



# **Green Power Partnership**

## **A Guide to Buying & Benefiting from Green Power**



**Green Power Partnership**

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# Preface

**T**he guide is intended for organizations that have decided to buy green power and want help figuring out how to do it, and also organizations that are still considering the merits of a green power purchase. It has been developed to assist current and potential future Partners in the Green Power Partnership.

The Green Power Partnership is a new EPA voluntary program that seeks to reduce the environmental impact of electricity generation by fostering the development of green power. The Partnership provides technical assistance and public recognition to organizations that commit to using green power for a portion of their electricity needs. The Partnership includes Fortune 500 companies, states, federal agencies, universities, and leading organizations around the country that have made a commitment to green power.

This is a second draft version of a document that will continually develop over time. We welcome your input. Please tell us your success stories and share with us the challenges you encountered so that we can improve this guide in the future.

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# Table of Contents

<b>Introduction</b>	<b>1</b>
<b>What Is Renewable Energy and Green Power?</b>	<b>2</b>
RENEWABLE ENERGY	2
GREEN POWER	2
Defining Green Power	2
<b>What Benefits Will My Green Power Purchase Bring?</b>	<b>3</b>
MEET CORPORATE ENVIRONMENTAL OBJECTIVES	3
DEMONSTRATE CIVIC LEADERSHIP	3
IMPROVE EMPLOYEE MORALE	3
PROVIDE A HEDGE AGAINST ELECTRICITY PRICE INSTABILITY	3
INCREASE ELECTRIC SUPPLY RELIABILITY	4
REINFORCE MESSAGES BEHIND PRODUCTS OR SERVICES	4
GENERATE POSITIVE PUBLICITY	4
<b>What Are My Options for Purchasing Green Power?</b>	<b>5</b>
PRODUCT AND SERVICE OPTIONS	5
Grid-based Green Power	5
Renewable Energy Certificates	6
On-site Renewable Generation	6
<b>How Do I Choose a Green Power Supplier and Product?</b>	<b>7</b>
SUPPLIER SELECTION CRITERIA	7
PRODUCT SELECTION CRITERIA	7
Obtaining Product Information	8
Product Certification	8
<b>What About the Cost of Green Power?</b>	<b>9</b>
COMPARING THE COST OF GREEN POWER TO YOUR CURRENT RATE	10
<b>What Are the Steps in Deciding To Buy Green Power?</b>	<b>12</b>
ASSEMBLE A MULTI FUNCTION TEAM	12
COME ARMED WITH DATA	12
DECIDE ON YOUR OBJECTIVES	12
DO YOUR HOMEWORK	12
OBTAIN MANAGEMENT BUY-IN	13
HOW MUCH SHOULD I BUY?	13

**What Procurement Methods Should I Use to Purchase Green Power? . . . . .14**

    NEGOTIATE WITH YOUR UTILITY . . . . .14

    PHONE CALLS TO MULTIPLE SELLERS . . . . .14

    ISSUE REQUEST FOR PROPOSALS . . . . .14

    PROCURING RENEWABLE ENERGY CERTIFICATES . . . . .15

    PROCURING ON-SITE GENERATION . . . . .15

**Appendix A: Additional Resources . . . . .17**

**Appendix B: Qualifying Sources of Renewable Electricity Generation . . . . .18**

**Appendix C: Emissions Factors . . . . .20**

**Appendix D: Retail Green Power Products, Competitive Markets . . . . .23**

**Appendix E: Retail Renewable Energy Certificate Products . . . . .25**

**Appendix F: Retail Utility Green Pricing Programs . . . . .27**

**Glossary . . . . .33**

# Introduction

**E**lectricity is fundamental to our society—it powers our homes, businesses, and industries. Conventional electricity generation, however, is the nation’s single largest industrial source of air pollution, adversely impacting human health and the environment.

In many parts of the country, consumers can now choose the source of their electric power, and can choose electricity generated from renewable energy sources. Commonly referred to as “green power,” renewable energy sources include wind, solar, geothermal, and various forms of hydro and biomass. Even if green power is not available as a grid-based electricity product, consumers can install their own onsite green power generation or support renewable energy by purchasing renewable energy certificates (these options are described in the “Options for Purchasing Green Power” section). By purchasing or supporting renewable energy instead of conventional power, consumers can reduce the environmental impacts associated with electricity consumption.

Many private and public organizations are already choosing to buy green power. Purchasing green power is helping organizations meet their environmental and social goals. Purchasing green power can help demonstrate civic leadership, boost employee morale, and provide public relations benefits.

Buying green power can also help manage an organization’s exposure to rising or volatile electricity prices. Organizations can lock in a price that may be lower than the cost of electricity from other sources that are subject to changing fuel prices. Green power can also be part of a diversification strategy for greater electricity reliability through onsite generation.

If your organization is considering buying green power, this guide is for you. It will answer many questions you may have about buying green power and illuminate some issues you will likely encounter. This guide addresses the following commonly asked questions:

- What is renewable energy and green power?
- What are my options for purchasing green power?
- How do I choose a green power product?
- What benefits will my green power purchase bring?
- What about the cost of green power?
- What are the steps in deciding to buy green power?
- What procurement methods can I use to buy green power?

## Possible Motivations for Buying Green Power

- Social and environmental goals
- Reduced risk of volatile fuel prices
- Increased electric service reliability
- Enhanced employee morale and stakeholder satisfaction
- Improved public relations and brand identity

# What Is Renewable Energy and Green Power?

## Renewable Energy

Renewable energy is derived from natural resources that replenish themselves over a short period of time. There are five principal renewable energy resources—the sun, wind, moving water, organic plant and waste material, and the earth’s heat. They are also commonly known as solar, wind, hydro, biomass and geothermal energy. Renewable energy is used for a variety of applications including generating heat, powering vehicles or generating electricity. Compared to using conventional energy resources, the use of renewable energy resources generally avoids, or least significantly reduces, environmental impacts such as air emissions, water consumption, thermal pollution, waste, noise, and land-use impacts.

## Green Power

The term “green power” generally refers to electricity supplied in whole or in part from renewable energy sources. By choosing to purchase a green power product, you can support increased development of renewable energy sources.

It is important to note that usually green power is not actually delivered to your location. Instead, it is generated and supplied to the grid that serves all customers. What you are paying for is the benefit of displacing other non-renewables sources from the grid.

Although green power’s environmental impacts are minimal, green power sources can have some effect on the environment. For example, generating electricity from biomass resources requires combustion, releasing some emissions. Hydroelectric dams can flood surrounding land and impede fish passage. Compared to conventional power, however, green power generally avoids, or at least significantly reduces, air emissions, water consumption, thermal pollution, waste, noise, adverse land-use impacts and other impacts typically associated with conventional electricity generation.

## Defining Green Power

There is a remarkable degree of consensus that solar, wind and geothermal meet the definition of “green” as long as siting and permitting requirements are met. Because of different regional sensitivities, however, regional differences remain with respect to the definition of acceptable biomass and hydro energy resources. Some regions of the country are more sensitive to specific energy resources and environmental issues than others. For example, in the Northeast and Southeast, where biomass potential is high, stakeholders have more experience with biomass development and biomass issues than stakeholders in other parts of the country. Similarly, stakeholders in the Pacific Northwest — where there is a lot of developed hydro capacity — tend to be more concerned with hydro impacts than stakeholders elsewhere.

The most commonly used definitions for green power are those developed by the Center for Resource Solutions (CRS) Green-e certification program, which is an ongoing effort to achieve consensus on green power definitions. In many states and regions, CRS has brought together stakeholders to develop consensus standards. In the Northwest, Renewable Northwest Project has developed criteria for green power called Renew 2000. Additional information concerning Green-e is available at <http://www.green-e.org>.

At the current time, EPA believes the consensus-based Green-e and Renew 2000 definitions of green power resources are the most widely held, best researched standards for green power, and are the basis for determining the resources that are eligible to meet the requirements for joining the Green Power Partnership. For additional information, see Appendix B, Qualifying Sources of Renewable Energy Generation. The Partnership’s definitions for renewable resources may change in the future as consensus standards for green power continue to evolve.



# What Benefits Will My Green Power Purchase Bring?

**T**he benefits of a green power purchase depend in part on your motivations and how you purchase green power.

For many organizations, green power can help foster community, social, and environmental objectives. Green power can also help distinguish an organization in the marketplace, adding value to an organization's operations or financial goals.

## Meet Organizational Environmental Objectives

Improved corporate environmental performance – consistent with organizational values – is a primary motivation for buying green power. For example, buying green power can help meet corporate sustainability goals or greenhouse gas reduction targets.

Buying green power helps reduce the air emissions and greenhouse gases associated with energy use. If you know your organization's annual electric load, you can calculate the emissions associated with your current

**Fetzer Vineyards**—a winery located in Mendocino County, CA—is committed to making high quality wines with as little impact on the planet as possible. Generating green power on their roof top with solar photovoltaic panels and buying green power from the grid are key strategies Fetzer uses to fulfill its corporate environmental objectives.

electricity consumption, and can estimate the emissions displaced by a green power purchase. Appendix C contains emissions factors, by state, that can be used for calculating emissions. In the Fall of 2002, the Green Power Partnership will release an online tool to provide assistance in estimating the air pollutants and greenhouse gases associated with electricity consumption.

## 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 you are a progressive organization that leads by example, and one that is willing to act on your environmental or social values.

## Improve Employee Morale

Attracting and keeping valuable employees is a constant concern for organizations. Demonstrating your organization's civic and environmental leadership may be important to your employees and prospective employees.

## Provide a Hedge Against Electricity Price Instability

Purchasing electricity generated by renewable energy resources can provide a financial hedge against unstable or rising fossil fuel prices. Wind, geothermal, hydro and solar energy are not subject to fuel cost variability. Biomass may have a fuel cost, but the rise and fall in the price of oil or natural gas do not affect it. Electricity

## Potential Green Power Benefits

- Meet organizational environmental objectives
- Demonstrate civic leadership
- Improve employee morale
- Hedge against electricity price instability
- Increase electric supply reliability
- Support organizational or product branding
- Generate positive publicity

**Cascade Engineering**—a Michigan-based developer and manufacturer of injection-molded products—bought green power in part because it was generated locally. Cascade's green power commitment helped bring about the construction of new wind turbines in Mackinaw, Michigan.

