314a Dynamics and Control of Phosphoric Acid Stationary Fuel Cell Power Plant

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UTC Power product portfolio includes PureCell^{TM}200, a commercially available 200 kW Phosphoric Acid based Stationary Fuel Cell Power Plant for onsite power generation. To date, we have sold roughly 250 units worldwide and continue to offer this product for clean and efficient energy generation for off-grid as well as supplementary power applications. Based upon our experience, we are further improving our product with the goal of lowering the overall cost significantly while improving the power plant performance and durability.

In this talk, we describe the dynamic interactions and control issues of the Phosphoric Acid based Stationary Fuel Cell Power Plant. The system includes a fuel processor that converts a hydrocarbon fuel such as natural gas into hydrogen rich gas for the fuel cell using a series of catalytic reactors including catalytic steam reformer (CSR). The thermal system manages the heat released by the cell stack and provides steam for the steam reforming reaction while maintaining water balance and system operating constraints. For off-grid operation, the power plant needs to respond to fast varying loads. During such transients, the fuel processor control and steam generation control is very critical to ensure that the fuel cell stack is not starved of hydrogen and is not poisoned by carbon monoxide.

Preliminary results will be presented from the system level modeling effort undertaken to study the system behavior at different operating points. We have developed validated steady state power plant model that increases our understanding of the system interactions and provides input related to power plant sizing and operating schedules. This information also feeds into our improved control solutions for the various decentralized power plant control loops.