

## THE FUTURE OF POWER DISTRIBUTION

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**Abstract:** Over the last decade, the energy crisis has made itself evident to the world. The ever-growing population and increase in demand for energy has put a severe strain on the earth's resources. The idea of a Microgrid, which is discussed in this article, allows for the modification of the present-day power grid with power electronics and control systems to create the ability to disconnect portions of the grid. With the help of simulation software and real-time digital simulation hardware, our research efforts are to simulate loading conditions for a local power grid.

**Key words:** power saving, microgrid, PHEVs, energy cost

### Background

Over the last decade, the energy crisis has made itself evident to the world. The ever-growing population and increase in demand for energy has put a severe strain on the earth's resources. This strain creates spikes in the prices of our natural resources and can influence economic turmoil as it has begun to do in many countries throughout the world [1].

About 10 years ago an idea came about that could help people more efficiently use the resources we have and to open the doorway for the incorporation of renewable energy sources to the power grid along with preparing our grid system for the advancement in technology on the horizon [2].

### Microgrids and plug-in hybrid electric vehicles (PHEVs)

The idea of a Microgrid (fig. 1) allows for the modification of the present-day power grid with power electronics and control systems to create the ability to disconnect portions of the grid. This unique characteristic has many advantages over the current structure. For instance, during fault conditions the section of the grid where the fault occurred can be isolated so that the fault is cleared and the entire grid is not affected. This characteristic also allows for better monitoring of power distribution so that the cost of energy can be kept to a minimum.

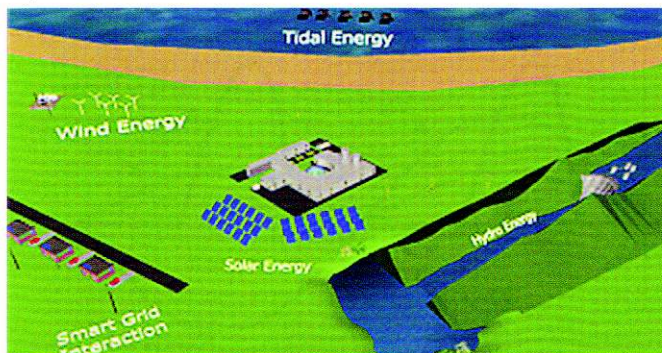


Fig. 1. Microgrid

Perhaps the most important attribute of Microgrids is that they allow for the influx and monitoring of plug-in hybrid electric vehicles – PHEVs [3]. These vehicles will give relief to the oil demand due to their lack of dependence on it, but increase the demand for energy from the utility companies. This increase in electrical energy demand would be hard to meet without the use of Microgrids and their ability to better monitor power distribution and allow for renewable energy incorporation. With new models being unveiled every year and the percentage of PHEVs on the road steadily increasing; the need for such a system is not far in the future.



Fig. 2. Simulation software and real-time digital simulation hardware

This increase in energy demand due to the increase in PHEVs may not be met only by the use of existing generation plants. During summer and other peak times when the utility companies are at their limit, an additional demand by PHEVs may be too much. By using Microgrids, the system is able to harness renewable energies such as solar, wind, tidal, and hydro to be used to relieve the generation plants of any overload conditions and make energy more economical for the consumer.

With the help of simulation software and real-time digital simulation hardware (fig. 2), our research efforts are to simulate these loading conditions for a local power grid. By obtaining an electrical model of a PHEV, the system can be loaded at various infiltration percentages and the system can be run through various charging scenarios for the PHEVs to get an idea for what types of load demands this new generation of automobile will create. Our hopes are that this system simulation will give utilities an idea of what to expect in terms of demand as these PHEVs begin appearing on the grid.

### Power saving in the future

Additionally, we hope that future works can be done to show how PHEVs can be used for energy storage. As stated before, utilities have peak and non-peak load demand times that occur in a cycle daily. If the PHEVs can be used to store energy during non-peak times, they can help reduce the demand on the instantaneous output of the generation facilities during peak demand times. This reduction in demand leads to longer life-expectancies of the systems and lower cost of energy to consumers.

### References

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