**New Belgium Brewing Company**—employees of this Fort Collins, Colorado company voted unanimously to purchase green power when it put its proposed green power purchase to a vote. The original motivation for New Belgium's purchase was offsetting the high CO<sub>2</sub> emissions resulting from its brewing and fermentation process. Buying wind power to offset the CO<sub>2</sub> emissions was cost less than the technological fix and highlighted the environmental commitment of New Belgium employees.

generated by renewable resources can offer a long-term fixed price, while electricity generated by fossil fuels usually contains a fuel price adjustment clause. Purchase of electricity can be thought of as an investment portfolio. Many investors are willing to accept a lower return in exchange for less risk. Renewable energy sources may sometimes cost more than non-renewable fuels, but can reduce price risk over the longer term.

### **A**dvanced Micro Devices

**(AMD)**—a semiconductor manufacturer with large facilities in Austin, Texas—is purchasing green power from its local utility at a fixed price. During a year in which natural gas prices spiked, AMD's green power costs were significantly lower than other Austin businesses that purchased the conventional electricity service.

### **Increase Electric Supply Reliability**

Reliability of electric supply has become increasingly important in an era of computers and a data-intensive economy. Organizations that need highly reliable power supply may be interested in on-site green power generation. In the event of an outage, onsite energy supply can provide critical service. Some renewable energy options are intermittent, meaning they generate electrici-

ty only when the sun shines or the wind blows. Battery storage or other backup devices can help provide the security necessary to provide essential services during an outage. Although on-site generation may be more expensive relative to the cost of grid-supplied electricity, many companies recognize the high value of reliable power and are willing to pay extra for it.

### **Support Organizational or Product Branding**

In some instances, using green power may help reinforce an organization's mission. For example, an organic food store or a company that sells camping gear may see unique ways to promote its products and services through the purchase of green power. Even if the environment is not directly related to your business, you may find ways to differentiate your products using green power.

**Johnson & Johnson**—a manufacturer of health-care products and services—generates green power with solar photovoltaic panels on several of its companies' rooftops. The recent installation of several solar arrays has resulted in significant positive publicity for the company, the likes of which would be expensive for the company to replicate with an advertising campaign.

### **Generate Positive Publicity**

Buying green power affords an opportunity for public recognition. Green power may provide public relations value that advertising and media relations can't buy. This may be particularly true for large corporations that are often in the public eye and which need to be responsive to the needs and concerns of environmentally conscious customers, shareholders and other constituents. Being among the first in a community or in an industry to buy green power can convey a first-mover advantage that can help distinguish an organization.

# What Are My Options for Purchasing Green Power?

**G**reen power is available in several basic forms, the availability of which partially depends upon the status of electric utility restructuring in the state where the purchase is being made. If your state electricity market has been restructured, you can probably choose both your supplier and the product you prefer. If your state continues to regulate electric utilities so that they have a monopoly franchise in specific geographic areas, your utility may offer a green power option also known as “green pricing.” Even if you have no green power marketers in your state or your utility does not offer a green power option, you can buy renewable energy certificates or install onsite renewable generation.

## Product and Service Options

Green power can be purchased in three types of products. The availability of each of these products is subject to your location and your electricity provider’s portfolio of offerings.

The options you pursue depend on your motivations for buying green power. For example, an organization driven by a desire to manage fuel price risk may be more interested in buying fixed-price grid-based green power. In many circumstances, an organization may choose to pay a premium above the standard market rate for electricity, because locking in a fixed price can provide a hedge against volatile spikes in fossil fuel-generated electric power prices. An organization that places high value on reliability of power supply may be more interested in onsite power generation.

## Grid-Based Green Power

It is important to note that usually green power is not actually delivered to your location. Instead, it is generated and supplied to the grid that serves all customers. What you pay for when you buy green power is the benefit of displacing other non-renewables sources from the grid.

Green power from the grid is usually offered by utilities or electric service providers in one of two ways (usually not both):

In some markets, electric service providers offer a blended green power product. Blended products allow customers, primarily in states with retail choice, to switch to electricity that contains a percentage of renewable energy. Some regulated utilities also offer this type of product. The renewable energy content of blended products can vary from two percent to 100 percent.

Block products are available in competitive markets, but are more typical in regulated markets. A block is a quantity of electricity, often 100 kWh, offered for a fixed monthly price. Customers choose how many blocks of renewable energy they want to purchase. Customers can decide how much they can afford and budget for a fixed amount.

## Three Types of Available Products

**Grid-based green power** may be purchased from utilities or competitive electric service providers and charged as part of your electricity bill.

**Renewable energy certificates** represent the environmental attributes or benefits of renewable energy generation and are sold separately from the electricity that created them. You buy certificates from someone other than your electricity provider.

**On-site generation** is the installation and operation of a renewable energy system on your premises for your own use. You can install on-site generation to supplement electricity from the grid.

## Renewable Energy Certificates

Renewable energy certificates (also known as green tags or tradable renewable certificates) represent the environmental attributes of power generated from renewable electric plants. These attributes are split off and sold separately from the underlying commodity electricity. When these attributes are sold separately, the seller creates a renewable energy certificate that can be traded. One renewable energy certificate typically represents the renewable attributes associated with one megawatt hour of green electricity.

Because renewable energy certificates are sold separately from electricity, they can be purchased from locations anywhere, enabling organizations to choose green power even if their local utility or marketer does not offer a green power product. Although there are theoretically no geographic constraints on purchasing renewable energy certificates, availability of verification systems to record and track the exchange of certificates may be limited.

Certificates are sold separately from electricity service (i.e., customers do not need to switch from their current electricity supplier to purchase certificates). Certificates are purchased based on a fixed amount of power, rather than on a customer's daily or monthly load profile. Because they are independent of your energy use, load profile and the energy delivery system, they provide greater flexibility than purchasing energy and attributes bundled together as green power, and may be cheaper to acquire.

If you want to ensure that you are supporting the development of a domestic renewables resource, you may want to purchase certificates from plants located in the U.S. In addition, if you want to be sure you also achieve local environmental benefits, you may want to purchase certificates only from plants located on, or able to deliver to, your regional electricity grid. It is also important to ask how certificates are verified. The Center for Resource Solutions Green-e Program has a certification standard for renewable energy certificates. For additional information see [http://www.green-e.org/ipp/trc\\_announcement.html](http://www.green-e.org/ipp/trc_announcement.html)

## On-site Renewable Generation

On-site generation can offer advantages such as enhanced reliability, power quality, and protection against price volatility, as well as a visible demonstration of your environmental commitment. In many states, green power generated on-site can be credited to your electric bill through a process called net metering. Green on-site technologies include photovoltaic panels and wind (generally small wind turbines). If you have a large facility sited near a municipal landfill or sewage treatment plant, you may be able to use recovered methane gas for on-site power production.

**Solar.** Photovoltaic (PV) cells and modules can be configured to just about any size from a few kW up to over one MW. There are many examples of on-site PV generation, from schools to homes to community facilities to service stations. Building-integrated photovoltaics can serve as a building component, displacing other building material costs.

**Wind.** Wind turbines vary in size. A typical small unit provides less than 25 kW. Large turbines can range from 500 kW to 2 MW.

**Landfill and sewage methane gas** projects use internal combustion engines or gas turbines, depending on the quality and quantity of the gas. They may also use a direct combustion boiler and steam turbine generator set, microturbine unit, fuel cell, or other power conversion technology. These projects are typically sized from 0.5 to 10 MW.

A potential challenge to installing your own generation capability are the regulations (or uncertainty about the regulations) for connecting to the utility distribution system, commonly referred to as "interconnection". These rules can be a barrier to self-generation. Standardization of interconnection rules can help, but sometimes the rules developed for large generators are unnecessarily burdensome for small installations. In recognition of this problem—and to encourage on-site generation—a few states have adopted simplified interconnection rules.<sup>1</sup>

<sup>1</sup>The Federal Energy Regulatory Commission (FERC) has also recently begun a rulemaking that will simplify interconnection requirements for smaller (0-20 MW) generators. More information is available on the FERC website (<http://www.ferc.fed.us/>).

# How Do I Choose a Green Power Supplier and Product?

Once you have an idea about the type of product that best meets your needs—green power (blended product or block product), renewable energy certificate, or on-site generation—the next step is to consider an appropriate vendor and a preferred product.

## Supplier Selection Criteria

You may want to consider the following criteria when you are evaluating potential green power suppliers.

**Supplier Is Socially Responsible** Selecting a supplier that is socially responsible and committed to the environment may be important to your organization. Determining a supplier's social values will require some research. The supplier's web site is a good place to start. Read its annual report or environmental report, examine the supplier's other electricity products, and review the supplier's other business activities.

**Supplier Is Easy to Work With.** Judging whether a supplier is easy to work with is an assessment only you can make, but you could ask the supplier for references of other customers. Talk with these customers to gauge their experience with the supplier.

**Supplier Has a Good Reputation.** Assessing a supplier's reputation may require references. Also ask your contacts in environmental organizations for their opinion of the supplier.

**Supplier's Financial Strength.** The financial strength of a supplier is also a key consideration. Again, researching the company's website and annual report may be of help.

**Supplier Is Local.** If buying from a local supplier is important to you, call the supplier and find out where its headquarters and branch offices are located. Public utility commission websites often have contact information for registered retail suppliers.

**Supplier Is Selling Certified Products.** Look for suppliers selling products that have been certified, such as through Green-e. Certification is especially critical if you are purchasing renewable energy certificates.

## Supplier Selection Criteria

- Supplier appears to be socially responsible and committed to the environment
- Supplier is easy to work with
- Supplier has a good reputation
- Supplier appears financially sound
- Supplier is a local organization
- Supplier is selling certified products

## Product Selection Criteria

Selecting a product can be confusing. Price is always a factor, but other factors such as quality of the green power are also important. Quality mostly relates to environmental benefits — the quantity of renewable energy, how much of it comes from new sources, and what kinds of renewable resources are used.

The following are some factors to consider in your selection of a green power product:

**Percent of Renewable Energy.** Percent of renewable energy refers to how much green power is in the product resource mix. Is it 100% green power or is it 10% green power? If you buy certificates, block products or on-site generation, you can still calculate the percentage of your energy use that is represented by green power.

