Optimizing Load Control within a Microgrid

ABSTRACT

Distributed energy generation sources and loads can be modeled using a systems approach as a "microgrid."[1] Microgrids are more common at larger facilities, such as industrial parks and university campuses, than at the scale of a smaller facility, such as a small national park. Marsh-Billings-Rockefeller National Historical Park in Woodstock, VT is particularly interested in developing local energy resources, we set out to design a microgrid system that would facilitate the use of local resources and allow for the addition of new resources without major changes to the existing infrastructure.

By utilizing an existing energy monitoring system for several buildings at Marsh-Billings-Rockefeller National Historical Park, I am designing a cooperative, intelligent microgrid demonstration system. This dynamic, intelligent agent-based control system model will optimize the power distribution for local microsources and improve energy efficiency. The model will include both proposed and exiting elements of the current microgrid at the park, including a photovoltaic (PV) system, micro-hydro generation unit, local utility connection, load centers and 5 Heating, Ventilation and Air Conditioning (HVAC) systems. It will seek to minimize environmental costs of NO_x and CO_2 emissions with respect to energy consumption within the microgrid, minimize the impact of a micro-hydro generation unit on the local ecosystem and maximize both energy production from local renewable resources and the robustness of the microgrid distribution network. Finally, it will incorporate an interactive display to increase park visitor and employee education about the cost of turning on a light bulb.

[1] R.H. Lasseter and P. Piagi, "Microgrid: A conceptual solution", in *IEEE Power Electronics Specialists Conference*, 2004, vol. 6, pp. 4285– 4291.