U.S. Department of Energy

ELECTRICITY DISTRIBUTION SYSTEM WORKSHOP

Mapping Challenges and Opportunities to Help Guide DOE R&D Investments over the Next Five Years

Sheraton Crystal City, 1800 Jefferson Davis Hwy, Arlington, Virginia
September 24-26, 2012

AGENDA

Monday, September 24, 2012

1:00-1:30	**Welcome and Introduction to the Grid Tech Team (GTT), Vision, and Framework** *The GTT synchronizes all grid-related activities across the DOE*	Dr. Anjan Bose, *Grid Tech Team Lead*
1:30-1:50	**OE Vision, Activities, and Issues**	Patricia A. Hoffman, *Assistant Secretary for the Office of Electricity Delivery and Energy Reliability (OE)*
1:50-2:10	**EERE Vision, Activities, and Issues**	Dr. David Danielson, *Assistant Secretary for the Office of Energy Efficiency and Renewable Energy (EERE)*
2:10-2:40	**Open Q&A**	Rich Scheer, *Lead Facilitator*
2:40-3:00	**Break**	
3:00-4:20	**Forward Looking Panel Presentation & Discussion** Moderator: Dr. Anjan Bose, *Grid Tech Team Lead* • Distribution – EPRI • Transmission – FERC • Data/Informatics – IBM • Cooperative Needs – NRECA	Mark McGranaghan, *Vice President, Power Delivery and Utilization, EPRI* Jon Wellinghoff, *Chairman, FERC* Allan Schurr, *Vice President, Strategy & Development, Global Energy & Utilities, IBM* John D. Hewa, P.E. *Vice President, Research, Engineering & Technical Services, NRECA (invited)*
4:20-4:50	**Open Q&A**	
4:50-5:00	**End of Day Remarks**	Dr. Anjan Bose, *Grid Tech Team Lead*

Tuesday, September 25, 2012

8:00-8:15	**Monday Recap** **Morning Instructions**	Dr. Anjan Bose, *Grid Tech Team Lead* Rich Scheer, *Lead Facilitator*
8:15-8:30	**Organize into Breakout Groups**	
8:30-11:30	**Challenges and Opportunities – Technologies and the Grid** Breakout Group Sessions: A. Plug-in Electric and Fuel Cell Electric Vehicles *What strategies can prevent adverse impacts to the distribution system as PEVs reach a critical level of market penetration?* B. Smart Grid Technologies *What is the proper balance of smart grid technologies within new smart grid control architectures?* C. Residential, Commercial, and Industrial Building Loads *What are the speed, scale, quality, and reliability requirements of a building's storage, load management, and generation strategies to achieve effective grid interactions?* D. Distributed Energy Storage *How does distributed energy storage (electrical and thermal) interact, compare, and compete with other flexibility resources such as demand response, smart inverters, and smart charging of electric vehicles?* E. Distributed Generation: Variable *What are cost-effective, reliable ways to address technical integration issues such as voltage regulation, islanding, protection coordination, and reverse power flow?* F. Distributed Generation: Dispatchable *What system-design, technical, operational, and safety requirements should be met for customer-sited dispatchable DG to provide ancillary services?*	Parallel Breakout Sessions *(see white paper: "DOE Action Plan Addressing the Electricity Distribution System")*
11:30-12:30	**Lunch**	
12:30-1:30	**Report Back on Challenges and Opportunities** Group Chairs report back to the whole group on key challenges and cross-cutting opportunities identified in the morning sessions	Moderator: Rich Scheer, *Lead Facilitator* Breakout Group Volunteer Chairs
1:30-1:45	**Instructions and Reorganize Into Breakout Groups** Participants will be assigned to a breakout group.	Rich Scheer, *Lead Facilitator*
1:45-4:45	**Key Grid Integration Challenges – Systems Approach** Each breakout group will identify 5-10 key challenges facing the grid as it integrates ALL the various technologies while ensuring a safe, reliable, and cost-effective system, building from the challenges discussed in the morning session and others that should be considered. Utilizing the GTT framework, a systems-based discussion will aim to identify	Parallel Breakout Sessions *(see white paper: "DOE Action Plan Addressing the Electricity Distribution System")*

