

# GREEN POWER – A WAY AHEAD

By

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## **Introduction**

Today the energy sources used to create electricity differ in many ways, including in their environmental impacts.

Electricity markets are changing, however, offering cleaner ways of producing power and giving many consumers the ability to choose how their power is generated. One of these choices is power from renewable sources that is marketed as green power. Innovative organizations are encouraging the use of these new sources of green power and, at the same time, are reducing their own impact on the environment.

In some parts of the world, the deregulation of electricity has enabled consumers to choose the provider of their electric power and thus to buy green power from their chosen supplier. In regulated markets too, hundreds of utilities now offer their customers the opportunity to purchase green power through “green pricing” programs. Even in areas where consumers cannot buy green power directly renewable energy certificates (RECs) are available to allow consumers to support green power.

While no form of electric power generation is completely benign, electricity generated from renewable resources such as solar, wind, geothermal, small and low-impact hydropower, and biomass has proved to be environmentally preferable to electricity generated from conventional energy sources such as coal, oil, nuclear, and natural gas.

Green Power or Green Energy is electricity that is environmentally preferable by virtue of the energy resource used to produce it.

“Environmentally preferable” can mean different things to different people, but there are some basic concepts which have gained currency for defining Green Power, as well as common pitfalls confronted when trying to navigate through terms and technologies.

## **What is green power?**

Green power is electricity generated from renewable, high efficiency, or low-pollution energy sources—such as wind, solar, fuel cells, or microturbines. Some electric utilities offer their customers the voluntary option to buy green power in general wind energy has been the technology of choice for green power programs. The term green power is used in a number of different ways. In the broadest sense, green power refers to environmentally preferable energy and energy technologies, both electric and thermal. This definition of green power includes many things, from solar photovoltaic systems to wind turbines to fuel cells for automobiles.

## **What are the benefits?**

Green power programs let electricity consumers contribute to the development and increased use of renewable and modern energy sources that result in environmental and economic benefits.

The purchase of green power decreases the use of more traditional fuel sources for electricity (primarily coal and furnace oil), which in turn reduces the pollution caused by their use. Some technologies, such as wind turbines, also bring economic benefits to the areas that host them.

While all sources of electricity cause at least some environmental disruption, the key difference between electricity sources is the relative harm caused by each one. For example, converting certain fuels into energy causes widespread environmental damage and can pose real risks to

human health – such as when electricity is produced by nuclear power plants or through the burning of coal or oil. It would be deceitful to describe these methods as “green”.

Renewable energy is derived from natural sources that replenish themselves over short periods of time. These resources include the sun, wind, moving water, organic plant and waste material (biomass), and the earth’s heat (geothermal). This renewable energy can be used to generate electricity as well as for other applications. For example, biomass may be used as boiler fuel to generate steam heat; solar energy may be used to heat water or for passive space heating; and landfill methane gas can be used for heating or cooking.

Although the environmental impacts of renewable energy are generally minimal, these power sources still do have some effect on the environment. For example, biomass resources are converted to electricity through combustion, which emits some air pollutants. Hydroelectric dams can flood the surrounding land and impede the passage of fish. Compared with conventional power, however, renewable power generally avoids, or at least significantly reduces, the adverse environmental impacts of conventional electricity generation.

Most energy experts and environmental advocates consider converting renewable sources such as wind, solar, geothermal, and biomass as the most clearly deserving of the green label. These power sources cause relatively few environmental impacts and pose a low risk to human health. Although renewable resources do more than generate electricity, green power is most commonly used in a narrower, marketing, sense to refer specifically to electricity from renewable resources.

