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7 Types of Renewable Energy to Support Commercial Sustainability

Many private enterprises and public entities (e.g. government agencies and educational institutions) are looking for clean, renewable energy sources to meet their sustainable energy solution needs. The motivation can be financial, driven by regulatory mandates, a desire to be more socially responsible or all the above. Sustainable energy solutions are literally found in the air, deep underground and in our oceans. Each of the following can be tapped directly or indirectly by organizations looking to go green.

1. Bioenergy:

What is it? This is a type of renewable energy derived from biomass to create heat and electricity (or to produce liquid fuels such as ethanol and biodiesel used for transportation). Biomass refers to any organic matter coming from recently living plants or animals. Even though bioenergy generates about the same amount of carbon dioxide as fossil fuels, the replacement plants grown as biomass remove an equal amount of CO₂ from the atmosphere keeping the environmental impact relatively neutral. There are a variety of systems used to generate this type of electricity ranging from directly burning biomass to capturing and using methane gas produced by the natural decomposition of organic material.

How can an organization use it? Depending on your operation, there are many ways to incorporate bioenergy into your sustainable energy plans:

- Organizations can convert to fleet vehicles that use biofuels such as ethanol or biodiesel.
- Manufacturing facilities can be equipped to burn biomass directly to produce steam captured by a turbine to generate electricity. In some cases, this process can have a dual purpose by powering the facility as well as heating it. For example, paper mills can use wood waste to produce electricity and steam for heating.
- Farm operations can convert waste from livestock into electricity using small, modular systems.
- Towns can tap the methane gas created by the anaerobic digestion of organic waste in landfills and use it as fuel for generating electricity.

Learn more about bioenergy:

<http://www.renewableenergyworld.com/bioenergy/tech.html>

<http://www.conserve-energy-future.com/pros-and-cons-of-biomass-energy.php>

2. Geothermal:

What is it? Geothermal energy, as the name implies, is derived from the heat of the earth itself. This heat can be sourced close to the surface or from heated rock and reservoirs of hot water miles beneath our feet. Geothermal power plants harness these heat sources to generate electricity. On a much smaller scale, a geothermal heat pump system can leverage the constant temperature of the ground found just ten feet under the surface to help supply heat to a nearby building in the winter, or help cool it in the summer.

How can an organization use it? Geothermal energy can be part of a commercial utility energy solution on a large scale, or be part of a sustainable business practice on a local level. Direct use of geothermal energy may include:

- Heating office buildings or manufacturing plants
- Helping to grow greenhouse plants
- Heating water at fish farms
- Aiding with various industrial processes (e.g. pasteurizing milk)

Learn more about geothermal energy:

<http://geo-energy.org/Basics.aspx>

<http://energyinformative.org/geothermal-energy-pros-and-cons/>

3. Hydroelectric:

What is it? Remaining waterwheels previously used to operate the gristmills and sawmills of early America are now largely functioning as historic sites and museums. Today, the kinetic energy of flowing rivers is captured in a much different way and converted into hydroelectricity. Probably the most familiar type of hydroelectric power is generated by a system where dams are constructed to store water in a reservoir which, when released, flows through turbines to produce electricity. This is known as “pumped-storage hydropower” where water is cycled between lower and upper reservoirs to control electricity generation between times of low and peak demand. Another type, called “run-of-river hydropower” funnels a portion of river flow through a channel and does not require a dam. Hydropower plants can range in size from massive projects like the Hoover Dam to micro-hydroelectric power systems.

How can an organization use it? Direct use of hydroelectric power is naturally dependent on geographic location. Assuming a dependable waterway source is accessible and available, it could be used in the following ways:

- Micro-hydroelectric plants can be constructed to supply electricity to farm and ranch operations or small municipalities.
- Small towns can harness the energy of local waterways by building moderately-sized hydroelectric power systems.

Learn more about hydroelectric energy:

<http://energy.gov/eere/water/types-hydropower-plants>

<http://water.usgs.gov/edu/hydroadvantages.html>

4. Hydrogen:

What is it? Hydrogen is the simplest (comprised of one proton and one electron) and most abundant element in the universe, yet it does not occur naturally as a gas on earth. Instead, it is found in organic compounds (hydrocarbons such as gasoline, natural gas, methanol and propane) and water (H₂O). Hydrogen can also be produced under certain conditions by some algae and bacteria using sunlight as an energy source. Hydrogen is high in energy, yet produces little or no pollution when burned. Liquid hydrogen has been used to launch space shuttles and other rockets into orbit since the 1950s. Hydrogen fuel cells convert the potential chemical energy of hydrogen into electricity, with pure water and heat as the only byproducts. However, commercialization of these fuel cells as a practical way for more companies to go green will likely be limited until costs come down and durability improves.

How can an organization use it? Almost all the hydrogen used in the United States is used in industry to refine petroleum, treat metals, produce fertilizer and process foods. In addition, hydrogen fuel cells are used as an energy source where hydrogen and oxygen atoms are combined to generate electricity. There are also currently a few hundred hydrogen-powered vehicles operating in the United States, a number that could increase as the cost of fuel cell production drops and the number of refueling stations increases. Other practical applications for this type of renewable energy include:

- Large fuel cells providing emergency electricity for buildings and remote locations.
- Electric motor vehicles powered by hydrogen fuel cells.
- Marine vessels powered by hydrogen fuel cells.

