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
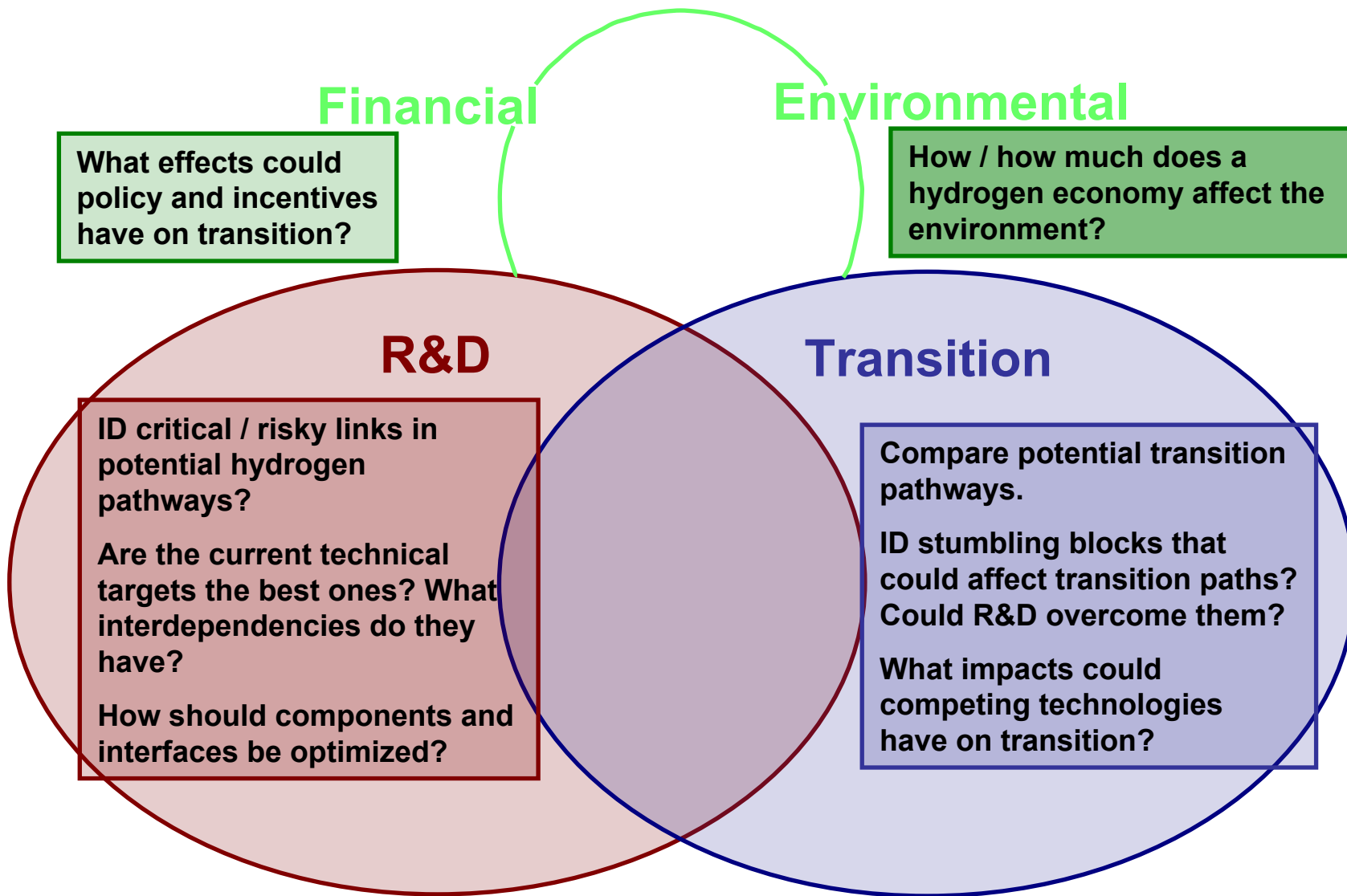- Transition modeling being developed
- NRC recommendation

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

Financial

What effects could policy and incentives have on transition?

Environmental

How / how much does a hydrogen economy affect the environment?

