Hydrogen and Fuel Cell Technical Advisory Committee (HTAC)

Washington, D.C.
9 January 2007

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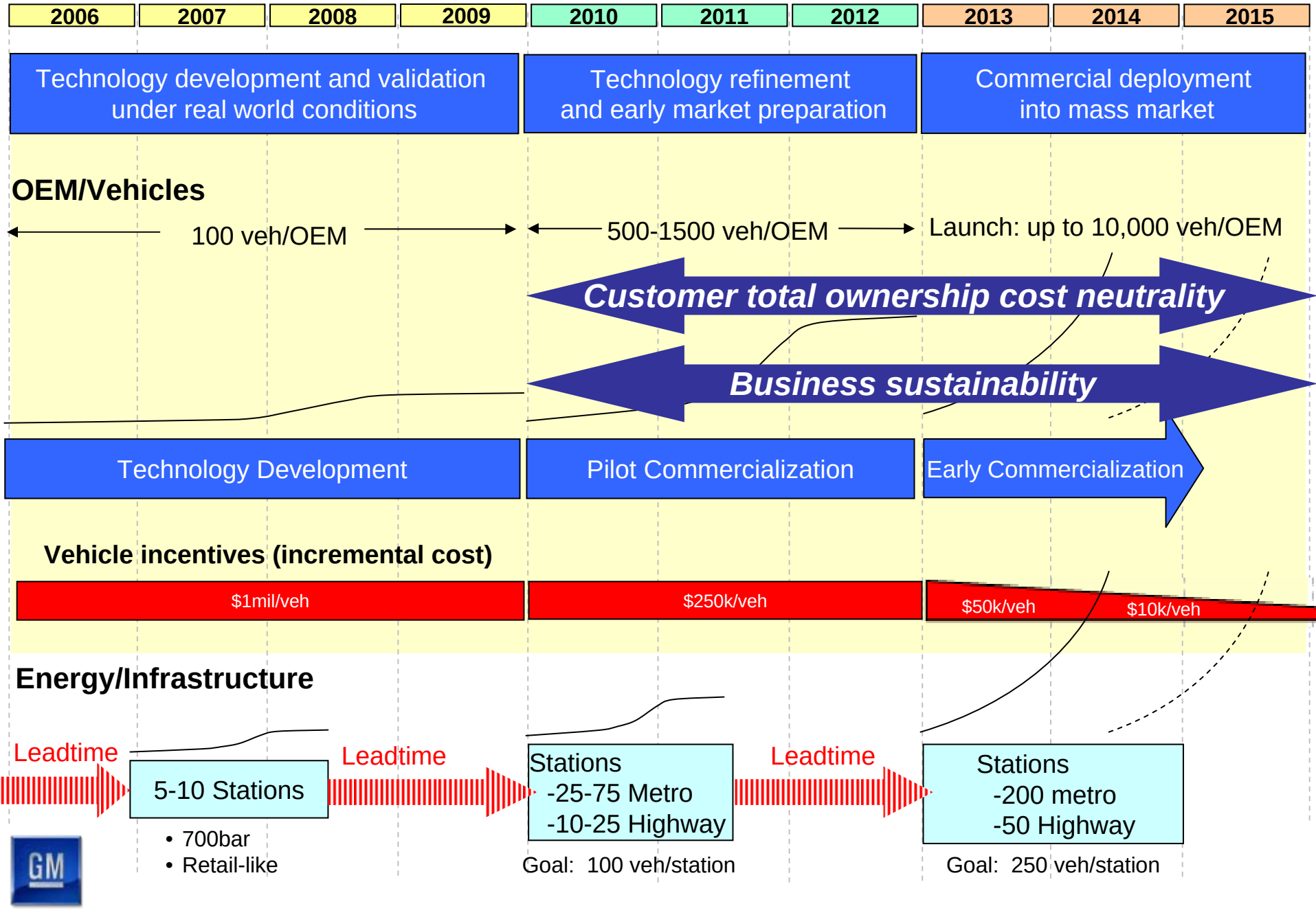
GM Fuel Cell Activities

Pathway to Commercialization (ad hoc industry group perspective)



Fundamental Enablers to Successful FCV Commercialization

Underlying all barriers!

1. Strong leadership of a clear national energy strategy

   Consistent/persistent support of alternative fuel program

   - Pathway to diversity and renewables; role of hydrogen

     → addressing energy security, energy/grid vulnerability, environment
   - Industry confidence in government's commitment to/potential of hydrogen
   - Public confidence in hydrogen safety and benefits through education

2. Sustained, long term, compelling incentives

   Overcoming near term and longer term business risk

   - Substantial incentives for automakers, suppliers, infrastructure, customers
   - Early demand development – government as a customer

3. Coordinated vehicle / infrastructure market introduction

   - Geographically concentrated market regions
   - Vehicle and Infrastructure deployment coordination

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Current Barriers

- Station Siting, Permitting & Liability Exposure
- Station Equipment and Footprint (storage and compression)
- Hydrogen Quality & Purification
- Supply Base Development
- Vehicle Use Restrictions
- Codes & Standards
- Public Confidence

Address Current Barriers

- Station Siting, Permitting & Liability Exposure
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Necessary

