Research Collaboration Opportunity:
Simulation of cooperating intelligent micro grids in a self-healing power grid

Background: Electric power transmission and distribution entities are facing concerns in interconnecting planned and currently operating (but islanded) micro grids (MGs). The migration of existing MGs onto regional grids will aid in addressing black outs, provide enhanced energy security and will allow more energy utilization from renewable sources. However, utility companies must have functional operating models in which to test and simulate MG operating scenarios. The rapid increase in demand for electrical energy predicted by the US DOE and increasing penetration of distributed and variable renewable generation to the power grid will only make this issue more complex. Because of this complexity, MGs which can operate in grid-connected or off-grid mode are now considered the cornerstone of the smart grid of the future and research on the feasibility of their use is ongoing. MG interest has further increased in recent years due to extreme weather events like super storm Sandy and as the price of solar, combined heat and power plants and other decentralized energy sources has dropped.

Proposed work: **Simulation and optimization of intelligent, cooperating MGs for real-time power management of MGs.** The research team has previously shown that real-time operation of MGs (in grid-connected or islanded mode) is possible with intelligent distributed SW/HW agents. They are now proposing to take steps toward a power system model comprised of cooperating smart MGs, which will have the ability to isolate a faulty MG from the rest of the system, so that the healthy MGs can continue normal operation by adjusting their operating point, thus making the system resilient/self-healing.

Proposed outcomes:
1. Hardware in the loop simulation of a small-scale system consisting of a pool of cooperating MGs, using an agent-based smart MG model
2. Expansion of #1 above to include simulation of a regional grid, comprised of several smart MG’s
3. Test series - including blackout and electrical fault - to show cooperation of the MG’s, separation from the grid, isolation of a specific MG and ability to operate independently in islanded mode
4. Test the performance of cooperating MGs under communication time delay among agents

Personnel:
Professor Hashem Nehrir, Ph.D., IEEE Life Fellow, has been working on the hybrid renewable-energy-based MG power management since 2005. He has supervised the research work of four Ph.D. students and five M.S. students in this area. [http://www.coe.montana.edu/ee/hashemn/Vitae/Nehrir%20Vitae%20full.pdf](http://www.coe.montana.edu/ee/hashemn/Vitae/Nehrir%20Vitae%20full.pdf)


Supporting publications

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