### **Green Technologies**

**WIND** - Using turbines, or windmills, to create electricity. Wind power emits no pollution and if care is taken to avoid placing the windmills in undeveloped areas, along ridge lines or in areas of sensitive habitat, these generators can have relatively little impact on the land. Wind is economical in locations where the average wind speed is at least 23 km per hour. Although a single wind turbine can produce a usable amount of electricity, most wind power is produced at wind farms – large groups of turbines grouped together at a site. Other land use, such as farming and grazing, can usually continue on land occupied by wind farms. Wind energy is environment-friendly and cheaper than natural gas even. Pakistan has been blessed with an enormous potential of Wind Energy. The 1,046 km coastline of Sindh has been identified as having wind power potential of 50,000 MW. The government has assigned Alternate Electricity Development Board (AEDB) to ensure installation of 700 MW wind power in coastal areas of Pakistan by the year 2010. AEDB has issued LOIs to 93 national and international investors for 50 MW wind power projects each and one LOI for 5 MW wind project. 33,976 acres of land (19,807 acres in Gharo and 14,169 acres in Jhimpir) has so far been provisionally allocated to 21 investors.

**SOLAR** – The sun’s radiation is used directly to produce electricity in two ways: solar thermal and photovoltaic (PV) systems. Solar thermal systems use the sun’s energy to heat a fluid that produces steam, which then turns a turbine and generator. PV panels, commonly called solar cells or modules, use semi conductor material to directly convert sunlight into electricity. These panels are commonly used in remote and rural areas where it is cheaper than stringing kilometers of electrical wire. The price of solar energy, which was once very high because of the cost of producing PV panels, has dropped steadily by half every five years over the last 25 years.

Pakistan has so far not used its solar potential to save on conventional energy sources. The solar potential exists in central and southern parts of the country where it receives 2,142, kWh of solar irradiation / m<sup>2</sup> / year. The government has assigned AEDB to electrify 7,874 remote off-grid villages in Sindh and Baluchistan using alternative technologies particularly solar energy under ‘Roshan Pakistan Programme’. AEDB has electrified 1,762 remote off-grid homes in 31 villages in all the four provinces. Another 3,000 remote off-grid homes in District Tharparker,

Sindh are in process of electrification using solar energy, out of which 700 homes have already been electrified.

**BIOMASS** - Organic matter, called biomass, can be burned in an incinerator to produce energy. Biomass resources include agricultural, forestry and food processing by-products, as well as gas emitted from landfills. In new facilities, the biomass is converted into a combustible gas, allowing for greater efficiency and cleaner performance. The cost of biomass energy remains high mainly because of the cost of transporting fuel from its source to an incinerator.

Bio-fuels (ethanol and bio-diesel) are strong contenders for provision of efficient and sustainable energy. Pakistan has started work on both the bio-ethanol (sugar-ethanol) and the cellulose biomass- bacteria route. AEDB has initiated the projects for bio-fuels in Pakistan. A pilot project of using Ethanol as an alternative fuel for vehicles has been launched in cooperation with HDIP and PSO. Furthermore, pilot project for production of bio-diesel has been successfully implemented and using local agriculture bio-diesel has been produced and used for village electrification. Government has also introduced "The National Policy for Power Co-Generation by sugar industries (the Co-Gen Policy). Co-Generation is a high-efficiency energy system that produces both electricity and mechanical power and valuable heat from a single fuel source. Pakistan has a potential of generating more than 3,000 MW of electricity through co-generation from its existing sugar industry.

**GEOTHERMAL** - Generated by converting the hot steam or water from deep beneath the Earth's surface into electricity, geothermal plants emit very little air pollution and have minimal impacts on the environment and are also very economical.

Some environmental advocates look favorably on low-impact HYDROELECTRIC facilities. Hydropower converts a renewable resource – river flows – into electricity and does not emit any air pollution. Judging the way a hydroelectric dam affects a river, is important in determining whether it qualifies as a "green" source of power. High-impact hydro projects cause concern because dams can change natural river flows, degrade water quality and block fish migration. The size of the dam is not the only criteria for judging high vs. low impact. Mitigation measures such as fish ladders that protect spawning and the choice of a hydro facility's location are critical features. Hydropower currently provides about 36 percent of the electricity generated in Pakistan – a percentage likely to increase further because of availability of sites for the construction of large dams on Indus River.

