CHAPTER

3

The Benefits and Costs of Green Power

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

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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

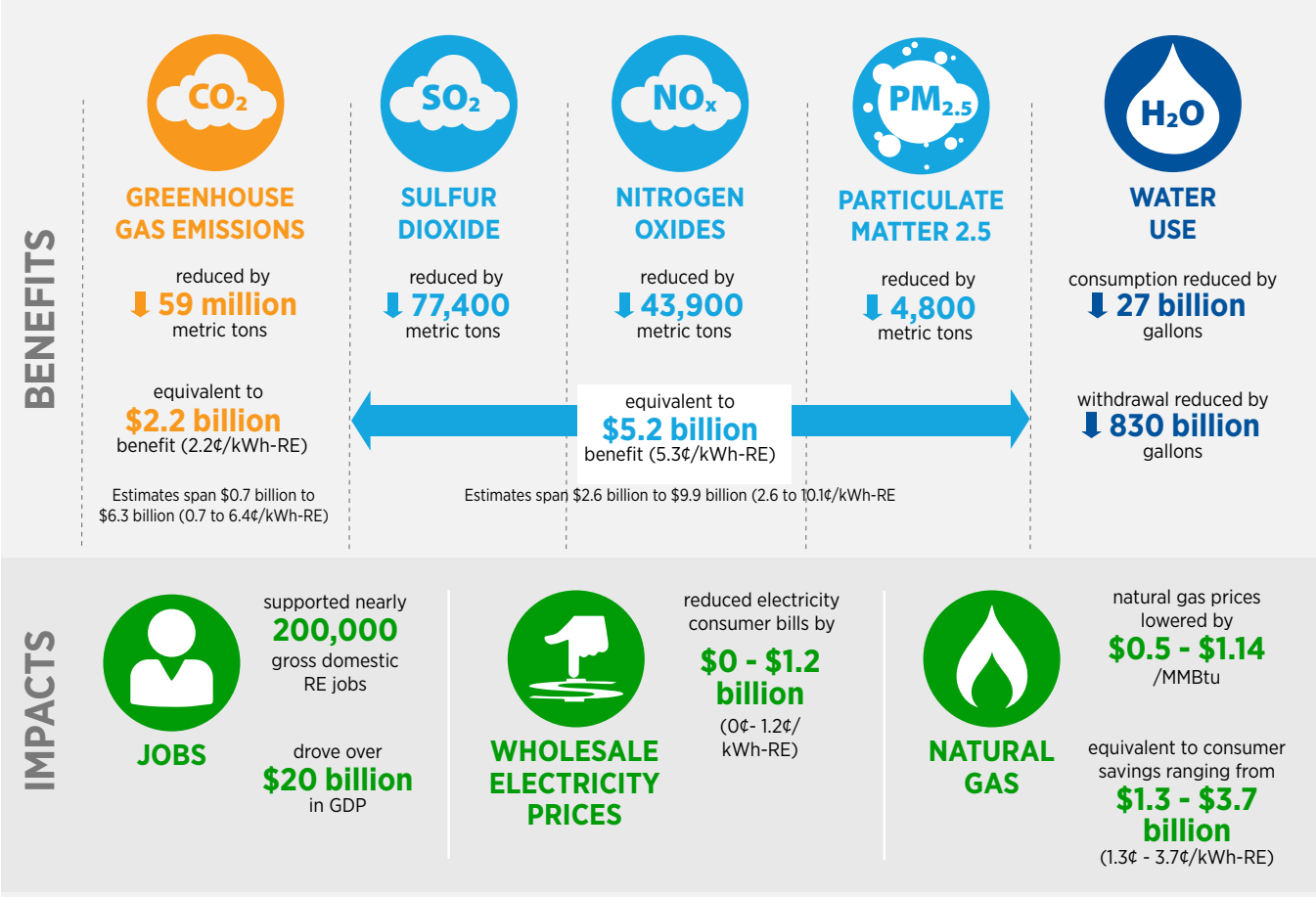
[3] Wiser, R., Barbose, G., Heeter, J., Mai, T., Bird, L., Bolinger, M., Carpenter, A., Heath, G., Keyser, D., Macknick, J., Mills, A., and Millstein, D. (2016). A retrospective analysis of the benefits and impacts of U.S. renewable portfolio standards. Lawrence Berkeley National Laboratory and National 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.

