

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

by
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What is Meant by the Smart Grid?

Last month, I wrote an article about the importance of the electrical grid to the introduction of renewable energy. The real benefit of renewable energy is a combination of free fuel, like wind and sun, and not emitting carbon dioxide which contributes to climate change. However, it is also important to conserve energy whether it is renewable or non-renewable, like coal or gas fired power plants. This is where the smart grid becomes very important.

Whether it is called a smart grid or anything else, the importance is to optimize the use of the electrical grid. By this we mean to get more out of the existing infrastructure and thus defer investments in new generation, transmission and distribution facilities. It also means to reduce the overall cost of delivering power, improve the reliability of power delivery, and reduce the resource usage and thus emissions of carbon dioxide and other pollutants.

When people talk about the smart grid, it may be better to call it a smarter grid. As telecommunications has advanced from the first telephone to telecom satellites to touch-tone phones to cell phones, to texting, and to phone calls over the internet, the electrical grid has the potential to advance in the same manner. Although today's electricity system is 99.97% reliable, there are still power outages and interruptions that cost Americans about \$150 billion each year. A smarter grid may be the answer to optimization, security and cost reduction.

The idea of a smarter grid is nothing new. It has been tried before and to some extent has been in operation. However, today we have digital technology that makes more technologies possible. For instance, the current grid does not really communicate, but when it does, it is one-way and typically not real-time. The smarter grid will communicate two-way and be real-time. The current grid has limited customer interaction while the smarter grid will consist of extensive interaction. Rather than centralized power generation, the smarter grid will rely on both centralized and distributed generation. Distributed generation refers to the use of small-scale power technologies located close to the load being served, capable of lowering costs, improving reliability, and reducing emissions. An example is the installation of solar panels on the roof of a house. The current grid has limited power flow control while the smarter grid will provide comprehensive and automated power flow control. If the current grid has a failure, the restoration must be done manually. A smarter grid is self-healing.

One of the earlier smarter grid technologies is smart meters. By installing such a meter in, say, a house, it will enable the consumer to determine how much electricity is

being used by each appliance, and along with real-time pricing will determine when is the best time to use a certain appliance. It relies on two-way communication and takes into account supply-demand and the price of power. This device not only helps the consumer, but it also helps the utility so there is more efficient use of the generated power.

Another smart grid technology is an alternative use of plug-in hybrid electric vehicles. If such a vehicle has a charged battery, during the evening it may be connect to the grid to provide distributed generation. As solar energy becomes more popular, the use of digital technology along with storage batteries will allow the consumption of solar power twenty-four hours per day. The smart grid will also allow for the seamless integration of renewable energy sources like wind power. Smarter grid technologies will also allow for more efficient use of power for buildings, for example, by incorporating devices that will turn off power automatically to unused equipment.

Other advancements in development include zero-net energy commercial buildings that will balance energy generation with consumption. Also being developed are superconducting power cables that will reduce line losses and carry three to five times more power than the traditional copper-based cable. Energy storage will become very important for wind and solar energy systems as these are intermittent and may not be generating power when it is in demand. Also, advanced sensors will allow for the monitoring and reporting of line conditions in real time.

The smart grid is coming real soon and we can't wait.