**Percentage of New Renewable Resources.** It is important to support existing renewable generation, but new generation is what provides additional environmental benefits. Buying electricity from new renewable

## Product Selection Criteria

- Percent of renewable energy
- Percentage of new renewable resources
- Type of renewable energy
- Price and contract length
- Product certified by third party
- Local renewable generation
- Short contract or commitment length

generation yields immediate and long-term environmental gains. Not only do new, cleaner sources of electricity provide significant environmental improvement over most current generating resources, but purchases from new renewable resources create the consumer demand necessary for more renewable resources to be constructed. The Green Power Partnership currently requires 5% of a Partner's green power commitment to be from new renewables,<sup>2</sup> a requirement that will increase over time.

**Type of Renewable Energy/Resource Mix.** This refers to the type of resources that are used in the green power product. Is the product generated from wind, biomass, solar, geothermal or hydro? Some options have more environmental impact than others do and each technology has different associated costs.

**Price and Contract Length.** Some buyers prefer a short contract length in case the market changes and better offers come along. But you may be able to lock in a lower price if you make a multi-year commitment to buy, and a longer-term contract may also give you greater price stability. You should also be aware of market fluctuations, as the price of green power can vary.

The financial benefits of a green power purchase should also be considered when evaluating cost. Green power purchasing can result in improved community relations, as well as enhanced branding and positioning. This value can translate into increased sales and other financial benefits.

**Third-party Certification.** The green power product may be certified by an independent third party such as Green-e. Such certification provides credibility and confirmation of environmental value. More information on certification is provided below.

**Local Renewable Generation.** Local renewable generation is desired by those who feel it is important to support their local economy and emphasize local environmental benefits.

## Obtaining Product Information

Ask your potential supplier what resources are used in the electricity product, including the percentage of new green power.

In many states that are open to electricity competition, suppliers are required to provide an electricity label, like a food nutrition label, that provides information in a standard format.

## Product Certification

Third-party certified green power products and renewable energy certificates are widely available and meet established consumer and environmental protection standards. Third-party certification usually requires electricity providers and renewable energy certificate marketers to disclose information about their product to their customers in a standardized format. This disclosure helps consumers to make informed purchasing decisions and helps to build consumer confidence in green power products.

Third-party certification sets standards for eligible resources. It answers the question, "What qualifies as green power?" Third-party certification also sets standards for green power products. While some certified products may be better than others, at least you know that they have cleared an environmental hurdle acceptable to most environmental groups. Finally, third-party certification sets standards of conduct for ethical behavior, including advertising claims, and requires regular reporting to police these claims.

Third-party certification usually carries a requirement for independent verification to document that green power purchased equals green power supplied. An independent auditor can make this verification. This is a protection against a lack of management (or at worst fraud) by a green power supplier.

Depending on the product you buy, third-party certification may allow you to use or publicize the certification mark or logo on your products, in your stores, or in your publicity. The predominant U.S. certification program for green power is Green-e. Additional information is available at: <http://www.green-e.org>.

<sup>2</sup>For the Green Power Partnership, the definition of "new" renewable resources is consistent with Green-e requirements—which usually means new renewable resources are those brought online starting in January 1997. See the Green-e website for additional details ([http://www.green-e.org/what\\_is/standard/standard.html](http://www.green-e.org/what_is/standard/standard.html)).

## Obtaining Product Information

- Ask the supplier
- Ask for the standard information disclosure label
- Look for third party product certification



# What About the Cost of Green Power?

**G**reen power can cost more than electricity from traditional sources because renewable energy technologies tend to be more capital-intensive than traditional technologies. These capital costs are declining, however, as growing demand justifies expanded manufacturing facilities and reduces production costs.

Most renewable energy sources have low operating costs and no fuel costs. Although biomass fuel must usually be purchased, the sun, wind, water, and heat from the earth are free. This lack of fuel cost is a major advantage for renewable energy resources. Low fuel costs means that electricity generated from renewable resources is less likely to be subject to price fluctuations that are driven by changes in fuel costs. Because renewable energy fuel costs are more predictable, you should be able to get a contract without a fuel price adjustment clause.

If you decide to pay a fixed price, when the market price of conventional electricity runs high, you may actually save money.

The actual price you pay will vary depending on a number of factors, including the availability and strength of the resource, the price of alternative sources of electricity, the availability of subsidies to encourage renewable energy, and the quantity and terms of your contract.

Generally, the price of green power will range from less than the standard alternative (especially in competitive markets and where state subsidies exist) to up to 1-2 cents more per kWh.

How do you manage the extra cost? There are several strategies:

- **Purchase green power for a portion of your use.** You don't have to purchase green power for all your electricity needs. For example, you might buy green power for just 5% or 10% of your electricity use. Purchasing 5% green power may add less than 2% to your electricity bill. Green Power Partnership requirements vary from 2% to 15% depending on the size of your annual electricity load.
- **Buy a green power blended product.** Some green power products are lower-cost because they are blended with traditional electricity and are similar to buying green power for a portion of your use.
- **Commit to a long-term purchase.** Cost may be slightly reduced by extending the time frame of your commitment to purchase green power.
- **Seek a fixed price contract.** Because of the predictable fuel cost, renewable energy should be available at a fixed price without fuel cost adjustments.
- **Offset the cost with energy efficiency savings.** Some green power providers also offer energy efficiency services.

## Ways to Reduce Cost

- Purchase green power for a portion of your use
- Buy a green power blended product
- Commit to a long-term purchase
- Seek a fixed price contract
- Offset the cost with energy efficiency savings
- Use savings from competitive choice
- Look for incentives for buying green power
- Use state incentives for on-site generation
- Investigate cost savings from on-site generation

**T**he Pennsylvania State University, one of the largest public universities in the country, is purchasing the output of over three wind turbines' worth of new wind energy. Penn State measurably cut its energy costs by investing in efficiency retrofits that save the university hundreds of thousands of dollars a year. These savings have helped defray the cost of Penn State's wind energy purchase.

A good starting point — if you haven't already considered your facility's energy performance — is the Energy Star Portfolio Manager, an online tool that can help you rate how your building's energy usage compares to similar buildings. The Energy Star website provides energy savings tips, and can also connect you with an energy services company. See <http://www.energystar.gov>.

- Use savings from competitive choice. In competitive electric markets, you may be able to save money by switching to a lower-cost electric service provider and use the savings to purchase green power.
- Look for incentives for buying green power. A few states offer incentives that reduce the cost of green power. The California state energy commission previously paid 1 cent per kWh to retail green marketers, who then passed it along to the customer as a bill discount (limits applied to large customers). Rhode Island now will pay for signing up green power customers, and New York is considering a similar program. For more information on incentives available in your state, visit the Database of State Incentives for Renewable Energy at <http://www.dsireusa.org>.
- Use state incentives for on-site generation. Many states offer financial incentives specifically for customers that install qualified renewable energy generation. For more information, visit the Database of State Incentives for Renewable Energy at <http://www.dsireusa.org>. The American Wind Energy Association also has a listing of state incentives for small wind installations at <http://www.awea.org>.
- Investigate cost savings from on-site generation. Check with your local utility to see if on-site generation could lower your demand charges or generate electricity at a time of day when prices are higher. Thirty-nine states have net metering rules, which enable organizations to generate more electricity than they use and get credit on their utility bill.

## Comparing the Cost of Green Power to Your Current Rate

Green power prices may be quoted in total cents per kilowatt-hour, or in extra cents per kilowatt-hour. If you are in a competitive market, you should compare the price of green power to your normal tariff. In competitive markets, there are three possible prices you could compare your green power price quote against: electric service

under default utility tariffs, electric service under the lowest price competitive alternative, or the electric service that you are currently receiving. You can choose which baseline is most appropriate for you. You should verify whether the green power price quoted is the full amount for generation (the case in most states), or a premium amount that is in addition to some index price, such as the power exchange or

It is critical to verify whether the green power price is fixed (and for how long) or variable.

spot market price. It is critical also to verify whether the green power price is fixed, and for how long, or variable. In restructured states, you will be comparing the green power price only to the cost of generation, not to the total price of grid-based electricity including transmission and distribution.

If you are in a regulated utility's service territory, you should compare the price of green power to your normal tariff or rate.<sup>3</sup> For example, if you buy 10 million kWh per year, and your electricity rate is \$.06/kWh, your annual bill (ignoring demand charges) is \$600,000. That rate is composed of generation, transmission and distribution charges (there may also be fixed customer charges, surcharges for special purposes, and taxes). Of the \$.06/kWh, perhaps only \$.025/kWh is for generation—the energy itself.

Utilities usually offer green power by quoting the premium, or extra price that you would pay. Using the same 10 million kWh annual use, if you bought 100% green power at a premium of \$.02/kWh, you would pay an extra \$200,000 a year. You should check to be sure whether the utility is quoting the premium price of green power, or quoting a separate green power tariff that includes the total generation cost and all the other delivery services, in which case it would be comparable to the standard \$.06/kWh rate.

Of course, you might choose to buy green power for only a portion of your electricity use. If you bought green power for 10% of your load, for example, the extra cost in this example would be \$20,000.

<sup>3</sup>Your tariff or rate schedule is usually explained on your bill, or perhaps in a separate contract agreement.



If you are buying renewable energy certificates, the cost is clearly in addition to grid-based electricity costs, because certificates are sold separately from grid-based electricity. However, some marketers are teaming with utilities to sell certificates, in which case the cost of the certificates might show up on your utility bill. Nevertheless, the offer of certificates will only quote the extra cost of the attributes, not the energy generated.

## Net Metering

**W**ith onsite generation, if you generate more than you use, you may be eligible for a credit to your bill through a process called net metering. Net metering allows your meter to spin backwards when you are generating more than you are using. Utilities in some 39 states have net metering rules. Some of the rules limit eligibility to small systems only. For more information, see <http://www.dsireusa.org/summarytables/index.cfm>

For onsite generation, the cost comparison is more complicated. For a cents per kWh comparison, you will need to estimate the levelized cost. This is the amortized capital cost of the generating equipment, and operation and maintenance cost, over the system's useful life.<sup>4</sup> The levelized cost of onsite generation should be compared to the full retail rate for grid electricity because the onsite generation is offsetting the need to buy electricity from the grid.

