A Sustainable Environment: Our Obligation to Protect God's Gift

by

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Distributive Generation May Be The Answer to Our Energy Problem

Since the beginning of man, we have gone from the wood age to the coal age to the oil age. While going from one source of energy to another, we have decreased the emission of carbon dioxide but it may be too late. Over the past few months, we have all been reading how there is now little doubt that global warming does exist and it is caused by carbon dioxide emissions. And in turn, there is speculation that the recent increase in hurricanes may be the result of global warming. Is there anything we can do reduce this trend? Distributive generation may be the answer, but exactly what is it?

Most of our electrical energy is derived from large power plants fueled primarily by coal and to a lesser extent gas and nuclear fuels. There are now a number of new power plants being designed with natural gas as the fuel source. In any event, with the exception of nuclear, all of these power plants consume a form of fossil fuel and emit carbon dioxide, with coal plants emitting much more than the natural gas plants. In addition to the emissions, these power plants have other negative factors. Being in a central location, distribution of the energy via power lines results in electrical losses. A coal power plant is only about 30% efficient meaning that if you burn 100 energy units of coal, the output will only be about 30 units of energy. Then the transmission and distribution of the energy loses another 9-10%. Another disadvantage is when a power plant goes down for any reason, an entire region is without power. In 2002, most of northeastern U.S. experiences a blackout, one of the worst power outages in U.S. history.

One answer to these carbon-emitting plants is the development of wind farms. We have seen these in California, Texas and a number of other states. Relying exclusively on wind as the fuel source, these power-generating plants emit no carbon to the atmosphere. In general, these wind farms are located in open areas without many people or a demand for electricity. Consequently, the generated power must be transmitted great distances to the cities with the electrical demand. Just like coal power plants, these wind farms are also subject to the transmission and distribution losses.

One way of eliminating these power losses and making the generating unit more efficient is to locate it right at the consumer, known as distributive generation. Instead of very large power plants generating as much as 2,000 megawatts, mini power plants in the 10 to 100 kilowatt range can be located in very close proximity of the primary consumer. Each business or home could eventually have its own power plant and the electrical grid, currently used to deliver electricity, can be used as a backup. If the mini power plant generates more than is consumed, the excess can be fed back to the grid by something called net metering. The business or home would then receive credit for the electricity going to the grid. A form of these small power plants driven by diesel fuel has been

around for some time but used primarily as a backup power supply. However, they have the same disadvantage of being polluters.

Small wind turbines, on the other hand, can deliver energy with absolutely no emissions – and the fuel is free. The most common criticism for wind turbines is that they may operate intermittently when there is little or no wind. This is not a major problem if the wind turbine is integrated with solar power since they complement each other. When conditions are bad for wind turbines, such as calm, sunny weather, they are good for solar energy, and the opposite is true. Cloudy, windy days, which are ideal for wind turbines, are not good for solar energy. Both of these renewable energy technologies can be sized for distributive generation.

Another technology that could be used for distributive generation is fuel cells. A fuel cell is another form of a battery, which requires the reaction of two chemicals to produce electricity. When the chemicals are consumed, the battery becomes "dead" and is either thrown away or recharged. In the case of a fuel cell, the two chemicals are hydrogen and oxygen, which when combined produce water and electricity. By providing a continuous supply of oxygen and hydrogen, a fuel cell will provide a continuous supply of electricity. Oxygen is very plentiful, as it is about 21% of the air around us. Hydrogen, on the other hand, must be produced because it is not readily found in its purest form. But how do you produce it and from where?

The most plentiful supply of hydrogen can be found in water, H_2O. It is only a matter of separating it from the oxygen. Since most chemical reactions are reversible, all one needs to do to separate the two chemicals is to provide electricity. Just as electricity is created when hydrogen and oxygen are combined, it takes electricity to separate them. However, does it make sense to use electricity to produce hydrogen so that electricity can be generated by a fuel cell? It does only when the electricity to be used to produce the hydrogen can be generated with free fuel, like a wind turbine or solar cell, and the consumer of the fuel cell generated electricity cannot depend on a wind turbine or solar. An example is a fuel cell powered automobile, which could not depend on a wind turbine or a solar cell. On the other hand, you can't really depend on using a wind turbine to produce the hydrogen to power an automobile. So what is the answer?

Two other sources of hydrogen are natural gas and methanol, both consisting of a large percentage of hydrogen. Since most homes already have a source of natural gas, a fuel cell can be used to power a home just by adding a simple process to extract hydrogen from the natural gas. In the case of automobiles, methanol may be a good source for hydrogen since it has similar transport and storage properties as gasoline. Looking into the future, we may see distributive generation as our new source of energy for businesses and homes. Wind turbines and solar cells are already proven and the economics improve every year. Fuel cells are about 10 to 20 years away from being commercially available along with the fuel infrastructure, but they won't arrive too soon as we continue to deplete our fossil fuel inventories.