BEHAVIOR DRIVEN BUILDING ENERGY MANAGEMENT SYSTEM

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Present-day building energy management systems are driven by engineering models of the buildings and their energy properties. In principle, equations can predict the most efficient distribution of energy among the building spaces, to maintain occupant comfort with the least use of energy. In practice, this goal is not reached for many reasons:

- Building models often don't exist and when they do exist, they are expensive and often inaccurate.
- The system control actions do not account for room occupancy or vacancy, sunlight hitting the building, or external temperature, nor do they use "look-ahead" methods that take advantage of future forecasts
- The building occupants are not treated as part of the building system. They have varying comfort levels, unpredictable behaviors, and they do not consciously contribute to energy conservation.

Given that DoD facilities generate energy costs of $4 billion annually, unnecessary losses in building efficiency cost DoD tens of millions of dollars per year. Furthermore, in the future, energy costs will vary throughout a day, due to time-of-use pricing and the increasing use of renewable energy sources. Present-day energy management systems are not designed to adjust for these variable costs, e.g., by using building thermal mass to "store" energy.

To address these challenges, the University of Southern California's Information Sciences Institute, is developing the DOE-funded Building Level Energy Management System (BLEMS). BLEMS is a multi-agent software system that attempts to maximize user/occupant comfort levels while simultaneously minimizing energy usage and/or energy cost. BLEMS learns/discovers the behavior of occupants, the building infrastructure and its devices. Based on this knowledge, BLEMS seeks to balance comfort with energy consumption goals. This balance involves making adjustments to lighting, heating/cooling, air handling, and other internal environmental devices that, based on the building occupant's behaviors, do not exceed their comfort levels while simultaneously meeting the energy consumption/cost goals. In some cases, it may be necessary for BLEMS to "rob Peter to pay Paul." That is, it may be necessary to reduce temperature in one space and increase the temperature in another space. Energy can come from the "grid" or from alternative energy sources (such as from stored batteries that were charged to capacity during the night when energy is readily available and is inexpensive.

This poster provides an overview of the BLEMS technology, results from the first working prototype and current project status.