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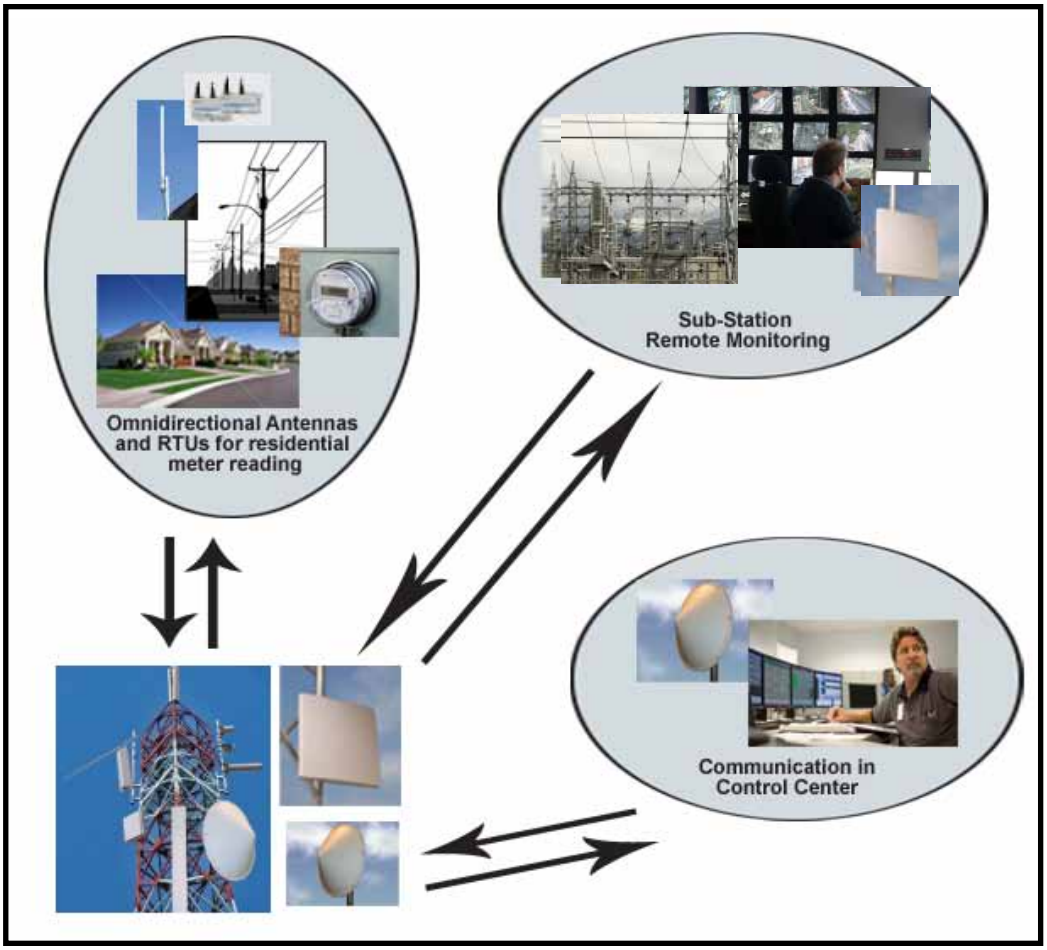
Antennas for Smart Grids and Metering

A smart grid, an updated electrical grid that includes wireless technology and smart meters, is needed for energy efficiency and security. In addition to reducing pollution and power outages, smart grids utilize real-time communication to optimize the delivery and storage of energy and prevent loss. To accomplish these goals, the electrical industry must modernize by using current technology that facilitates communication on the electrical grid. The United States government recently allocated billions of dollars towards the creation of a smart grid to achieve these goals. One important component of the grid is smart meters and pole-mounted radios, which provide more accurate monitoring of electricity usage and the corresponding ability to change consumption and delivery patterns. The other component is wireless remote monitoring and control units at power sub-stations to distribute power efficiently. Antennas made by PCTEL, Inc. are already in use on some smart metering systems and utility poles and sub-stations, elements of the evolving smart grid.

Modernization of the U.S. electrical grid is overdue and essential to ensure the safe and efficient supply of energy throughout the nation. Much of the current electrical grid was developed in the1960s or earlier and increasingly faces shortcomings, according to the National Energy Technology Laboratory (NETL). With population growth, skyrocketing use of technology such as computers and air-conditioners, and concerns about the pollution and global warming that results from electricity generation, there is an urgent need to update the grid. NETL estimates that power interruptions cost U.S. electricity consumers $79 billion per year.[1]



Two-way communication is a key to making the grid smarter. The smart grid refers to a system that can communicate data back and forth between a utility company and a customer, or between the utility company and a point on the grid or another utility company. Wireless technology and antennas that utilize Radio Frequency (RF) signals are often best suited to facilitate this grid communication. Supervisory Control and Data Acquisition (SCADA) using two-way communication provides faster alerts about problems and better responses to them. In addition, improving communication on the grid cuts labor costs by reducing the need for manual monitoring and repairs.