There are other types of financial analysis than levelized cost. You may also want to calculate the net present value of onsite generation investments, or the years to payback by determining when the net

present value goes to zero. Remember that with onsite generation you are shifting operating costs to capital investment, and the project becomes an organizational asset.

Finally, before committing to onsite generation, check to see whether your utility will impose a standby rate or charge. Utilities sometimes impose a standby charge because they must be prepared to serve your full load if your onsite generation is not generating at the utility's peak load time.

<sup>4</sup>Software is available to help with the financial analysis of onsite generation. See for example RETScreen International (<http://retscreen.gc.ca/ang/menu.html>) or RETFinance (<http://analysis.nrel.gov/retfinance>)

# What Are the Steps in Deciding to Buy Green Power?

**T**housands of organizations across the country already buy green power. For many, however, it is still a new concept. Some organizations have outdated perceptions about the reliability of renewable energy technologies, misunderstandings about using an intermittent resource, or worries about the cost. You may encounter questions about the viability of green power within your own organization and may have to educate other individuals about the benefits of green power purchasing.

Steps in deciding to buy green power include the following:

**Assemble a Multi-function Team.** Identify people in your organization who have an interest in green power. These departments may include purchasing, facilities/energy management, environmental health and safety, corporate relations and/or marketing. Investigate their concerns and identify any issues that need to be addressed. Be sure that senior management is involved. In many cases, the largest champion for buying green power is the CEO.

**Come Armed with Data.** Take an inventory of your electricity use. Collect data from your utility bills for each facility or business unit, and for your total organization. This will help you understand (1) where to look for energy efficiency savings, (2) how much green power to buy and, (3) the environmental impacts of your electricity use.

Using energy efficiently means that you need to buy less energy, which can save you money. This can be especially important if the green power you will buy includes a cost premium above conventional energy prices. In case you haven't already considered making energy efficiency upgrades to your building or equipment, the Energy Star web-site can get you started. It lists efficient products which can save you money. Also, look for the Energy Star Portfolio Manager, an online tool that can help you rate how your building's energy usage compares to that of similar buildings. See <http://www.energystar.gov>

You may also want to evaluate your organization's environmental impacts by multiplying your annual electricity consumption by pollution rates. This will show you how much your organization contributes to emissions of air pollutants and greenhouse gases.

The Green Power Partnership will soon have available an online calculator to determine the environmental impact of the electricity you use. As you consider how much green power to buy, you will be able to calculate how much of these impacts you can avoid by buying green power. If you are interested in learning about the fuel mix in your state or region (i.e. what percentage is currently generated from fossil fuels, renewables, etc.), access EPA's E-GRID database at <http://www.epa.gov/cleanenergy/>.

**Decide On Your Objectives.** You must decide on your objectives for purchasing green power. Questions to consider are:

- Why are you considering green power?
- What do you hope to get out of it?
- What selection criteria are important to your organization?
- How important is buying new renewable resources?
- How important is independent certification?
- What length of contract are you willing to sign?

**Do Your Homework.** Research the information and resources that are available. Many internet sources are listed in this guide. Each of these sources will provide links to other resources. Of course, EPA's Green Power

## Steps in Decision-Making

- Assemble a multi-function team
- Come armed with data
- Decide on your objectives
- Do your homework
- Obtain management buy-in

Partnership staff are also available to help answer your questions. As you begin to collect data, focus on estimating the cost of green power for your organization and evaluating the cost/value tradeoff.

**Obtain Management Buy-in.** Management buy-in may need to occur early in the process, particularly in organizations that emphasize tacit management approval for changes in business operations. Once your team can make a strong argument showing the costs and benefits to your organization of purchasing green power, make a presentation to management. Expect management to ask questions about the products you would buy, cost, and the benefits of your proposal. It is also a good idea to find out what limits management might place on a green power purchase, or whether they would be bolder than you thought.

## How much should I buy?

How much green power you buy depends mainly on your own internal management performance goals. These goals might include the following:

- Offset emissions from operations
- Secure back-up generation and increase supply reliability
- Add to risk management activities
- Support environmental stewardship efforts
- Demonstrate new technology
- Reduce exposure to electricity price increases or fuel price volatility
- Reduce peak demand charges

Another factor, or course, is the cost of green power and your budget for the purchase. You may have to establish a budget based on the relevant goals from the above list.

How much you buy may be influenced by relationships you have with various stakeholders, including your board of directors, stockholders, employees, constituents, or non-governmental organizations (NGOs). If environmental NGOs take a particular interest in your organization, you might be wise to consult them about your purchase.

Finally, consider the minimum purchases of green power that the EPA requires to be recognized as a Partner in the Green Power Partnership. These minimum purchase thresholds are based on the size (by electricity use) of the facility or organization. The Partnership commitment levels are shown below.<sup>5</sup>

## Green Power Partnership Commitment Levels

Annual Electricity Usage (kWh)	Green Power Partnership Commitment
> 100,000,000	2%
< 100,000,000	3%
< 10,000,000	6%
< 1,000,000	10%
< 100,000	15%

<sup>5</sup>EPA reserves the right to revise commitment standards periodically to reflect changes in the green power market. If an organization decides to join with just one of its facilities, the Partnership benefits, including recognition, will extend only to that facility.

# What Procurement Methods Should I Use to Purchase Green Power?

The procurement of green power can be simple or complex, depending on the green power options available to you and the procurement method used. Generally, the more load you can aggregate, the more attractive a customer you will be to a potential supplier. If your load is small, you may be limited to purchasing off-the-shelf products, or calling around to a few suppliers.

## Negotiate With Your Utility

Procurement is simple, though you tend to have fewer choices, if you are served by a utility in a regulated market where there is only one supplier. If your local utility offers green power, visit their website and then call to discuss your interest. Appendix F contains a list of utility green pricing programs. Perhaps the only issue for discussion is the quantity you are going to buy, but you may be able to negotiate a slight price break if you are making a large purchase. If your utility doesn't offer a green power option, and you are a large, highly visible customer, you may be able to encourage them to offer green power by promising to buy a large amount.

## Phone Calls to Multiple Sellers

You can keep the procurement process relatively simple by calling the few green power providers active in your area. You may find an off-the-shelf product that meets your needs. If you want something different, and there are only one or two green power suppliers in your area, call them. Let them know you would be interested in a proposal. After discussion, you may be ready to enter direct negotiation with one of them on product definition, price and terms. Or they may be willing to tailor something to your organization's needs if you are planning a large enough purchase.

## Issue Request for Proposals

Large companies, and public institutions in particular, often issue a formal solicitation or request for proposals (RFP) for electricity supply. For grid-based electricity, this may only be possible for organizations that are located in restructured states where choice of supplier is possible. If your state does not allow choice of electricity supplier, you may nevertheless solicit proposals for renewable energy certificates or for onsite generating equipment (see below).

An RFP requires more preparation time, time for responses to be prepared, and evaluation and negotiation — but it may be more suitable for a large purchase and in situations where there are more than a few green power options available.

With an RFP, it is important to state your objectives clearly in advance. For example, a greenhouse gas reduction goal can be translated into a quantity of green power or renewable energy certificates purchased. You should also think about your evaluation criteria, such as the following:

- Cost
- Fixed or variable pricing
- Percent and type of renewables
- Role of new renewables
- Resources you want to exclude
- Emission standards
- Third party certification
- Term commitment
- Ownership of the renewable energy attributes
- Location of resources

RFPs can be as simple as a letter sent to selected suppliers, describing your objectives and asking for a bid. This would be appropriate for just a few suppliers. RFPs can also be more formal, casting a wider net through a broadly advertised solicitation. This requires more effort to prepare and respond.

You can also pursue a hybrid, two-step process, in which you first issue a Request for Qualifications (RFQ), and from that response you send a more detailed RFP to selected suppliers that meet your generation qualifications. The RFQ would be broadcast to a larger audience, not only to find out who meets your qualifications, but also to gauge the amount of interest.

For large quantity purchases, RFPs can also be directed at clean energy generators as well as retail suppliers. Buying directly from generators may lower your cost, but will probably require a longer-term purchase commitment.

## Procuring Renewable Energy Certificates

If green power block or blended products are not an option for your organization, consider purchasing renewable energy certificates. These attributes can be bought and sold separately from the underlying commodity electricity.

There are, however, special issues that you should address in buying certificates. What the certificate represents should be clearly stated in a contract. If you want to claim greenhouse gas reductions, this attribute must be included with the certificate. If any attributes are disaggregated and not included, then the exceptions should be clearly stated and publicly represented, so that an informed third party can understand that the product sold does not contain all of its environmental attributes.

**B**e explicit about the attributes you want included in the certificate, and about ownership of the attributes.

You may want to buy certificates only from renewable energy generators that meet your specifications, so the same selection

criteria mentioned above should still be considered in your procurement process. In fact, because certificates can come from anywhere, where the certificate was generated may be more important than it would be for purchased green power. You may also want to pay closer attention to the location criterion and consider where the environmental benefits are likely to accrue.

If you are purchasing renewable energy certificates, look for products that are Green-e certified. See [http://www.green-e.org/ipp/certified\\_products.html](http://www.green-e.org/ipp/certified_products.html)

## Procuring On-site Generation

Procurement for on-site generation will be different from the above options. In most cases, you buy, own and operate the generation equipment. In some circumstances you may be allowed to write a performance contract to buy the electricity generated by a renewable energy system installed on your property, but this approach may be limited in states where you are allowed to buy electricity only from the utility that serves your area.

If you choose to own and operate a small power system, there is a lot to learn, but there are excellent information resources available. Before you buy, you will want to study the technology and develop sufficient familiarity with it to know what you want and what questions to ask, such that you will be able to write a procurement specification.

The procurement options for on-site generation fall generally in these categories:

- You are the general contractor (especially if you want to do some of the work in-house). If you have design engineers on staff, they might develop the specifications and then solicit bids for equipment and installation.
- You hire a general contractor for a turnkey system. You would probably use an RFP to select an equipment manufacturer, a system designer, or a system installer to work with you to design the system to your needs, procure materials, arrange for installation, and commission the system.