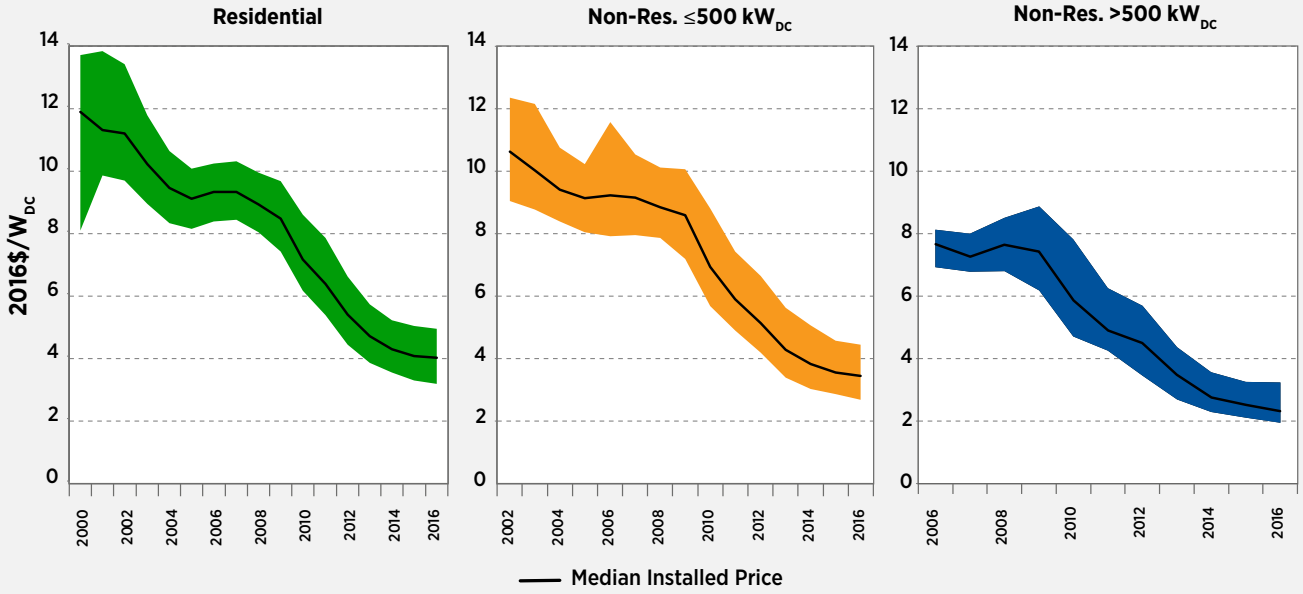
[6] Wiser et al., op. Cit.

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.

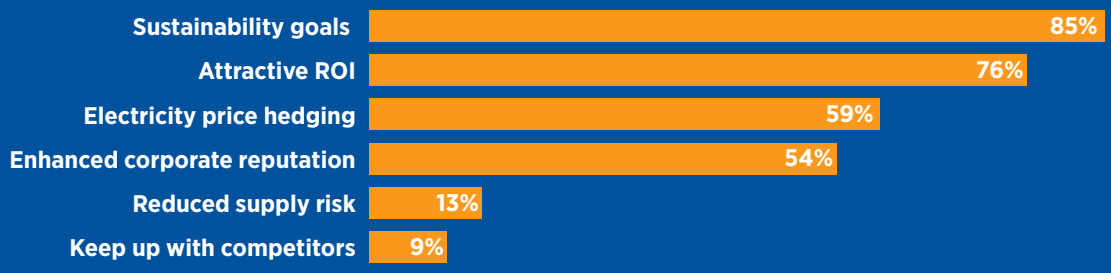
Demonstrate civic leadership. Being among the first in a community to purchase green power is a demonstration of civic leadership. It makes a statement that an organization is willing to act on its stated environmental and social goals. Committing to green power can also demonstrate a company's willingness 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.