Advanced Metering Infrastructure (AMI), or smart metering, allows communication between consumers and utility companies, providing the information and incentives needed for more efficient use of electricity. Electricity is more expensive to generate during peak load periods, such as hot summer days when air-conditioners

are running. At such times, utility companies generate power from older and less efficient plants (as electricity generally must be consumed as soon as it is produced). Generating power to meet this peak demand is expensive for utility companies and the environment. Forty percent of the production of the greenhouse gas carbon dioxide in the United States comes from burning fossil fuels to generate electricity, according to the Department of Energy and Environmental Protection Agency. Coal-powered electricity generation provides 51 percent of the nation's electricity and is responsible for 80 percent of the carbon dioxide emitted in the U.S. to produce electricity, the DOE and EPA state.[2]

Smart meters can wirelessly transmit information between consumers and utilities, allowing companies to take more frequent (such as 15-minute interval) and accurate electric meter readings than those obtained through monthly manual meter checks or estimates. Two-way smart meters can also give consumers real-time pricing information, which provides the information and incentives to modify behavior to save energy. So, on a hot summer day, people have the incentive to do laundry at night, when the temperature is cooler and electricity is cheaper because demand has been reduced. Moreover, appliances ranging from thermostats to computers can be connected in Home Area Networks (HANs) to give consumers the power to further control energy use.

Low profile vertical antenna and portable antenna for Smart Meters

PCTEL antennas were recently installed as part of a smart meter project involving a leading utility company, which is responsible for meter reading and service maintenance for approximately 2 million customers in the United States. The new meters have benefits ranging from energy efficiency to reducing labor costs. Remote meter reading eliminates the need to physically read each customer's meter, according to the utility company. Eventually, the technology is anticipated to be able to remotely connect and disconnect electric service, allowing remote operation of devices such as thermostats.

While smart meters are an important development, the smart grid refers to a host of technological improvements to the electric system. A smart grid's SCADA (Supervisory Control and Data Acquisition) capabilities, for example, could alert the utility provider about an outage immediately instead of waiting until homeowners call the utility company to report the problem. Other smart grid features, such as Distribution Automation (DA), can isolate problems and reroute power through less direct routes, potentially saving many people from losing power. The interconnected nature of the electricity on the grid also leaves it vulnerable to other disruption. The smart grid could provide increased protection by alerting operators to problems sooner and providing the capacity to "self-heal" through redirection of electricity, as well as technology capable of repairing problems discovered through continuous monitoring. A smart grid would also save power losses by optimizing assets in ways that, for example, route power to delivery points from nearer sources.

The stimulus package (HR1) signed into law in February 2009 contains approximately $4.5 billion to "modernize the electric grid" and a number of state governments have mandated increased use of renewable energy sources. Pieces of the smart grid are in place throughout the United States and in other countries, but completing the smart grid requires significant development. In addition to reducing energy use by making consumers more aware of and active in their habits, a smart grid has the potential to better accommodate renewable sources of energy such as wind and solar by adding them onto the electrical system more rapidly – the current grid cannot adequately accommodate these cleaner sources of energy. The smart grid is also hoped to improve electricity storage, partly by facilitating the use of Hybrid Plug-in Electric Vehicles (HPEV). It will also provide the computers, sensors and nodes to meet the challenge of bringing intermittent sources of energy like wind and solar onto the grid in a way that provides reliable power.\

Currently, smart metering networks and patchworks of smart grids use either wireless or wired communication, but wireless is more popular for several reasons. While some terrain that blocks RF signal is more conducive to broadband or fiber-optic cables, many of the pole-mounted devices in the electric grid are in

Flat panel and omnidirectional antennas for smart grid remote monitoring and control

remote areas where wired communication would be expensive (many wind and solar plants, for example, would be located in remote areas). Also, a single antenna (e.g., a Yagi antenna) can support multiple devices and is less labor-intensive to install. This is particularly important for communication with pole-mounted devices in rural areas. Finally, the unlicensed band used to communicate wirelessly is affordable and does not require leasing. Ultimately, antennas will be utilized in many different parts of the smart grid, from smart meters and other appliances in homes and businesses to sensors and devices on power plants, transmission systems and distribution substations.

In conclusion, the original electric grid was not built to accommodate present-day demands from new technology and population growth or concerns about the environment and greenhouse gases. Improvements to the efficiency and security of the electric grid will be achieved in part through better communication on the grid, which will help to provide the information and incentives needed to alter energy consumption habits and the capability to fix problems on the grid faster. Wireless communication offers several advantages, such as reducing labor costs and increased ease of adding components, especially in remote areas. To make this communication on smart grid possible, a variety of antennas will be needed.

Parabolic and yagi antennas are also used for smart grid remote monitoring and control

PCTEL designs and manufactures a range of a wide range of antennas covering 800-900MHz , 1710-2170MHz, 2.3-2.7GHz, 3.3-3.8GHz and 4.9-6GHz for Smart Metering and Smart Grid Applications. These include robust high performance and cost effective omni-directional antennas for smart meters and several point to point and point to multipoint Basestation antennas (Parabolic, Yagi, Flat panel, sector panel and omnidirectional) for remote monitoring and control infrastructure.

For your smart grid and metering application needs, contact PCTEL Sales at antenna.sales@pctel.com.

[1] http://www.netl.doe.gov/moderngrid/
[2] http://www.eia.doe.gov/cneaf/electricity/page/co2_report/co2emiss.pdf (pages 6-7)

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