Vehicle Electrification—An International Perspective

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June 30, 2011
Presentation Overview

- The ICCT Electrification Study
  - www.theicct.org/2011/03/vehicle-electrification-policy-study
- Key Findings on EVs and update on California, US, China
- Context for Today’s Discussion
ICCT Electrification Study

- **Purpose**
  - Inform the pending update of CA Zero Emission Vehicle Program
  - Primary focus is battery electric and fuel cell vehicles (not plug hybrids)

- **Four Tasks Completed**
  - Technology status, metrics, complementary policies, international lessons learned

- **Research**
  - Comprehensive review of recent studies
  - Meetings in Germany, France, UK, China, US
Key Findings
Unprecedented Global Interest in Vehicle Electrification

2006

Who Killed the Electric Car?
A documentary about electric cars, hybrids, hydrogen and the future of transportation...

Buy the DVD

2011

REVENGE OF THE ELECTRIC CAR
Drivers for Global Interest

- **Government**
  - Industrial policy, energy security, climate, air quality
  - Top-down policy push from political leadership

- **Automakers**
  - Gain first mover advantage in emerging market
  - Avoid falling behind in technology

- **Customers**
  - Pent-up demand from early adopters
Costs Declining, But Remain High

- Costs declining for fuel cells and batteries
- Commercialization prospects still uncertain
- Continuum of powertrains likely

Source: General Motors presentation to Hydrogen Technical Advisory Committee
Need to Plan for “Second Wave” Customers

- Initial rollouts well underway
  - Government incentives
  - Manufacturer investment
  - Waiting lists for early models

- “Second wave” customers are risk averse, new emphasis needed
  - Reliability
  - Resale value
  - Range
Infrastructure

- Public hydrogen refueling needed
- Evaluate use of initial plug-in infrastructure rollout before committing to additional public chargers beyond those already planned
Green Energy

- Increasing renewables increases GHG and air quality benefits
- California renewable electricity standard (RES) includes electricity for plug-ins
- Voluntary options for additional renewables, potential marketing advantages
California, US, China
California Regulatory Program

- **ZEV Mandate**
  - Requires large volume manufacturers to place increasing percentage of ZEVs in CA

- **PV Greenhouse Gas Standards**

- **Low Carbon Fuel Standard (LCFS) & RES**
  - LCFS credit amount based on electricity and hydrogen upstream production emissions

- **Cap-and-Trade**
  - Upstream PV emissions in 2012, tailpipe in 2015
ZEV Mandate “Value Added”

- Uniquely able to sustain progress during uncertainty and market challenge
  - Sets binding mid term deployment targets
  - Transitional push, ultimate goal is fleet average

- Incentivizes all platforms
  - BEVs, FCEVs, PHEVs

- CA policy portfolio focused on environmental outcomes
  - ZEV, tailpipe standards, LCFS, RES
California EV Support

- Hydrogen infrastructure
  - 31 hydrogen fueling stations built or under construction pursuant to the California Hydrogen Highway program
  - $53 million over several years for hydrogen infrastructure under the California AB 118 program

- Plug-in purchase incentives
  - $5,000 per vehicle (will decline in 2011-2012)
Other CA Activities of Interest

- Fuel Cell Partnership
- Plug-In Electric Vehicle Collaborative
- Public Utilities Commission Infrastructure Proceedings
- Incentive Programs
- DriveClean Website (Buyers’ Guide)
US Program

- **Goal**
  - 1 million cumulative PHEVs by 2015
- $4.4 billion manufacturing grants/loans for BEVs, PHEVs
- Up to $7,500 federal purchase incentive plus some state incentives
- About 20,000 federally funded charging stations plus some state funded
Chinese Program

- **Goal**
  - 100,000 BEVs in Beijing by 2015
  - 5 million cumulative EVs/PHEVs by 2020
  - 1 million EVs/PHEVs annually in 2020
  - 20% to 30% market share by 2030
Chinese Program

- **Incentives**
  - CNY100 billion ($15 billion) earmarked over 10 years for research and development for new energy vehicles and components
  - National deployment incentives of $8,800 for a 20 kWh BEV and $6,600 for 15 kWh PHEV
  - CNY30 billion ($4.4 billion) over 10 years for infrastructure
  - Regional deployment incentives can double purchase incentive
  - Many pilot projects underway
Context for Today’s Discussion
EU in Context of Global Market

- Roland Berger (high case)
- Deutsche Bank
- Boston Consulting Group (mid case)
- J. D. Power
- Advanced Automotive Batteries
Upstream Emissions Increasingly Important

- Policies for startup phase may not be appropriate for mature program
- As vehicle numbers increase...
  - Treatment of upstream emissions becomes more important
  - Incentives may not be workable or sustainable
Projected Emissions, 2015

EU 2015 grid = 409 g/kWh; upstream emissions for ICE @ 12%
Projected FCEV Emissions, 2020

Daimler B-cell

- Wind electrolysis
- Coal w/CCS
- Coal w/out CCS
- CA grid - 33% RPS
- Natural gas - distributed
- Natural gas - central liquid

\[ g \text{ CO}_2/\text{km, NEDC cycle} \]