



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

Summary

Chapter 1. Introduction

Chapter 2. Introducing Green Power

What is Green Power?

Introduction to Renewable Energy Certificates

Introduction to the Voluntary Market

Certification and Verification

Tracking Systems

Chapter 3. The Benefits and Costs of Green Power

The Benefits

The Costs

Public Relations Considerations

Chapter 4. Green Power Product Options

Purchase Options

Self-Generation Options

Green Power Supply Options Summary

Chapter 5. Using Organizational Goals to Guide Green Power Purchases

Setting Goals

Identifying Key Decision-Makers

Gathering Energy and Facility Data

Choosing Green Power Options

Chapter 6. Contracting for Green Power

Developing Criteria for Screening Green Power Suppliers and Products

Collecting Product Information

Creating a Procurement Plan

Chapter 7. Planning a Self-Generation Renewable Project

Screening the Options

Obtaining Resources and Assistance

Creating a Project Plan

Installing and Operating a Renewable Generation Project

Chapter 8. Capturing the Benefits of the Purchase

The Environmental Benefits

Promoting the Organization's Purchase

Chapter 9. Conclusion

Chapter 10. Resources for Additional Information

Glossary

Appendix A. Green Power Considerations for Federal Agencies

Appendix B. Commercial Solar Financing Options

Appendix C. Purchasing renewable energy as a residential customer



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.

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.

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.

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.