- You hire an Energy Services Company (ESCO). An ESCO would be responsible for design, installation, maintenance and financing. It differs from a turnkey project in that ESCOs typically work under performance contracts, meaning they get paid based on how well the project performs. Usually this is through energy savings, but it could also be based on generation or reliability.

Some factors to consider in selecting an on-site generation provider include experience with the type of system you are considering, licenses and certification, and performance history. If rebates or other financial incentives are available in your state for the installation of an on-site system, check first to be sure that the system you install qualifies for the incentive. Some state programs may also require that only certified installers install systems.

# Appendix A: Additional Resources

For more information contact the following organizations:

- Green Power Partnership  
<http://www.epa.gov/greenpower>
- EPA Clean Energy  
<http://www.epa.gov/cleanenergy>
- Green Power Network  
<http://www.eren.doe.gov/greenpower>
- Center for Resource Solutions Green-e Program  
<http://www.green-e.org>
- Energy Star  
<http://www.energystar.gov>
- Department of Energy Distributed Power site  
<http://eren.doe.gov/distributedpower/>
- American Wind Energy Association  
<http://www.awea.org>
- Solar Energy Industries Association  
<http://www.seia.org>
- Interstate Renewable Energy Council  
<http://www.irecusa.org>
- FEMP Green Power Procurement Guide for Government Agencies  
[http://www.eren.doe.gov/femp/techassist/der\\_resources.html](http://www.eren.doe.gov/femp/techassist/der_resources.html)
- EnergyGuide  
<http://www.energyguide.com>

# Appendix B: Qualifying Sources of Renewable Electricity Generation

The definitions of resources eligible for the Green Power Partnership are listed below.

- 1. Geothermal:** Geothermal energy is heat contained within the Earth that can be recovered and used to generate electricity.
- 2. Wind:** Wind energy is used to turn blades attached to a turbine, which generates electricity.
- 3. Hydro:** Hydro must comply with regional criteria to qualify for recognition in the Green Power Partnership. In California, New England, Texas and the Mid Atlantic, eligible hydro includes facilities with capacity equal to or less than 30 MW. In New England, hydro facilities re-licensed by FERC after 1986 also qualify. In any region, hydropower facilities certified by the Low Impact Hydropower Institute (LIHI) are eligible and qualify as green power.

In Ohio, eligible hydro includes facilities with a capacity equal to or less than 42 MW, or hydro facilities that are certified by LIHI. Starting 1/1/2005, eligible hydro resources in Ohio will only include hydro facilities certified by LIHI, provided that LIHI is accepting applications for new hydro facilities added to existing dams or other diversion structures by 1/1/2003. In the Northwest, only hydro that is certified by LIHI qualifies.

Where there are no regional standards, and until regional stakeholder standards are developed, the default definition of eligible hydro will be hydro equal to or less than 30 MW capacity, or hydro that is certified by the Low Impact Hydro Institute.

- 4. Solar Electric:** Photovoltaic cells or solar thermal energy used to generate electricity.
- 5. Biomass:** Biomass must comply with regional criteria to qualify for recognition in the Green Power Partnership (see Biomass table below). In California, qualifying sources of biomass include all wood based biomass, agricultural crops or wastes, animal and other organic wastes, landfill gas and municipal solid waste.

In the Northwest, biomass includes methane gas from landfills, sewage treatment plants or animal wastes, and energy based on solid organic fuels from forest or field residues, dedicated energy crops or wood that does not include pieces that have been treated with chemical preservatives such as creosote, pentachlorophenol or copper chrome arsenic. Eligible biomass excludes municipal solid waste and tires.

In the Mid Atlantic, approved biomass sources include: landfill gas, digester gas, clean urban waste wood (no painted, treated, or pressurized wood or wood contaminated with plastics or metals) animal and other organic waste, non-herbaceous agricultural waste, mill residues, and bioenergy crops.

In New England, Ohio, and Texas, qualifying sources of biomass include: waste wood (including construction debris that does not contain any painted, treated, or pressurized wood), agricultural crops or waste, animal and other organic waste, digester gas, and landfill gas. In Ohio, the use of whole trees, tops, and logging slash as a biomass resource will be revisited in two years, or 7/01/03.

Where there are no regional standards, and until regional stakeholder standards are developed, the default definition of eligible biomass will be agricultural crops or wastes, animal and other organic wastes, landfill and sewage gas, and clean wood waste (excluding painted, treated or pressurized wood and not mixed with non-organic waste). Also excluded is municipal solid waste.

**Biomass Emissions:** In both New England and the Mid Atlantic, the average weighted NO<sub>x</sub> emissions from all biomass sources, except landfill gas or digester gas, that contribute to a specific Green-e product sold in New England or the Mid Atlantic shall not exceed:

- 2.9 lbs./MWh in 2000, 2001, 2002;
- 2.63 lbs./MWh in 2003, 2004, 2005; and
- 2.25 lbs./MWh in 2006, 2007, 2008.



In New England only, the NOx emissions from landfill gas facilities shall not exceed 3.5 lbs./MWh based on a weighted average of the landfill gas mix contributing to a specific Green-e certified product.

Where there are no regional standards, and until regional stakeholder standards are developed, the New England biomass emissions standards will apply.

**6. Cofired Fuels:** Cofired fuel must comply with regional criteria to qualify for recognition in the Green Power Partnership.

In California, New England, Ohio and the Mid Atlantic, cofiring of landfill methane with natural gas, either piped directly to a natural gas facility or commingled in a natural gas pipeline is permitted if the following conditions are met: 1) the landfill gas is separately metered, and 2) contracts are in place to support verification that the landfill gas was converted to electricity, and 3) in New England only, the facility meets the emissions criteria for landfill gas facilities. Only the amount of energy generated from the landfill methane may count towards the green power requirements. Landfill methane is the only renewable resource that can be cofired and still count toward the green power requirement.

In Texas, no cofiring will be allowed to contribute to the minimum renewable requirement.

**7. Ocean-based Resources:** EPA will consider adopting ocean-based resources and will review these technologies as they mature and as practical application reaches near term. In addition, all eligible resources in the Northwest must have commenced commercial operation after May, 1999 (but still excluding specified portions of the Foote Creek Wind Project), and be to meet a state or federal mandate.

## Appendix C: Emissions Factors

The following emissions factors are from E-GRID2000, an EPA information resource based on the integration of data from 23 federal energy databases. For additional information, see <http://www.epa.gov.airmarkets/egrid/index.html>

State	NO <sub>x</sub> Rate (lb per MWh)	SO <sub>2</sub> Rate (lb per MWh)	CO <sub>2</sub> Rate (lb per MWh)	Hg Rate (lb per GWh)
AK	6.15	3.40	1,375.45	0.00
AL	3.43	9.64	1,380.29	0.04
AR	2.11	3.35	1,305.27	0.02
AZ	2.22	2.50	1,109.11	0.01
CA	0.38	0.34	477.84	0.00
CO	4.22	5.14	2,099.33	0.01
CT	2.24	5.12	1,358.80	0.00
DC	5.42	10.42	2,480.19	0.00
DE	4.97	13.61	2,364.85	0.04
FL	3.85	8.75	1,502.33	0.01
GA	3.40	11.26	1,398.47	0.02
HI	6.02	4.80	1,604.32	0.00
IA	4.55	9.21	2,126.23	0.05
ID	0.03	0.04	32.64	0.00
IL	4.35	11.93	1,387.44	0.04
IN	6.19	16.03	2,305.01	0.04
KS	4.10	5.63	1,749.42	0.03
KY	7.04	13.74	2,177.99	0.04
LA	2.34	4.17	1,229.57	0.01
MA	2.01	6.70	1,386.08	0.01
MD	4.84	11.51	1,460.01	0.03
ME	1.39	3.85	756.74	0.00
MI	4.36	8.49	1,636.41	0.03
MN	4.65	4.62	1,727.25	0.02
MO	5.77	8.05	1,974.27	0.03

<b>State</b>	<b>NO<sub>x</sub> Rate (lb per MWh)</b>	<b>SO<sub>2</sub> Rate (lb per MWh)</b>	<b>CO<sub>2</sub> Rate (lb per MWh)</b>	<b>Hg Rate (lb per GWh)</b>
MS	3.61	8.89	1,418.79	0.02
MT	3.01	1.64	1,468.73	0.03
NC	4.36	8.27	1,294.86	0.02
ND	6.62	13.22	2,534.82	0.08
NE	3.63	4.18	1,620.29	0.03
NH	1.84	7.03	721.97	0.00
NJ	1.32	1.78	742.02	0.00
NM	5.28	5.04	2,202.10	0.04
NV	3.46	3.28	1,586.45	0.01
NY	1.48	4.39	953.22	0.01
OH	7.09	19.30	1,890.52	0.05
OK	3.88	3.99	1,781.99	0.03
OR	0.44	0.51	286.75	0.00
PA	2.84	11.14	1,347.84	0.05
RI	0.31	0.02	973.56	0.00
SC	2.28	4.74	833.78	0.01
SD	4.80	4.43	784.96	0.01
TN	4.89	9.67	1,223.36	0.02
TX	2.68	3.89	1,486.05	0.03
UT	4.48	1.91	2,179.82	0.01
VA	3.38	6.71	1,231.76	0.02
VT	0.21	0.04	24.46	0.00
WA	0.51	1.48	258.64	0.00
WI	4.21	8.19	1,851.47	0.03
WV	6.50	14.53	2,041.35	0.05
WY	4.55	4.69	2,464.37	0.03

**Notes:**

N/A= Not applicable.

<sup>1</sup>Commercial/Industrial products and prices are negotiable.

<sup>2</sup>New is defined as operating or repowered after January 1, 1999 based on the Green-e TRC certification standards.

<sup>3</sup>Green Mountain Energy and the Connecticut Coop offer products in the service territories of Connecticut Light & Power (CL&P) and United Illuminating. Product prices are for CL&P service territory.

<sup>4</sup>Offered in PEPCO and Baltimore Gas & Electric service territories. Product prices are for PEPCO service territory. PEPCO Energy Service's commercial green power offering is Green-e certified.

<sup>5</sup>Green Mountain Energy offers products in Conectiv, GPU, and PSE&G service territories. Product prices are for Conectiv service territory.

