

TRANSITION STRATEGIES

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TRANSITION STRATEGIES



- **January 26, 2006:** Meeting to introduce DOE analyses to be conducted
- **July, 2006:** Review of preliminary results
- **November, 2006:** Public symposium
- **March, 2007:** Draft report to National Research Council



TRANSITION STRATEGIES



National Research Council Report on the Review of the FreedomCAR and Fuel Partnership

Fuel Cells and Hydrogen Storage

- For fuel cells, durability and cost are the most difficult goals
- For hydrogen storage size, weight and cost are the most difficult issues

Hydrogen Fuel Production and Distribution

- Pay special attention to the transition to a nascent hydrogen economy
- Analyze cost goals that are appropriate for the transition
- Significant development efforts should be directed to distributed hydrogen production

Electrochemical Energy Storage

- The development of high-energy batteries would increase the efficiency of advanced hybrid electric vehicles and fuel cell vehicles and accelerate the deployment of plug-in hybrid vehicles

These scenarios are provided for transition analyses as recommended by the National Research Council to evaluate the transition phase and do not represent any specific policy recommendation₃



TRANSITION STRATEGIES



Roles of the Federal Government and Industry

- For this relationship to work, the program's pre-competitive research must be adopted by the industrial partners
- DOE should analyze the implications of alternative market interventions for the technical goals of the Freedom CAR and Fuel Partnership.

FreedomCAR in the Policy Context suggested by NRC

- Cap-and-Trade Programs
- Motor Fuel Taxes
- CAFÉ Standards
- Subsidies

Other Prior Congressional Programs

- Vehicle tax credits to public
- Fuel tax abatements
- Federal government early buy down programs
- Investment tax credits

State Program

- ZEV Mandate

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TWO STRATEGIES



Research and Development- MYPP

- 100% Penetration, Business Model and Transportation sector.

Transition

- Partial Penetration over 10-20 years, Policy Options (Federal and State) and Transportation and Electric Generation Sectors.

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VALIDATION PROGRAM



The Validation Program is a Window on Transition Options.

- Natural Gas → Hydrogen
- Biomass → Hydrogen
- Distributed Coal / IGCC → Hydrogen
- Compressed Gas and Liquid Storage
- Electrolysis
- Compressed Gas Delivery
- Cold Gas Delivery and Liquid Delivery
- Co-Production of Hydrogen and Electricity
- Power Take-Off

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TRANSITION STRATEGIES



Focus on near-term nascent hydrogen economy

Stage 1:

- Forecourt
- Cluster or network from mid-size plant
- Use existing infrastructure
- Investigate liquid delivery systems

Stage 2:

- Nascent interconnect system

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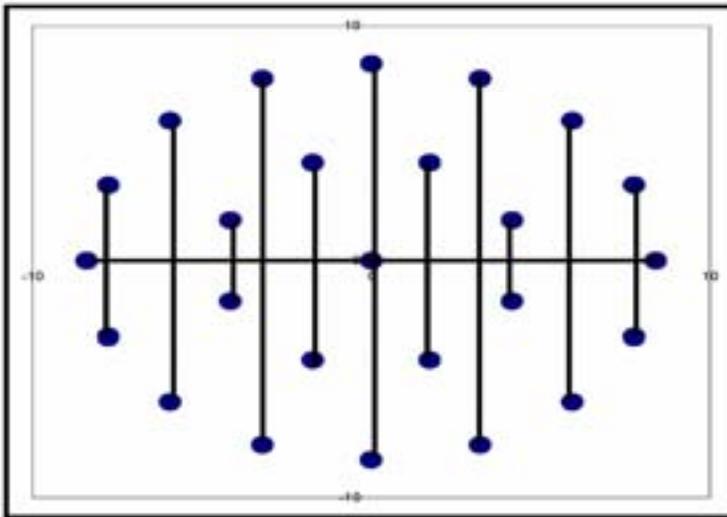


