Multi-Path Transportation Futures Study: Workscope Discussion 1/26/2006

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The study responds to:

- EERE Senior Management request: **Integrated analysis of EERE's vehicle-and-fuel-related technologies and how they can leverage each other in the short- and long-term. Inclusion of tar sands and oil shale is desired.**
- Also, National Academy of Sciences has called for an assessment of pathways other than hydrogen that can yield similar outcomes (low oil use and low carbon emissions)
- Two phases, with Phase I essentially a scoping study with modest resources

Tasks (and estimated completion dates)

1. Identify review panel (Jan)
2. Select Phase 1 pathways (Feb)
3. Develop criteria and measurement methods for Phase 1 (Feb)
4. Develop alternative to the Base Case Scenario for Phase 1 (March)
5. Develop vehicle market penetration rates and start dates for Phase 1; ditto for fuel production (March)
6. Develop vehicle fuel economy estimates for Phase 1 (April)
7. Collect other information for pathway analysis for Phase 1 (April)
8. Analyze the selected pathways for Phase 1 (June)
9. Write Phase 1 report (July)
10. Develop Phase 2 Analysis Plan (June)

Task 1: Develop a formal review panel and identify experts who can contribute to study

Review panel will:

- Provide *both* technical reviews *and* assistance in gathering information on specific technologies and fuels
- Play a significant role in the development of the analysis plan for Phase 2

Review panel candidates

- Chairman: Phil Patterson, PAE
- Jeff Dowd, PAE
- Tien Nguyen, PAE
- Fred Joseck, HFCIT Program
- Lee Slezak, FCVT Program
- Neil Rossmeissl, BP Program
- Lynn McLarty, TMS, PAE Center
- Doug Arendt, NREL, PAE Center

Experts: people who can provide information for use in this study and may wish to provide reviews of various aspects of the study

Potential Experts and/or Sources of Information for Study

- Walter Short, NREL, Plug-in HEVs and Wind Energy
- Laboratory Working Group Energy Science & Technology Portfolio Assessment
- NETL study of alternate pathways to reduce petroleum consumption and GHG emissions
- Etc.
- Suggestions welcome

Task 2: Select Phase 1 Pathways

Vehicle types:

- Advanced conventional (gasoline, diesel)
- HEVs (gasoline, diesel, flex-fuel, plug-in)
- FCVs

Fuels to be examined:

- Gasoline & diesel
- Ethanol
- Hydrogen
- Electricity

Sources:

- Biomass (for liquid fuels)
- Tar sands (for diesel, possibly some gasoline)
- Coal with sequestration, possibly with some gas (for liquid fuels)
- Mixed (for hydrogen and electricity)

Task 3: Develop criteria and measurement methodology for Phase 1 (Bold will definitely be done in Phase 1)

- **Oil savings**
- **Carbon emissions reductions**
- **Criteria pollutant reduction**
- **Ease of adapting existing vehicle refueling infrastructure**
- **Technical risk**
- Potential to penetrate all major LV market niches
- Cost
- Potential for large stranded assets
- Potential strain on feedstock resource, price escalation
- Vehicle ability to use multiple fuels
- Etc.

