Dynamic Energy and Environmental Dispatch of Power Systems
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1. Project objective

This project will develop a framework that allows power system operators to co-optimize power flows and environmental flows (air pollution transport). This framework has the potential to provide a cost-effective way for the power sector to meet the increasingly stringent environmental regulations and systems reliability.

2. Major technical accomplishments that will be completed this year

We have developed a new mechanism to analyzer Continuous Emission Measurement (CEM) data of electric generation units (EGUs). We have came up with a methodology evaluating the effects of dynamic pricing on load profiles. We will soon finish evaluating the effects of dynamic pricing on reducing EGU emissions during high energy demand days (HEDDs). Coming up, we expect to 1) complete the analysis on the effects of thermal energy storage on reducing EGU emissions during HEDDs, and 2) complete the analysis on the effects of dynamic pricing and thermal storage on improving air quality during HEDDs, 3) generate the locational and temporal dependent damage functions of EGU emissions during HEDDs, and 4) implement the damage functions, dynamic pricing and thermal storage into SuperOPF simulations.

3. Deliverables and schedule for activities to be completed under FY2012 funding

We expect to generate two journal publications, one on the the effects of dynamic pricing and thermal storage on improving air quality during HEDDs, and the other on the results of SuperOPF simulations described above.

4. Risk factors affecting timely completion of planned activities

The main risk factor is whether the power systems network we are using (in this case, reduced 36-bus NPCC network) is able to represent HEDD conditions. The reduced network was originally developed to represent normal days, not HEDDs.

5. Early thoughts on follow-on work that should be considered for funding in FY2013

We recommend the follow-on work to this project is to investigate the planning and operations of power systems under extreme weathers. A consequence from global climate change is the increasingly frequent extreme weather conditions such as heat waves, droughts, and heavy precipitations. The widespread blackouts resulting from the recent heat waves in 2012 indicate that the power systems are still not adapted to the extreme weathers. Neither technological nor economics solutions alone will be sufficient. CERTS is uniquely positioned to come up with integrated technological and economics solutions to address this challenge.