pdf

National Renewable Energy Laboratory. NREL Finance Team Publications: https://financere.nrel.gov/finance/content/nrel-finance-team-publications

Solar Energy Industries Association. Solar power purchase agreements: https://www.seia.org/research-resources/solar-power-purchase-agreements

Terms of service commercial 1.1. (n.d.) https://financere.nrel.gov/finance/content/terms-service-commercial-11

U.S. Environmental Protection Agency. Solar power purchase agreements: https://www.epa.gov/greenpower/solar-power-purchase-agreements

World Bank Group. Power purchase agreements (PPAs) and energy purchase agreements (EPAs): http://ppp.worldbank.org/public-private-partnership/sector/energy/energy-power-agreements/power-purchase-agreements

Financial PPAs (Virtual PPAs, Contracts for Differences)

Business Renewables Center: Tools and resources (available to members) http://businessrenewables.org/

Giji, M. John, Sachdev, R., Sherman, L., and Spielberg, D. (2016). Corporate PPAs: Market trends and opportunities. Orrick Herrington & Sutcliffe LLP. Retrieved from http://s3.amazonaws.com/cdn.orrick.com/files/Corporate-PPAs-Market-Trends-and-Opportunities.pdf

Gurch, M.J. (2017). Financing projects with virtual PPAs. Project Finance Newswire. (p. 14) Retrieved from. http://www.nortonrosefulbright.com/knowledge/publications/157593/financing-projects-with-virtual-ppas.

Mickelsen, S. (2016). Dodd-Frank compliance for corporate VPPA buyers. *Futures and Derivatives Law Report*. 36, 4. Retrieved from https://3degreesinc.com/wp-content/uploads/2016/05/GLFDLR4_Article-1.pdf

Turk, G. (2007). How market dynamics impact PPA, VPPA contracts. Smart Energy Decisions. Retrieved from https://www.smartenergydecisions.com/columns/2017/03/09/how-market-dynamics-impact-ppa-vppa-contracts

U.S. Environmental Protection Agency. (n.d.) Introduction to virtual power purchase agreements. https://www.epa.gov/sites/production/files/2016-09/documents/webinar_kent_20160928.pdf

Community Solar/Community Renewables

Interstate Renewable Energy Council. Shared renewables: http://www.irecusa.org/regulatory-reform/shared-renewables/

National Renewable Energy Laboratory. Solar technical assistance for states: https://www.nrel.gov/technical-assistance/states.html

National Renewable Energy Laboratory. (2010). *A guide to community shared solar: Utility, private and nonprofit project development.* Retrieved from http://www.nrel.gov/docs/fy12osti/54570.pdf

National Renewable Energy Laboratory. (2014). *Community shared solar: Policy and regulatory considerations.* Retrieved from https://www.nrel.gov/docs/fy14osti/62367.pdf

National Renewable Energy Laboratory. (2015). *Shared solar: Current landscape, market potential and the impact of federal securities regulation.* Retrieved from https://www.nrel.gov/docs/fy15osti/63892.pdf

Rocky Mountain Institute. Shine: Community scale solar: https://www.rmi.org/our-work/electricity/shine-community-scale-solar/

Solar Energy Industries Association. Shared renewables/community solar: http://www.seia.org/policy/distributed-solar/shared-renewablescommunity-solar

Writing RFPs for Green Power

National Renewable Energy Laboratory. (2016). Writing solar requests for proposals (RFPs): Lessons from NREL's university PV implementation assistance program. Retrieved from http://www.nrel.gov/docs/gen/fy16/66369.pdf

The World Resources Institute Green Power Market Development Group (n.d.). Guidelines for writing a REC request for proposal and sample contract for renewable energy certificates. Retrieved from www.thegreenpowergroup.org/tools.cfm?loc=us

The Solar Foundation. (2012). Steps to a successful solar request for proposal. Retrieved from https://www.thesolarfoundation.org/steps-to-a-successful-solar-request-for-proposal/

U.S. Environmental Protection Agency. Toolbox for renewable energy project development: https://www.epa.gov/repowertoolbox

Self-generation (On-site)

Bolinger, M. (2009). *Financing non-residential photovoltaic projects: options and implications.* Lawrence Berkeley National Laboratory. Retrieved from https://jointventure.org/images/stories/pdf/lbnl.financing.pv.pdf

California Energy Commission. (2001). A *guide to photovoltaic (PV) system design and installation.* http://www.energy.ca.gov/reports/2001-09-04_500-01-020.PDF

California Energy Commission. (2003). *Buying a photovoltaic solar electric system: A consumer guide.* Retrieved from http://abcsolar.com/pdf/2003-03-11_500-03-014F.pdf

Hassett, T. C., and. Borgerson, K.L. (2009). *Harnessing nature's power: Deploying and financing on-site renewable energy.* World Resources Institute. Retrieved from http://pdf.wri.org/harnessing_natures_power.pdf

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Gagnon, P., Govindarajan, A., Bird, L., Barbose, G., Darghouth, N., and Mills, A. (2017). *Solar + storage synergies for managing commercial-customer demand charges.* Lawrence Berkeley National Laboratory and the National Renewable Energy Laboratory. Retrieved from https://emp.lbl.gov/sites/default/files/solarstorage_synergies_report.pdf and https://emp.lbl.gov/sites/default/files/solarstorage-execsummary.pdf.

Midwest region consumer's guide to buying a solar electric system. (n.d.). Retrieved from https://www.itasca-mantrap.com/sites/itascamantrap/files/PDF/Consumer_Guide_to_Solar_Systems_MNDOC.pdf

U.S. Department of Energy. (2007). *Small wind electric systems: A U.S. consumer's guide.* Retrieved from https://energy.gov/sites/prod/files/2013/12/f5/small_wind_guide.pdf

WINDExchange:
http://apps2.eere.energy.gov/wind/windexchange/

On-site Renewable Generation Financial Analysis Tools

Each of the many available tools offers different features, which should be examined closely to determine whether they are appropriate to the particular situation.

Carbon Value Analysis Tool
Developer: World Resources Institute.
A screening tool to help companies integrate the value of carbon dioxide emissions reductions into energy-related investment decisions: http://www.wri.org/publication/carbon-value-analysis-tool-cvat

PV Watts
Developer: NREL
Provides estimated system output and savings calculations based on customizable system specifications and in the field system performance data. User inputs system information and selects a system in the general area of the user's own site to provide calculations: http://pvwatts.nrel.gov/

RETFinance
Developer: Energy Analysis Team at NREL
Simulates a 30-year nominal dollar cash flow for renewable projects, including earnings, debt payments, levelized cost-of-electricity, after-tax internal rate of return and debt service coverage ratio (net operating income divided by total debt service): https://cleanenergysolutions.org/resources/renewable-energy-technologies-financial-model-ret-finance

RETscreen International:
Developer: Natural Resources Canadas CANMET Energy Diversification Research Laboratory (CEDRL).
Assesses the economics of various renewable energy installations: www.retscreen.net

Interconnection with the Grid

DSIRE database lists state interconnection rules:
www.dsireusa.org/

The Federal Energy Regulatory Commission (FERC) has issued standard procedures and a standard interconnection agreement for the interconnection of generators to the transmission grid. The rules differ depending on whether the generator is larger or smaller than 20 megawatts. This site lists the applicable rules: https://www.ferc.gov/industries/electric/indus-act/gi/small-gen.asp

Standards Board of the Institute for Electrical and Electronics Engineers, Inc. (IEEE). (2015). *Standard 1547: Standard for interconnecting distributed resources with electric power systems*: http://grouper.ieee.org/groups/scc21/1547/1547_index.html

Varnado, L., and Sheehan, M. (2009). *A guide to distributed generation interconnection issues*, Sixth Edition. N.C. Solar Center and Interstate Renewable Energy Council. Retrieved from http://www.irecusa.org/wp-content/uploads/2014/11/Connecting-to-the-Grid-Guide-6th-edition1.pdf

Measurement and Verification of Renewable System Performance

The regional tracking systems' operating procedures specify how generators must measure, verify and report generation to be issued certificates. See links under Tracking Systems.

Cory, K., Coughlin, J., and Coggeshall, C. (2008). *Solar photovoltaic financing: Deployment on public property by state and local governments.* National Renewable Energy Laboratory. NREL/ TP-670-43115. Retrieved from
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Renewable Energy Certificates (RECs)

American Bar Association, American Council on Renewable Energy, and Environmental Markets Association. Master Renewable Energy Certificate Purchase and Sale Agreement: http://emahq.org/node/29

Center for Resource Solutions. (2016). How renewable energy certificates make a difference. Retrieved from https://resource-solutions.org/wp-content/uploads/2016/03/How-RECs-Make-a-Difference.pdf

EPA's Green Power Partnership. Renewable Energy Certificates: https://www.epa.gov/greenpower/renewable-energy-certificates-recs

EPA's Green Power Partnership. (2017) *Renewable Energy Certificate (REC) Arbitrage*. Retrieved from https://www.epa.gov/greenpower/renewable-energy-certificate-rec-arbitrage

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Jaineel, A., and Lau, C. (2008). *Bottom line on renewable energy certificates.* World Resources Institute. Retrieved from http://www.wri.org/sites/default/files/pdf/bottom_line_renewable_energy_certs.pdf

Jones, T., Quarrier, R., and Kelty, M. (2015). Center for Resource Solutions. *The legal basis for renewable energy certificates.* Retrieved from https://resource-solutions.org/wp-content/uploads/2015/07/The-Legal-Basis-for-RECs.pdf

Renewable Energy Tracking Systems

APX: https://apx.com/registries/nar/

Electric Reliability Council of Texas (ERCOT): www.ercot.com: www.texasrenewables.com/

International REC Standard (I-REC Standard): http://www.internationalrec.org/

Michigan Renewable Energy Certification System (MIRECS): http://www.mirecs.org/

Midwest Renewable Energy Tracking System (M-RETS): www.mrets.org

New England Power Pool Generation Information System (NEPOOL GIS): www.nepoolgis.com/

New York Generation Attribute Tracking System (NYGATS): https://www.nyserda.ny.gov/nygats

North American Renewables Registry (NAR): www.narecs.com

North Carolina Energy Tracking System (NC-RETS): http://www.ncrets.org/

PJM Generation Attribute Tracking System (GATS): https://www.pjm-eis.com

U.S. Environmental Protection Agency. Green Power Partnership renewable energy tracking systems: https://www.epa.gov/greenpower/renewable-energy-tracking-systems

Western Renewable Energy Generation Information System (WREGIS): www.wregis.org/

Renewable Energy Associations

American Council on Renewable Energy: www.acore.org

American Solar Energy Society: www.ases.org

American Wind Energy Association: www.awea.org

Geothermal Energy Association: www.geo-energy.org

Geothermal Resources Council: www.geothermal.org

Interstate Renewable Energy Council: www.irecusa.org

Low Impact Hydropower Institute: www.lowimpacthydro.org

Midwest Renewable Energy Association: https://www.midwestrenew.org/

National Hydropower Association: http://www.hydro.org/

National Wind Coordinating Collaborative: www.nationalwind.org

North Carolina Clean Energy Technology: https://nccleantech.ncsu.edu/

Northeast Sustainable Energy Association: www.nesea.org

Renewable Energy Markets Association: www.renewablemarketers.org

Smart Electric Power Alliance: www.sepapower.org

Solar Energy Industries Association:www.seia.org

Utility Variable Integration Group: www.uvig.org

Windustry: http://www.windustry.org/

Greenhouse Gas Accounting and Inventories:

California Energy Commission. California climate change: www.climatechange.ca.gov/

CDP (formerly Carbon Disclosure Project): www.cdp.net

Center for Resource Solutions (2016). The greenhouse gas benefits of renewable energy purchases. Retrieved from https://resource-solutions.org/wp-content/uploads/2016/11/GHG-Benefits-of-RE-Purchases.pdf

The Climate Registry: www.theclimateregistry.org

Greenhouse Gas Protocol. (2004). A corporate accounting and reporting standard. Retrieved from http://www.ghgprotocol.org/corporate-standard

Greenhouse Gas Protocol. (2015). Scope 2 guidance. Retrieved from http://www.ghgprotocol.org/scope_2_guidance

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Metzger, E. (2008). Bottom line on climate policy terminology. World Resources Institute. Retrieved from http://www.wri.org/publication/bottom-line-climate-policy-terminology

The Regional Greenhouse Gas Initiative: www.rggi.org/rggi

U.S. Environmental Protection Agency, Center for Corporate Climate Leadership: https://www.epa.gov/climateleadership

World Resources Institute Carbon Value Analysis Tool: www.wri.org/publication/carbon-value-analysis-tool

World Wildlife Fund's (WWF) Climate Savers: https://www.worldwildlife.org/partnerships/climate-savers

Glossary

To view the full Guide, visit https://www.epa.gov/greenpower/guide-purchasing-green-power

DOCUMENT MAP

This glossary defines some of the important terms used in this guide. More definitions can be found at https://www.epa.gov/greenpower/green-power-partnership-tools-and-resources.

Additionality. A quality criterion for emissions reduction (offset) projects stipulating that the project would not have been implemented in a baseline or "business-as-usual" scenario. Additionality is often applied to greenhouse gas project activities, stipulating that project-based emission reductions should only be quantified if the project activity "would not have happened anyway"—i.e., that the project activity would not have been implemented in its baseline scenario. Additionality is a test(s) used only for project offsets that result in direct emissions accounting and not for RECs or green power purchases. See Chapter 8 for more information.

Annual consumption. The amount of electricity used by a consumer in one year, typically measured in kilowatt-hours (kWh). This information can be acquired from an electricity bill or by contacting the energy provider.

Balancing power. The power purchased or provided by the electric grid system operator to match the power supply with grid demand for maintaining voltage frequency of electricity service delivery.

Behind the meter. Connection of an on-site generating facility to the electrical grid on the energy consumer's property before the energy reaches the main electrical panel, rather than on the utility side of the panel.

Bundled RECs. Renewable energy certificates (RECs) that are sold by a power marketer with electricity to an end-use consumer. For a retail electricity sale to be considered green power, it must include transfer of the RECs. See unbundled RECs.

Certification. A program or process in which an independent third party assures environmental standard compliance, quality and ownership of a green power product. Thus, certification bolsters the credibility and affirmation of the environmental benefits associated with a green power purchase.

Combined heat and power (CHP). An electricity generation technology, also known as cogeneration, that recovers waste heat from the electric generation process to produce simultaneously other forms of useful energy, such as usable heat or steam. On average, two-thirds of the input energy used to make electricity is lost as waste heat. In contrast, CHP systems are capable of converting more than 70 percent of the fuel into usable energy.

Commodity electricity. Generic electricity not associated with a particular power generation source.

Community solar. A procurement option in which a solar or renewable-electric system provides power and/or financial benefit to, or is owned by, multiple community members. The green power purchaser will typically receive utility bill credits and associated RECs for its share of the community/shared project output.

Community choice aggregation (CCA). A policy that enables local governments to aggregate electricity demand within their jurisdiction and the authority to pursue and negotiate bulk electricity purchase contracts (primarily renewable power) on behalf of participating end users.

Competitive markets. Electricity markets in which consumers can choose from among several competing retail electricity suppliers. In the late 1990s and early 2000s, several states restructured their electricity markets to allow competition for retail customers, according to price or environmental preferences. In contrast, many states have continued traditional regulation of their electricity markets. In these regulated utility markets, customers may procure green power through separate green tariffs from their utility - which procures the green power from a renewable energy project, on behalf of their customers (see Chapter 4, Green Power Product Options).

Conventional power. Power produced from nonrenewable fuels such as coal, oil, natural gas and nuclear fuels. These fuels are a finite resource that cannot be replenished once they have been extracted and used.

Direct purchase. A procurement option in which the purchasing organization contracts directly with a specific generator to purchase REC-based green power. Physical and financial power purchase agreements (PPAs) are examples of direct purchase. These options are generally customized products negotiated between the consumer and supplier and involve long-term commitments by consumers to purchase a volume tied to the output of a pre-determined generation capacity.

Distributed generation. Small, modular, decentralized, grid- connected or off-grid energy systems located in or near the place where energy is used.

Electricity supplier. A generic term encompassing regulated utilities as well as non-utility electricity marketers that provide retail generation service.

Energy efficiency. Using less energy to provide the same of better energy service (e.g., heating, cooling, lighting) than conventional products or systems. Energy efficiency saves energy, saves money on utility bills and helps protect the environment by reducing the amount of electricity that needs to be generated (and associated environmental impacts).

Financial power purchase agreement (PPA). A contract in which a generator and purchaser agree upon a predetermined reference electricity price (also called a "strike price"), but the power is sold into the local wholesale electricity market near the generator rather than directly to the power purchaser. The generator and the purchaser compensate each other on the difference between the previously agreed-upon reference electricity price and wholesale market prices, providing both with stable income and expense. Financial PPAs are also referred to as contracts for differences, virtual power purchase agreements (VPPAs), or synthetic PPAs.