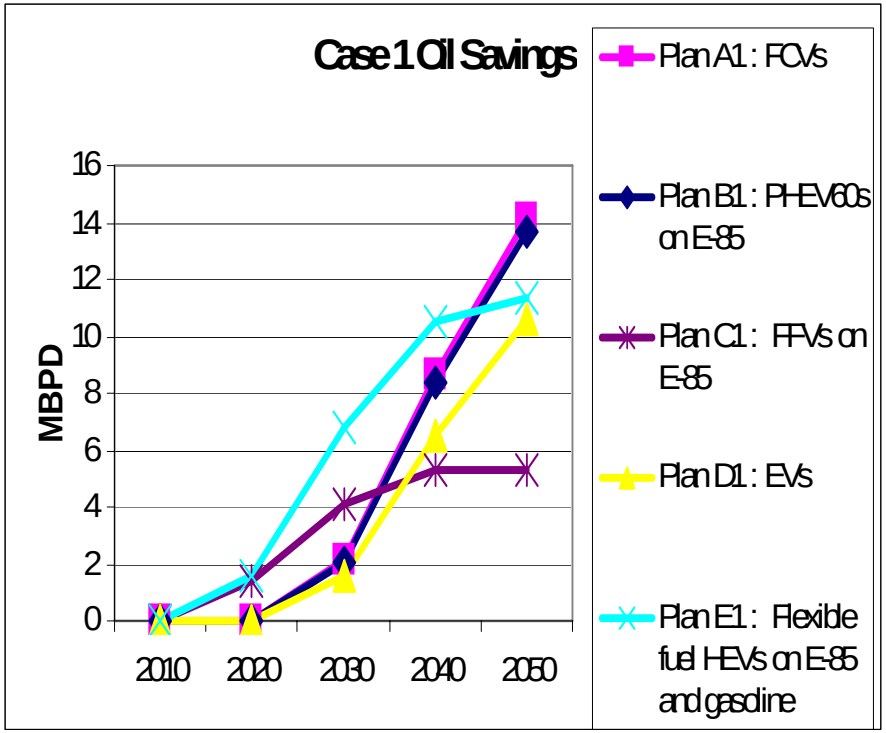
Task 6: Develop Phase 1 fuel economy estimates for the vehicles

- BASIC PHILOSOPHY: Compare vehicles on a level playing field
  - (Includes same glider for all pathways)
- Hydrogen Fuel Cell vehicles: Program's drivetrain requirements demand very large improvements over time
- Implication: for a level playing field, drivetrains using liquid fuels should be very advanced (HCCI engines, continuously variable transmissions, hybrid drivetrains)
- However, may also want to include vehicle fuel economies that can be achieved at less technical risk
- For Phase 1, need to rely on available drivetrain analysis, e.g. GPRA (based on PSAT), other sources

Task 8: Analyze the selected pathways

- Feed vehicle penetration and fuel production estimates (Task 5), fuel economies (Task 6), and fuel cycle GHG emissions (Task 7) into VISION for **total fleet oil use and carbon emissions**
- For other criteria (criteria emissions, technical risk, ease of adapting infrastructure), use qualitative analysis based on literature review, expert advise, semi-quantitative analysis

Sample results



VISION Model Is Publicly Available

- Excel spreadsheet model
- Publicly available at http://www.transportation.anl.gov/software/VISION/index.html
- Includes published report describing model

Inputs required/desirable for VISION runs for Multi-Path Study

	Start date	2010	2020	2030	2040	2050
For each vehicle and vehicle fuel technology (by car and LT separately)						
% market penetration (sales)	?	?	?	?	?	?
Fuel economy relative to baseline CV (2 for PHEVs)	?	?	?	?	?	?
For PHEVs:						
% VMT on electricity	?	?	?	?	?	?
For fuels, resource fuels						
Share (percent)						
For gasoline:% conventional petroleum, ethanol blend, tar sands, coal	?	?	?	?	?	?
For diesel, % conventional petroleum, F-T, tar sands, coal	?	?	?	?	?	?
For E-85, % from corn	?	?	?	?	?	?
For H2, % distributed (electricity and natural gas) and % centralized production (by resource fuel)	?	?	?	?	?	?
For electricity, resource fuel by %	?	?	?	?	?	?
Estimates of maximum volumes that can be technically produced over time (e.g., gallons, metric tons)						
Ethanol	?	?	?	?	?	?
Liquids from tar sands	?	?	?	?	?	?
Liquids from coal	?	?	?	?	?	?
H2 from various sources	?	?	?	?	?	?
Other	?	?	?	?	?	?

Task 10: Develop analysis plan for Phase 2

- More pathways
- More criteria, with more extensive quantitative analysis
- Use of NEMS, MARKAL to evaluate interaction with overall economy
- “Integrated analysis”/”how they can leverage each other” – not clear except for interaction between fuels and vehicle technologies.
- Needed budget and milestones
- Possible Phase 3