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?
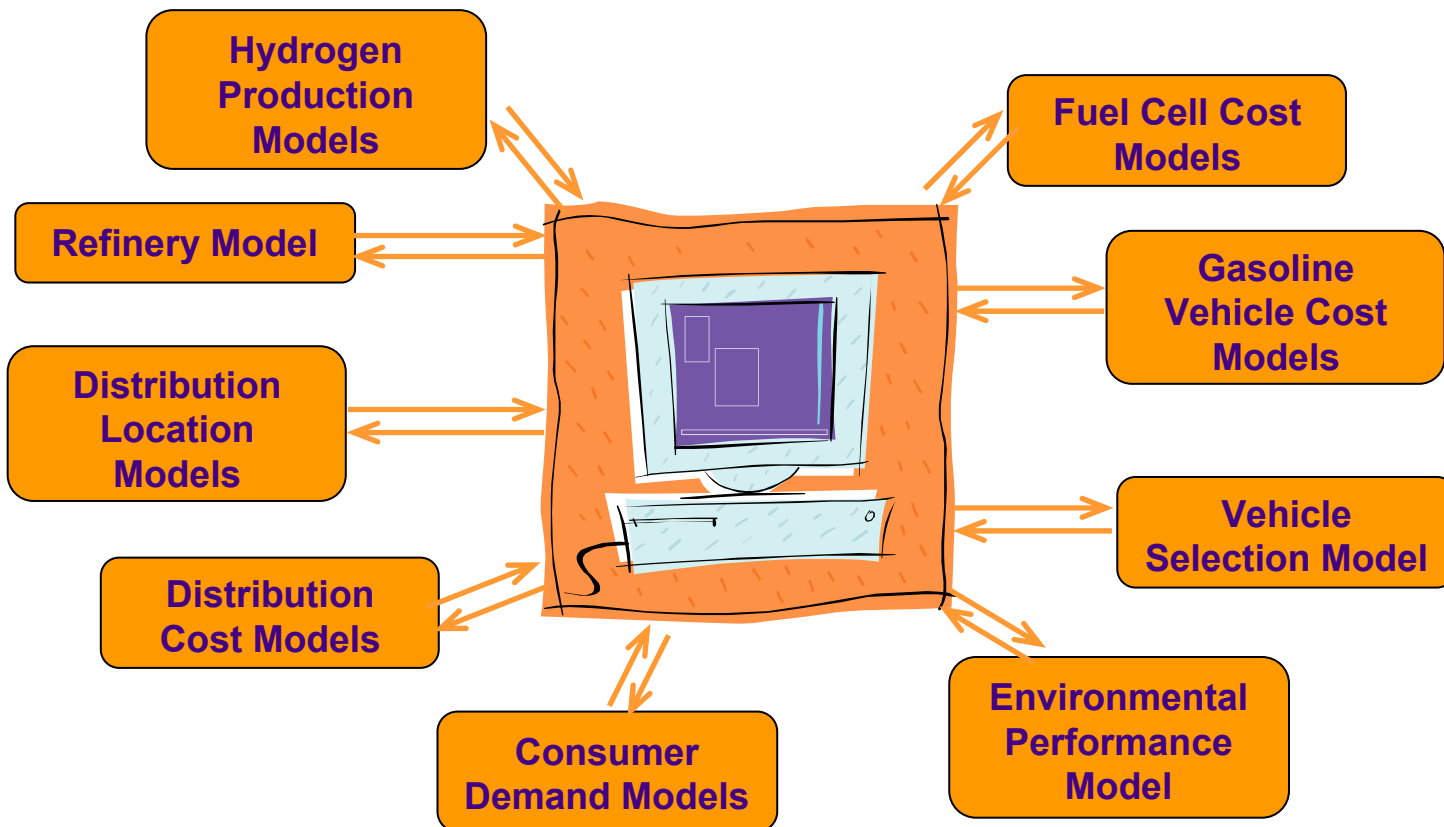
What Will the MSM be?

