Project Summary

Overview. The "Smart Grid" represents a new vision for the electrical infrastructure of the United States, whose goals include more active participation by consumers, new generation and storage options including renewable energy, and new products, services, and markets. To reach its full potential, the Smart Grid must provide information to consumers in a way that enables positive, sustained changes to energy-related behaviors.

The central question to be pursued in this research is: *What kinds of information, provided in what ways and at what times, enables consumers to make positive, sustained changes to their energy consumption behaviors?* Prior research indicates that such changes can potentially be motivated by an appropriate combination of personalized information, general and specific commitments, achievable goals, social reinforcement, feedback, and financial incentives.

Intellectual Merit. This project will develop a collection of open source components called WattBlocks, which will provide novel and useful scientific infrastructure for investigating the ways in which energy-related information can affect human behavior. The project will also develop eSpheres, a novel social networking application that provides users with access to energy-related communities at configurable levels of scale. The combination of WattBlocks and eSpheres will lower the technological efforts required for empirical, replicable studies of human energy-related behaviors.

The project will use this infrastructure in a series of two case studies, one involving campus dormitory energy competitions and one involving community home energy challenges. The project will investigate a number of important research questions, including: (1) What are the requirements for consumer-facing, open source, scientific energy information infrastructure? (2) What are the strengths and weaknesses of a dedicated social network technology like eSpheres for energy behavior change? (3) What combination of behavioral change motivators, under what conditions, induce positive change? (4) What factors influence the sustainability of these changes? (5) What is the influence of energy data feedback latency (i.e. 1 minute, 15 minutes, 1 hour, 1 day) on behavioral change?

The research group is well-qualified for the development challenges, as they have over ten years experience in the development of open source, component-based software for software engineering process and product data through the successful Hackystat Project. They also have broad prior experience in empirical experimentation, data collection, and analysis. The project will gain additional strength from partnerships with other University of Hawaii groups (REIS, Sustainable UH) and community groups (Kanu Hawaii, Blue Planet Foundation).

Broader Impacts. This project will serve underrepresented populations, as the University of Hawaii is in an EPSCOR state. Approximately 84% of undergraduates at the University of Hawaii are minorities. WattBlocks and eSphere will be released as open source software, providing new and useful infrastructure for others interested in investigating energy-related human behavior. Finally, the resulting insights can inform the design of consumer-facing Smart Grid information systems, with potentially significant cost-saving or service benefits for the U.S. population.

Key Words: smart grid; human behavior; social networks; energy.