The identified hydro power potential is 46,000 MW out of which only 14 percent (6,500 MW) has been exploited so far. There are plans to develop the hydro resources on a large scale through storage and run-of-the-river projects. Feasibility studies of several projects have already been prepared, while studies of several additional projects are in progress or planned. Hydro is one of the major economic energy supply options in Pakistan for increasing the energy security of the country.

It is emphasized that for the time horizons of around 100 years, hydro storage projects are 'non-renewable' due to the silting of these reservoirs. For example, over the last 30 years, the storage capacity of Tarbela dam has been reduced by 27 percent due to silting.

Small hydro projects can also make significant contribution to the national energy supply. Some 300 micro and mini hydroelectric plants, installed by the private and public sector in the northern hilly areas, are supplying electricity to areas not connected with the grid, and more have been approved recently. The potential for further development of such hydro projects would be fully utilized by 2030.

Other advocates also look favorably upon the new generation of NATURAL GAS- fired power plants called combined cycle combustion turbines. These plants are very efficient and only produce a fraction of the air pollution of other types of fossil-fuel fired power plants. Other

advocates do not consider this a “green” technology because the exploration for and extraction of natural gas can severely damage ecosystems, and the burning of natural gas does emit carbon dioxide and greenhouse gases.

By buying green power instead of conventional power, consumers can reduce the environmental impact caused by their use of electricity and fossil fuel. For instance, on average, every kilowatt-hour (kWh) of renewable power avoids the emission of more than one pound of carbon dioxide. Because of the sheer quantities of energy involved, consumers of a large amount of electricity may have an enormous environmental impact. If the typical commercial facility switched to 100 percent renewable power or used RECs (Renewable Energy Certificates) to offset emissions, this could amount to thousands of tons of emissions avoided each year.

Leading organizations are finding that green power is an effective part of a strategic energy management plan to achieve environmental, financial, and other goals. Successful energy management plans are often a “portfolio analysis” that considers options such as energy efficiency, load management, power purchases, on-site generation, and nonelectric (thermal) energy needs. As with any investment portfolio, the best mix of these options depends on the particular situation.

Because buying green power is still relatively uncommon in today’s energy markets and because these markets offer a wide range of choices, therefore, there is need for the Guide for organizations that have decided to buy green power but want help in figuring out how to do it, as well as for organizations that are still considering the merits of buying green power.

In the context of the Guide to Purchasing Green Power, the term green power refers to electricity products that include significant proportions of electricity generated from energy resources that are both renewable and environmentally preferable.

### **The Benefits**

Green Power can help many organizations meet environmental, financial, stakeholder relations, economic development, and national security objectives.

#### **Environmental**

- **Avoid environmental impacts.**

Green power and renewable energy avoid most of the environmental impacts associated with traditional power generation, helping protect human health and the health of the environment.

#### **Financial**

##### **Provide a hedge against risks posed by**

- **Electricity price instability.** Purchasing electricity generated by renewable energy resources creates a financial hedge against unstable or rising fossil fuel prices by diversifying a consumer’s energy portfolio. Wind, geothermal, hydro, and solar energy are not subject to the rise and fall of fuel costs. For these reasons, renewable electricity can offer a fixed price over the long term.
- **Fuel supply disruptions.** On-site renewable generation can reduce the risk of disruptions in fuel supplies resulting from transportation difficulties or international conflict.
- **Additional environmental regulation.** To address global climate change and regional air quality issues, strict regulations would effectively increase the price of conventional electricity. But green power would be largely unaffected by these regulations, resulting in more stable prices over the long run.

- **Electricity blackouts.** Organizations that need highly reliable power usually use on-site power generation, such as diesel engines and gas turbines, for their facilities in the event of a power outage. On-site renewable generation can provide this back-up power without fossil fuel emissions. Some renewable sources, however, require battery storage or other back-up devices for essential electrical services during an outage.