- **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**
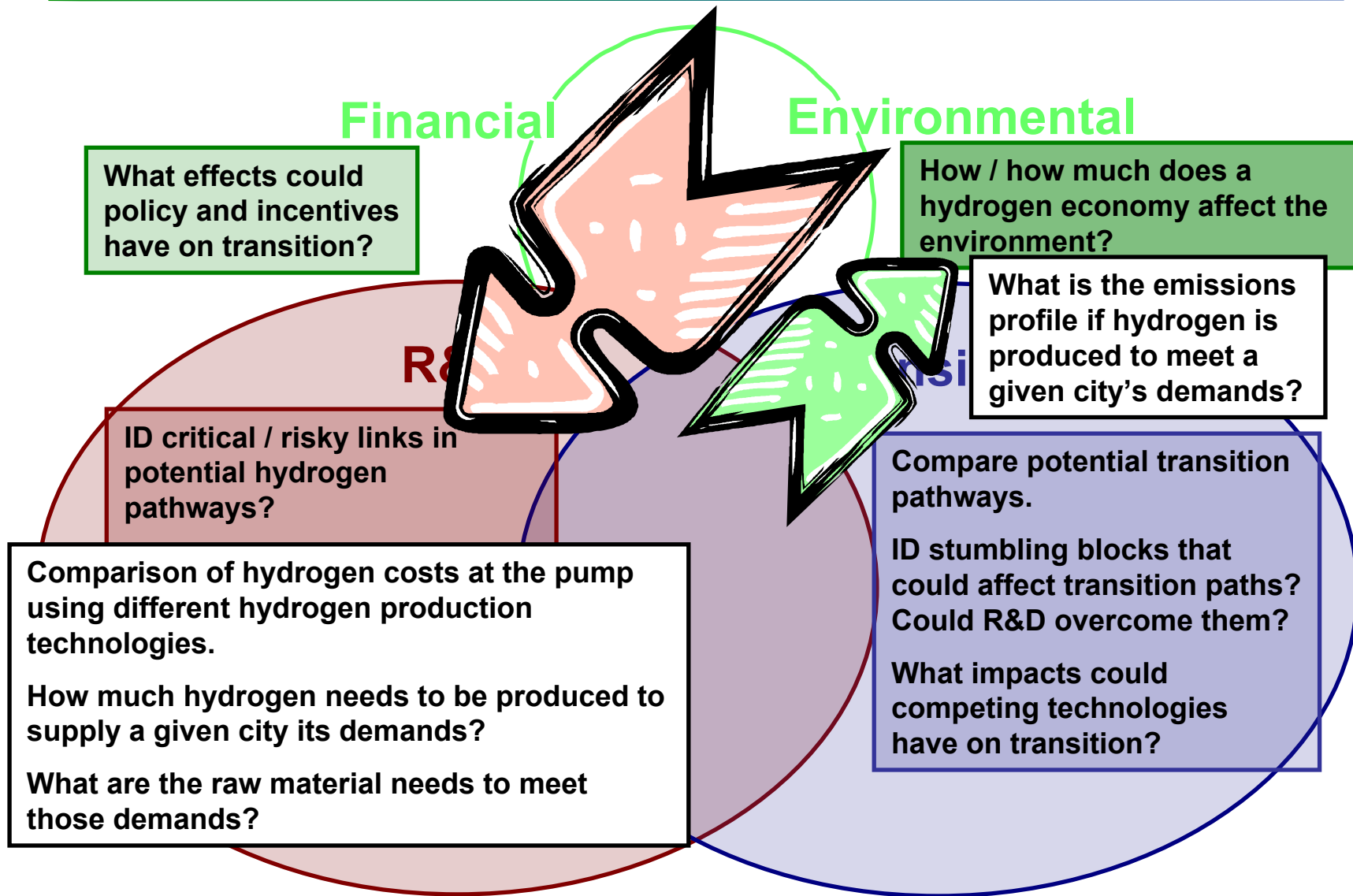
High Level Architecture (HLA)

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
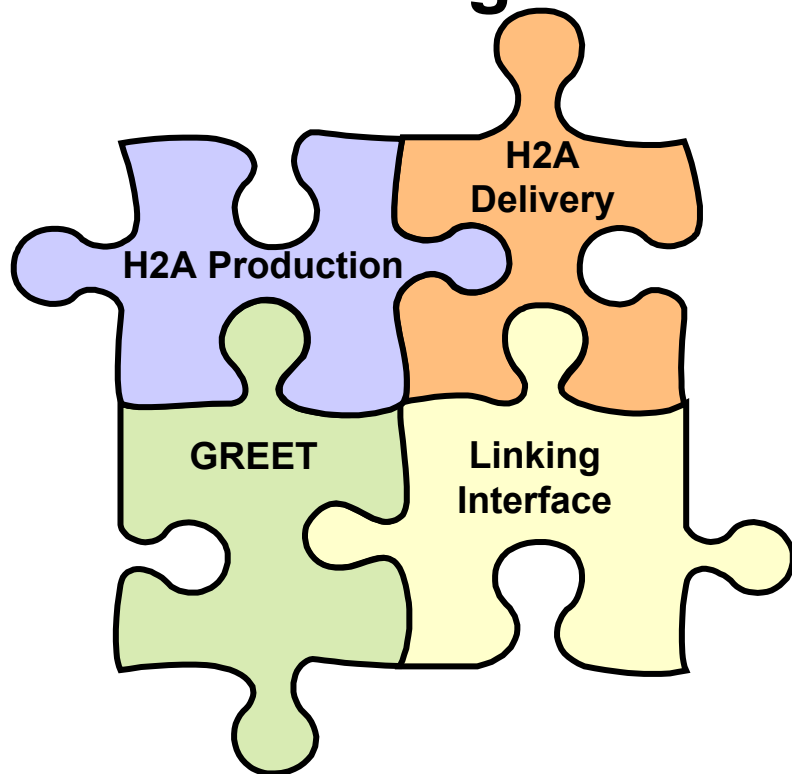

- Hydrogen Production Models
- Refinery Model
- Distribution Location Models
- Distribution Cost Models
- Consumer Demand Models
- Fuel Cell Cost Models
- Gasoline Vehicle Cost Models
- Vehicle Selection Model
- Environmental Performance Model

Initial Issues the MSM Will Address

Financial

Environmental

R&...

What effects could policy and incentives have on transition?

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?

ID critical / risky links in potential hydrogen pathways?

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?

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?

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.**