Learn more about hydrogen power:

<http://www.renewableenergyworld.com/hydrogen/tech.html>

http://www.eia.gov/energyexplained/index.cfm?page=hydrogen_use

5. Ocean:

What is it? There are two types of energy that can be produced by the ocean: thermal energy from the sun's heat and mechanical energy from the motion of tides and waves. "Ocean thermal energy" can be converted into electricity using a few different systems that rely on warm surface water temperatures. "Ocean mechanical energy" harnesses the ebbs and flows of tides caused by the rotation of the earth and the gravitational influence of the moon. Energy from wind-driven waves can also be converted and used to cut business electricity costs. There are also lesser-developed technologies that leverage ocean currents, ocean winds and salinity gradients as sources of power conversion.

How can an organization use it? Ocean energy is an evolving sector for alternative energy production, but with over 70 percent of the surface of our planet covered by ocean, its future looks promising. Commercial and public applications for this energy resource are limited to geography and regulatory guidelines. Other practical uses for energy derived from the ocean include:

- Cold ocean water from deep below the surface can be used to cool buildings (with desalinated water often produced as a by-product).
- Seaside communities can employ the methods to tap natural ocean energy described above to supplement municipal power and energy needs.

Learn more about ocean power:

<http://www.renewableenergyworld.com/ocean-energy/tech.html>

<http://www.energy.ca.gov/oceanenergy/>

6. Solar:

What is it? Aside from geothermal and hydrogen, the sun plays a significant role in each of the other types of renewable energy listed here. The most direct use of this renewable energy source, however, is achieved by capturing the sun's energy directly. A variety of solar energy technologies are used to convert the sun's energy and light into heat, illumination, hot water, electricity and (paradoxically) cooling systems for businesses and industry. Photovoltaic (PV) systems use solar cells to convert sunlight into electricity. Solar hot water systems can be used to heat buildings by circulating water through flat-plate solar collectors. The sun's heat can be concentrated by mirror-covered dishes that are focused to boil water in a conventional steam generator to produce electricity. Commercial and industrial buildings can also leverage the sun's power for larger scale needs such as ventilation, heating and cooling. Finally, thoughtful architectural designs can passively take advantage of the sun as a source of light and heating/cooling.

How can an organization use it? Public and private entities can take advantage of the benefits of solar power for business in a wide variety of ways:

- Install a commercial solar power system (rooftop equipment, field array or carport construction) and become an owner/operator, lessee or participant in a solar power purchase agreement (PPA).
- Purchase solar energy that's been generated by an offsite commercial solar installation.
- Construct or retrofit a building to incorporate a solar hot water, cooling or ventilation systems.
- Employ architectural designs for structures that take advantage of the sun's natural attributes for passive heating and lighting.

Learn more about solar power:

<http://www.renewableenergyworld.com/solar-energy/tech.html>

<http://businessfeed.sunpower.com/business-feed/the-advantages-and-disadvantages-of-going-solar>

7. Wind:

What is it? Wind can be considered a form of solar energy because winds are caused by the uneven heating and cooling of the atmosphere by the sun (as well as the rotation of the earth and other topographical factors). Wind flow can be captured by wind turbines and converted into electricity. On a smaller scale, windmills are still used today to pump water on farms.

How can an organization use it? Wind is one of the sustainability ideas for business that can be incorporated to cut business electricity costs. Commercial grade wind-powered generating systems are available to meet the renewable energy needs of many organizations.

- Single-wind turbines generate electricity as a supplement to an organization's existing electrical supply (when the wind blows, power generated by the system goes to offset the need for utility supplied electricity).
- Utility-scale wind farms generate electricity that can be purchased on the wholesale power market, either contractually or through a competitive bid process.

Learn more about wind power:

<http://windeis.anl.gov/guide/basics/>

<http://apps2.eere.energy.gov/wind/windexchange/utility-scale-wind.asp>

How to indirectly participate in any or all of these sustainable energy solutions:

There is another way for your organization to embrace corporate social responsibility and invest in renewable energy that does not require the construction or maintenance of any equipment. Renewable Energy Certificates (RECs) are tradable, non-tangible energy commodities that confirm electricity was generated by a renewable energy resource and fed into a shared power grid. A certifying agency assigns a unique identification number to each REC produced by a green energy provider. The REC can then be sold on the open market. Electric utilities, businesses and public entities can purchase these certificates to fulfill clean energy regulatory requirements or to otherwise reduce their environmental impact. RECs allow buyers to support renewable energy initiatives while also allowing market forces to spur the further development of green energy. Depending on where you are located, you may also be able to purchase renewable energy directly from an offsite power generating facility.

Learn more about indirect participation in renewable energy sources:

<http://energy.gov/eere/femp/federal-site-renewable-energy-purchases-and-renewable-energy-certificates>

<http://www.wri.org/publication/bottom-line-renewable-energy-certificates>