Green power. Electricity generated or used from renewable energy sources with low or no environmental impacts. Green power implies a lesser environmental impact than that from conventional electricity generation and some forms of renewable energy. Large hydropower or municipal solid waste are generally not considered green power despite being renewable energy resources due to their environmental impacts. Green Power is renewable electricity that goes above and beyond what is otherwise required by mandate or requirement – it is voluntary or surplus to regulation. For more details, see Chapter 2, Introducing Green Power.

Green power products. Electricity supply options generated from renewable resources. Options include electricity products purchased from electricity suppliers, community choice aggregators and renewable energy generators, as well as renewable energy that is self-generated.

Interval meter. An electricity meter that measures a facility's energy usage in short increments (typically 15 minutes). These meters are useful for determining electricity demand patterns and participating in real-time pricing programs.

Kilowatt-hour (kWh). The basic unit for measuring the generation and consumption of electrical energy. A megawatt-hour (MWh) of electricity is equal to 1,000 kilowatt-hours. A kilowatt and a megawatt are units of generation capacity.

Low-impact hydropower. Hydroelectric power generated with fewer environmental impacts than large-scale hydropower, by meeting criteria such as minimum river flows, water quality, fish passage and watershed protection. These hydropower facilities may be certified by the Low Impact Hydropower Institute and often operate in a "run of the river" mode, in which little or no water is stored in a reservoir.

Net metering. A policy that allows owners of certain on-site power generation systems to export the net excess electricity to the utility grid and accrue credit for it on their electric bills. Customers generating their own electricity offset what they would have purchased from their utility. If they generate more than they use in a billing period, their electric meter turns backward to indicate their net excess generation. Depending on the individual state or utility rules, the net excess generation may be credited to their account (either at the retail price or the avoided cost of electricity generation, carried over to a future billing period, or ignored. Presently many states are reconsidering the compensation mechanism for net metering.

New renewable generation facilities. Facilities built in the recent past or that will be built to meet the growing market demand for green power. Currently, new generation must be from renewable energy generating facilities that began operation within the past 15 years (a moving window), according to the Green-e Energy certification standard and EPA Green Power Partnership requirements.

Offsets. A project offset is measured in metric tons of carbon dioxide equivalent ($MTCO_2e$) and represents a direct reduction of global GHG emissions that can compensate for or offset emissions made elsewhere. Project offsets may be created from a variety of actions not necessarily related to energy production, such as energy efficiency or changes in land use. While a

project offset allows its owner to claim direct global emissions reductions, offsets do not support claims of renewable energy use. However, output from a project that is used to create RECs cannot also be claimed for offset purposes.

On-site renewable generation. Electricity generated by renewable resources using a system or device located at the site where the power is used.

Peak demand. The maximum power consumption for a facility, measured over a short time period such as 15 minutes or an hour.

Physical power purchase agreement (PPA). A contract for the purchase of power and associated RECs from a specific renewable energy generator (the seller) to a purchaser of renewable electricity (the buyer). Physical PPAs, which are usually 10- to 20-year agreements, define all of the commercial terms for the sale of renewable electricity between the two parties, including when the project will begin commercial operation, schedule for delivery of electricity, penalties for underdelivery, payment terms and termination. The project may be located onsite at the user's location, or be off-site with the electricity being grid-delivered to the user. Physical PPAs by non-utility consumers are generally only allowed in competitive electricity markets, and the renewable energy generator and customers must be located in the same power market to allow for physical delivery of electricity. Compare to financial PPA.

Power marketer. An entity that buys and sells power generated by others. Power marketers exist at the wholesale market level, buying and selling power from generators and to retail resellers such as utilities. Power marketers at retail level distribute and sell power to end users. A green power marketer is an electricity supplier that offers a green power product.

REC arbitrage. When there is significant discrepancy in REC prices in different REC trading markets, an organization can gain financially by selling its RECs (generated from a renewable system it owns) in the higher priced (usually compliance) market and purchasing replacement RECs in the lower priced market. This is commonly referred to as REC arbitrage (also known as a REC swap). Under REC arbitrage, an organization would have to claim the attributes of the replacement RECs it purchases rather than the attributes of the RECs it sells.

Renewable electricity. Power generated from renewable energy resources. See Chapter 2, Introducing Green Power.

Renewable energy certificates (RECs). A REC is a tradable instrument that represents the environmental attributes of the generation of 1 megawatt- hour (MWh) of electricity from a renewable energy source. RECs serve two purposes--one as a tracking instrument to substantiate and verify green power and environmental claims (either to meet a compliance obligation or to satisfy a voluntary goal), and one as a key component of all green power product options. As a component of green power products, RECs can be sold separately from electricity (as unbundled RECs), sold with electricity service (as bundled RECs), or retained as an output of a renewable energy project. Each REC denotes the underlying generation energy source, location of the generation, year of generation (a.k.a. "vintage"), environmental emissions and other characteristics associated with the generator.

Renewable energy resources. Resources that are continuously replenished on the Earth, such as such as wind, solar, geothermal, hydropower and biomass. Some definitions include other types renewable resources, such as municipal solid waste. See green power.

Renewable portfolio standard (RPS). Sometimes called a renewable electricity standard. A regulatory mandate or target stating that a minimum percentage or amount of each electricity supplier's resource portfolio must come from renewable energy.

Self-generation. A procurement option in which an energy consumer installs and owns generation to supply all or a portion of its electricity needs, either on-site or off-site.

Shared renewables. An emerging model allowing multiple customers to buy, lease or subscribe to a portion of a shared renewable electricity system that is located away from their homes or businesses. The model is especially appealing to customers who do not have sufficient renewable resource, who rent, or who are otherwise unable or unwilling to install renewables on their residences or commercial buildings. Shared renewables can be in the form of 'community-owned' projects or third party-owned renewable electricity generators whose electricity is shared with multiple customers. Consumers must receive the renewable

energy certificates from a shared renewables project in order that they can claim use of renewable electricity.

Tracking system. An electronic database that is used to track the ownership of RECs, much like an online bank account. A tracking system issues a uniquely numbered certificate for each MWh of electricity generated by a generation facility registered in the system, tracks the ownership of certificates as they are traded, and retires the certificates once they are used or claims are made based on their attributes or characteristics. Because each MWh has a unique identification number and can only be in one owner's account at any time, a tracking system reduces ownership disputes and the potential for double counting.

Unbundled RECs. Renewable energy certificates (RECs) that are purchased separate from electricity; in other words, RECs and electricity are purchased from two different suppliers. See bundled RECs.

Verification. A third-party audit of a green power purchase that accurately accounts for the quality and quantity of the product and protects against dual claims or double counting of the green power purchase's environmental benefits. Verification may be a requirement of a certification program.

Virtual power purchasing agreement (VPPA). See financial PPA.

APPENDIX

A

Green Power Considerations for Federal Agencies

Authored by the U.S. DOE Federal Energy Management Program

To view the full Guide, visit https://www.epa.gov/greenpower/guide-purchasing-green-power

DOCUMENT MAP

Introduction

Since the federal government is the largest consumer of electricity in the United States, with an annual electricity bill of nearly $4.75 billion in fiscal year 2016,[1] the ability of federal agencies to save money, increase resilience and diversify their energy supply through the use of renewable energy is significant.[2] This appendix provides renewable energy information and considerations specific to federal agencies, as well as available resources.

By reading this guide and taking advantage of the technical and procurement support provided by the U.S. Department of Energy's (DOE) Federal Energy Management Program (FEMP), energy managers can help the federal government achieve its energy goals.

Information in this Appendix is subject to change. Please contact FEMP or the appropriate organization for updated information.

Federal Goals and Renewable Usage Information

Section 203 of the Energy Policy Act of 2005 (EPAct 2005, 42 U.S.C. 15852 Federal Purchase Requirement) directs that federal agencies meet renewable energy consumption goals of not less than 7.5 percent of the electric energy consumed in fiscal year 2013 (FY2013) and each fiscal year thereafter. Section 203 of EPAct 2005 defines renewable energy as "electric energy generated from solar, wind, biomass, landfill gas, ocean (including tidal, wave, current, and thermal), geothermal, municipal solid waste, or new hydroelectric generation capacity achieved from increased efficiency or additions of new capacity at an existing hydroelectric project" (42 U.S.C. 15852).

Visit the Federal Energy Management Program (https://www.energy.gov/eere/femp/federal-energy-management-program) websites for current statutory requirements and mandates for renewable energy goals. Consult with FEMP for calculation procedures and additional information.

Tables A-1 and A-2 show the type of electric and non-electric renewables used by federal agencies, in megawatt-hours (MWh). Figure A-1 shows federal renewable use from 2010 through 2016.

Table A-1: Federal Government Renewable Electric Energy by Source, FY2016 (MWh)

Wind	3,240,640
Wood and Wood Residuals	1,216,486
Solar Photovoltaic	827,268
Biogas (Captured Methane)	505,735
Ground Source Heat Pump	443,917
Incremental Hydropower	308,142
Agricultural Byproducts	162,613
Geothermal	85,623
Renewables through Serving Utility (mix of resources)	72,789
Municipal Solid Waste	16,976
Concentrating Solar Power (CSP)	7,995
Total	**6,888,182**

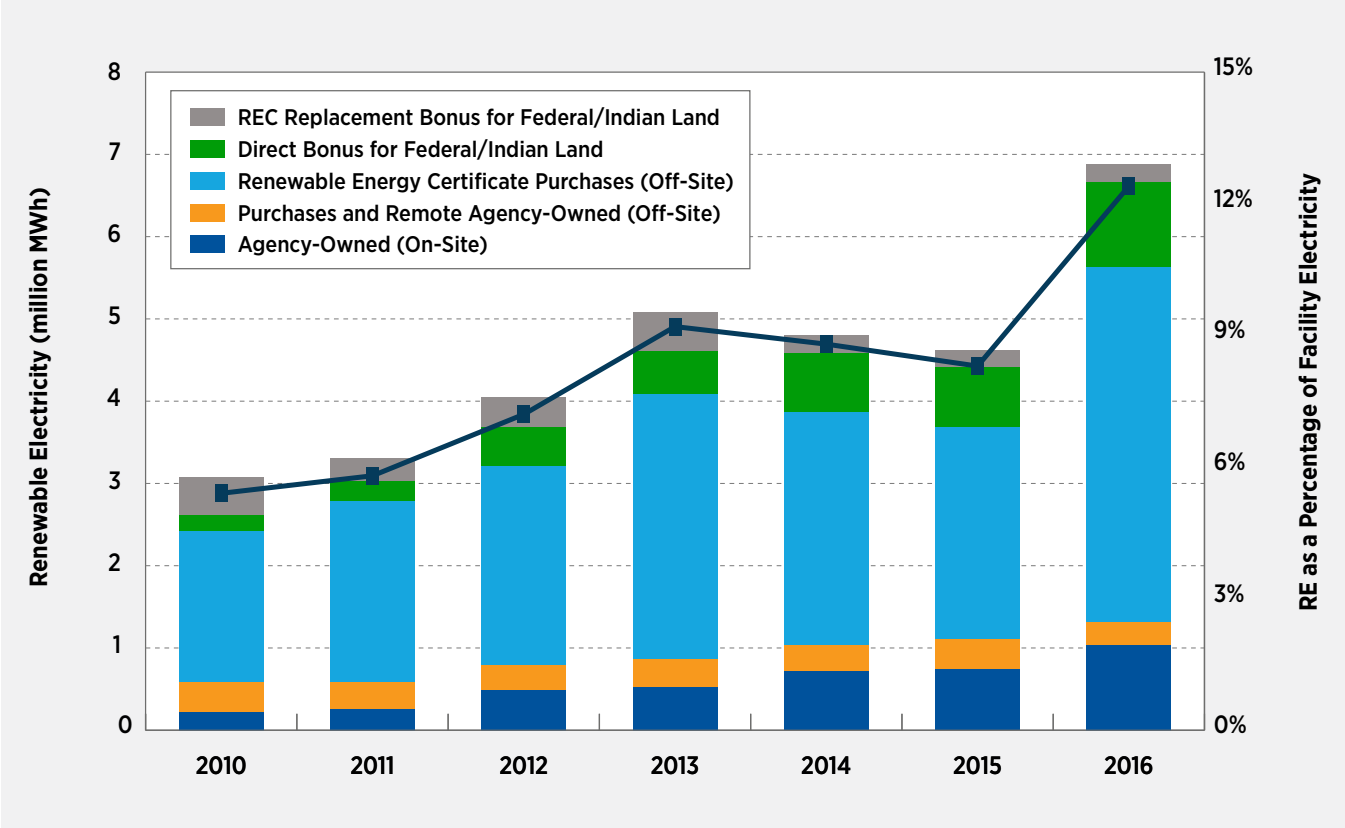
[1] U.S. Department of Energy. Comprehensive annual energy data and sustainability performance. (n.d.). Retrieved from http://ctsedwweb.ee.doe.gov/Annual/Report/SiteDeliveredEnergyUseandCostsbyEndUseSectorAndEnergyTypeByFederalAgencyNativeUnitsAndBillionBtu.aspx.

[2] The federal government uses the term "renewable" instead of "green" in this Appendix because "renewable energy" is defined in federal law (see 42 U.S.C. § 15852).

Table A-2: Federal Government Renewable Non-electric Energy by Source, FY2016 (MWh)

Wood and Wood Residuals	2,145,250
Municipal Solid Waste	1,886,197
Solar Thermal (including water and space conditioning)	332,831
Biogas (Captured Methane)	302,097
Daylighting	15,140
Geothermal	14,104
Ocean/Aquifer	300
Mechanical (i.e., direct water pumping)	7
Total	**4,695,927**

Figure A-1. Federal Government Renewable Electricity Use



Benefits from Federal Renewable Power Purchases

In addition to the benefits discussed earlier in this guide, federal renewable use provides economic and other benefits including the following:

- **Cost savings.** On-site renewable power purchase agreements (PPAs) and purchases from off-site renewable projects can provide low-cost power at a fixed price.[3]
- **Budget certainty.** Low-cost power at a fixed price provides a federal agency with budget certainty for a percentage of its electricity use, which can insulate the agency from commodity electricity price fluctuations experienced with open market purchases.
- **Accomplishment of an agency's organizational mission.** Renewable energy use supports the mission of many federal agencies.
- **Energy security/resilience.** The Department of Defense (DoD) and other federal agencies are becoming increasingly concerned with ensuring the energy resilience/security of their facilities. On-site renewable projects can improve energy resilience if they are configured to remain operational during a grid outage.
- **Federal leadership.** Federal renewable use helps the federal government lead by example.
- **Compliance with federal goals.** In addition to helping agencies meet the EPAct 2005 renewable energy goal (42 U.S.C. § 15852), on-site renewable projects and off-site renewable purchases may also help federal agencies meet other federal mandates.

Federal renewable energy purchases also include societal benefits:

- **National security.** National security is one of the principal responsibilities of the federal government. By purchasing domestically produced renewable energy and implementing on-site renewable projects, federal agencies can contribute to the nation's energy security.
- **Market transformation.** Due to the large volume of electricity consumed by the federal government, even small increases in renewable use can positively impact the overall market and result in societal and transformative market benefits.

Renewable Procurement Authorities and Regulations

Federal procurements are governed by the Federal Acquisition Regulation (FAR) as well as agency-specific regulations. Below is a discussion of some of the important FAR clauses and other regulations that are pertinent to federal on-site renewable projects and off-site renewable purchases. Federal regulations restrict the allowable contract length for renewable projects and purchases. This section contains long-term contract option information, as does the "On-Site Renewable Projects" section. Agency legal and contracting staff should be consulted early in the process regarding agency-specific regulations, policies and viable contracting options.

FAR Part 41 Utility Services (40 U.S.C. 501)

FAR Part 41 provides 10-year General Services Administration (GSA) purchasing authority that may be used for both on-site and off-site renewable procurements. Certain agencies have received delegation to use this authority; all other agencies interested in using this authority must seek delegation from GSA. Alternatively, an agency may ask GSA, the Defense Logistics Agency (DLA Energy) or another entity with GSA delegation to conduct a renewable procurement on its behalf.

[3] Often a fixed price with an escalation rate.

10 U.S.C. 2922a Contracts for Energy or Fuel for Military Installations

The 10 U.S.C. 2922a authority is only available to DoD and allows for 30-year contracts. Secretary of Defense approval is required.[4] This authority can be used for both on-site projects and purchases of off-site renewables.

Applicable Legislation

Energy Policy Act of 2005

Section 203 of EPAct 2005 (42 U.S.C. 15852) directs that federal agencies meet renewable energy consumption goals of not less than 7.5 percent of the electric energy they consume in FY2013 and each fiscal year thereafter.

Project Financing Authorities—Energy Savings Performance Contracts (ESPCs) and Utility Energy Service Contracts (UESCs)

ESPC (42 U.S.C. 8287, et seq.) and UESC (42 U.S.C. 8256) contracts may be used for on-site renewable projects.[5] See the "On-site Renewable Projects" section for additional information.