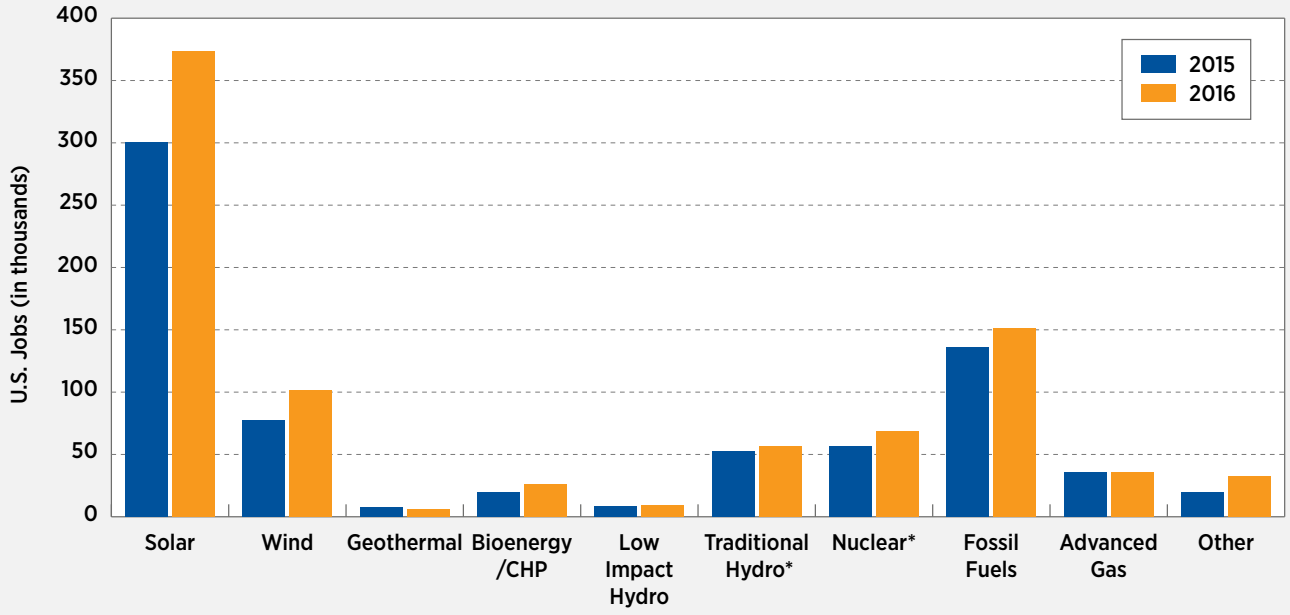
Case Study: Demonstrating Community Leadership

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.

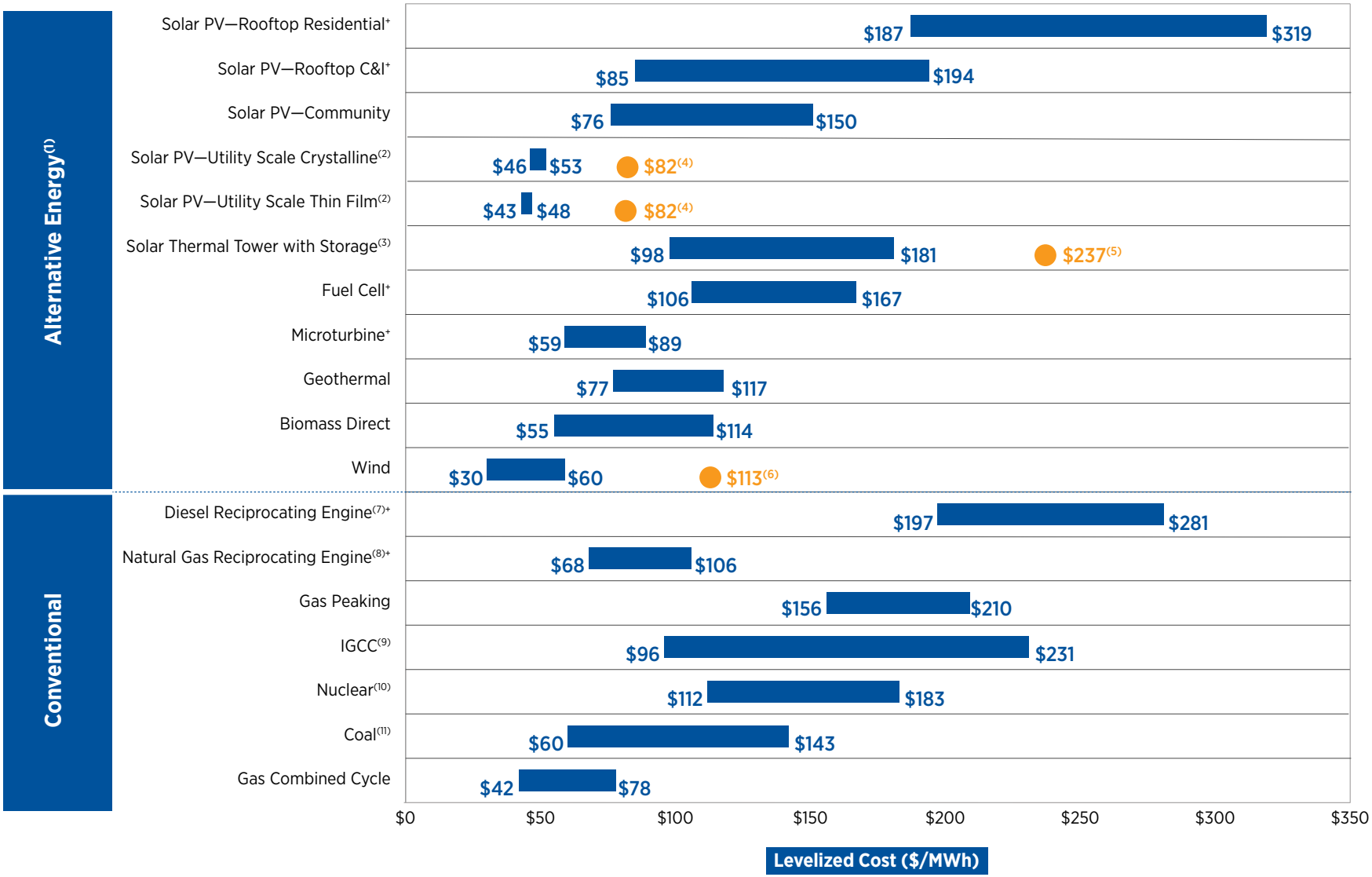
For example, while self-generation can require a major capital outlay that varies significantly depending on the size of the installation, that cost can be recovered over time through stable and, in some cases, lower ongoing operating costs.