<sup>6</sup>Green Mountain Energy offers products in PGE and Pacific Power service territories. Product prices are for Pacific Power service territory.

<sup>7</sup>Product prices are for PECO service territory. Green Mountain Energy and Community Energy offer products in all utility service territories (PECO, Allegheny, Duquesne, Met Ed, Penelec, Penn Power, UGI, and PPL). The other green power marketers listed only offer products in the PECO service territory.

<sup>8</sup>The Energy Cooperative's 50% renewable product is supplied by ElectricAmerica. Its 100% renewable energy product is supplied by Mack Services Group.

<sup>9</sup>Offered in CPL, TXU, TNMP, and Reliant service territories. Product prices are based on kWh rate for the TXU service territory (does not include monthly fee). Customer purchasing 500 kWh per month would pay 0.95¢/kWh more for 100% wind power than TXU price to beat on average including the monthly fee.

<sup>10</sup>Products are only available in Dominion service territory.

### **Sources:**

- Green power marketer and utility web sites.
- District of Columbia Public Service Commission  
[http://www.dcpsc.org/ci/cch/elec/calculators/static\\_calc\\_table.html#ft10](http://www.dcpsc.org/ci/cch/elec/calculators/static_calc_table.html#ft10)
- Maryland Attorney General <http://www.oag.state.md.us/Energy/pepco-other.htm>, 5/21/02
- Pennsylvania Office of Consumer Advocate Residential Price Comparison Charts, 5/31/02
- Maryland Attorney General Electricity Supplier Rate and Service Information  
<http://www.oag.state.md.us/energy/>
- Virginia's State Corporation Commission <http://www.yesvachoice.com/howtochoose/howtocompare.asp>

# Appendix D: Retail Green Power Products, Competitive Markets

## Competitive Electricity Markets

### Retail Green Power Product Offerings (as of June 2002)

Company	Product Name	Residential Price Premium <sup>1</sup>	Fee	Resource Mix <sup>2</sup>	Certification
<b>Connecticut<sup>3</sup></b>					
CT Energy Coop	EcoWatt	1.0¢/kWh	Initial \$30	65% small hydro, 29% landfill gas, 6% new wind	Green-e
	EcoWatt PLUS	1.48¢/kWh	Initial \$30	65% small hydro, 29% landfill gas, 6% new wind, plus investment in CT solar fund	Green-e
Green Mountain Energy Company	Green Mountain Energy Electricity	1.0¢/kWh		6% new wind, 94% biomass and small hydro	Green-e
<b>District of Columbia<sup>4</sup></b>					
PEPCO Energy Services	100% Green Electricity	0.95¢/kWh	—	100% landfill gas	Green-e (Commercial only)
	51% Green Electricity	0.45¢/kWh	—	51% landfill gas and less than 1% hydro	Green-e (Commercial only)
<b>Illinois</b>					
AES NewEnergy	Green Power (non-residential only)	N/A	N/A	100% landfill gas, 40% new	ERT
<b>Maryland<sup>4</sup></b>					
PEPCO Energy Services	100% Green Electricity	0.99¢/kWh	—	100% landfill gas	Green-e (Commercial only)
	51% Green Electricity	0.49¢/kWh	—	51% landfill gas and less than 1% hydro	Green-e (Commercial only)
<b>New Jersey<sup>5</sup></b>					
Green Mountain Energy Company	Enviro Blend	1.08¢/kWh	\$3.95/mo.	45% small hydro, landfill gas, wind, or solar, 50% large hydro, 5% new	Green-e

<b>Company</b>	<b>Product Name</b>	<b>Residential Price Premium<sup>1</sup></b>	<b>Fee</b>	<b>Resource Mix<sup>2</sup></b>	<b>Certification</b>
<b>Oregon<sup>6</sup></b>					
Green Mountain Energy	Green Mountain Energy Electricity	0.78¢/kWh	—	100% renewable, wind and geothermal	—
	Green Mountain Energy Salmon-Friendly Plan	0.78¢/kWh	\$2.50/mo.	100% renewable, wind and geothermal, plus monthly contribution to support salmon habitat restoration	—
<b>Pennsylvania<sup>7</sup></b>					
ElectricAmerica Energy Cooperative of Pennsylvania <sup>8</sup>	50% Hydro	-0.14¢/kWh	—	50% large hydro	—
	Eco Choice 100	1.25¢/kWh	\$5/year	100% landfill gas	Green-e
	50% Hydro	-0.14¢/kWh	None	50% large hydro	—
Green Mountain Energy Company	Enviro Blend	0.96¢/kWh	\$3.95/mo.	40% renewable, 10% new renewable, 50% hydro or natural gas	Green-e
	Nature's Choice	1.63¢/kWh	\$3.95/mo.	90% renewable, 10% new renewable	Green-e
Mack Services Group	100% Renewable	1.25¢/kWh	—	100% landfill gas	Green-e
<b>Texas<sup>9</sup></b>					
Green Mountain Energy Company	100% Wind Power	-0.05¢/kWh	\$4.95/mo.	100% wind	Green-e
	Big Texas Sun Club	-0.05¢/kWh	\$9.95/mo.	100% wind, \$5 goes toward new solar fund	Green-e Green-e
<b>Virginia<sup>10</sup></b>					
PEPCO Energy Services	100% Green Electricity	2.33¢/kWh	—	100% landfill gas	Green-e (Commercial only)
	51% Green Electricity	1.83¢/kWh	—	51% landfill gas and less than 1% hydro	Green-e (Commercial only)

# Appendix E: Retail Renewable Energy Certificate Products

## Green Energy Certificate Product Offerings (as of June 2002)

Certificate Marketer	Product Name	Renewable Resources	Location of Renewable Resources	Residential Price Premium <sup>1</sup>	Certification
Aquila Inc.	Aquila Green (non-residential only)	New wind	Kansas	N/A	Green-e
Bonneville Environmental Foundation	Green Tags	99% new wind, up to 1% new solar	Washington, Oregon, Wyoming	2.0¢/kWh	Green-e
Community Energy	New Wind Energy	New wind	New York, Pennsylvania	2.5¢/kWh	Green-e
Connecticut Energy Coop	Green Certificates	Landfill gas, small hydro, new wind	New England	~2.4¢/kWh for members ~2.7¢/kWh for non-members	—
Los Angeles DWP	Green Power for Green LA Certificates	Wind, landfill gas	Wyoming, California	Minimum \$5 contribution	—
Missouri River Energy Services	RiverWinds (municipal utilities only)	New wind	Minnesota	2.5¢/kWh	—
Native Energy	Windbuilders	New wind	South Dakota	\$60-120 annual membership	—
	Vermont CoolHome (residential only)	New biomass (dairy farm methane) and new wind	Vermont (biomass), South Dakota (wind)	\$6/month or \$60/year	—
	EarthCoolers (non-residential only)	Various	Not known	N/A	—
PG&E Corporation	PureWind Certificates	New wind	New York, California	4.0¢/kWh	—
Renewable Choice Energy	American Wind	New wind	Texas	2.5¢/kWh	Green-e
	EcoChoice	90% renewable/ 10% new wind	Texas, California, other	1.8¢/kWh	—

<b>Certificate Marketer</b>	<b>Product Name</b>	<b>Renewable Resources</b>	<b>Location of Renewable Resources</b>	<b>Residential Price Premium<sup>1</sup></b>	<b>Certification</b>
Sterling Planet	Green America	40% wind 35% biomass 15% geothermal 5% low-impact hydro 5% solar (all new)	Nationwide	1.6¢/kWh on average	Green-e
Sun Power Electric	Regen (available in New England only)	99% new landfill gas, 1% new solar	Massachusetts, Rhode Island	3.6¢/kWh	Green-e
Waverly Light & Power	Iowa Energy Tags	Wind	Iowa	2.0¢/kWh	—

<sup>1</sup>Large users may be able to negotiate price premiums.

N/A = Not applicable.

Source: National Renewable Energy Laboratory.



# Appendix F: Retail Utility Green Pricing Programs

## Utility Green Pricing Programs (as of June 2002)

	Utility Name	Program Name	Resource Type	Size	Start Date	Price Premium
AL	Alabama Power (Southern Company)	EarthCents Solar	central PV	joint 1 MW	2000	\$6.00/100 watts
AL	City of Athens, Cullman Electric Coop, Cullman Power Board, Florence, Hartselle, Huntsville, Joe Wheeler EMC, Muscle Shoals, Scottsboro, Sheffield, Tuscumbia (TVA)	Green Power Switch	wind, landfill gas, solar	joint 8.7 MW	2000	2.67¢/kWh
AZ	Arizona Public Service	Solar Partners Program	central PV	1 MW	1996	\$2.64/15kWh
AZ	Salt River Project	Earthwise Energy	central PV, landfill gas, small hydro	4.4 MW	1998/2001	3.0¢/kWh
AZ	Tucson Electric	GreenWatts	landfill gas, PV	6 kW	2000	7.5-10¢/ kWh
CA	City of Alameda	Clean Future Fund	various, electric vehicles	—	1999	1.0¢/kWh
CA	City of Palo Alto Utilities	Green Resources	biomass, geothermal	N/A	2000	3.0¢/kWh
CA	Los Angeles Dept. of Water and Power	Green Power for a Green LA	wind, landfill gas	27 MW	1999	3.0¢/kWh
CA	Roseville Electric	Green Energy Program	geothermal, PV	9 kW	2000	1.0¢/kWh
CA	Sacramento Municipal Utility District	Greenergy	landfill gas, PV	8.3 MW	1997	1.0¢/kWh
CA	Sacramento Municipal Utility District	PV Pioneers I	PV	1.9 MW	1993/1998	\$4/month
CA	Turlock Irrigation District	Green Valley Energy	existing small hydro	—	1999	~1.0¢/kWh
CO	City of Loveland Water & Light	Wind Program	wind	215 kW	1999	2.5¢/kWh
CO	Colorado Springs Utilities	Green Power	wind	1 MW	1997	3.0¢/kWh
CO	Estes Park	Wind Power	wind	165 kW	2000	2.5¢/kWh

