**"Overview of Current Day - Energy Market Management Systems and Challenges",
Dr. Sankaran Rajagopal, Siemens Energy, Minneapolis, MN.
Electric Power and Energy Systems Graduate Seminar at the Department of
Electrical and Computer Engineering, Iowa State University**

Objective: To provide the Students with an overview of the engineering and problem formulation challenges, the depth and width of functionality behind these systems, and the associated Information Technology complexity and needs.

The previous generation of Energy Market Management (EMM) Systems and the loop holes in the Market Design of the past caused considerable strain to the Public, Load Serving Entities, PUC's and FERC by means of price spikes, increased average cost, and compromised the reliability of the electric grid. The current day EMM Systems and the Market Design ensure stability of prices while ensuring the grid-reliability is not compromised. The current market design and the Smart Grid - EMM systems prevent the gaming of the Market, ensures the energy producers cannot exercise the market power by nature of where they reside, levels the play-field for all the market participants, allows participation of demand response and renewable energy. .

The Electric Energy Market usually comprises of I) Bilateral contracts, II) Forward Market (typically, Day Ahead Market), and III) Real-Time (Balancing) Market. The Day Ahead Market allows producers to off-load excess supply in the form of Energy and Ancillary Services (AS for capacity products), and the Load Serving Entities to secure pricing against the incremental demand changes due to changes in forecasted load. The Real-Time Market provides the spot market to meet instantaneous demand. The ISOs and RTOs typically need the Energy Market Management Systems to: (a) manage transmission allocation for energy and AS, (b) facilitate the wholesale energy and AS markets for buyers and sellers, and (c) maintain system reliability in real-time.

The typical solutions for the Energy Market Management (EMM) systems require an Energy Management System (EMS) already in place for functionality of SCADA, Network Analysis/Security Applications, Automatic Generation Control, Forecast, and Outage Management. The EMM systems typically comprise of an Integrated Forward Market: (a) Day Ahead Market (Market power mitigation, Security Constrained Unit Commitment, and Reliability Unit Commitment), (b) Real Time Market (Very Short-Term Load Forecast, Market Power Mitigation, Short-term-Unit-commitment, real-time dispatch, and contingency dispatch), and (c) the Full Network Model represented in the Market Solutions to properly represent transmission constraints, contingency analysis, and loss modeling. The EMM system also needs to have the underlying business processes to be modeled and Market time lines need to be met. These systems also require systems to manage the business processes rules, bid submission, market time line management, bid validation, and credit verification. EMM systems need an after-the-fact energy accounting also, which poses the need for the complex energy/price slices accurately calculated based on the tariffs to make the billing and settlement straight forward and timely. The IT challenges are in two main categories: (A) Availability (99.99%): fail-over for computer outages and multi-site operation in case of natural disturbances (fire, storms, earth-quake, etc); (B) Systems Integration (typically, Enterprise Integration based on Service Oriented Architecture) to have a controlled Integration by means Orchestration of services maintaining data flows, and allow easy maintenance/upgrades of the involved (numerous) systems.