Western Area Power Administration (WAPA)

In marketing renewable electricity to other federal agencies, the Western Area Power Administration (WAPA) must follow many laws, regulations, orders and policies, including the following statutes:

- The Reclamation Act of 1902, 32 Stat. 388
- The Economy Act, 31 U.S.C. 1535
- The Reclamation Project Act of 1939, 53 Stat. 1187
- Flood Control Act of 1944, 58 Stat. 887
- DOE Organization Act of 1977, 91 Stat. 565
- Energy Policy Act of 1992 (Public Law 102-486)

The reclamation statutes cited above allow WAPA to enter into power marketing contracts of up to 40 years in duration.

FAR Part 12 Commercial Items

FAR Part 12, which covers purchase of commercial items,[6] is typically used by DLA Energy and GSA for the purchase of off-site renewable power and may also be used for other renewable procurements, often in conjunction with other authorities including FAR Part 41. Policies and procedures for solicitation, evaluation and award prescribed in Part 13, Simplified Acquisition Procedures; Part 14, Sealed Bidding; or Part 15, Contracting by Negotiation, shall be used, as appropriate for the particular acquisition. Market research, per FAR Part 11 or other regulation, may help determine if a desired service should be considered a commercial item.

Third-Party Certification and Renewable Energy Certificate (REC) Tracking Systems

Third-party certification provides value to the federal government through verification and annual audits to eliminate double counting of renewable products. REC tracking systems (electronic databases that are used to track REC ownership) provide information that is often used by certification organizations as part of their certification process. Information regarding REC tracking systems is available in Chapter 2 of this guide and at https://www.epa.gov/green-power/renewable-energy-tracking-systems.

[4] Contact DoD leadership for the current approval process.

[5] Other authorities apply; contact FEMP for support with performance contracts.

[6] Under FAR Part 12 commercial items are broadly defined as goods and services sold competitively in the commercial marketplace in substantial quantities (FAR subpart 2.101).

Renewable Procurement Approaches

There are four primary options for federal agencies seeking renewable energy:

1. On-site renewable projects that are government-owned.
2. On-site renewable projects that are privately owned.
3. Purchase of electricity from off-site renewable projects.
4. Purchase of RECs.

On-site projects receive a bonus towards the EPAct 2005 42 U.S.C 15852 if federal renewable energy is produced on federal lands or facilities or Indian land and used at a federal facility (EPAct 2005, Sec. 203(c)).[7]

REC ownership should be clearly articulated in contracts involving private ownership of a renewable project. If the local REC market price is high, the contractor can monetize the project RECs and reduce the contract price.

If the agency does not purchase the project RECs, "replacement" RECs must be purchased for credit towards the federal renewable goal.[8]

Below is information regarding the various renewable procurement approaches.

On-Site Renewable Projects

On-site renewable projects can be either government-owned or privately owned. Below is a summary of these ownership options. For additional details contact FEMP or visit the FEMP website at http://energy.gov/eere/femp/financing-mechanisms-federal-renewable-energy-projects.

NOTE: It is very important to notify the serving electric utility of any on-site renewable energy project under consideration. The utility will provide information on mandatory interconnection requirements, the interconnection agreement, available incentives, whether the project will result in potential increases or decreases to your utility bill or a change in the applicable utility tariff, and metering or other applicable policies. In addition to the information the utility will provide, the agency must analyze and address numerous other considerations including, but not limited to, the National Environmental Policy Act, the National Historic Preservation Act, future site plans, security issues and other similar requirements.

Government-Owned Renewable Projects

Agencies can purchase on-site renewable systems using appropriated funds. There is a GSA Supply Schedule (SIN 871-209, Innovations in Renewable Energy[9]) for complete solar project delivery, including all hardware, design, installation and other services. On-site systems that are government-owned can also be procured through a variety of private financing mechanisms including ESPCs, ESPC ENABLE, and UESCs.

Privately Owned Renewable Projects

Federal agencies can also implement renewable projects that are privately owned, with the electricity from the renewable project purchased by the federal site through a PPA, as described in Chapter 4 of this guide, or other

[7] This does not mean that a project generates twice as many RECs; the bonus is only for federal renewable goal accounting purposes

[8] Based on renewable goal guidance at the time this document was published.

[9] U.S. General Services Administration. (n.d.). Contractor listing. 03FAC — Facilities maintenance and management. Energy management, water conservation and support services. 871 209 Innovations in renewable energy. Retrieved from http://www.gsaelibrary.gsa.gov/ElibMain/sinDetails.do?scheduleNumber=03FAC&flag=&specialItemNumber=871+209.

similar arrangements.[10] One challenge the federal government faces is that private-sector PPA contracts are typically 20 years; however, civilian agencies have limited long-term contract authorities (see the "Renewable Procurement Authorities and Regulations" section).

ESPC Energy Sales Agreements (ESPC ESA)

An ESPC energy sales agreement, or ESPC ESA, uses long-term ESPC authority to implement an on-site renewable project energy conservation measure (ECM) on federal buildings and/or land, with the agency purchasing the electricity for the term of the contract.

The ESPC ESA must meet all ESPC legal requirements (See, e.g., 42 U.S.C. 8287, et seq.), including the requirement that the agency pay for the cost of the ESPC ESA from energy savings generated each year over the life of the contract. In addition to ESPC requirements, the title retention and other annual scoring requirements of Office of Management and Budget Memo M-12-21 apply. Thus, the government must take title by the end of the contract term; and the purchase must be fair market value for compliance with the IRS Revenue Procedure 2017-19. Note that tax incentive due diligence is the responsibility of the energy service company, not the government.

Contact FEMP for additional information regarding the ESPC ESA model and implementation options.

Other Options

See "WAPA Renewable Services" for another long-term contract option. As mentioned earlier, DoD can use authority under 10 U.S.C 2922a for long-term contracts.

Federal agencies can also host privately owned renewable projects with some or all of the electricity sold to another party. These projects use some type of real property arrangement such as a lease, easement or other instrument. The contract could be with the serving utility or a renewable developer.

A federal agency may be able to contract with its serving utility for the purchase of electricity from an on-site renewable project that is owned by the utility/partner.

Off-Site Renewable Purchases

Competitive Electricity Markets

Federal agencies can purchase electricity from an off-site renewable project in a competitive electricity market. GSA and DLA Energy (and in some cases, WAPA) should be used as contracting agents due to their expertise in conducting electricity procurements, and because they can aggregate federal agency procurement requirements (for example, by state or distribution utility service territory) when desirable to take advantage of economies of scale.

Fully Regulated Markets

Where retail competition is not available, federal agencies may be able to buy renewable power through a green pricing, green tariff program or other utility renewable product (see description in Chapter 4 of this guide) offered by their serving utilities. Agencies should carefully research the price and other product information, such as whether RECs are included in the product or whether the product includes unbundled RECs purchased by the utility without the underlying electricity, as well as the specific participation requirements. Agencies can purchase utility renewable products via the GSA Areawide Contract. In very limited cases WAPA may be able to help with off-site renewable purchases in regulated markets (see the "WAPA Renewable Services" section).

[10] Determine whether PPAs are legal in the state and utility service territory before pursuing this type of arrangement.

RECs

Federal agencies can buy RECs throughout the country in the voluntary REC market. Since numerous suppliers offer RECs, full and open competitive solicitation procedures should be followed. GSA and DLA Energy can assist federal agencies with REC procurements. Federal agencies that are existing WAPA preference power customers can request assistance from WAPA for the purchase of RECs.

GSA, DLA Energy, and WAPA Services

The organizations listed below can provide renewable procurement assistance to federal agencies. Contact FEMP to discuss the best option for a specific project or purchase.

GSA Procurement Services

GSA has assisted many federal agencies in the procurement of on-site and off-site renewables, and its ability to aggregate renewable procurement requirements for many agencies could result in lower prices. GSA's support to its federal customers for energy-related products is provided by the GSA Energy Division. Through this division, GSA negotiates and signs Areawide Contracts with utility companies across the country. GSA customizes its competitive electricity and natural gas procurements to meet the financial and physical supply requirements of its federal and non-federal agency clients. Visit http://www.gsa.gov/portal/category/21093 for more information.

DLA Energy Procurement Services

DLA Energy's Installation Energy Program offers acquisition support for electricity, RECs, and on- and off-site renewable power projects. DLA Energy is involved in retail electricity purchases in states that have approved and implemented deregulation or restructuring. RECs can be purchased nationwide. DLA Energy's offerings include competitive purchases for on- and off-site renewable generation that are financed, owned, operated and maintained by a third party.

Under its Installation Energy Program, DLA Energy:

- Procures electricity for DoD and federal civilian activities.
- Uses aggregation to attract market interest without customer cross-subsidization.
- Acts as procurement agent for on- and off-site PPA projects.
- Works with customers to develop requirements, identify risk preferences and develop risk-mitigation plans.
- Tailors each solicitation to market conditions and customer requirements.
- Conducts "best value" and "low-price technically acceptable" acquisitions, depending on requirements and customer preference.
- Contracts for load response services.
- Uses various pricing methods: fixed price, block and index, and locational marginal pricing.
- Has extensive experience procuring power for the federal government.
- Performs all contract administration functions

DLA Energy's program uses commercial practices for its solicitations and procurement strategy, which has been central to successfully engaging the market. In addition, DLA Energy's program is flexible enough to support unusual

customer requests and requirements while complying fully with applicable procurement regulations. DLA Energy is also involved in ESPC and UESC procurements on behalf of DoD and federal civilian agencies.

WAPA Renewable Services

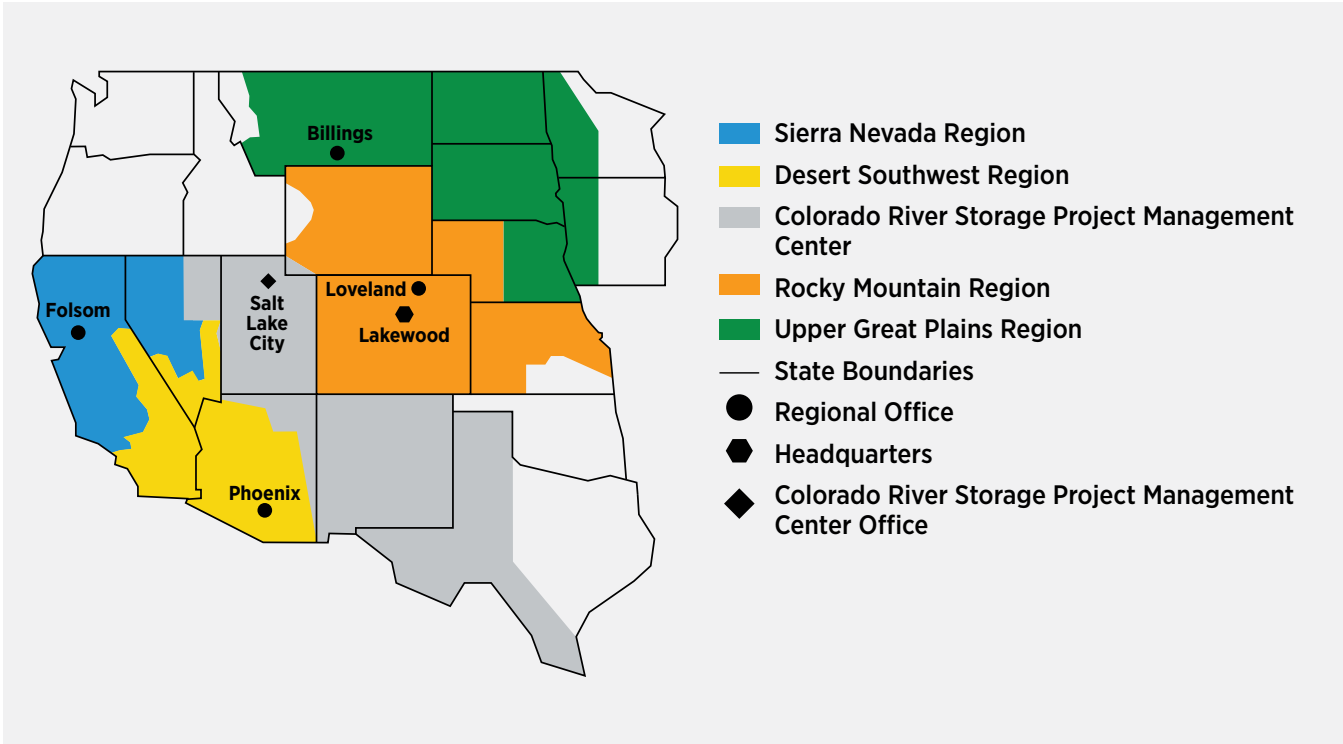
If a federal agency has a physical site for a renewable energy project within the WAPA territory (see Figure A-2 below) and is willing to host a third-party owned system, WAPA can facilitate the purchase of energy from that project on behalf of the agency under a long-term contract.[11]

For a federal agency that is an existing WAPA preference customer, WAPA may be able to buy and deliver renewable energy to the federal site. Agency costs include renewable power generation, transmission (if needed), related ancillary services, distribution (if needed), and program administration. If the agency receives power from another utility, the agency will generally need to obtain the cooperation of that utility before arrangements can be made to obtain renewable energy from WAPA.

Federal agencies that are existing WAPA preference power customers can request assistance from WAPA for the purchase of RECs.

An agency pays for the renewable energy at cost, plus a fee to cover the administrative cost of acquiring the renewable resources from a supplier. For more information about these programs, visit WAPA's web site at https://www.wapa.gov/Renewables/ForFederalAgencies/Pages/federal-agencies.aspx. To request assistance from WAPA, contact, Ron Horstman, Energy Services Program Manager at 720-962-7419 or horstman@wapa.gov, and complete the non-binding statement of intent at https://www.wapa.gov/Renewables/Documents/RR_SOIfeds13.pdf.

Figure A-2. WAPA Territory, Including Regions



[11] WAPA evaluates each request based on its current workload, among other considerations.

Key Elements of a Successful Renewable Procurement

The following lessons have emerged based on federal agency experience with on-site renewable projects and off-site renewable purchases.

Stakeholder Involvement

A cross-functional team with representatives from across the organization will result in the best renewable project. Approval from management and other key decision-makers is crucial before moving forward with a project or purchase. Stakeholders must participate in the process and make reasoned, balanced decisions. It is important to be honest and clear about the renewable project's benefits. External stakeholders, such as the serving utility, should also be consulted.

Cost-effectiveness

Most federal agencies are not willing to pay more for renewable energy, so renewable projects and purchases should result in cost savings at the time of award. Government-owned renewables can be bundled with energy efficiency projects in an ESPC or UESC, resulting in a shorter payback period.

Developing an Effective Solicitation

FEMP recommends that agencies use procurement documents from a previous solicitation (DLA Energy, GSA, other) or a FEMP template as a starting point, to take advantage of lessons learned from prior renewable projects and purchases. This will minimize the effort required to complete a renewable procurement. Agencies should consult with the assigned contracting officer and attorney early in the process regarding required clauses and the document review process. The request for proposals (RFP) should include the site electricity consumption data (at least monthly; in some cases, interval data may be beneficial) and other pertinent information as attachments. The RFP should be well publicized (typically posted on the federal business opportunities website FedBizOpps (https://www.fbo.gov), and a pre-proposal conference is recommended.

Load Aggregation

As mentioned earlier, federal on-site renewable purchase requirements can be aggregated to achieve lower costs through economies of scale. There are also opportunities to save money by aggregating federal load for the purchase of electricity from off-site renewable projects. Both GSA and DLA Energy have significant experience with aggregating federal loads for electricity procurements. An aggregated procurement may involve one award or multiple awards. Contact FEMP for aggregation recommendations.

Publicizing Renewable Projects and Purchases

After successfully completing a renewable project or purchase, a federal agency may want to publicize its efforts through ribbon-cutting ceremonies, press conferences or press releases. It is important to be careful regarding the environmental claims made in any public documents if the renewable project RECs are sold (even if replacement RECs are purchased). Only the entity owning the project RECs can make claims regarding use of the renewable energy generated by the project. The Federal Trade Commission has established rules in this area to ensure that organizations do not make erroneous claims.[12]

[12] U.S. Federal Trade Commission. (2012). "FTC issues revised 'Green Guides'". Retrieved from https://www.ftc.gov/news-events/press-releases/2012/10/ftc-issues-revised-green-guides.

Agencies with exemplary energy management programs and projects are eligible for FEMP awards, which enhance an agency's image both inside and outside the government. A federal agency can also join the Environmental Protection Agency's (EPA's) Green Power Partnership (GPP) if its project or purchase meets the EPA GPP requirements (see https://www.epa.gov/greenpower). The EPA GPP lists its top 10 federal government partners on the same website.

Information for Potential Suppliers to the Federal Government

Federal government procurements are typically competitive, and most federal RFPs are posted on the FedBizOpps website. Companies can register on FedBizOpps to receive notification when certain RFPs are released (based on designated parameters such as NAICS industry classification code, agency and keyword). WAPA RFPs are posted on WAPA's website, https://www.wapa.gov/Renewables/ForFederalAgencies/Pages/solicitations.aspx.