	<b>Utility Name</b>	<b>Program Name</b>	<b>Resource Type</b>	<b>Size</b>	<b>Start Date</b>	<b>Price Premium</b>
CO	Fort Collins Utilities	Wind Power Pilot Program	wind	3.8 MW	1996	2.5¢/kWh
CO	Holy Cross Energy	Wind Power Pioneers	wind	5.0 MW	1997	2.5¢/kWh
CO	Longmont Power & Light	Wind Energy Program	wind	230 kW	1999	2.5¢/kWh
CO	Xcel Energy	WindSource	wind	56 MW	1997	2.5¢/kWh
CO	Xcel Energy	Renewable Energy Trust	PV	100 kW	1993	Contribution
CO	Tri-State Generation & Transmission (16 of 44 coops offer program)	Renewable Resource Power Service	wind, landfill gas	planned 2.66 MW	1999	2.5¢/kWh
CO	Yampa Valley Electric Association	Green Power	wind	450 kW	1999	3.0¢/kWh
FL	Gainesville Regional Utilities	Solar for Schools Program	rooftop PV	32 kW	1993/ 1997	\$3.00/50 watts
FL	Gulf Power Company (Southern Company)	Solar for Schools; EarthCents Solar	PV in schools; central PV	10 kW; joint 1 MW	1996/ 1999	Contribution; \$6.00/100 watts
FL	New Smyrna Beach	SunSmart	local PV projects	4.8 kW 2002	1999/	20¢/kWh
FL	Tampa Electric Company (TECO)	Smart Source	PV, biomass (co-firing)	3 kW	2000	10.0¢/kWh
GA	Electric Membership Corporation (13 of 42 coops offer program)	Green Power EMC	landfill gas	13 MW	2001	Varies
HI	Hawaiian Electric	Sun Power for Schools	PV in schools	22 kW	1996	Contribution
ID	Idaho Power	Green Power Program	various	TBD	2001	Contribution
ID	Avista Utilities	Wind Power Rate	wind	TBD	2002	1.8¢/kWh
IA	Alliant Energy	Second Nature	landfill gas, wind	4.6 MW	2000	2.0¢/kWh
IA	Basin Electric Power Cooperative	Prairie Winds	wind	2.6 MW	2000	3.0¢/kWh
IA	Cedar Falls Utilities	Wind Energy Electric Project	wind	1.5 MW	1999	Contribution
IA	Waverly Light & Power	Iowa Energy Tags	wind	planned 900 kW	2001	2.0¢/kWh
IN	Hoosier Energy (5 of 16 coops)	Enviro Watts	landfill gas	—	2001	2.5¢/kWh
IN	PSI Energy/Cinergy	Green Power Rider	wind, solar, landfill gas, digester gas	TBD	2001	Contribution

	<b>Utility Name</b>	<b>Program Name</b>	<b>Resource Type</b>	<b>Size</b>	<b>Start Date</b>	<b>Price Premium</b>
IN	Indianapolis Power & Light	Elect Plan <sup>SM</sup> Green Power Program	geothermal	0.5 aMW	1998	0.9¢/kWh
IN	Wabash Valley Assoc. (7 of 24 coops offer program)	Enviro Watts	landfill gas	7.5 MW	2000	0.5-1.0¢/kWh
KS	Western Resources	Wind Power	wind	1.5 MW	1999	5.0¢/kWh
KY	Bowling Green Municipal Utilities, Franklin Electric Plant Board (TVA)	Green Power Switch	wind, landfill gas, solar	joint 8.7 MW	2000	2.67¢/kWh
KY	East Kentucky Power Cooperative	EnviroWatts	landfill gas	—	2002	2.75¢/kWh
MI	Consumers Energy Program	Green Power Pilot	wind, various	1.8 MW	2001	3.2¢/kWh
MI	Detroit Edison	Solar Currents	central PV	55 kW	1996	\$6.59/100 watts
MI	Lansing Board of Water and Light	GreenWise Electric Power	landfill gas, small hydro	1 aMW	2001	3.0¢/kWh
MI	Traverse City Light and Power	Green Rate	wind	600 kW	1996	1.58¢/kWh
MN	Dakota Electric Association	Wellspring Renewable Wind Energy Program	wind	660 kW	1997	1.28¢/kWh
MN	Basin Electric Power Cooperative	Prairie Winds	wind	2.6 MW	2000	3.0¢/kWh
MN	Great River Energy (all 29 coops offer program)	Wellspring Renewable Wind Energy Program	wind	6 MW	1997	1.28-2.0¢/kWh
MN	Minnesota Power	Wind Sense	wind	1 MW	2000	2.5¢/kWh
MN	Minnkota Power Cooperative	Infinity Wind Energy	wind	900 kW	1999	3.0¢/kWh
MN	Moorhead Public Service	Capture the Wind	wind	1.5 MW	1998	1.5¢/kWh
MN	Otter Tail Power	Tailwinds	wind	900 kW	2001	2.6¢/kWh
MN	Southern Minnesota Municipal Power Agency (all 18 munis offer program)	Wind Power	wind	900 kW	2000	3.0¢/kWh
MN	Xcel Energy	WindSource	wind	TBD	TBD	2.5¢/kWh
MS	City of Oxford, North East Mississippi Electric Power Assoc. (TVA)	Green Power Switch	wind, landfill gas, solar	joint 8.7 MW	2000	2.67¢/kWh
MO	City Utilities of Springfield	WindCurrent	wind	purchase from Western	2000	5.0¢/kWh

	<b>Utility Name</b>	<b>Program Name</b>	<b>Resource Type</b>	<b>Size</b>	<b>Start Date</b>	<b>Price Premium</b>
MT	Basin Electric Power Cooperative	Prairie Winds	wind	2.6 MW	2000	3.0¢/kWh
MT	Flathead Electric Cooperative	Green Power	wind, small hydro	1.0 aMW	1999	2.0¢/kWh
NC	Duke Power	NC GreenPower	TBD	TBD	TBD	4.0¢/kWh
NC	CP&L	NC GreenPower	TBD	TBD	TBD	4.0¢/kWh
ND	Basin Electric Power Cooperative (49 coops offer program in 5 states)	Prairie Winds	wind	2.6 MW	2000	3.0¢/kWh
ND	Minnkota Power Cooperative (11 coops and 1 muni offer program)	Infinity Wind Energy	wind	900 kW	1999	3.0¢/kWh
NE	Lincoln Electric System	LES Renewable Energy Program	wind	1.32 MW	1998	4.3¢/kWh
NE	Municipal Energy Agency of Nebraska (MEAN)	TBD	wind	5 MW	TBD	TBD
NE	Nebraska Public Power District	Prairie Power Program	TBD	TBD	1999	Contribution
NE	Omaha Public Power District	Energy Choices Program	landfill gas, wind	3.9 MW	2001	3.0¢/kWh
NE	Tri-State (Chimney Rock Public Power District)	Renewable Resource Power Service	wind, landfill gas	planned 2.66 MW	2001	2.5¢/kWh
NM	Xcel Energy	WindSource	wind	660 kW	1999	3.0¢/kWh
NM	Tri-State (Kit Carson Electric Cooperative)	Renewable Resource Power Service	wind, landfill gas	planned 2.66 MW	2001	2.5¢/kWh
OK	Oklahoma Gas & Electric	TBD	wind	TBD	TBD	TBD
OH	City of Bowling Green	Green Power	small hydro, PV	2 kW	1999	1.38¢/kWh
OR	City of Ashland	Ashland Solar Pioneer Program	PV	30 kW	1999	\$4/month
OR	Eugene Water & Electric Board	EWEB Wind Power	wind	6.5 MW	1999	1.32¢/kWh
OR	Midstate Electric Cooperative	Environmentally Preferred Power	wind, small hydro	0.2 aMW	1999	2.5¢/kWh
OR	Pacific Northwest Generating Cooperative (5 of 16 coops offer program)	Green Power	landfill gas	1.1 MW	1998	1.8-2.0¢/kWh

	<b>Utility Name</b>	<b>Program Name</b>	<b>Resource Type</b>	<b>Size</b>	<b>Start Date</b>	<b>Price Premium</b>
OR	Pacific Power (PacifiCorp)	Blue Sky	wind	joint 3 MW	2000	2.95¢/kWh
OR	Portland General Electric Company	Clean Wind Power	wind	planned 14 MW	2000	3.5¢/kWh
SC	Santee Cooper	Green Power Program	landfill gas	2.2 MW	2001	3.0¢/kWh
SD	Basin Electric Power Cooperative	Prairie Winds	wind	2.6 MW	2000	3.0¢/kWh
SD	Missouri River Energy Services	RiverWinds	wind	planned 1.8 MW	2002	2.5¢/kWh
TN	Appalachian Electric Coop, Bristol Tennessee, Caney Fork Electric Coop, Clarksville, Clinton, Cookeville, Cumberland EMC, Duck River EMC, Elizabethton, EPB (Chattanooga), Erwin, Gibson Electric, Greeneville, Johnson City Power Board, Jackson, Knoxville, Lawrenceburg, Lenoir, McMinnville, Middle Tennessee EMC, Morristown, Mountain Electric Coop, Murfreesboro, Nashville, Newport, Oak Ridge, Paris BPU, Powell Valley Electric Coop, Pulaski, Sevier County, Tullahoma (TVA)	Green Power Switch	landfill gas, solar, wind	joint 8.7 MW	2000	2.67¢/kWh
TX	Austin Energy	GreenChoice solar	wind, landfill gas,	76.7 MW	2000/ 1997	1.076¢/kWh
TX	City Public Service of San Antonio	Windtricity	wind	25 MW	2000	4.0¢/kWh
TX	El Paso Electric Tariff	Renewable Energy	wind	1.32 MW	2001	1.92¢/kWh
UT	Utah Power (PacifiCorp)	Blue Sky	wind	joint 3 MW	2000	2.95¢/kWh
WA	Avista Utilities	Wind Power Rate	wind	TBD	2002	1.8¢/kWh
WA	Benton County Public Utility District	Green Power Program	landfill gas, wind	1 MW	1999	Contribution
WA	Chelan County PUD	Sustainable Natural Alternative Power (SNAP)	PV, wind	20 kW	2001	Contribution
WA	Clark Public Utilities	Green Lights	PV, wind	TBD	2002	1.5¢/kWh