	R&D activities and initiatives for overcoming key grid integration challenges, addressing ALL of the following topics: • Grid Flexibility *What R&D advances could be made in the physical domain (component technologies, inverters, power flow controllers, transformers, cable and conductors, protection device, etc.) to increase the flexibility/controllability of the grid? What are the characteristics and functionalities needed to address the challenges identified and ensure a safe, reliable, cost-effective system?* • Grid Visibility *What R&D advances could be made in the informational domain (sensors and relays, AMIs, PMUs, end-use energy management systems, communications hardware and protocols, etc.) to increase the visibility/controllability of the grid? What are the characteristics and functionalities needed to address the challenges identified and ensure a safe, reliable, cost-effective system?* • Grid Understanding *What R&D advances could be made in the knowledge domain (databases, planning tools, models and simulators, analyses and assessments, etc.) to increase the understanding/controllability of the grid? What are the characteristics and functionalities needed to address the challenges identified and ensure a safe, reliable, and cost-effective system?*	
4:45-5:00	**Reconvene and End of Day Remarks**	Dr. Anjan Bose, *Grid Tech Team Lead*

Wednesday, September 26, 2012

8:00-8:15	**Tuesday Recap** **Day's Instructions**	Dr. Anjan Bose, *Grid Tech Team Lead* Rich Scheer, *Lead Facilitator*
8:15-9:45	**Report Back on Key Grid Integration Challenges** Volunteers report back to the whole group on key challenges and potential R&D activities and initiatives identified in the Tuesday afternoon sessions Facilitator: Rich Scheer	Breakout Group Volunteer Chairs
9:45-10:00	**Break**	
10:00-11:00	**Facilitated Discussion on Priorities and Role of DOE** Moderators: Steve Chalk, *Deputy Assistant Secretary, EERE* Bill Parks, *Senior Technical Advisor, OE*	Open Session
11:00-11:30	**DOE/GTT Panel Thoughts and Next-Steps**	GTT Members
11:30-11:45	**Closing Remarks**	Dr. Anjan Bose, *Grid Tech Team Lead*

BREAKOUT SESSIONS

The GTT developed a draft vision which *describes* a future electricity system and lists several *key attributes* of that system. Reactions to the draft vision have been positive, and it will continue to be further refined as the GTT engages with the broader stakeholder community. This vision is:

A seamless, cost-effective electricity system, from generation to end-use, capable of meeting all clean energy demands and capacity requirements, while allowing consumer participation and electricity use as desired:

- Significant scale-up of clean energy (renewables, natural gas, nuclear, fossil with CCUS)
- Allows 100% consumer participation and choice (including distributed generation, demand-side management, electrification of transportation, and energy efficiency)
- 100% holistically designed (including regional diversity, AC-DC transmission and distribution solutions, microgrids, and centralized-decentralized control)
- Accommodates two-way flows of energy and information
- Reliable, secure (cyber and physical), and resilient

This vision accommodates the diversity and uncertainty of future demands and generation portfolios, recognizing the inherent regional differences in needs, goals, and available resources. The GTT supports the significant scale-up of clean energy but is also sensitive to the impacts on consumer costs and economic prosperity. To allow for 100% consumer participation and choice, from using electric vehicles to producing and selling electricity, the future grid will need to accommodate two-way flows of energy and information. The future grid will also require a combination of transmission and distribution solutions, as well as a balance between centralized and decentralized control including microgrids. Through all these changes, the grid must remain reliable and secure against cyber and physical threats, while becoming much more resilient to disruptions and outages.

Morning Sessions

Each of the morning breakout groups will discuss the challenges and opportunities of their respective technologies for achieving the vision stated above. These challenges and opportunities should reflect the integration of the technology into the grid as well as the interactions between various technologies. These discussions can begin with the opportunities, challenges, and questions presented in the white paper. A volunteer chairperson will be asked to report key results back to the larger group.

Afternoon Sessions

New groups will be formed in the afternoon that will provide a more holistic perspective to key grid integration challenges. Building off the challenges reported back from the morning session, the groups will discuss key challenges to the grid with ALL the various technologies integrated. The groups will then apply the framework developed by the GTT to identify R&D activities and initiatives that can address the key challenges. A volunteer chairperson will be asked to report results back to the larger group the following morning.