Resources

FEMP Renewable Assistance

FEMP provides training as well as technical and procurement assistance to help federal agencies with on-site renewable energy projects, purchases from off-site renewable projects, and REC purchases.

To request assistance from FEMP, please visit FEMP's Assistance Request Portal: https://www4.eere.energy.gov/femp/assistance/.

Technical Assistance

FEMP offers technical assistance to federal agencies throughout the entire project development process. For example, FEMP works with agencies at the very beginning of this process, as they assess renewable energy opportunities at their site(s) through a renewable energy screening. A renewable energy screening combines renewable energy resource data, energy costs, incentives, economic inputs, and other site-specific constraints to identify renewable energy technologies that most cost-efficiently meet defined energy goals. The screening provides a recommended set of solutions including a combination of technologies, system sizes, associated capital costs, operation and maintenance costs, savings, and net present value.

Once cost-effective renewable energy opportunities are identified at a site, FEMP can provide technical assistance for further project validation, such as feasibility studies. FEMP can provide technical assistance for projects deciding on a procurement vehicle or entering into a procurement process. Such technical assistance may include developing or reviewing an RFP, reviewing response, and drawing design. Lastly, FEMP can provide technical assistance such as commissioning and operations and maintenance support during the construction and performance period of the project.

Technical assistance funding may not be used for equipment or labor costs. For more information, visit FEMP's Renewable Energy website: http://energy.gov/eere/femp/federal-renewable-energy-projects-and-technologies. For assistance, visit the FEMP Assistance Request Portal, or contact the following staff:

- Rachel Shepherd, DOE FEMP, (202) 586-9209, rachel.shepherd@ee.doe.gov
- Andy Walker, National Renewable Energy Laboratory, (303) 384-7531, andy.walker@nrel.gov
- Emma Elgqvist, National Renewable Energy Laboratory, (303) 275-3606, emma.elgqvist@nrel.gov

Procurement Assistance

FEMP also offers renewable energy procurement assistance to federal agencies for on-site renewable projects, purchases from off-site renewable projects and REC purchases. The FEMP team provides information on the available procurement vehicles for the desired renewable product and assists with selecting the optimal approach. Then the FEMP team describes important considerations, participates in team conference calls or meetings and provides assistance with the development of the RFP and other procurement documents. Once an RFP is issued, the FEMP team can assist with the pre-proposal conference, answering potential offeror questions and/or assisting with proposal evaluation.

For more information, visit FEMP's website: http://energy.gov/eere/femp/renewable-energy-procurement-federal-agencies. For assistance visit the FEMP Assistance Request Portal or contact:

- Rachel Shepherd, DOE FEMP, 202-586-9209, rachel.shepherd@ee.doe.gov
- Chandra Shah, National Renewable Energy Laboratory, (303) 384-7557, chandra.shah@nrel.gov
- Gerald Robinson, Lawrence Berkeley National Laboratory, (510) 486-5769, GTRobinson@lbl.gov
- Mike Warwick, Pacific Northwest National Laboratory, (503) 417-7555, mike.warwick@pnl.gov

FEMP Training

Visit FEMP's training website: http://energy.gov/eere/femp/federal-energy-management-program-training for information regarding FEMP's renewable training courses. FEMP is accredited by the International Association for Continuing Education and Training (IACET) and awards continuing education units upon the successful completion of select courses.

FEMP Tools

FEMP's Federal Energy Management Tools website, http://energy.gov/eere/femp/federal-energy-management-tools, includes links to various tools such as software, calculators, data sets and databases created by DOE and other federal organizations. These tools are intended to support energy managers and their teams in identifying and developing a renewable energy project. After identifying but before initiating a project, project champions should consult an expert for a professional evaluation.

Other FEMP Resources

The ESPC ESA Toolkit provides federal agency contracting officers and other acquisition team members with information that will facilitate the timely execution of ESPC ESA projects implemented as site-specific/stand-alone ESPCs. Toolkits for ESAs for an indefinite delivery/indefinite quantity contract or ENABLE are under development. The toolkit includes a process diagram, project checklist, team member descriptions, project considerations and other information. At the end of the toolkit are a series of appendices that contain reference documents and editable templates such as an RFP, site access agreement, acquisition plan and source selection plan. The acquisition plan and source selection plan are available to federal agency staff upon request. Some of the toolkit information is useful for any renewable project, regardless of implementation method. Federal agency staff should contact FEMP when utilizing a mechanism other than a stand-alone ESPC ESA for recommendations on the appropriate use of the toolkit and recommended modifications.

FEMP developed a technical specification template for solicitations for on-site solar photovoltaic. This document provides sample language and considerations that address technical factors for three sections of the Uniform Contract Format, which is the most commonly used format in the federal sector. Section C: Descriptions/Specifications/Statement of Work is the main section covered in this document. However, Section E: Inspection and Acceptance and

Section M: Evaluation Factors for Award are addressed as well. To obtain a copy, go to: https://energy.gov/sites/prod/files/2017/01/f34/solar_pv_procurement.pdf.

Contact FEMP for the latest information regarding contract options and FEMP resources.

Other Resources and Contacts

- Federal Acquisition Regulation (FAR): www.acquisition.gov/far
- DLA Energy: Andrea Kincaid (703) 767-8669, andrea.kincaid@dla.mil
  http://www.dla.mil/Energy/Offers/Products/Installation-Energy/
- General Services Administration
  energy@gsa.gov
  http://www.gsa.gov/portal/category/21093
- Western Area Power Administration (WAPA)
  Renewable Resources for Federal Agencies Program
  Ron Horstman, Energy Services Program Manager, 720-962-7419 or horstman@wapa.gov
  https://www.wapa.gov/Renewables/ForFederalAgencies/Pages/federal-agencies.aspx

APPENDIX

B

Commercial Solar Financing Options

Authored by Alison Holm and Jenny Heeter, National Renewable Energy Laboratory

To view the full Guide, visit https://www.epa.gov/greenpower/guide-purchasing-green-power

DOCUMENT MAP

Introduction

The U.S. solar photovoltaic (PV) market has expanded dramatically in the past decade, with cumulative installed PV capacity in 2016 registering at 140 times greater than in 2006. PV installations across all sectors, including utility, residential, and nonresidential,[1] totaled 104 megawatts (MW) in 2006 and rose to 14,762 MW by the end of 2016, with nearly half of that capacity (7,261 MW) coming online between 2015 and 2016 alone.[2] With the number of PV installations increasing, system costs have continued to decrease. As of 2017, commercial PV systems cost an average of $1.85/Watts dc (Wdc) (a 65 percent decrease since 2010). For comparison, utility-scale fixed-tilt systems averaged $1.03/Wdc in 2017 (a 74 percent reduction since 2010) and residential systems average $2.80/Wdc (a 61 percent reduction over the same period).[3]

As the solar PV market in the United States has evolved, so too have the financing mechanisms associated with it. Third-party ownership (TPO) models, which include power purchase agreements (PPAs) and leases, in addition to loans and cash purchases, are the historical mainstays of the solar financing spectrum. Relatively more recent additions include property-assessed clean energy (PACE) financing and green bonds, among others. This appendix provides a snapshot of the current commercial solar financing arena and an overview of existing financing mechanisms. While there is significant overlap in solar financing options among the residential, government, and commercial sectors, this report focuses on options and considerations for commercial entities only. Performance contracting mechanisms commonly used by federal agencies and also available to the private sector, including energy savings performance contracts (ESPCs) or utility energy service contracts (UESCs), are briefly mentioned in the final section of this appendix but are discussed in more detail in Appendix A, Green Power Considerations for Federal Agencies.

For potential commercial solar energy consumers, the menu of available financing options often depends on whether the PV system is developed on-site or off-site. As corporations, universities, and other potential consumers have begun introducing or expanding renewable energy and carbon reduction goals, many are required to pursue off-site opportunities in order to approach the scale of renewable energy development needed to actually meet those goals. Traditional solar financing models are thus being adapted to encompass these increasingly complex relationships between solar energy consumers and solar development. As new options emerge for financing solar projects, it is important for commercial consumers to consider the role of renewable energy certificates (RECs) in their transactions. The number of RECs associated with a renewable energy project is based on the megawatt-hours of electricity generated and can be sold either together with or separately from the underlying electricity. Commercial consumers that do not keep the RECs associated with a solar energy project—even if they are purchasing electricity from or otherwise own that installation—will not be able to make a claim to the environmental benefits represented by the RECs. In other words, if a consumer does not retain the RECs from a solar project, the consumer will not be able to count that project toward any renewable generation, carbon reduction or other environmental goals.

Initial Considerations

Though not purely financial, determining whether to pursue on-site versus off-site development and evaluating other location-based factors are critical for commercial solar consumers. Incentives and financing structures may apply differently depending on where the electricity is generated versus consumed and whether PV systems are located on- or off-site. Another potential issue for commercial consumers is whether or not they own the property where they wish to site a solar energy system. Institutions leasing their buildings, for example, generally will not have the authority to make decisions regarding rooftop solar installations.

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[1] Nonresidential may include commercial, industrial, and other midscale-market installations.

[2] GTM Research & Solar Energy Industries Association. (2017). *Solar market insight report 2016 year in review.* Retrieved from https://www.greentechmedia.com/research/subscription/u.s.-solar-market-insight

[3] Fu, R., Feldman, D., Margolis, R., Woodhouse, M., and Ardani, K. (2017). U.S. solar photovoltaic system cost benchmark: Q1 2017. National Renewable Energy Laboratory. NREL/TP-6A20-68925. Retrieved from http://www.nrel.gov/docs/fy17osti/68925.pdf.

Additionally, larger consumers (such as governments, commercial property owners and universities) may need to seek off-site PV development in order to meet significant portions of their electricity load with solar. The percentage of a building's annual electricity load that can be offset with rooftop solar PV depends on available roof space, solar resource availability, and annual electricity consumption, as well as local net metering laws and limits. A National Renewable Energy Laboratory (NREL) analysis of representative commercial buildings found that the percentage of annual energy loads that can be reduced with PV systems that fill a building's total available roof area ranges from less than 5 percent (for hospitals) to up to 100 percent (for warehouses).[4] For institutions with less available rooftop or other solar development space, impact at scale will stem from engaging in larger off-site projects.

Institutions have a number of factors to consider when selecting a financing option for their solar purchase. Table B-1 outlines some of these key financing considerations. In addition, organizations will need to evaluate the role of RECs in their solar procurement strategies. While selling RECs to another party can lower the cost of procurement, the procuring institution then cannot legally make a renewable energy claim for that transaction. Organizations could consider a "swap" or "arbitrage" transaction, where they buy renewable energy from a different region or resource type, at lower cost. Renewable claims under a swap transaction will be based on the renewable energy purchased, not the RECs sold. [5]

Table B-1. Commercial-Sector Solar Financing Considerations[6, 7, 8, 9]

Financing Considerations	Details
Desired level of solar PV system ownership	Under loan-financed or cash purchase options, the solar consumer directly owns the PV system(s) and receives all associated tax benefits and incentives. Under TPO arrangements, these benefits still go to the owner of the system, in this case the third-party. Ownership requires a relatively large upfront capital investment, enough taxable income to benefit from tax breaks, and an understanding of potential risks and uncertainties inherent to owning solar PV.
Building ownership and lease terms	Tenant-landlord relationships and building lease terms add layers of complexity to solar financing options. Solar consumers that lease property will likely need to work with the property owner in some capacity to install solar. Discrepancies between building lease timeframes (e.g., 6-8 years) and the lifetime of a solar PV asset (20-plus years) are another challenge that solar consumers will need to consider when obtaining solar financing.

[4] Davidson, C., Gagnon, P., Denholm, P., and Margolis, R. (2015). *Nationwide analysis of U.S. commercial building solar photovoltaic (PV) breakeven conditions (p.7).* National Renewable Energy Laboratory. NREL/TP-6A20-64793. Retrieved from http://www.nrel.gov/docs/fy16osti/64793.pdf

[5] Center for Resource Solutions. (2016). *Solar energy on campus: Part II: solar purchasing options and communicating renewable energy use.* Retrieved from https://resource-solutions.org/wp-content/uploads/2016/09/Solar-Energy-on-Campus-II.pdf

[6] Feldman, D., and Lowder, T. (2014). *Banking on solar: An analysis of banking opportunities in the U.S. distributed photovoltaic market (pp.14).* National Renewable Energy Laboratory. NREL/TP-6A20-62605. Retrieved from http://www.nrel.gov/docs/fy15osti/62605.pdf(p. 14)

[7] Bird, L., Gagnon, P., and Heeter J. (2016). E*xpanding midscale solar: Examining the economic potential, barriers, and opportunities at offices, hotels, warehouses, and universities.* NREL/TP-6A20-65938. Retrieved from http://www.nrel.gov/docs/fy16osti/65938.pdf

[8] The office supply retailer Staples provides a case study in financing and installing solar on leased buildings. See: Feldman, D., and . Margolis, R.. (2014). *To own or lease solar: Understanding commercial retailers' decisions to use alternative financing models.* NREL/TP-6A20-63216. Retrieved from http://www.nrel.gov/docs/fy15osti/63216.pdf

[9] The Database of State Incentives for Renewables & Efficiency (DSIRE) provides information on programs and policies on a state-by-state basis. Solar consumers can refer to the database to determine the applicable policies in their location. DSIRE is available at http://www.dsireusa.org/.

Table B-1. Commercial-Sector Solar Financing Considerations (continued)

Financing Considerations	Details
Liability and maintenance costs associated with solar PV system ownership	Historically, one of the primary selling-points for TPO models is that the third party-owner will cover all operations and maintenance (O&M) functions, including equipment replacement and possibly production guarantees, whereas the solar consumer incurs those costs and liabilities under loan or cash purchase models. However, the introduction of stand-alone O&M and other services packages are expanding the options available to solar consumers who wish to directly own their PV systems but contract out for O&M services.
Credit requirements	Solar consumers with a poor credit rating or no credit history may find it more difficult to secure PPAs or loans and, based on assessed risk, might face higher interest rates. Either cash purchases or PACE financing, which is generally assessed based on property value rather than the borrower's credit score, are potential alternative options.
Tax credits and other incentives	Tax incentives represent the largest public investment in solar energy, but consumers must have the requisite tax appetite to monetize tax credits. Commercial consumers may also benefit from accelerated depreciation benefits (i.e., the Modified Accelerated Cost Recovery System, or MACRS). Tax-exempt entities, including many universities and other not-for-profit organizations, cannot directly use tax incentives. For these consumers, partnering with a third-party owner that can monetize the tax credits is one way to indirectly benefit from these incentives, assuming the third party passes on the associated cost savings via lower PPA or lease prices.
Payback and contract terms	For both loan and TPO configurations, the contract terms can have a significant impact on the total cost of solar financing. Longer contract periods will generally result in lower individual payment installments, but can also increase the overall cost of financing, depending on interest rates. In addition to the contract length, other factors such as down payments or pre-payment can influence financing costs.
State policy and electricity market structures	State policies and electricity market structures also dictate what types of financing mechanisms are available. For example, on-site third-party PPAs, or direct PPAs, are not available in all states. State and local financial incentives and utility rates vary by location, all of which influence the cost and economics of solar projects. These factors may impact the relative attractiveness of different financing mechanisms on a place-by-place basis.

The following pages provide summaries of common solar finance models.

Third-Party Ownership Models

Under TPO arrangements, which include PPAs and leases, a third party owns, installs, and operates a solar PV system and either sells the power output (PPA) or leases the system to a solar consumer. Under a PPA, a third-party owner sells electricity generated from a solar PV system, usually on a per kilowatt-hour (kWh) basis, to a solar consumer over a fixed contract period. PPAs are considered off-balance-sheet transactions, an attractive feature to some entities.[10] PPAs can make solar PV (or electricity more generally) accessible to consumers at a known price that parallels (but is

[10] Feldman, D., and R. Margolis, *To own or lease solar* (p. 24).

