

# Smart grid technology essay

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Smart grid is an electricity network type which integrates digital communication features to the service. Generally it provides central energy management to both parties of the electricity network, it enables

- Consumers to monitor their utilization, costs and provide recommendations on usage habits.
- Micro-stations to manage and monitor their input to electricity network
- Providing remote monitoring micro-stations input to electricity network from
- Power distributors to manage their grid much more intelligently and efficiently by providing real-time access to all metrics and configuration in a proactive manner.

Currently there are three main communication methods are used to build Smart Grid systems, these are using the utility's power lines as carrier, wireless networks based on unlicensed radio spectrum and licensed spectrum.

Using power line to create data networks is well-known method because it has been used for years. But it has several disadvantages and technological bottlenecks to respond today's and future's requirements. These are slow data rates and need for a large number of repeaters to be able to carry data to longer distances and high pass filters to increase data rates. Also communication path is not resilient to power failures and switching operations. But developing Smart grid applications need better connection rates and availability than power line carrier systems can provide. Drawbacks of power line carrier systems and healthier connection requirements make wireless alternatives more preferable systems. Other two options are wireless communications on unlicensed and licensed radio spectrums.

Unlicensed wireless devices operate in license-free radio bands, because of these reasons they must adhere to FCC rules. There is no cost for the spectrum license but total cost of ownership is also dependent on other elements. Free spectrum is vulnerable to harmful interference and unlicensed devices must accept but must not produce interference due to rule set. They have also limited bandwidth (up to 8kbps per channel after hops. ) and need of large number of repeaters because of range limitations up to 0.25 miles, these limitations and higher hop count also cause high latency. Licensed wireless devices operate in licensed spectrum and range is regulated by governments and license holders.

This provides higher signal power for devices and less noise because spectrum managed to prevent interference, these features increase the range and speed of communications. It can transmit up to 25 miles between nodes and endpoint, which means less investment in network devices like repeaters and related installations. Also no interference and direct communications between tower and endpoint result in very low latency under 100ms and make it significantly reliable.