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

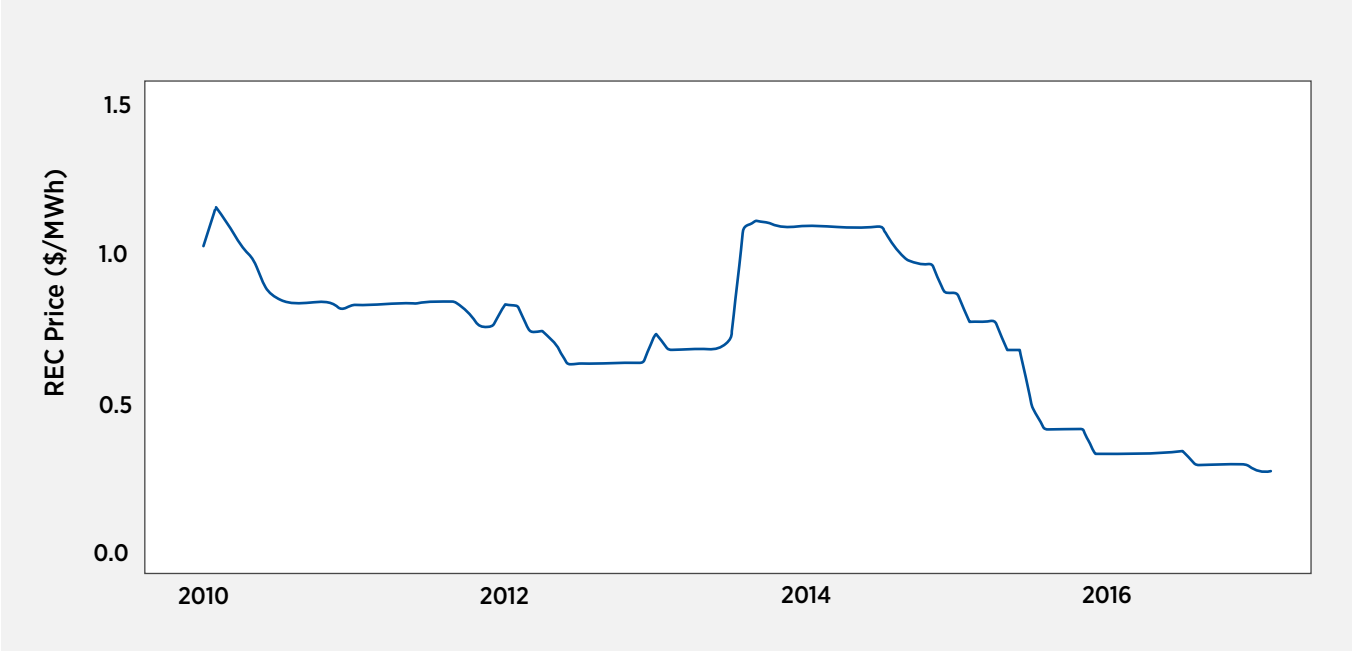
The premiums associated with green power were originally conceptualized as representing the incremental cost of the renewable resource above the utility's "avoided cost," meaning the cost of building the next power plant the utility will need, discounted to today's present value. This avoided cost can 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