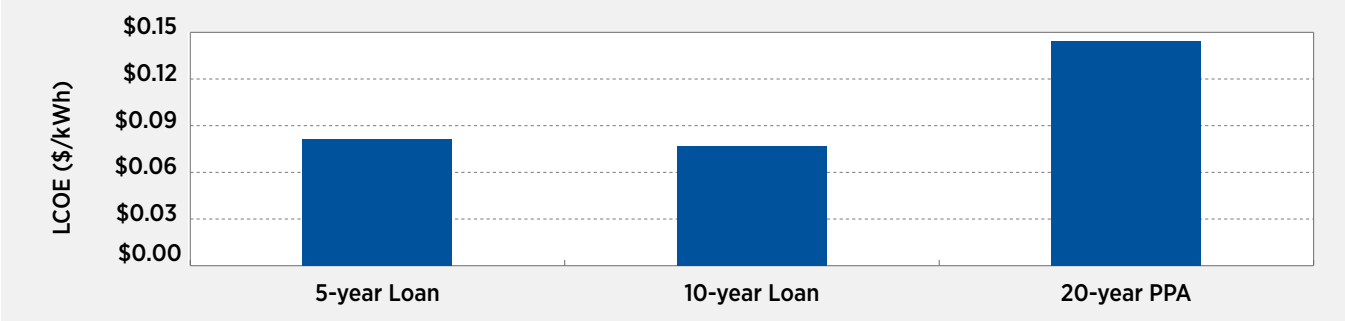
sometimes less than) retail electricity rates, depending on the sector, market and contract terms.[11] There are two varieties of solar PPAs: on-site (or "physical") PPAs, in which the electricity generated from a solar PV facility is directly tied to the consumer's meter, and off-site (or "financial") PPAs, under which a consumer still agrees to pay a fixed price per unit of electricity generated from a solar PV installation, but the arrangement is purely financial rather than a physical transfer of electricity. Both types of PPAs are discussed in more detail in subsequent sections.

Under any of the TPO configurations, the third-party owner, not the commercial solar consumer, is investing the upfront capital to develop the system. TPO models offer an attractive risk-return balance for many consumers. Advantages include:

- **No upfront costs.** There are no upfront costs associated with TPO for the solar consumer.[12]
- **Reduced exposure to risk.** TPO arrangements incorporate services that historically have not been included under direct ownership, allowing consumers to reduce their exposure to risks related to PV underperformance, O&M costs, and delays in receiving incentives or grid-connection approval.[13] However, as the commercial solar market evolves, installers and companies specializing in after-market operations may provide more of these services to solar consumers who elect to directly own their PV system(s).[14]
- **Access to technical and market expertise.** Consumers can access technical and market expertise of third-party PV owners, which can facilitate more rapid PV deployment. Due to the somewhat fragmented nature of current federal, state, and local solar policies, navigating the various tax and incentives programs can be a complex undertaking.
- **Potential cost savings.** For tax-exempt or other entities that cannot directly monetize solar tax incentives, working with a third-party owner can facilitate cost savings if the third party takes the tax incentive and integrates the associated cost savings into the PPA or lease prices.

The benefits of TPO do come with tradeoffs. The financing mechanism selected can have a significant impact on the overall system costs of the solar investment. TPO options may offer several advantages, but do not provide the same long-term cost benefits associated with direct ownership alternatives.[15] As shown in Figure B-1, the modeled levelized cost of energy (LCOE) for commercial PV systems under loan configurations are lower than they would be under a TPO PPA arrangement, due to the higher cost of capital required for sponsors and tax-equity providers under PPAs.[16]

Figure B-1. LCOE of Commercial PV Systems, Financed Under a PPA or Loan[17]



[11] Feldman, D., and Lowder, T., *Banking on solar* (p. 14)

[12] Coughlin,J. and Kandt, A. (2011). *Solar schools assessment and implementation project: Financing options for solar installations on K-12 schools* (p.16). National Renewable Energy Laboratory Retrieved from https://www1.eere.energy.gov/office_eere/pdfs/51815.pdf

[13] Feldman, D., and Margolis, R., *To own or lease solar* (p. 3)

[14] Feldman, D., and Lowder, T., *Banking on solar* (p. 14)

[15] Feldman, D., and Margolis, R., *To own or lease solar* (p. 24)

[16] FFeldman, D., and Lowder, T., *Banking on solar* (p. 28)

[17] Feldman, D., and Lowder, T., *Banking on solar* (pp. 28-29)

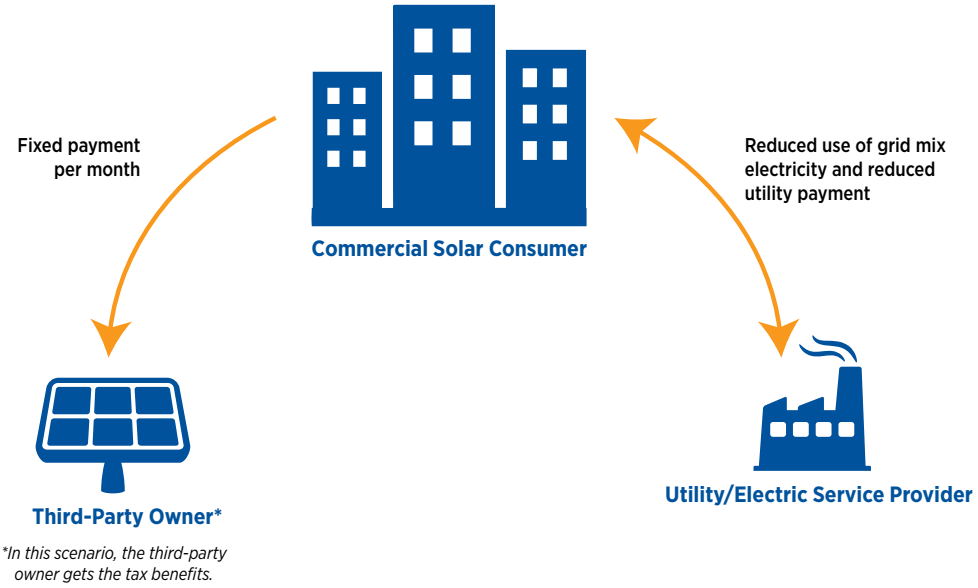
REC ownership is another potential tradeoff for solar consumers under a TPO arrangement. TPOs typically retain ownership of and monetize RECs associated with the solar project. Institutions seeking to claim environmental benefits to meet renewable energy or carbon reduction goals may not be able to do so under a TPO arrangement, depending on the flexibility of the third-party's contract terms.

On-Site Power Purchase Agreement (PPA): Physical PPA

Description

On-site PPAs can be considered "physical" PPAs, because the electricity production is tied to the consumer's meter, directly reducing the amount of electricity purchased from the utility (Figure B-2). Some organizations have also structured off-site "physical" PPAs, where the solar is contractually delivered to the consumer; those structures are far less common and therefore not addressed here.

Figure B-2. Overview of On-Site PPA



Note: Typical term is 15 to 20 years.

Market Insights

In 2015, third-party owned systems made up 65 percent of the nonresidential solar market; GTM Research projects that figure to increase to 74 percent in 2020.[18]

Policy Drivers

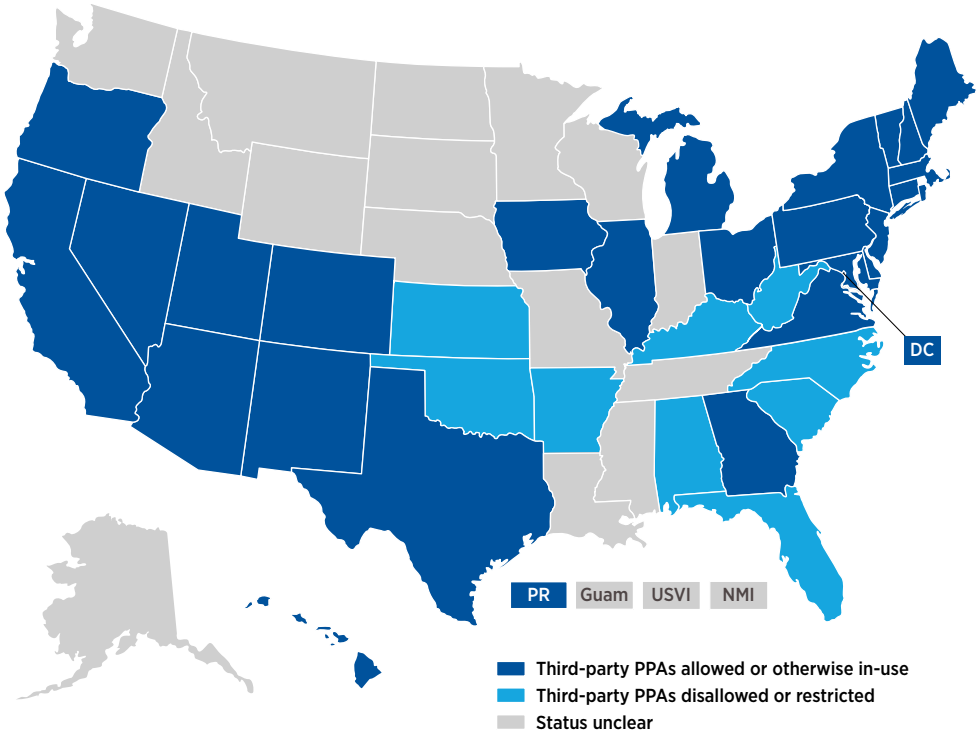
PPAs are a prominent solar financing tool but are not available in all locations. As of April 2017, 26 U.S. states have authorized or otherwise allow third-party PPAs, while at least nine have disallowed them (status is unclear in the remaining 15 states) (Figure B-3).[19] Even in states that have authorized third-party PPAs, specific regulations vary and

[18] GTM Research. (2016). U.S. commercial solar landscape 2016-2020. (2016). Retrieved from https://www.greentechmedia.com/research/report/us-commercial-solar-landscape-2016-2020#gs.QDgdNsQ

[19] DSIRE Database. 3rd Party solar PV power purchase agreement (PPA). Retrieved from http://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2017/04/DSIRE_3rd-Party-PPA_April_2017.pdf

may not apply unanimously to all systems. Some policies, for example, only authorize third-party owned systems that are on-site or net metered.

Figure B-3. Status of Third-Party PPA Authorization[20]



Contract Risks

- Solar consumer only pays for production of system, thereby eliminating performance risk
- Solar consumer's exposure to electricity price fluctuations is directly reduced

Target Consumer & Example

- Non-taxpaying organizations (e.g., nonprofit organizations, governments) that cannot directly use tax incentives
- Organizations with good credit ratings
- Organizations not wanting or not able to make a capital investment

Staples worked with SunEdison to deploy solar on its buildings using a PPA model. Staples is a public company with a good credit rating and large balance sheet, but it preferred not to assume the risks associated with solar ownership. Staples has worked with SunEdison to install solar on 37 of its U.S. facilities, totaling 14 MW.[21]

Contract/Cost Implications

- Off-balance sheet
- Typically 15-20 year contracts
- Annual price escalators of around 2 percent

[20] DSIRE Database. 3rd Party Solar PV Power Purchase Agreement (PPA). Retrieved from http://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2018/03/DSIRE_3rd-Party-PPA_March_2018.pdf.

[21] Feldman, D. and Margolis, R., *To own or lease solar* (p.6)

RECs

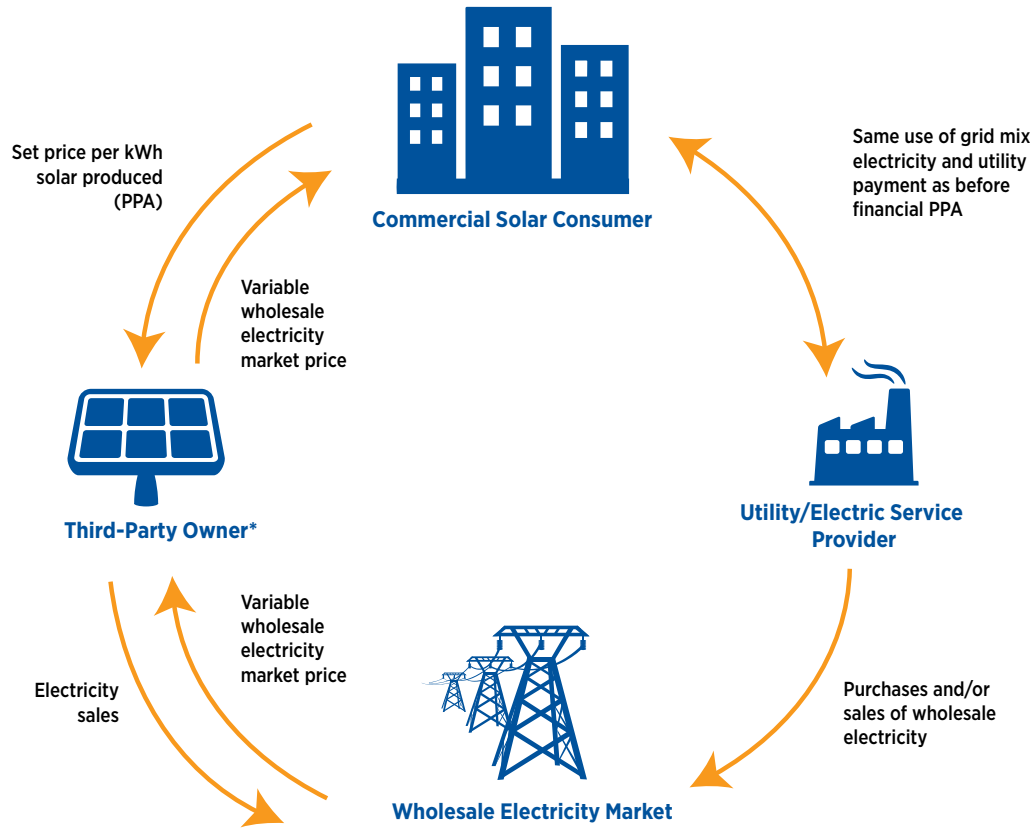
RECs should be defined in the PPA and ownership should be assigned to one party. In higher-priced REC markets and in territories where utilities are offering incentives for RECs, commercial consumers typically sell the RECs to the utility or project developer in order to lower the cost of the transaction, but in doing so they relinquish environmental claims.

Off-Site Power Purchase Agreement (PPA): Financial PPA

Description

Under financial PPAs, which are a common arrangement for an off-site generation PPA, the consumer does not take delivery of the electricity. Rather, the consumer agrees to pay a fixed price per unit of electricity generated from the solar facility, and the electricity producer sells the power to the electric grid and is compensated at the market rate. If the market rate the electricity producer receives is different than the negotiated PPA settlement price per unit of electricity, the difference is paid for via a stipulation in the PPA contract referred to as a contract for differences. If the market power rate exceeds the fixed PPA price, then the electricity producer pays the consumer the difference; if the market power rate is less than the PPA price, the consumer pays the electricity producer the difference. This transaction typically occurs monthly. The consumer's on-site electricity consumption is not affected. See Figure B-4.

Figure B-4. Overview of Off-Site PPA



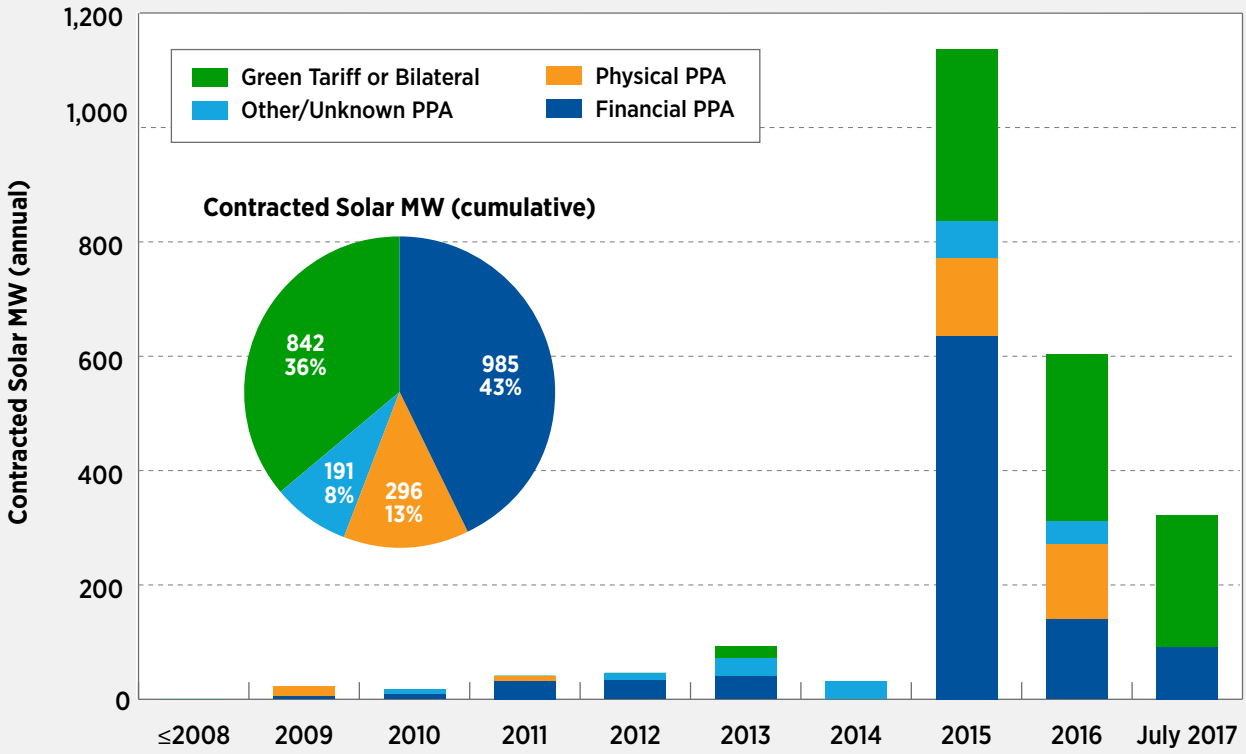
**In this scenario, the third-party owner gets the tax benefits.*

Note: Typical term is 15 to 20 years.