Fundamental Enablers

- Clear national energy strategy
- Compelling incentives
  - → Government as a customer
- Coordinated vehicle / infrastructure market introduction

Sufficient

We Know:

- **What the barriers are**
- **What is needed**

We Need:

- **How to address (action plan)**
  - **Who (public/private players)**
  - **What resources**
  - **What funding**
  - **How (mechanisms)**
  - **Roadmap/timeline**

HTAC Sub-Committee should focus on how to address identified barriers to successful FCV commercialization

Current Barriers to Successful FCV Commercialization

Station Siting, Permitting & Liability Exposure

- Define a mechanism to limit the liability of all refueling station participants (drivers, OEMs, energy companies, hydrogen suppliers) to ease station access concerns and expedite refueling agreements (consider shared liability through a government funded limited liability pool)
  - Critical for 700bar as there is less experience
  - Includes availability of affordable insurance
- Allocate government/public property to site retail-like fueling infrastructure
  - i.e. commercial-like refueling at a federal, state, or city site such as City of Burbank
- Identify government mechanisms (incl. funding) to incentivize communities to accept H2 refueling/vehicle service sites (address NIMBY and WIIFM)
- Harmonize station permitting processes at the state and local level to ensure that permitting officials/processes adhere to a common baseline to eliminate interpretation and variability (coordinate federal, state & local hydrogen permitting processes) - e.g. develop a state standard and incentivize local jurisdictions to implement (not to exceed)

Current Barriers to Successful FCV Commercialization

Station Equipment and Footprint (storage and compression)

- Develop and validate storage and compression designs that can be installed in conventional/practical fueling station footprints
- Fund efforts to develop solutions and demonstrate safety and cost-effectiveness of elevated and below ground hydrogen storage – liquid or compressed
- Fund efforts to develop solutions for reducing required setback/separation distances at fueling stations between equipment, buildings and station perimeter by developing and demonstrating alternative barriers and shieldings
- Fund efforts to improve compression technology to minimize on-site hydrogen storage challenge
- Reassess requirements for stationary storage, including 700bar composite storage, by increasing funding of test/validation in order to safely accelerate approval

Current Barriers to Successful FCV Commercialization

Hydrogen Quality and Purification

Total cost of ownership of a hydrogen fuel cell vehicle is achieved by the right balance between fuel cell stack durability/cost and the quality/cost of hydrogen delivered to the vehicle:

- Establish sufficient funding of hydrogen quality efforts that increase understanding of the effect of impurities on fuel cell stack life
- Fund efforts to develop cost-effective hydrogen purification technology for gaseous hydrogen dispensing
- Fund efforts to develop cost-effective hydrogen quality measuring devices to ensure hydrogen quality at the station

Current Barriers to Successful FCV Commercialization

Supply Base Development

OEM and infrastructure component and equipment suppliers do not have the financial wherewithal or incentive to deal with the business risk associated with the development and introduction of hydrogen and fuel cell vehicle components.

- Creatively incentivize development and early capacity investment without traditional cost-share for high-risk/high-priority technologies required in PEM fuel cells, hydrogen storage (including 700bar) and refueling infrastructure

Current Barriers to Successful FCV Commercialization

Codes & Standards

Development and approval of C&S related to hydrogen must be accelerated – without them, progress is slow, unpredictable and often unsuccessful. But C&S can only be written once there is a thorough understanding of the technology and sufficient safety demonstration/validation and experience:

- Fund all technology development and test/validation efforts that are needed to support the development of C&S (some examples provided earlier)
- Encourage the development of interim requirements/standards (ensure regulators adopt only finalized ANSI-approved codes/standards)
- Test and validate vehicle storage technologies as basis for standards formulation; accelerate NHTSA efforts to establish fuel cell vehicle crash requirements and fuel and electrical safety requirements through leadership of UN Global Technical Regulation (GTR) process

Current Barriers to Successful FCV Commercialization

Vehicle Use Restrictions – Complexities of interpreting local regulations

- Incentivize (education and eligibility for federal funding) local authorities having jurisdiction over bridges, tunnels and highways in key vehicle deployment areas (e.g. NYC) to allow passage by hydrogen vehicles (i.e. just like gasoline-fueled vehicles)
- Incentivize local authorities to adopt only ANSI-approved codes, standards and guidelines to ensure that hydrogen vehicles can be parked in public and home garages and parked/serviced at dealerships and other service facilities.

For example:

New York City area - multiple local authorities have jurisdiction over bridges and tunnels (e.g. NY/NJ Port Authority)

- **Hydrogen vehicles currently not allowed per NY/NJ Port Authority regulation.**
- **Bridges/tunnels under other jurisdictions not yet clear to us.**

NYC Bridges and Tunnels

Refueling Infrastructure: What is Needed Today?

- Access to all existing stations
(e.g. all DOE, AQMD, … and including reasonable liability terms in agreements)
- Retail-like refueling stations in locations where automakers want to put vehicles (geographically targeted regions)
- 700bar fast-fill refueling capability
- Local official and community support of all proposed stations
- Reliable and expedient permitting process
- Favorable tax policy on hydrogen as a fuel
- Compelling incentives for infrastructure providers, suppliers and customers

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