Distribution System Layout for Idealized Cluster=> lengths, costs

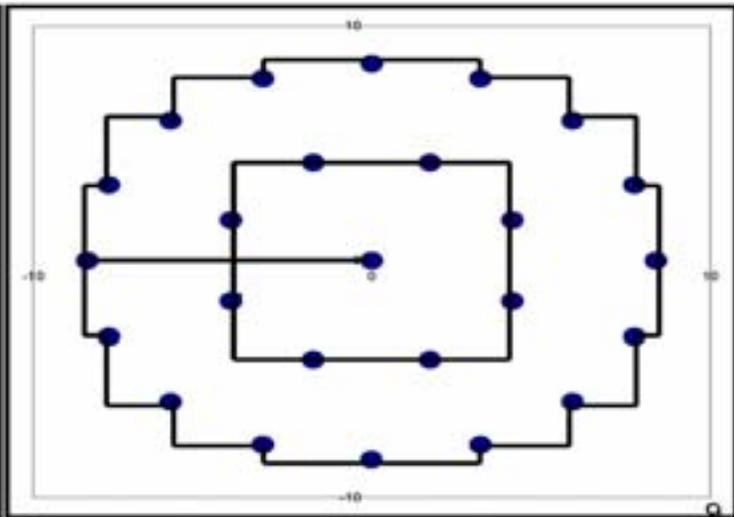


Distribution System Layout for Idealized City => lengths, costs

Truck delivery



Pipeline



Proposed Hydrogen Fueling Stations in Relation to USPS Facilities



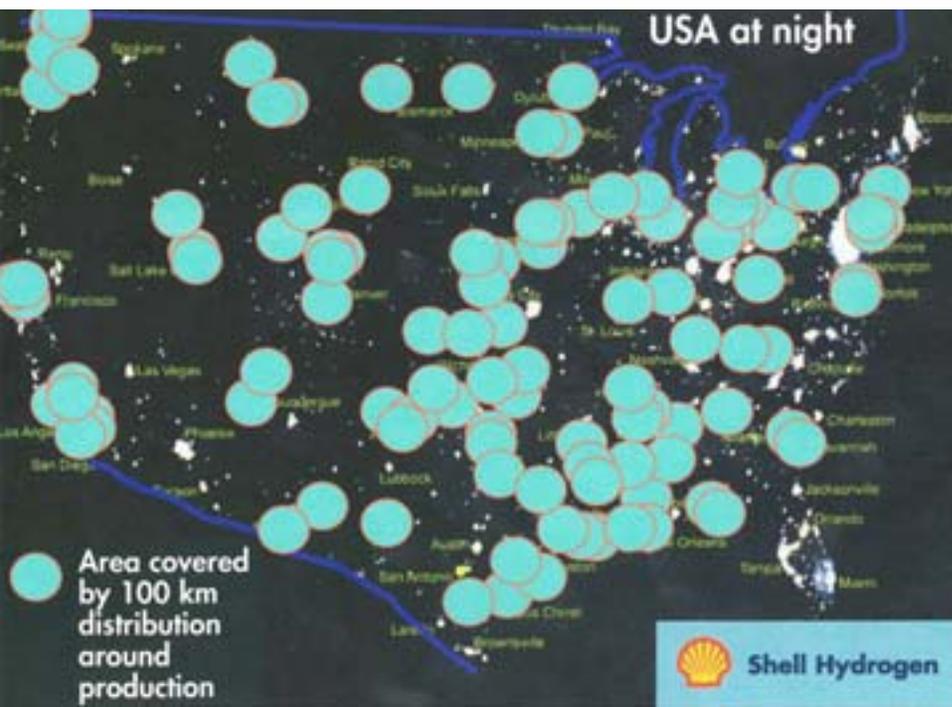
- Proposed Hydrogen Fueling Stations
- USPS Facilities



Areas Within 30 Miles of Gasoline Depots and Proposed Hydrogen Fueling Stations

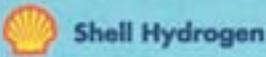


60% of the proposed H2 stations are within 30 miles of gasoline depots...



USA at night

Area covered by 100 km distribution around production



USA at night

Area covered by 100 km distribution around refinery





Market Penetration Scenarios

The following scenarios represent the estimated penetration of hydrogen fuel-cell vehicles (HFCV) given different government incentives:

A. Introduction strategies following “Hydrogen Fuel Initiative”:

Option 1: In 2015 HFCVs are introduced into the market. The government introduces a program to support the introduction of *thousands* of vehicles per year and by 2018 the government supports the introduction of *tens of thousands* of vehicles per year. This option is expected to have a market penetration of 1.8 million HFCVs by 2025.

Option 2: Same as option 1, but the government supports the introduction of *hundreds of thousands* of HFCVs by 2018. Expected market penetration for this option is 3.4 million HFCVs by 2025.

B. Early Introduction Strategy:

Option 3: The government supports the introduction of *thousands* of HFCVs by 2012, and *tens of thousands* by 2015 and by the *hundreds of thousands* by 2018. This strategy is expected to have a market penetration of 5.0 million HFCVs by 2025.

Option 4: The government supports the introduction of *thousands* of HFCVs by 2012, and *millions* by 2021. Expected market penetration is 10.0 million by 2025 with support for multiple OEMs and multiple vehicle models.



Market Penetration Scenarios

Government Support - Program Options (in thousands of vehicles)

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total
Option 1				5	5	5	60	60	100	200	200	240	500	500	1.8M
Option 2				5	5	5	200	200	300	400	500	500	600	700	3.4M
Option 3	5	5	5	60	60	60	200	300	400	500	600	700	1000	1100	5.0M
Option 4	5	5	5	60	100	150	300	500	750	1000	1200	1500	2000	2500	10.0M

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