Market Insights

Through July 2017, financial PPAs represented 43 percent of the total off-site contracts (in terms of cumulative MW of renewable energy contracted) signed by corporate consumers (Figure B-5).[22] Procurement in 2015 was likely higher than 2014 and 2016 because of uncertainty around the production tax credit and investment tax credit extensions.

Figure B-5. Contracted Solar MW[23]



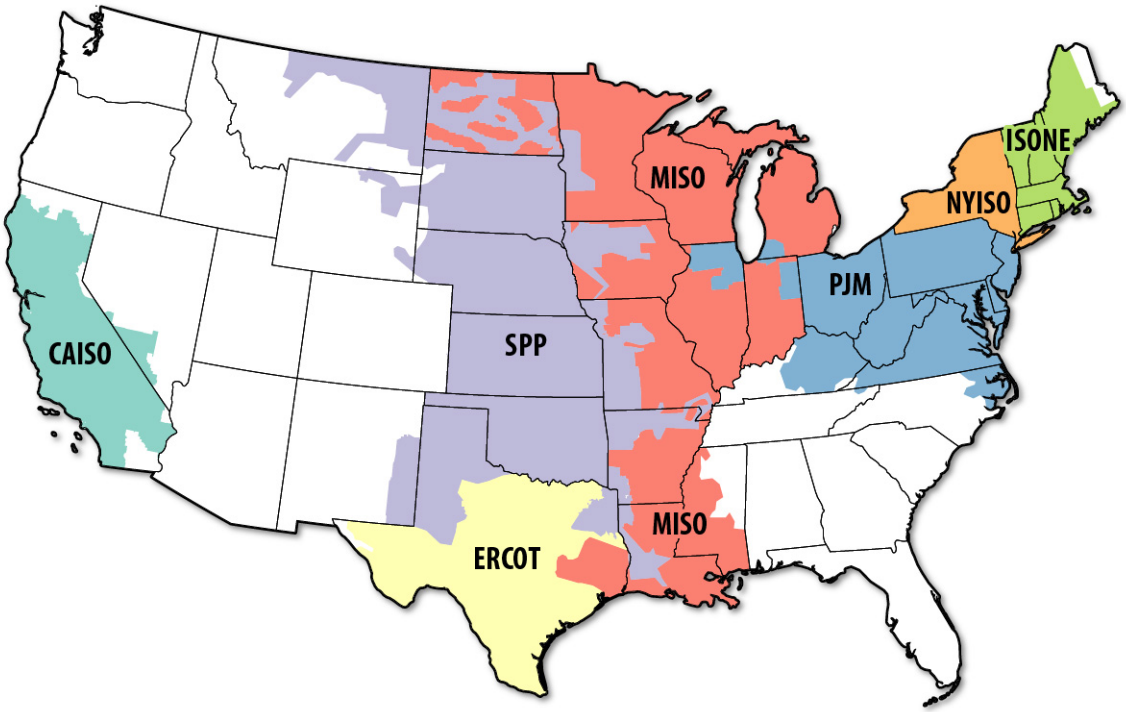
Policy Drivers

With financial PPAs, the generator must be able to sell into a wholesale spot market (Figure B-6). The generator and the consumer are typically located in the same power market in order to ensure the best hedge against rising electricity prices. This is because the consumer would want the wholesale price the generator is receiving to track the retail price the consumer is paying its existing utility as closely as possible, so that if retail rates increased, the consumer would also receive a higher payment from the renewable generator selling into the wholesale market. With solar projects built in areas not served by a regional transmission organization or organized wholesale market, developers and consumers may find it difficult to agree upon a market price index, since there is less market transparency.

[22] Green tariff or bilateral contracts are those in which the commercial consumer is contracting with the utility for renewable generation; the utility then signs a separate contract with the renewable generator. For more on green tariffs, see: Heeter, J., Cook, J., and Bird, L. (2017). *Charting the emergence of corporate procurement of utility-scale PV.* NREL/TP-6A20-69080. Retrieved from https://www.nrel.gov/docs/fy17osti/69080.pdf

[23] Heeter, J., Cook, J., and Bird, L., (2017). *Charting the Emergence of Corporate Procurement of Utility-Scale PV. National Renewable Energy Laboratory.* https://www.nrel.gov/docs/fy17osti/69080.pdf.

Figure B-6. Map of Regional Transmission Organizations and Independent System Operators



Contract Risks[24]

- The consumer will assume locational basis risk if the project is being settled at the busbar (point of interconnection) rather than the hub (the average of multiple busbars).[25]
- Setting a price at the busbar may offer greater opportunity for the consumer to earn greater returns than setting a price at the hub because of the minimized transmission congestion costs, but it comes with more risk.

Target Consumer & Example

- Organizations with finance and legal expertise, or interest in working with partners to understand complex transactions
- Organizations with limited space available for on-site generation
- Organizations with large electrical loads
- Organizations with good credit ratings
- Organizations not wanting or not able to make a capital investment

[24] For more discussion of financial PPA risks, see Schwabe, P., Lowder, T., Feldman, D., Fields, J., and Edward Settle. (2017). *Wind energy finance in the United States: Current practice and opportunities*. National Renewable Energy Laboratory. NREL/TP-6A20-68227. Retrieved from https://www.nrel.gov/docs/fy17osti/68227.pdf; and Renewable Choice Energy. (2017). *Proactively managing risks to accomplish your long-term energy goals using renewable PPAs*. Retrieved from http://www.renewablechoice.com/wp-content/uploads/2017/01/White-Paper-Risk-Mitigation-2017.pdf.

[25] Locational basis risk is the difference between where the renewable generator sells power and the location at which the contract price is set, as defined in the financial PPA.

Massachusetts Institute of Technology, Boston Medical Center, and Post Office Square Redevelopment Corporation executed a financial PPA for 60 MW of solar from a facility to be built in North Carolina. This transaction represented one of the largest solar financial PPAs ever, as most financial PPAs executed as of 2017 have been for wind. Although the price hedging opportunity may not be perfect since the project is located in a different region than the consumers, the project partners cited other benefits, including that North Carolina had larger stretches of contiguous available land for solar development than the Boston area, and that the project would contribute to reducing greenhouse gas emissions in North Carolina, which has a higher grid carbon intensity than New England.[26]

Contract/Cost Implications

- Off-balance sheet
- Typically 10-15 year contracts
- May have annual escalator payment to electricity producer
- The Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank)[27] may have recordkeeping, reporting and other implications for financial PPAs.
- The financial PPA structure will determine if Dodd-Frank compliance is required and can be configured so that reporting and recordkeeping responsibilities are assigned to the seller; responsibilities will vary depending on the PPA structure.

RECs

RECs should be defined in the financial PPA and ownership should be assigned to one party. In many cases, financial PPAs are being signed where the commercial solar consumer is keeping the RECs to make a renewable energy claim, however, there are cases where the consumer sells the RECs or engages in a REC swap.

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[26] Massachusetts Institute of Technology. (2016). MIT to neutralize 17 percent of carbon emissions through purchase of solar energy. Retrieved from http://news.mit.edu/2016/mit-neutralize-17-percent-carbon-emissions-through-purchase-solar-energy-1019.

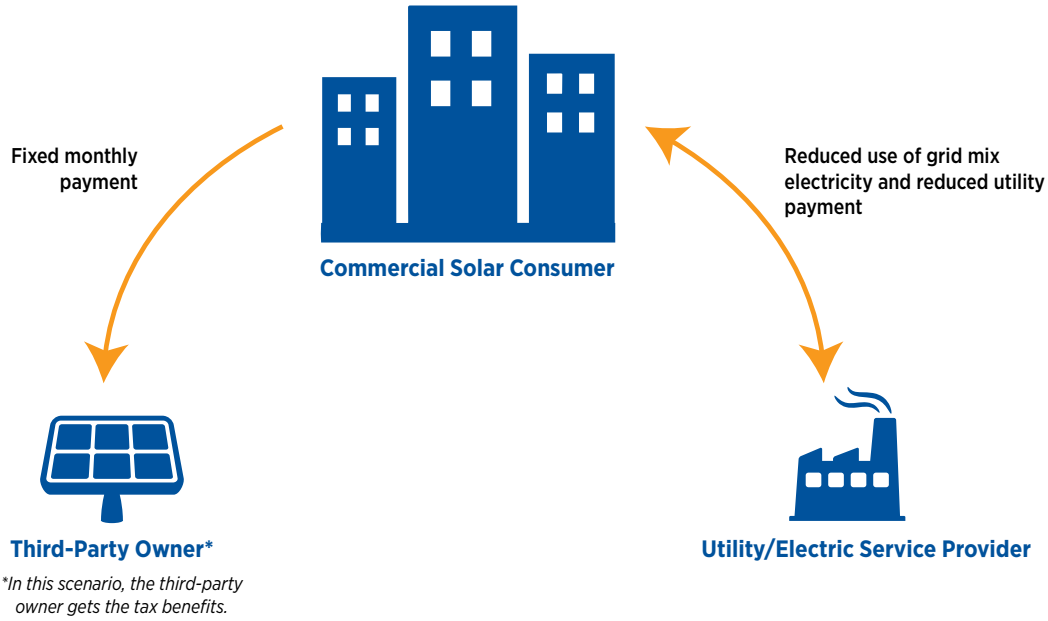
[27] Dodd-Frank Wall Street Reform and Consumer Protection Act. (2010). Pub. L. 111-203. 124 Stat. 1376. 21. Retrieved from https://www.sec.gov/about/laws/wallstreetreform-cpa.pdf.

Lease

Description

Solar leases also fall under the TPO model and mirror other common lease arrangements, such as an automobile lease. Generally, a solar consumer leases a solar PV system from a third party for a monthly rate over a pre-determined contract period (typically 10-20 years) (Figure B-7). The defining characteristic of a solar lease that distinguishes it from a PPA is the fixed monthly payment—consumers are making fixed payments every month rather than paying for the power generated. Because monthly costs are fixed, leases typically include production guarantees. Lease terms and prices vary depending on a number of factors, including physical location, PV system size, roof specifications (for rooftop installations), and the consumer's credit score, among others. Depending on how the lease is structured, consumers may also have the option of pre-paying a portion of the lease to reduce monthly payments.

Figure B-7. Overview of Lease



Note: Typical term is 15 to 20 years.

Market Insights

In 2015, third-party owned systems, including commercial leases, made up 65 percent of the nonresidential solar market; GTM Research projects TPO market share to increase to 74% in 2020.[28]

Policy Drivers

The TPO model of solar leases allows tax-exempt organizations to partner with other entities to monetize tax benefits but is currently not available in all states.

Contract Risks

The solar lessee assumes performance risk, which is typically mitigated by including a performance guarantee.

[28] GTM Research. U.S. commercial solar landscape 2016-2020.

Target Consumer & Example

- Non-taxpaying organizations (e.g., nonprofit organizations, governments) that cannot directly take advantage of tax incentives
- Organizations already using equipment leases
- Organizations with good credit ratings
- Organizations not wanting or not able to make a capital investment or that take a long time to make capital budgeting decisions

Luther College installed a 280-kilowatt (kW) solar PV array in 2012 under a lease agreement with Decorah Solar Field, LLC. The leasing company was able to take advantage of accelerated depreciation and federal grants under the 1603 Treasury Program to reduce project costs.[29]

Contract/Cost Implications

- Typically includes an annual escalator
- In order for a solar lease to qualify for the federal investment tax credit (ITC), both parties (e.g., the third-party owner and the lessee) must be taxpaying entities. Non-taxpaying entities may also enter into solar leases with a third-party owner but risk losing the ITC in that scenario. Taxpaying entities can use operating and capital leases to monetize tax credits directly.
  - An operating lease ("tax lease") is an off-balance sheet transaction which, for accounting purposes, closely resembles a traditional lease or rental. Under an operating lease, the lessor remains the owner of the asset and takes the tax credit. Operating leases are more common and are structured assuming the lessee will not necessarily assume direct ownership of the system in the future.
  - Conversely, a capital lease is an on-balance-sheet transaction that shares many characteristics of a rent-to-own or direct ownership arrangement and assumes the lessee will eventually own the system outright; the lessee is the owner for tax purposes.[30]

RECs

RECs should be defined, in the lease and ownership should be assigned to one party. In higher-priced REC markets and in territories where utilities are offering incentives for RECs, commercial consumers typically sell the RECs to the utility or project developer in order to lower the cost of the transaction, but in doing so they relinquish environmental claims.

Loan

Description

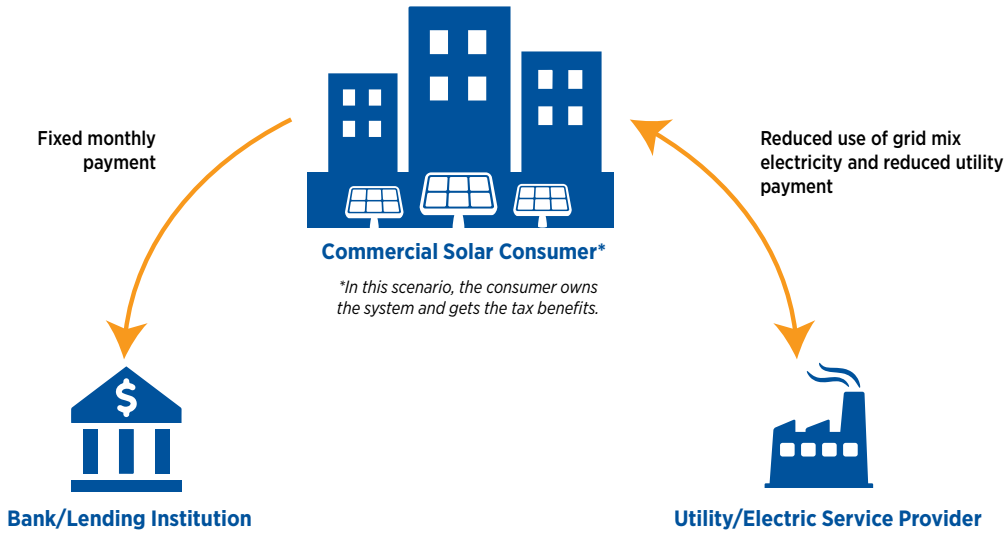
Solar-specific loans provide a pathway to direct ownership, which offers the benefit of free or low-cost electricity after the loan is paid off, and spreads the system cost out over a number of years (usually 5-15, depending on the loan terms), reducing upfront costs (Figure B-8). Solar loans are an ownership model—the consumer is paying for the PV

[29] Aznar, A., Mathur, S., Kim, A., Schramm, J.M. (2016). Non-power purchase agreement (PPA) options to financing solar deployment at universities. National Renewable Energy Lab. Retrieved from https://www.nrel.gov/technical-assistance/assets/pdfs/nonppa-universities-webinar-2016-oct4.pdf.

[30] Bolinger, M. (2009). Financing nonresidential photovoltaic projects: Options and implications. Lawrence Berkeley National Laboratory. LBNL-1410E. Retrieved from https://eta.lbl.gov/sites/all/files/publications/report-lbnl-1410e.pdf.

panels, not for the electricity production, thus the risk of poor performance falls to the commercial solar consumer. Solar loans are typically structured in two parts to allow consumers to take advantage of the 30 percent federal ITC. For example, the loan can be split into a 12- to 18-month zero-interest (also known as "same as cash") bridge loan for 30 percent of the project, and then a second longer-term, fully amortizing loan for the remaining 70 percent. Under this scenario, the solar consumer would pay the full amount of the ITC bridge loan upon receiving the tax benefit. The longer-term loan would be paid back with interest over the loan period. As these loan packages have evolved, some now also include service packages, often covering the same O&M coverage historically associated with TPO models.

Figure B-8. Overview of Loan



Note: Typical term is 15 to 20 years.

Market Insights

Owned systems (including those where a consumer took out a loan to finance the system) made up 35 percent of the nonresidential solar market in 2015; GTM Research projects this will decrease to 26 percent in 2020 as TPO market share increases.[31]

Solar-specific loan offerings—for which the underwriting loan terms, lender security, interest, and other programmatic aspects are designed for financing solar installations exclusively—started emerging as a prominent financing tool in late 2013, partially supplanting the use of more standardized home or commercial loans to finance solar.[32]

Policy Drivers

Loans are a way for solar consumers to finance and directly own a PV system. Loans are used in states that have not authorized third-party ownership or where the status of third-party ownership is unclear.

Contract Risks

- Purchaser assumes performance risk, including risk of delayed interconnection

[31] GTM Research. U.S. commercial solar landscape 2016-2020.

