

**Thursday, September 2nd**

Scaife Hall Auditorium  
Room 125

4:30 p.m.  
Refreshments at 4:00 p.m.

## **Towards Energy-Aware Facilities: Inferring Appliance-Level Consumption**

### **Abstract:**

Global climate change, record-high oil prices and the decreasing availability of fossil fuels are forcing all of us to rethink the way we deal with our energy needs. Out of the 99.2 quadrillion BTU (quads) of total annual primary energy consumption in the United States, 40% is used to generate electricity. Residential and commercial buildings use 68% of this energy. Thus, reducing the consumption on any or both of these types of facilities can have a significant effect on the total energy savings for the country.

Studies have shown that by providing building occupants with real-time energy use feedback, even at the aggregate level, savings of up to 10-15% can be achieved. Larger savings are potentially achievable if more detailed data were available not only to the user but also to automated building control systems or to electricity suppliers, allowing them to reward peak-shifting loads or subsidize equipment upgrades. However, the granularity of the power consumption data is typically proportional to the price of the solution required to obtain it. Nevertheless, there are ways to circumvent this relationship and this is the main topic of my work.

Specifically, my research is on enabling awareness of the electricity consumption of buildings by exploiting low-cost data streams for high-value information, particularly through the use of signal processing tools and machine learning techniques. I envision a scenario where facilities can perform inference and automatically learn from different data sources in the building, in order to provide relevant and specific feedback targeted at influencing behavior and reducing consumption.

In this talk I will present some of the work I have been doing towards this goal. In particular, I will present a Non-Intrusive Load Monitoring prototype system that we have installed in four buildings around Pittsburgh, along with preliminary results and early findings from our deployments. I will also present my approach to the problem of inter-operability and integration of sensor systems in buildings. Lastly I will describe some ideas for automating the configuration and training of these systems. The talk will conclude with a discussion on current challenges and future work.

### **ECE Seminar Hosts**

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**Mario E. Bergés**, is an Assistant Professor in the Civil and Environmental Engineering department at Carnegie Mellon University.

His research interests include infrastructure monitoring, building energy management, machine learning for signal processing and sensor networks.

He received his B.Sc. in 2004 from the Instituto Tecnológico de Santo Domingo, in the Dominican Republic; and his M.Sc. and Ph.D. in Civil and Environmental engineering in 2007 and 2010, respectively, both from Carnegie Mellon University.