Smart Communication of Energy Use and Prediction in a Smart Grid Software Architecture

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The increasing deployment of smart meters and other sensor technologies in the Smart Grid environment enables us to monitor, transmit and give feedback on consumer energy usage in realtime. Energy data is also being sensed and collected in disaggregated form, continuously and at high frequency, from individual devices and appliances. This information-rich Smart Grid environment has opened up research opportunities for understanding and drawing conclusions on energy consumption behavior, predicting future usage trend, designing demand-response policies, and improving efficient use of energy.

In this poster, we discuss techniques for analysis of energy consumption data to automatically provide meaningful, personalized feedback to the consumers, as part of the software architecture for demand-response in the Los Angeles Smart Grid Demonstration Project.

The consumer is an active and vital participant in the functioning of the Smart Grid, making it critical to effectively communicate energy usage and prediction information to them. However, providing extensive consumption information to the consumer may not necessarily translate into modifying their behavior and persuading users towards better energy management and conservation. For instance, even in conventional grids, consumers have long had information about their monthly (or daily) usage and rebates for energy efficiency improvement offered by utilities, but this has had limited impact on consumer behavior. Rather than increasing the quantity of information in Smart Grids, that may only serve to overwhelm them, consumers need to be provided with better quality of information.

Research indicates that interpersonal communication methods are more effective in influencing attitudes and motivating behavior change. The premise of this research is that providing personalized and actionable energy information in a simple language to the consumer will go a long way in changing behavior. In particular, we posit that information communicated in well-written text form is easier for consumers to comprehend and interpret, than structured data presented as tables or graphs. Moreover, this allows utility companies to communicate actionable items and targeted incentives in a simple language to specific consumer groups. We present several use-case scenarios in the poster to illustrate the type of feedback that could be provided to the user.

As part of ongoing research, we are using Natural Language generation techniques to automatically generate text information from structured data. The generated messages would be tailored in content and style according to the user models. Several AI methods can also be incorporated to build such a smart energy information communication system. Machine Learning methods can be used to build user models based on their past energy consumption data and other individual information.