[32] Feldman, D., and Lowder, T., *Banking on solar* (p. 11)

Target Consumer & Example

- Smaller organizations, which PPA providers may not serve or require an interest rate of the organization that is unfeasible, may be able to get a loan through their banks or credit unions.
- Organizations not wanting or not able to make a capital investment
- Organizations able to take on operations and maintenance responsibilities or to contract for those services

Solar loans are used by small commercial consumers; the products are similar to those used by residential households installing solar. Many large solar developers offer solar loan products in addition to PPA or lease options.

Contract/Cost Implications

- Interest rates vary depending on factors like the borrower's credit score, length of the loan, and the loan provider, but generally fall in the 2.99 to 8 percent range.[33]
- On-balance sheet; may limit organization's borrowing potential

RECs

Banks and financial institutions may examine potential revenue from selling RECs; commercial solar consumers may monetize their RECs to make the loan terms more favorable, but they relinquish environmental claims if they do so.

Cash Purchase

Financing Option Description

Cash purchases are the most straightforward solar financing option: the solar consumer directly purchases, owns and is responsible for maintaining the solar installation (Figure B-9). Although PV system costs have fallen in recent years, purchasing a solar PV system outright requires significant upfront capital outlay, making this option unrealistic for many consumers, but appealing to others. Cash purchases also represent the most direct procurement type when selling or transferring an asset because it is already paid off. Owners typically assume all O&M costs and related expenses, but also maintain control over a long-term, high-quality asset.[34] Because cash purchase is a direct sale, there are fewer entities involved in the transaction than there are with loan or TPO options and the solar consumer does not incur financing costs (e.g., interest on a loan or the cost of capital).[35] This generally results in a higher rate of return over the lifetime of the PV system, although consumers typically will not see immediate economic benefits under a cash purchase—depending on the configuration, commercial solar consumers may see a negative cash flow for the first 5-11 years of system ownership.[36]

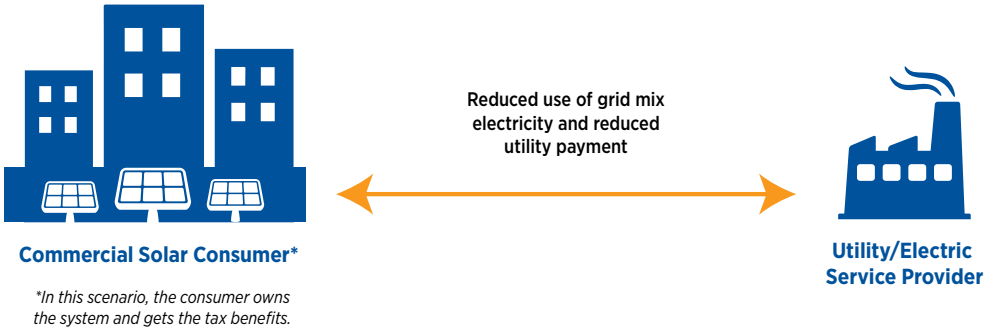
[33] Feldman, D., and Bolinger, M. (2016). *On the path to SunShot: Emerging opportunities and challenges in financing solar* (p. 40). National Renewable Energy Laboratory. NREL/TP-6A20-65638. Retrieved from http://www.nrel.gov/docs/fy16osti/65638.pdf

[34] Feldman, D., and Margolis, R., *To own or lease solar* (p. 2)

[35] Feldman, D., and Margolis, R., *To own or lease solar* (p. 2)

[36] GTM Research. U.S. commercial solar landscape 2016-2020

Figure B-9. Overview of Cash Purchase



Market Insights

Consumer-owned systems accounted for 35 percent of the commercial solar market in 2015; GTM research projects that this figure will decrease to 26 percent by 2020.[37]

Policy Drivers

Some institutions (universities, for example) may be able to utilize internal funding, bond financing, grants and incentives, including rebates or donor funding, as potential revenue streams for cash purchases. However, tax-exempt entities may not be able to take advantage of tax benefit incentives if opting for direct financing, which could impact the economic viability of solar projects.

Contract Risks

Purchaser assumes performance risk, including risk of delayed interconnection

Target Consumer & Example

- Organizations with available capital
- Organizations with access to grants, bond financing or donor funding (e.g., universities, nonprofit organizations)
- Organizations with tax liability

IKEA, a home furnishing retailer, decided to purchase solar installations outright based on several factors: it believed it would get a better rate of return than it would under a PPA, it was comfortable with a longer payback period, and it had the capacity to finance the PV system through the company's available balance sheet. IKEA did initially work with outside partners (including an engineering, procurement and construction contractor) while focusing on building internal, institutional knowledge about managing solar PV systems and learning to navigate the solar policy, financing and risk landscape.

Contract/Cost Implications

- On-balance sheet

[37] Feldman, D., and Margolis, R., *To own or lease solar* (p. 9)

RECs

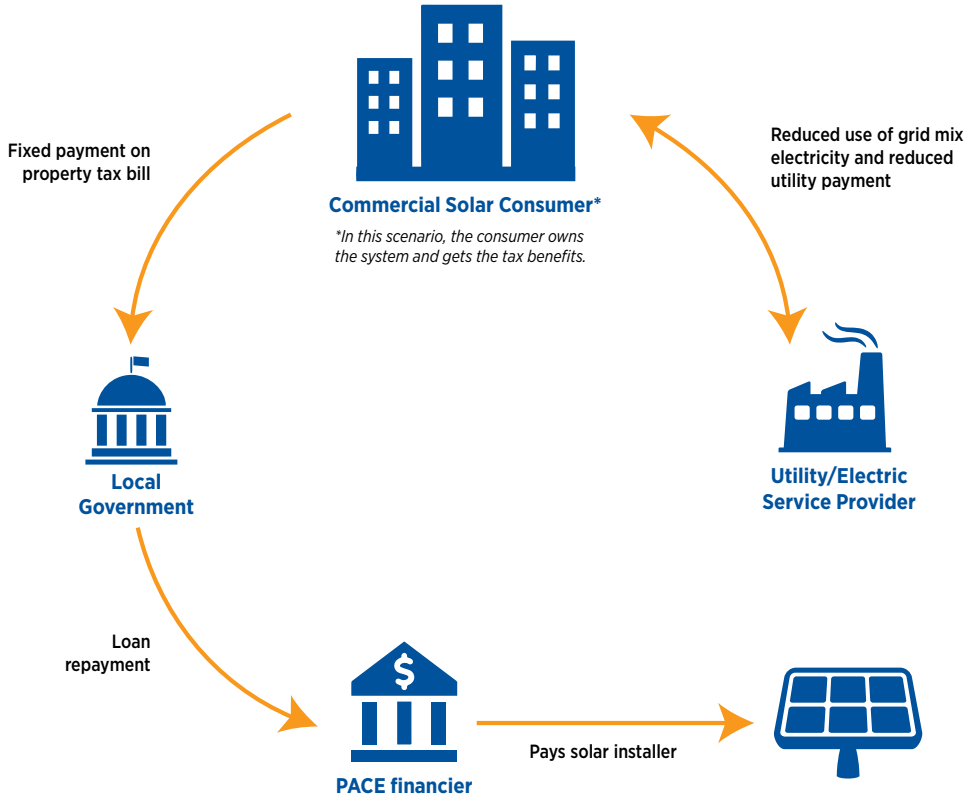
Organizations may examine potential revenue from selling RECs; they may monetize their RECs to ensure shorter payback periods, but they relinquish environmental claims if they do so.

Property-Assessed Clean Energy (PACE)

Financing Option Description

PACE financing, which was first introduced in California in 2008, is a financing option for renewable energy, energy efficiency and water conservation upgrades in certain locations where the state has authorized and local governments have implemented PACE programs. Under PACE financing, a third party finances (but does not own) PACE-eligible projects on behalf of a property owner and, after the project is completed, an assessment for the project costs (plus administrative expenses and interest) is attached to the property. Property owners repay the assessment over time as part of their property taxes (Figure B-10).

Figure B-10. Overview of PACE



Note: Typical term: <= 20years

PACE financing is unique in being property-based—PACE liens are typically evaluated against the underlying property value rather than the borrower's credit score—and transferable, meaning that if a property owner decides to sell, the PACE lien stays with the property and any subsequent owner. PACE can also be used to pay for solar leases and PPAs, in which cases the potential tax benefits associated with TPO arrangements may be combined with the proper-

ty-based advantages of PACE financing, though this option is not as widely used as a PACE-only product.[38] Because the PACE assessment is typically senior to the mortgage loan attached to a property, PACE programs typically require commercial PACE (C-PACE) projects to obtain consent from the mortgage lender.

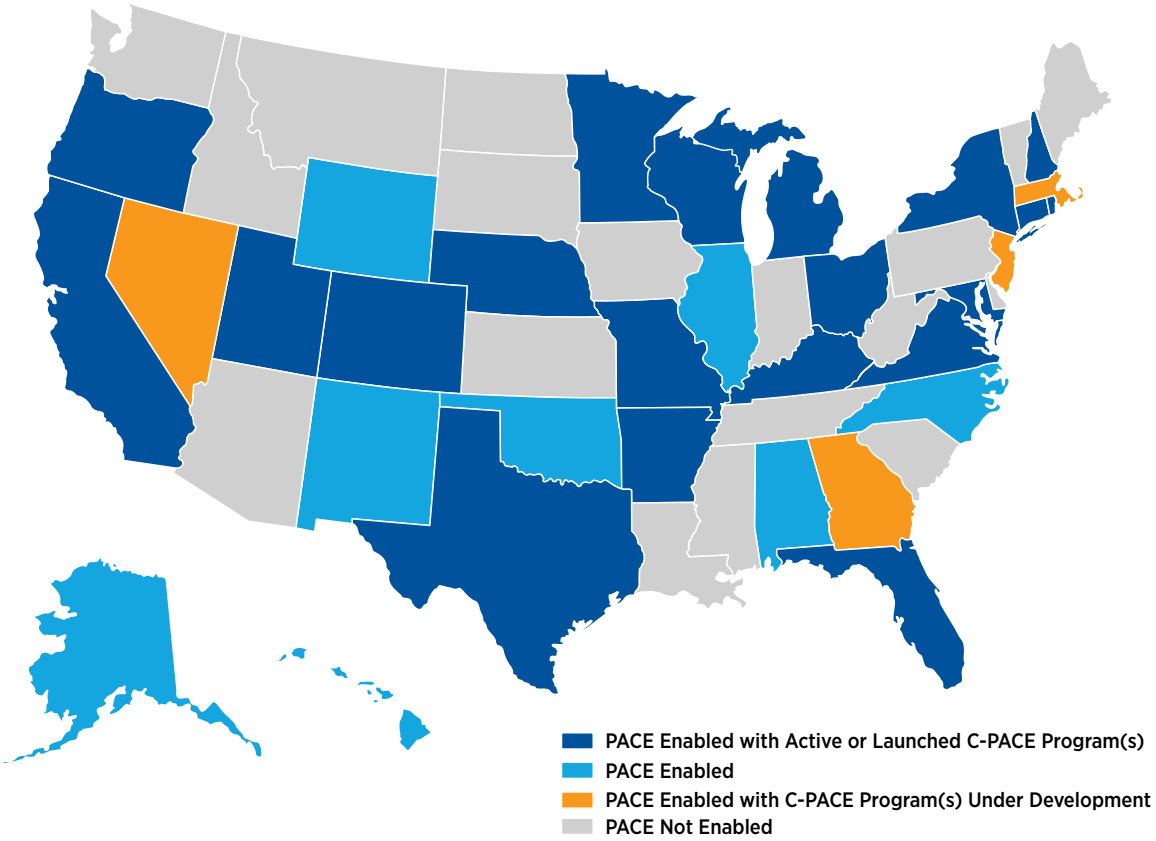
Market Insights

As of May 2017, 1,030 properties had used C-PACE, totaling $400 million in investment; 34 percent of the funding went to renewable energy projects, 51 percent to energy efficiency projects and 15 percent to mixed projects.[39]

Policy Drivers

PACE financing is currently enabled in 33 states and Washington, D.C.; of those, 20 states and Washington D.C. have an active PACE program (Figure B-11).

Figure B-11. Status of Commercial PACE Programs[40]



Contract Risks

- Consumer assumes performance risk, including risk of delayed interconnection

[38] The Connecticut Green Bank, for example, is offering a PACE PPA product. See http://pacenation.us/pace-talk-pace-power-purchase-agreements-ppa-is-a-game-changer-for-connecticut-and-beyond.

[39] PACENation. (2017). PACE market data. Retrieved from http://pacenation.us/pace-market-data/.

[40] PACENation. (2018). Commercial PACE Near You. Retrieved from http://pacenation.us/pace-programs/commercial.

Target Consumer & Example

- Organizations with poor credit or no credit history
- Organizations that may be moving before the end of the expected life of a solar system
- Building owners who lease their space, or organizations that own and use their building but expect to leave in less than 10 years (e.g., office buildings, hotels)[41]

A wholesale distribution facility operator in Chico, California, utilized C-PACE financing to install a 77.74-kW rooftop solar PV system. The building had ample roof space and did not require additional energy efficiency modifications. The annual PACE assessment is $265,458, with an interest rate of 7.99% over 20 years. In this case, the availability of tax incentives and rebates for solar PV systems also factored into the project economics.[42]

Contract/Cost Implications

- May be considered off-balance sheet, depending on accounting practices[43]
- Repayment is tied to the property; does not affect the organization's creditworthiness

RECs

Banks and financial institutions may examine potential revenue from selling RECs; commercial solar consumers may monetize their RECs to make the loan terms more favorable, but they relinquish environmental claims if they do so.

Other Financing and Solar Purchasing Options

There are several additional solar financing or purchasing options that may be available in certain markets, some of which can be used in conjunction with the mechanisms presented in the previous section.

Bond financing. Public institutions, governments and corporations have the option of issuing bonds to raise revenue to finance solar purchases.[44] Green bonds are an emerging subset of bonds specifically dedicated to financing environment-related projects, such as energy efficiency, renewable energy, water conservation and similar measures.[45]

Direct investments. In limited cases, direct investments such as grants, donor funding, endowments or internal capital funds may be available to facilitate solar cash purchases, particularly for larger institutions. Dedicated sustainability or renewable energy funds, such as those collected through student fees at some universities, represent another potential funding stream.

Energy performance contracting. Energy performance contracting mechanisms are structured to allow government agencies and commercial institutions to pay for renewable energy upgrades over time using money saved on energy bills resulting from energy-saving measures. Energy performance contracting structures are used extensively by federal agencies and are also open to the private sector. They include ESPCs and UESCs. Under both types of agreements, the company providing the energy efficiency or renewable energy service upgrades—an energy service

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[41] For more on the implications of leased spaces on solar procurement, see Bird, L., Gagnon, P., and Heeter, J. (2016). *Expanding midscale solar: Examining the economic potential, barriers, and opportunities at offices, hotels, warehouses, and universities*. NREL/TP-6A20-65938. Retrieved from http://www.nrel.gov/docs/fy16osti/65938.pdf.

[42] PACENation. Wholesale distributor. Retrieved from http://pacenation.us/projects/wholesale-distributor/.

[43] Bird, L., Gagnon, P., and Heeter, J. (2016). *Expanding midscale solar: examining the economic potential, barriers, and opportunities at offices, hotels, warehouses, and universities.* NREL/TP-6A20-65938. http://www.nrel.gov/docs/fy16osti/65938.pdf.

[44] For more information on bonds, see Cory, K., Coughlin, J., Coggeshall, J. (2008). *Solar photovoltaic financing: Deployment on public property by state and local governments.* NREL/TP-670-43115. Retrieved from http://www.nrel.gov/docs/fy08osti/43115.pdf.

[45] For more information on federal clean renewable energy bonds see https://energy.gov/savings/clean-renewable-energy-bonds-crebs.

company (ESCO) under ESPCs or the utility in the case of UESCs—guarantees reduced energy expenditures resulting from energy-saving projects. The ESCO or utility typically conducts a building energy audit, identifying specific energy conservation measures. Once the ESCO or utility and the building owner agree on the course of action, the ESCO or utility arranges project financing and makes the upgrades. The building owner then repays the ESCO or utility using its normal operating budget and the freed-up money from reduced energy costs stemming from the energy conservation measures. ESPCs and UESCs are discussed further in Appendix A, Green Power Considerations for Federal Agencies.[46]

Green tariffs. Green tariff programs are an emerging product among utilities that allow consumers (usually larger commercial and industrial entities) to purchase renewable power directly from the utility, typically under a long-term contract. Consumers opting into these programs may purchase electricity at the green tariff rate, which typically replaces the standard electricity rate and may result in cost savings to the consumer over the contract term. Typically, the utility's green tariff will specify key terms and conditions, then consumers will sign an individual contract with the utility specifying the costs. As of April 2017, five utilities had a subscribed green tariff, with 900 MW of renewable capacity committed.[47]

Conclusion

The solar PV financing landscape continues to evolve and expand, with new products and configurations affording solar consumers a variety of potential options. Specific financing mechanisms offer different combinations of advantages and challenges. A consumer's tax profile, location, and access to upfront capital, among other factors, will impact the viability and relative attractiveness of the different approaches. Individual solar consumers will need to carefully consider solar financing options within their specific contexts. Table B-2 summarizes the overarching advantages and challenges associated with the different financing mechanisms and identifies the types of end users that may benefit most from the respective financing options.