The GTT strategic framework is described below:

There is a multitude of R&D activities that are needed to overcome the technical challenges identified for grid modernization. The GTT proposes a strategic framework (Figure 1) that organizes these activities into three interrelated domains (informational, knowledge, and physical,), representative of the systems nature of the grid. Each of these domains corresponds to a strategic focus that aims to increase the visibility, understanding, and flexibility of the electric power system. The logic behind these focus areas is that a modernized grid should be able to "see" an event or condition, "know" what is happening or about to happen, and "do" something appropriate in response – quickly and seamlessly. In addition to the overlap and interactivity among these three technical focus areas, there are many institutional factors (markets, regulations, policies, standards, etc.) that underpin and influence the success of R&D activities. The diverse institutional challenges associated with specific technical challenges must be addressed and integrated into any initiatives which support the three strategic focus areas.

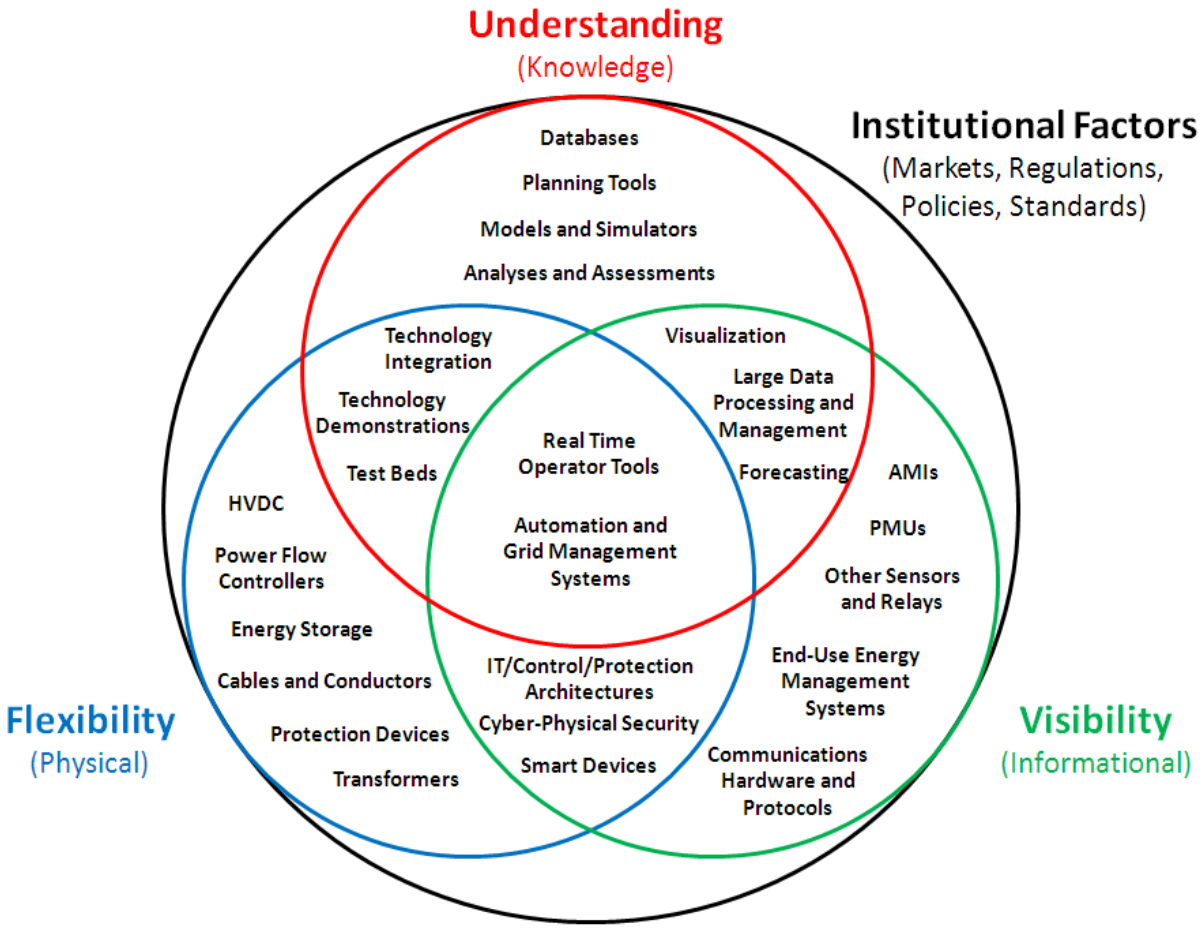

Figure 1 – Strategic Framework for Grid Modernization