

**Hydrogen Systems Analysis Workshop
July 28-29, 2004 – Washington, DC**

FACILITATED DISCUSSION SESSION RESULTS

Session 1: What are the Key Questions That Analysis Should Answer?

- How can we develop and maintain a technical baseline for a high-risk technical program?
(We need objective systems management)
- Where should we invest our research dollars to maximize chances for success?
 - Success is more than simply meeting out technical targets – it's also creating *systems/products* that are commercial-izable
- Analysis should support our timeline for decision-making
- WHY should we invest in hydrogen?
- How much will it *cost* to develop the hydrogen infrastructure?
- We need to increase our analysis of *systems* vs. *technologies*
- Help answer questions form Congress – we can anticipate questions as well as answer past questions.
- Use analysis products to help create a *briefing book*
- Help to understand how we'll make the transition so that we can create a vision that people can understand
- Help define the right questions and *realistic targets*
 - Define cost factors and how these affect market penetration
 - What kind of flexibility is there in the targets?
 - What are the tradeoffs among cost factors
 - Base targets on analysis rather than assumptions
- Hydrogen fuel cell vehicle vs. competition – we need better comparisons with alternative technologies
- Clarify differences between hydrogen pathways and conventional pathways (include ethanol/hydrogen vehicles as integrating option)
- Need improved analysis of the role of other sectors in the hydrogen economy
- Analysis should help to understand how hydrogen fits into a *portfolio* of energy supply options that can help meet goals for reducing CO₂ (and other) emissions and reducing dependence on foreign energy supplies.

Session 2: Where are There GAPS or OVERLAPS on Hydrogen Systems Analysis?

- Need more analysis focused on *systems* vs. *technologies*
 - Modeling of complex interactions among pathways, sectors, etc.
 - Support to EIA models (hydrogen input to NEMS)
 - Is there a single modeling framework that will do this?
 - Ensure that safety/security costs are included in systems models
- Include some “non-traditional” companies in our brainstorming sessions on the hydrogen transition to get some fresh ideas for “out of the box” thinking

- Include more representation of the utility industry
 - get their input on costing, etc.
 - explore synergies between stationary and transportation sectors
 - find out how hydrogen has *already* been considered by utility companies
- Need a model of the overall energy systems that can predict impacts of all the technology options
- Strengthen connections in models between the vehicle needs and hydrogen production
 - Improve data transfer among the research communities
- Need to increase attention to *uncertainties* and better incorporate these into models
- Gather more input from stakeholders to help inform analysis
- Make tools robust enough to handle data for multiple scenarios
- Improve understanding of the global energy market and impacts on hydrogen penetration
 - Define the questions we want to answer and look at capability of existing models to address (e.g., MINI-CAM)
 - Need life-cycle modeling on all levels – global, national
- Establish *explicit* relationships between existing models and how they can support each other
- Need more analysis on stationary applications and how they can play a role in the transition
- Consider the “energy and water nexus” – how will a hydrogen economy impact water supply and demand?
- Safety analysis and costs should be a high priority since this is a potential “showstopper”
 - Safety analysis conducted by the Codes and Standards program needs to inform technoeconomic and systems analyses
- Need to increase efforts to *validate* models
- Need a structured technology planning process
 - Create for each technology area a “*targets requirements document*” that explains the assumptions for each target (like the Storage program has done)

Session 3: Development of Common Assumptions – Areas Where Common Assumptions are Needed

- **Create a *Data Book***, issued annually by the program, which would establish a common set of data/assumptions for use in analysis
 - Require all folks doing analysis for the program to use these data, at least in a reference case
 - Create a *reference case* that all models must run
 - Require that modelers make all their assumptions explicit in their publications and reference and characterize the analytical basis of the assumptions (i.e., is this validated data or not?)
 - Make the data book available on the web
 - Use RD&D Plan’s targets/assumptions
- Hydrogen purity, quality, characteristics
 - Pressure, composition, etc.
- Technology status (i.e., technology at what scale of manufacturing? -- hand-built or mass-produced?)

- Possible categories for assumptions include physical linkages among components and economics
- Establish priorities for *validating* key assumptions

Session 4: What are the Opportunities for Coordination?

- Create a Systems Analysis Working Group
 - Include the draft “Roles and Responsibilities Matrix” as a discussion item
 - Develop content needs for the Data Book
 - Help develop the Analysis Plan
 - Consider how all targets/milestones interact and coordinate
 - Provide for a routine exchange of information
- Develop mechanisms for linking different tools and models
 - Comment was made that this would require a big computer science effort, and further, that the effort might not be worth it if the life of the model is short
 - Standardize programming language or interfaces (I/Os) between models?
 - Consider how existing models can be tweaked to incorporate additional modeling needs
- Continue coordination between HY-TRANS and NEMS modelers
- Modelers should coordinate with the validation activities to get validated data for the models
 - Data from validation efforts should be widely disseminated
- Continue to coordinate R&D plans, milestones and development timelines among the offices – some concern that perhaps OFCVT and OHFCIT development timelines are not in synch
- OFCVT has expertise with PSAT on rolling vehicle component costs up to vehicle cost which may be useful with hydrogen systems analysis
- Consider setting up a formal review process for analytical efforts (to include all labs in comment chain)

Action Items (Technology Analyst and Systems Integration coordinate these)

- Create a *useful* matrix of key laboratory strengths and capabilities
- Create an inventory of available analytical *tools* – who developed, capabilities, cost (funding), status of validations, public availability, etc.
- Create an inventory of analysis *projects* – contractor name, scope, is a tool being created?, etc.
- Explore potential for forming a Systems Analysis Working Group
 - Labs should let Systems Integration know who should be the contact person from their lab
- Systems Integration will distribute to participants a soft copy of the full set of presentations from the workshop and a final list of participants with contact information.
- Technology Analyst and Systems Integration will develop and distribute a list of their action items, generated from the meeting