[46] For more information on the basics of ESPC, see the DOE Office of Energy Efficiency and Renewable Energy's overview at https://energy.gov/eere/slsc/energy-savings-performance-contracting.

[47] World Resources Institute. (2017). Grid transformation: Green tariff deals. Retrieved from http://www.wri.org/resources/charts-graphs/grid-transformation-green-tariff-deals; for more on green tariffs, see Heeter, J., Cook, J., and Bird, L. (2017). *Charting the emergence of corporate procurement of utility-scale PV*. NREL/TP-6A20-69080. Retrieved from https://www.nrel.gov/docs/fy17osti/69080.pdf.

Table B-2. Summary of Solar Financing Mechanisms

Financing Mechanism	Advantages	Challenges	Which end users benefit most?
On-site, Physical PPAs	• Little or no upfront capital investment • Tax-exempt consumers can take advantage of tax benefits, including MACRS • Consumer only pays for production • Reduces consumer exposure to electricity price fluctuations • O&M responsibilities covered by TPO • Utility bills reduced by amount the PPA covers • Off-balance sheet	• Not available in all states • Requires long-term contract for power • Consumer must have good credit • Potential transfer issues at property sale • RECs must be assigned to one party; selling RECs may lower transaction costs, but consumer then cannot claim environmental benefits	• Consumers with little or no tax appetite • Consumers with limited access or interest in spending upfront capital • Organizations with good credit
Off-site, Financial PPAs	• Same advantages as on-site PPAs, plus: • Option for consumers where physical PPAs are not allowed • Often issued for shorter contract terms (10 years) than on-site PPAs	• Complex financial arrangement; consumers may experience steep learning curve in executing contracts • Consumer continues to pay existing electricity bill; may not provide perfect hedge against rising utility rates • Electricity producer must be located in restructured markets • Consumer must have good credit • Dodd-Frank Wall Street Reform and Consumer Protection Act may have recordkeeping, reporting and other implications • RECs must be assigned to one party; selling RECs may lower transaction costs, but consumer then cannot claim environmental benefits	• Consumers in restructured electricity markets • Consumers with distributed loads • Consumers with interest and ability to learn about new financial products • Large electricity users • Consumers with limited space available for on-site solar development • Consumers in restructured electricity markets • Consumers with distributed loads • Consumers with interest and ability to learn about new financial products • Large electricity users • Consumers with limited space available for on-site solar development • Organizations with good credit rating • Consumers with little or no tax appetite • Consumers with limited access to or interest in spending upfront capital

Table B-2. Summary of Solar Financing Mechanisms (continued)

Financing Mechanism	Advantages	Challenges	Which end users benefit most?
Lease	• Little or no upfront capital investment • Can work with existing equipment lease financial partners • Fixed payments monthly	• Lease may impact balance sheet, depending on the structure • Consumer assumes performance risk • RECs must be assigned to one party; selling RECs may lower transaction costs, but the consumer then cannot claim environmental benefit	• Non-taxpaying organizations (e.g. nonprofit organizations, governments) • Organizations already using equipment leases • Organizations with good credit ratings • Large corporations with aversion to debt • Organizations not wanting or not able to make a capital investment or that take a long time to make capital budgeting decisions
Solar Loan	• Reduced upfront costs • Consumer enjoys benefits of ownership after loan is paid off • Typically lower cost to consumer than TPO models	• Consumer must have good credit • Consumer assumes risk of nonproduction • On-balance sheet	• Consumers in states that disallow third-party PPAs • Organizations not wanting or not able to make a capital investment • Organizations able to take on operations and maintenance responsibilities, or contract for those services
Cash Purchase	• Owner avoids financing charges and interest payments • May expedite the solar installation process • May expedite property sale or transfer	• Competing uses for organizations' funds • No accelerated depreciation benefits (residential consumers) • Tax-exempt entities may not be able to monetize tax benefits • Owner responsible for O&M (or contract out for those services)	• Consumers with available upfront capital • Organizations with access to grants, bond financing, or donor funding (e.g., universities, nonprofit organizations) • Organizations with tax liability
PACE	• Little or no upfront capital investment • Transferable to subsequent property owners • Financing is primarily property-based rather than credit-based	• Limited availability • PACE requires clear communication with underlying mortgage lender	• Building owners who lease their space, or organizations that own and use their building but expect to leave in less than 10 years • Public-sector consumers • Organizations with poor or no credit history

Resources

PPAs

National Renewable Energy Laboratory. (2016). U*sing power purchase agreements for solar deployment at universities.* National Renewable Energy Laboratory. NREL/BR-6A20-6556777. Retrieved from http://www.nrel.gov/docs/gen/fy16/65567.pdf.

Leases

National Renewable Energy Laboratory. (2014). H*omeowners guide to leasing a solar electric system.* National Renewable Energy Laboratory. NREL/BR-7A40-60972. Retrieved from http://www.nrel.gov/docs/fy14osti/60972.pdf.

Standard PPA and Lease Contracts

National Renewable Energy Laboratory. (n.d.). Renewable energy project finance. Retrieved from https://financere.nrel.gov/finance/content/solar-securitization-and-solar-access-public-capital-sapc-working-group#standard_contracts.

Solar Financing Market and Trends

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Feldman, D., and Lowder, T. (2014). *Banking on solar: An analysis of banking opportunities in the U.S. distributed photovoltaic market (p. 14).* National Renewable Energy Laboratory. NREL/TP-6A20-62605. Retrieved from http://www.nrel.gov/docs/fy15osti/62605.pdf.

Energy Savings Performance Contracting

U.S. Department of Energy. (2017). *Energy savings performance contracting.* Retrieved from https://energy.gov/eere/slsc/energy-savings-performance-contracting.

PACE Financing

U.S. Department of Energy. (2014). Chapter 12: Commercial property-assessed clean energy (PACE) financing *U.S. Department of Energy Clean Energy Finance Guide.* Retrieved from https://energy.gov/sites/prod/files/2014/06/f16/ch12_commercial_pace_all.pdf

U.S. Department of Energy. (2017). *Property-assessed clean energy programs.* Retrieved from https://energy.gov/eere/slsc/property-assessed-clean-energy-programs.

Other Financing Options

National Renewable Energy Laboratory. (2016). *Non-power purchase agreement (PPA) options for financing solar deployment at universities.* National Renewable Energy Laboratory. NREL/BR-6A20-67111. Retrieved from http://www.nrel.gov/docs/fy17osti/67111.pdf

Cory, K., Coughlin, J., and Coggeshall. J. (2008). Solar photovoltaic financing: Deployment on public property by state and local governments. NREL/TP-670-43115. Retrieved from http://www.nrel.gov/docs/fy08osti/43115.pdf.

Renewable Energy Claims

Solar Energy on Campus Past I-IV

https://resource-solutions.org/wp-content/uploads/2016/08/Solar-Energy-on-Campus-I.pdf

https://resource-solutions.org/wp-content/uploads/2016/09/Solar-Energy-on-Campus-II.pdf

https://resource-solutions.org/wp-content/uploads/2016/12/Solar-Energy-on-Campus-III.pdf

https://resource-solutions.org/wp-content/uploads/2016/12/Solar-Energy-on-Campus-IV.pdf

APPENDIX

C

Purchasing renewable energy as a residential customer

Co-Authored by the U.S. DOE and U.S. EPA

To view the full Guide, visit https://www.epa.gov/greenpower/guide-purchasing-green-power

DOCUMENT MAP

Residential consumers can drive demand for green power

Residential electricity consumers looking to reduce their environmental impacts and increase the demand for cleaner sources of power can contribute to the growing green power industry. Depending on their location, there are several ways that residential electricity consumers can purchase green power and drive demand-side change on the grid.

Renewable Energy Certificates (RECs) are used in the United States to track the delivery and consumption of renewable energy and substantiate all green power generation and use claims, something that would otherwise not be possible on a shared distribution network or utility grid. Each REC represents the environmental attributes associated with one megawatt-hour (MWh) of renewable energy generation, and can be sold together with or separately from physical electricity. These energy attribute certificates include the location and type of generation (e.g. wind, solar, geothermal, hydropower) and any emissions associated with generation source. In aggregate and over time, RECs allow electricity consumers to choose renewable energy, which can drive change in the electricity market through the increased development of renewable energy source to meet increasing REC demand.

All green power purchasing options must include RECs in order for consumers to claim the environmental attributes and use of green power and to have an impact on transforming the market towards cleaner sources of energy. The options below allow consumers to purchase green power from the electric grid without having to install renewable generation equipment themselves, such as rooftop solar photovoltaic panels.

Purchasing Options for Residential Consumers

Purchasing green power through a retail electricity supplier

In some areas of the U.S., residential customers may be able to sign up for an optional green power service to procure a bundled electricity and REC product from their utility or default service provider. These types of default utility provider supply options are called “green pricing programs” and are often structured in a range of ways to include a small premium of up to a few cents per kilowatt-hour above the utility’s standard electricity service, be sold in blocks of kilowatt-hours or as a percentage of the consumer’s total electricity use at a fixed cost.

In other areas of the country, some residential customers have the option to choose an electricity provider who may not always be their local distribution utility. Consumers that can competitively choose a retail supplier who is not their local distribution utility do so through “green power marketing programs.” Consumers will often pay a premium for green power marketing products, though in some regions, competitive green power products may be price competitive with default electricity options.

In either case, suppliers will often offer a range of green power products, allowing customers to choose levels of renewable energy often up to 100% green power. In either case, all green power products involve renewable energy certificates. Many consumers will seek out suppliers and products that are third-party certified (see below).

Receiving green power through a community choice aggregation

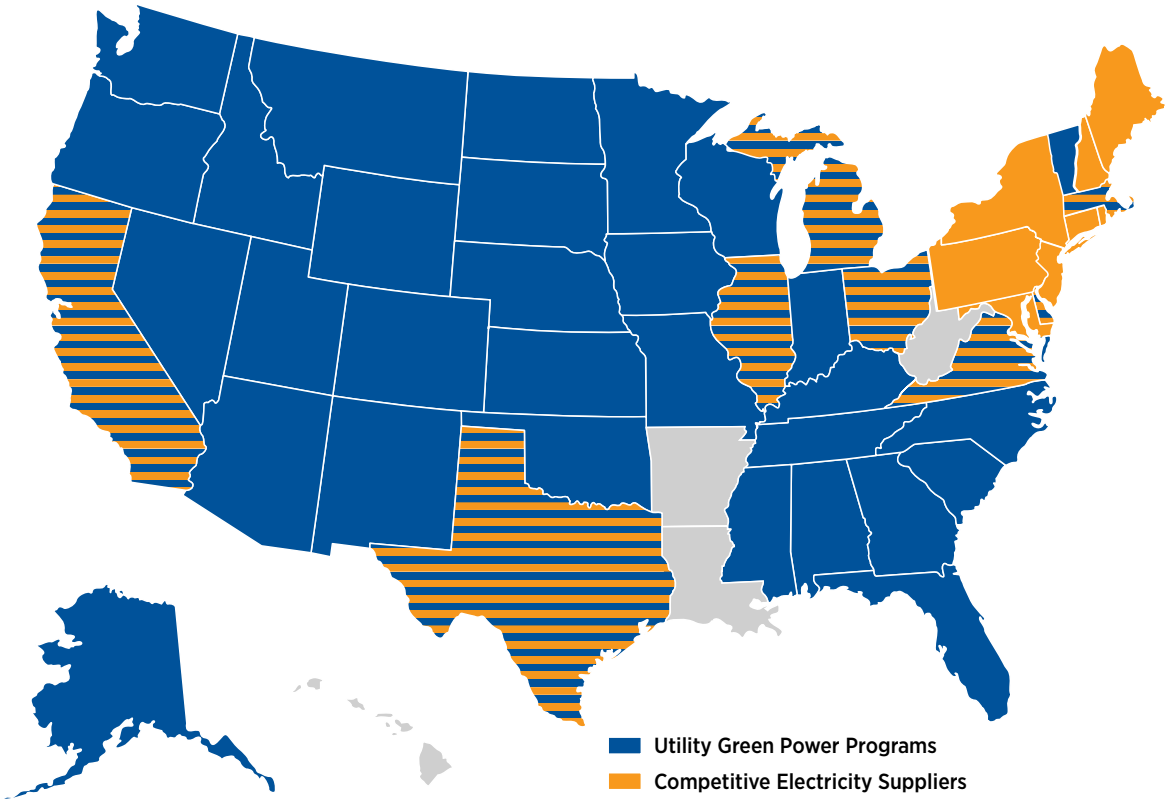
Some residential customers may be automatically enrolled in a green power option that has formed under a “community choice aggregation.” This occurs in a few states where policy or legislation have authorized community choice aggregation, which allows a municipality or local jurisdiction to purchase green power on the behalf of the community at-large. Community choice aggregations are generally structured as an “opt-out” option for residential customers, meaning that residential consumers will receive green power unless they choose to not participate, which tends to be uncommon. Due to the ability of community choice aggregations to drive scale, some customers may receive their green power service at or below standard electricity rates. Residential consumers generally have little to no control

over the green power selected under a community choice aggregation approach, including the ability of the consumer to choose the resource type or location.

Direct Purchase of Renewable Energy Certificates

All electricity consumers have the option to purchase renewable energy certificates as a stand-alone product that are unbundled, or sold separately, from the physical electricity delivered to the consumer over the grid. Because RECs can be unbundled from the underlying electricity at the point of generation, RECs can be sold and consumed anywhere within the U.S. electricity market. REC instruments help solve the challenge of knowing the origin or source of the electricity delivered over the grid, since physical electricity is undifferentiated (e.g., it all looks the same). REC instruments are used to assign ownership to generation delivered to the grid, while offering consumers the flexibility to specify among other things, exactly what type of resource and the location of the generator they prefer to have serving their demand. Buying RECs separately does not affect the consumer's existing utility service relationship, but does result in two separate billings from both their electricity and REC suppliers, unlike retail utility supply options that involve bundled products. Consumers that buy RECs as a green power product can legally claim to be using renewable electricity based on the attributes conveyed by the RECs and the generator that produced them to meet demand. All green power supply options include RECs, so there is little difference if you purchase the REC bundled or unbundled from the underlying electricity.

Figure C-1. U.S. Residential Green Power Purchasing Options



Notes
1. Unbundled Renewable Energy Certificates (RECs) are available nationally
2. Community Choice Aggregation (CCA) programs are available in CA, IL, MA, NJ, NY, OH, and RI
3. Not all indicated options are available statewide

Verification and Certification

Because voluntary sales and purchases of renewable energy are not subject to governmental oversight, it is important that residential customers look for green power options that are certified by an independent third party. The non-profit Center for Resource Solutions developed the Green-e standard and certification program to help consumers identify high quality renewable energy products. Green-e verifies that all green power product sales are substantiated with RECs and that ultimately each REC is only issued to one buyer or consumer. This also involves making sure that RECs purchased by voluntary residential consumers are also not counted towards a mandate, which gives consumers assurances that their purchase goes above and beyond what would otherwise have occurred due to regulation (also known as regulatory surplus). Finally, Green-e requires that customers receive accurate and transparent disclosures about what they are purchasing (including resource types and facility locations). Additionally, Green-e conducts regular reviews of marketing and promotional materials for truth in advertising by certified suppliers. It is considered a consumer best practice to seek out third party certified green power products from eligible suppliers. To learn more about Green-e or find a certified product in your area, visit http://www.green-e.org.

Green Power Purchasing Preferences

Residential customers may express preferences for certain green power options and products in terms of the following:

- Resource Type – for example, generation from solar, wind, geothermal, or low-impact hydropower.
- Resource emissions rate – for example, a resource type that generates electricity at a low or zero emissions rate.
- Facility Location – for example, a specific project, generation from the same state, a certain region of the country, or national (no preference).
- Facility Age – for example, generation from facilities that were built in the last 5 to 10 years or that are new or yet to be built.
- Facility Size – for example, generation from large, utility-scale facilities vs. small, distributed generation.
- Length of Commitment – for example, enrollment in a utility program to pay monthly with the option to opt out at any time vs. entering into a 5-year purchase contract vs. making a one-time purchase of unbundled RECs.
- Other Considerations – for example, supporting generation from renewable facilities that may have broader system effects such as job, security, and reliability benefits. Some buyers may choose to support local renewable facilities or facilities in regions where the grid is considered to be more polluting.
- Cost – the cost of green power will vary based on all of the preferences listed above, as well as other factors.

Residential consumers may also find some of the information in the Guide to Purchasing Green Power useful when selecting a supply option despite the Guide being focused on non-residential consumers.