	<b>Utility Name</b>	<b>Program Name</b>	<b>Resource Type</b>	<b>Size</b>	<b>Start Date</b>	<b>Price Premium</b>
WA	Orcas Power & Light	Green Power wind, PV	small hydro,	0.5 aMW	1999	3.5¢/kWh
WA	Pacific Power (Pacifcorp)	Blue Sky	wind	joint 3 MW	2000	2.95¢/kWh
WA	Puget Sound Energy	Green Power	wind, various	TBD	2002	2.0¢/kWh
WA	Seattle City Light	Green Power	solar, wind, biomass	TBD	2002	Contribution
WA	Snohomish County PUD	Planet Power	wind	0.5aMW	2002	2.0¢/kWh
WA	Tacoma Power	Evergreen Options	small hydro, wind	1 aMW	2000	Contribution
WI	Alliant Energy	Second Nature	wind, landfill gas	4.6 MW	2000	2.0¢/kWh
WI	Dairyland Power Cooperative	Evergreen Renewable Energy Program	wind	660 kW	1997	3.0¢/kWh
WI	Madison Gas & Electric	Wind Power Program	wind	8.22 MW	1999	3.3¢/kWh
WI	Wisconsin Electric Power Company	Energy for Tomorrow	wood, landfill gas, hydro, wind	9.8 MW	1996	2.0¢/kWh
WI	Wisconsin Public Power Inc. (25 of 32 munis offer program)	Renewable Energy Program	small hydro, wind, digester gas	6.0 MW	2001	2.0¢/kWh
WI	Wisconsin Public Service	Solar Wise for Schools	PV installations in schools	66 kW	1996	Contribution
WI	Wisconsin Public Service	NatureWise	wind, landfill gas, animal waste	1.32 MW	2002	2.65¢/kWh
WY	Pacific Power (Pacifcorp)	Blue Sky	wind	joint 3 MW	2000	2.95¢/kWh
WY	Tri-State (Carbon Power & Light)	Renewable Resource Power Service	wind, landfill gas	planned 2.66 MW	2001	2.5¢/kWh

Source: National Renewable Energy Laboratory

# Glossary

This glossary provides definitions of a number of important terms associated with power generation technologies and their environmental impacts, including definitions of specific pollutants, technologies, and the key terms related to the electric power marketplace.

## Acid Rain

Acid rain is a broad term used to describe several ways that acidic compounds fall out of the atmosphere, causing a variety of ground-level environmental effects. These effects include damage to forests and soils, fish and other living things, and human health. Acid rain also reduces visibility. Sulfur dioxide and nitrogen oxides are the primary causes of acid rain. In the United States, about two-thirds of all sulfur dioxide and one-quarter of all nitrogen oxides come from electric power generation that relies on burning fossil fuels like coal.

## Annual Consumption of Electricity

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

## Carbon Dioxide

Burning fossil fuels releases carbon into the atmosphere. The carbon in fossil fuels is transformed into carbon dioxide, the predominant gas contributing to the greenhouse effect.

## Coal

Coal is formed from plant and animal matter that has been subjected to geologic heat and pressure, transformed over millions of years into hard black solids. Because coal is a readily available resource in the United States, coal power plants provide about half of the nation's electricity. However, coal-fired power plants generally cause more pollution per unit of electricity than any other fuel. Most coal plants are required to have several pollution control devices to reduce the amount of pollutants that are released into the air from burning coal.

## Commercial Energy Customer

A commercial energy customer refers to non-industrial customers occupying retail space or office buildings.

## Conventional Power

Conventional power is produced from non-renewable fuels such as coal, oil, nuclear and gas, also known as traditional power.

## Energy Efficiency

Energy efficiency refers to products or systems using less energy to do the same or better job 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 (and associated environmental impacts) that needs to be generated.

## Fossil Fuels

Fossil fuels are the nation's principal source of electricity. The popularity of these fuels is largely due to their low costs. Fossil fuels come in three major forms — coal, oil, and natural gas. Because fossil fuels are a finite resource and cannot be replenished once they are extracted and burned, they are not considered renewable.

## **Greenhouse Effect**

Greenhouse gases allow incoming solar radiation to pass through the Earth's atmosphere, but prevent part of the outgoing infrared radiation from the Earth's surface and lower atmosphere from escaping into outer space.

## **Green Power**

Electricity that is generated from renewable energy sources is often referred to as "green power." Green power products can include electricity generated exclusively from renewable resources or, more frequently, electricity produced from a combination of fossil and renewable resources.

## **Green Power Marketers**

The term "green power marketers" usually refers to energy providers operating in states that permit retail competition in electricity markets.

## **Green Power Purchasing**

Green power can be purchased nationwide from several sources. Green power marketers offer green power products to consumers in restructured markets — such as New Jersey, Pennsylvania, and New England. In states that do not allow retail competition in electricity markets, many utilities offer renewable energy products through green pricing programs. In addition, all customers nationwide have the opportunity to buy renewable energy and stimulate the development of renewable generation sources through renewable energy certificates. Finally, customers can choose to install on-site renewable generation.

## **Green Pricing**

Green pricing refers to a utility service that allows customers of traditional utilities to support a greater level of utility investment in renewable energy by paying a premium on their electric bill to cover any above-market costs of acquiring renewable energy resources. See Appendix F for a list of green pricing programs.

## **Ground-level Ozone**

Ground-level ozone is formed by a chemical reaction between volatile organic compounds and oxides of nitrogen in the presence of sunlight. Ozone concentrations can reach unhealthy levels when the weather is hot and sunny with little or no wind. High concentrations of ozone near ground level are harmful to people, animals, crops, and other materials.

## **Kilowatt (kW):**

A unit of electrical power used to indicate the capacity or size of a generating unit, or to measure the peak electricity demand of a consumer. A kW is a measurement of the capacity to do work at any instant in time.

## **Kilowatt-hour (kWh):**

A unit of electrical energy equal to the work done by one kilowatt acting for one hour. Typically, an electricity bill is based on the number of kilowatt-hours used per month and (for larger commercial and industrial customers) the peak demand of the consumer.

## **Hydroelectric Power**

The process of generating electricity by harnessing the power of moving water is called hydroelectricity. Hydroelectric power (hydropower) is generated by forcing water that is flowing downstream, often from behind a dam, through a hydraulic turbine that is connected to a generator.

## **Mercury**

Mercury is a toxic heavy metal that is a byproduct of the combustion of fossil fuels, especially coal. It can accumulate in the environment and is highly toxic to humans and animals if inhaled or swallowed.



## **Natural Gas**

Natural gas is a fossil fuel formed when layers of buried plants and animals decompose over a long period of time. The energy that the plants and animals originally obtained from the sun is stored in the natural gas. The primary component of natural gas is methane, a potent greenhouse gas. Natural gas is a nonrenewable resource.

## **Nitrogen Oxides**

Nitrogen oxides are a byproduct of the combustion of fossil fuels. They include various nitrogen compounds like nitrogen dioxide and nitric oxide. These compounds play an important role in the atmospheric reactions that create ground-level ozone and acid rain. The two major sources of nitrogen oxides are transportation vehicles and stationary combustion sources, such as electric utility and industrial boilers.

## **Nuclear Energy**

Nuclear energy originates from the splitting of uranium atoms in a process called fission. At the power plant, the fission process is used to generate heat for producing steam, which is used by a turbine to generate electricity. Because nuclear power plants do not burn fuel, they do not emit air pollutant emissions. However, all of the nuclear power plants in the United States collectively produce about 2,000 metric tons per year of radioactive waste.

## **Oil**

Oil, a liquid fossil fuel, is formed from layers of buried plants and animals that have been subjected to geologic heat and pressure over a long period of time. In addition to carbon, oil contains elements such as nitrogen, sulfur, mercury, lead, and arsenic. Oil is a nonrenewable resource because it cannot be replenished on a human time frame.

## **Particulate Matter**

Particulate matter (PM) is a byproduct of the combustion of fossil fuels. PM includes dust, dirt, soot, smoke, and liquid droplets directly emitted into the air by sources such as factories, power plants, cars, construction activity, fires, and natural windblown dust. Particles formed in the atmosphere by condensation or the transformation of emitted gases such as sulfur dioxide and volatile organic compounds (VOCs) are also considered particulate matter.

## **Power Marketer**

An entity that buys and sells power generated by others.

## **Renewable Energy**

The term renewable energy generally refers to electricity supplied from renewable energy sources, such as wind and solar power, geothermal, hydropower, and various forms of biomass. These energy sources are considered renewable energy resources because they are continuously replenished.

## **Renewables Portfolio Standard**

The renewables portfolio standard (RPS) is a requirement that a minimum percentage of each electricity generator's or supplier's resource portfolio come from renewable energy.

## **Retail Competition**

In states with retail competition, consumers have the opportunity to choose their energy provider and purchase products based on the price or on the source of power supplied.

## **Small Hydro**

In addition to very large hydro plants in the West, the United States has many smaller hydro plants. Like large plants, small-scale hydroelectric systems capture the energy in flowing water and convert it to electricity.

## **Sulfur Dioxide**

High concentrations of sulfur dioxide affect breathing and may aggravate existing respiratory and cardiovascular disease. Sensitive populations include asthmatics, individuals with bronchitis or emphysema, children, and the elderly. Sulfur dioxide is also a primary contributor to acid rain, which causes acidification of lakes and streams and can damage trees, crops, and buildings. In addition, sulfur compounds in the air contribute to visibility impairment in large parts of the country. Sulfur dioxide is released primarily from burning fuels that contain sulfur (such as coal, oil, and diesel fuel). Stationary sources such as coal and oil-fired power plants, steel mills, refineries, pulp and paper mills, and nonferrous smelters are the largest releasers.

## **Tariff**

A schedule of charges for electricity service from a regulated utility, approved by a state regulatory commission or utility oversight board. A utility may have a different tariff for each class of customers, where the class is defined by level of kWh energy use, level of kW demand, or other characteristics of a large group of customers.

## **Renewable Energy Certificates**

Renewable energy certificates (also known as green tags) represent the environmental attributes of power generated from renewable electric plants. For a list of vendors of renewable energy certificates, see Appendix E.

## **Utility**

A utility is a municipal or private business that provides electricity to the public and is subject to governmental regulation.