Macro-System-Model Overview: DOE H2 Analysis Workshop

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Outline

• Need for the MSM
• What the MSM will be
• Initial issues the MSM will address
• Status update
Need for a MSM framework

Current Situation:
• Numerous element models
• Transition modeling being developed
• NRC recommendation

Need for MSM:
• Support Systems Analysis, to help guide R&D
• Standardization of information transferred between element models
• Reduce resources needed for multi-model analyses
• Analyze interrelationships
• Provide results with different perspectives, concerns, and system envelopes
• Ease of updating information when new model versions become available

2005 EERE Multi-Year RD&D Plan
Barrier: Lack of a Macro-System Model. Although numerous models exist to analyze components and subsystems of an eventual hydrogen economy, a modeling architecture does not exist that addresses the overarching hydrogen fuel infrastructure as a “system.” Such a macro-system model is critical to assessing the transition from the existing energy infrastructure to one including hydrogen. Individual models spanning a wide range of modeling platforms (operating systems, software, inputs, outputs, boundary conditions, etc.) must be integrated into a common macro-system model.
Key Issues for the MSM to Address

R&D

- ID critical / risky links in potential hydrogen pathways?
- Are the current technical targets the best ones? What interdependencies do they have?
- How should components and interfaces be optimized?

Transition

- Compare potential transition pathways.
- ID stumbling blocks that could affect transition paths? Could R&D overcome them?
- What impacts could competing technologies have on transition?

Financial

- What effects could policy and incentives have on transition?

Environmental

- How / how much does a hydrogen economy affect the environment?
What Will the MSM be?

- Tool and framework that links existing and emerging engineering-domain models
- Focus: Evolution and performance of infrastructure
- Used to support decisions regarding programmatic investments
- Use distributed architecture to link existing/emerging models that analyze individual elements
High Level Architecture (HLA)

A type of distributed architecture that will integrate and utilize existing and emerging component models to every extent possible.

Share standard inputs, credible/documented data, and outputs that can be used by the economic/market model and program model domains.

- Hydrogen Production Models
- Refinery Model
- Distribution Location Models
- Distribution Cost Models
- Consumer Demand Models
- Fuel Cell Cost Models
- Gasoline Vehicle Cost Models
- Vehicle Selection Model
- Environmental Performance Model
Initial Issues the MSM Will Address

**R&D**

- ID critical / risky links in potential hydrogen pathways?
- Are the current technical targets the best ones? What interdependencies do they have?
- How should components and interfaces be optimized?
- ID stumbling blocks that could affect transition paths?
- Could R&D overcome them?
- What impacts could competing technologies have on transition?
- What effects could policy and incentives have on transition?

**Financial**

- Comparison of hydrogen costs at the pump using different hydrogen production technologies.
- How much hydrogen needs to be produced to supply a given city its demands?
- What are the raw material needs to meet those demands?

**Environmental**

- How / how much does a hydrogen economy affect the environment?
- What is the emissions profile if hydrogen is produced to meet a given city’s demands?
- Compare potential transition pathways.
- ID stumbling blocks that could affect transition paths? Could R&D overcome them?
- What impacts could competing technologies have on transition?
Status Update

Currently Linking

- Information that needs to be transferred has been identified
- A linking workbook has been developed
- Links need to be reviewed by model developers
- Sandia has developed method to transfer data from a linking spreadsheet to models
- Need a method to transfer data from models
- Need a method to launch VBA macros in models
Conclusions

• The MSM is needed for cross-cutting and transition analysis.
• The MSM will use High Level Architecture to provide an interface between models.
• Initially, the MSM will be used to compare production/delivery pathways’ costs, raw material requirements, and emission profiles.
• The initial linking process is underway.
Questions