### Stakeholder relations

- Meet organizational environmental objectives. Reducing an organization's environmental impact is one of the main motivations for buying green power. For example, buying green power can help meet green-house gas reduction targets. If an organization is interested in ISO-14001 certification for environmental performance, a program for reducing energy-related emissions will be an important part of this certification process.
- Demonstrate civic leadership. Being among the first in a community to purchase green power is a demonstration of civic leadership. It makes a statement that an organization is willing to act on its stated environmental or social goals. These purchases also demonstrate an organization's responsiveness to its customers, the majority of whom favor renewable energy.
- Generate positive publicity. Buying green power affords an opportunity for public recognition and public relations that advertising and media relations cannot buy. Companies that are in the public eye need to be responsive to the concerns of environmentally conscious customers, shareholders, regulators, and other constituents. Groups promoting green power, such as the EPA's (Environment Protection Agency) Green Power Partnership, provide assistance in reaching broad audiences to convey the benefits of green power purchases.
- Improve employee morale. Progressive action and leadership on environmental issues like renewable energy may improve employee morale, which in turn can reduce employee turnover, attract new employees, and improve productivity. In a survey of 464 organizations, sponsored by the National Wind Coordinating Committee, improving employee morale was cited as the third most important motivation for buying green power.
- Differentiate products or services. By purchasing green power, a company may be able to differentiate its products or services by, for example, offering them as "made with certified renewable energy" or "climate neutral". Purchasers of green power can also join their power supplier to market their products together. In addition, purchasers of products certified by the center for Resource Solutions Green-e program can display the Green-e logo on their product packaging to indicate the share of renewable energy used by company or in its production.

### Economic development and national security

- **Stimulate local economies.** Because renewable resources are typically local, jobs are created to install and operate renewable generation facilities. Renewable power facilities also increase the local tax base and can provide income for farmers and rural communities. The renewable energy industry may be an important growth opportunity in mature, post-industrial economies like that of the United States, Japan and China.
- **Increased fuel diversity.** Renewable energy diversifies the nation's fuel resources a good way to manage risk and, because renewable resources are indigenous, reduces its dependence on imported fuels.
- **Reduce infrastructure vulnerability.** The wide distribution of most renewable energy resources improves the robustness of energy systems by reducing the robustness of energy systems by reducing the country's reliance on a vulnerable, centralized energy infrastructure.
- **Market transformation.** By purchasing green power now, organizations can reduce long-term production costs and transform markets for renewable energy technologies.

Most renewable technologies are not yet produced in great volumes, but their production costs should drop significantly as their production volume increases, which in turn will attract more purchases.

The actual price for green power depends on a number of factors, including the availability and quality of the resources, the market price of conventional electricity, and the availability of subsidies to encourage green power, and the quantity and terms of the contract. Generally, the price of green power ranges from less than that of the standard power mix, especially in competitive markets and where states subsidies exist. When the market price of conventional electricity is high, purchasers of green power at a fixed price may actually save money. Of course, when the market price of conventional electricity drops, they will be paying a premium.

### **Contracting challenges**

Green power may also be more difficult than conventional power for an organization to purchase, causing transaction costs in addition to any price premiums. Although organizations that are buying green power for the first time may need to invest extra effort, these costs fall significantly over time as the electricity purchasers gain experience. In addition, sample contract templates now are publicly available to help buyers avoid difficulties in signing a green power contract.

### **Public relations risk**

Some stakeholders may regard the purchase of green power as a token effort or “green washing”. Organizations can avoid this criticism by buying green power as part of a broader environmental management program. Another strategy to improve the credibility of a purchase is to work with third-party organizations for independent auditing, endorsement, and minimum purchasing benchmarks.

### **Conclusion**

Purchasers of electricity can have a significant impact on the way that power produced, both now and in the future. Businesses, governments, and non profits have an unprecedented and increasing range of options for buying green power. In restructured electricity markets, retail access allows customers to choose their electricity supplier and, by extension, how their electricity is produced. In regulated markets, utility green-pricing programs enable customers to support the addition of renewable energy to the grid without leaving their current utility. Renewable energy certificates and on-site renewable generation allow organizations everywhere to achieve the benefits of green power. Organizations that act in their own and society's best interests can take advantage of the Green Power strategies and help move their country towards a more sustainable energy future.