

Summary of System Operations Group Findings

Hybrid System Workshop

3 April 2012

Outline

- Synthesis of topics discussed
- Focus on high-level gaps and R&D and analysis topics
- Many others were discussed and will be reported upon; however, time will be insufficient to include them in this presentation.
- R&D and Analysis focus on near-term needs

Modeling, Integration, & Optimization (1)

Microeconomic (AKA Techno-economic) Analysis (to guide investments in R&D)

GAP: Additional objective economic feasibility studies are needed

RESEARCH TOPIC: Analysis of inputs, outputs, and capital for the potential HES to assess opportunities and issues in multiple arenas:

- financial (e.g., levelized cost of energy),
- environmental (e.g., GHG emissions, fossil energy use, water use, land use),
- energy security,
- Social (e.g., jobs),
- political, and
- Economic

We will brainstorm on these issues this morning

Compare to baseline technologies

Identify near-term winners with today's incentives as well as long-term, high payoff opportunities

Modeling, Integration, & Optimization (2)

Technical Analysis

GAPS:

- Heuristics to prioritize and screen alternatives
 - Development of criteria
- Cultural and tool incompatibilities
 - Different industries need to come together but they have different bases for design and different systems analysis tools. Integrating those paradigms and tools will be challenging.
 - Multi-domain dynamic analysis is needed

RESEARCH TOPIC:

- Assemble stakeholders to develop criteria and identify heuristics (prioritize)
- Develop open computational tool set for analysis of the dynamic system

Life Cycle Assessment

GAP: Lifecycle analysis of each system

RESEARCH TOPIC: Review status of baseline technology and LCAs (identify where they are today to do a comparative)

Sociopolitical & Financing Challenges

Regulatory/ Licensing/Safety

GAP: Different regulatory and design codes for nuclear, electrical, and chemical industries

RESEARCH TOPIC: Identification of policy/regulatory conflicts and commonalities among the various agencies

Market Challenges

GAPS:

- Understanding of near versus long-term and what steps, especially near-term, are required to get commercial-scale experience
- Knowledge of the availability for retrofitting instead of new construction

RESEARCH TOPIC: Develop roadmap identifying technologies, piloting requirements, and possible evolution

Grid Management

Intermittent Generation

GAP: Need for stable output – how might HES be operated to stabilize the grid (responsive to changes in demand and variability)

RESEARCH TOPIC: Looking at HES in context of national grid management goals (relates to research bullet 1 above)

Electrical Power Transmission

GAP: Siting—using different resources, different products—how to optimize siting decisions

RESEARCH TOPIC: Computational/system model/matrix of the HES (providing the range of options) to increase understanding of how systems might meet goals even though adding systems increases complexity (regional basis)

Energy Storage/Batteries

GAP: Determining storage levels (capacity) and which technologies should be used, what is sufficient?

RESEARCH TOPIC: Sweet spot analysis of storage capacity versus system flexibility/response

System monitoring & control (instruments & operators)

Human Factors

GAP: Coordination between multiple control systems--interaction between the different systems

RESEARCH TOPIC: Preliminary investigation of current analogs – petrochemical plants or flight control systems

Instrumentation

GAP: Potential safety issues due to contamination

RESEARCH TOPIC: Identification of issues that require sensors (e.g., contamination or interferences) and or interpretive algorithms (e.g., diagnostics/ prognostics)

Dynamic System Modeling

GAP: Lack of ability to predict and model the interaction of the application of the various systems you are using

RESEARCH TOPIC: Develop open computational tool set for analysis of the dynamic system (**see above--repeat**)

Items of long term value, but not immediate R&D

Overcoming historic high mega-project failure rates

Assuring that pilot and demo scale projects provide useful full-scale info

Assessing safety consequences of process interactions, especially failures

Opportunities for phased construction (very different time scales for chemical vs nuclear projects)

