

# **The Electrical Grid and Supercomputer Centers: An Investigative Analysis of Emerging Opportunities and Challenges**

*Layout Changes v2.0*

*Sridutt Bhalachandra*

*01-22-2014*

---

1. Introduction
  - Define Demand Response(DR)
  - Explain why DR is important?
  - Explain the recent developments that have aided DR
  - Sensitize the situation by asking
    - “We know supercomputer centers want to save energy costs, but is that a key interest of the electricity provider? Likewise, is it a key interest of the supercomputer center to improve electricity grid reliability?”
2. SC view of world.
  - SC wants energy efficiency to lower costs
  - Explain the technology developments and research going on to achieve energy efficiency through power management(Prior Work content)
3. Electricity Service Providers(ESP) view of world.
  - ESP wants reliability and match demand with response.
  - Explain the challenges faced by ESP to meet the demand with response.
  - Explain the incentives offered by ESP to help meet challenge to match demand with response.
4. Questionnaire
  - This would illustrate the readiness of SC to help ESP with DR.
  - Provide the list of strategies that SC think feasible to help ESP.
5. Opportunities/Solutions and Barriers
  - Starting negotiations
  - System software - Sites are developing experience with energy efficiency that can transfer to power management for utility integration.
  - Briefly introduce the datacenter-grid integration model(more detail in appendices)
    - i. Demand-side programs can integrate fine-grained power management, coarse-grained management, and job scheduling (table 3) to achieve energy efficiency at supercomputing facility without impacting the reliability of the electric grid.
    - ii. Apart, from allowing energy efficiency in the supercomputing facility the demand-side programs can also now respond to requests from ESP in conjunction with the supply-side programs.
    - iii. The integration of the demand and supply programs facilitate real-time energy monitoring and forecasting.
6. Conclusion.
  - Potential HPC-specific value proposition for active DR engagement
  - Based on Grid Integration solutions – local and system-wide impacts
  - Next steps – specific directions or target areas to focus
    - Emphasis on how understanding the endurance of electric grid to power swings and sensitivity of power distribution grid to rapid transients can help to understand grid reliability.