

Resources for the Future

The Role of the States in Federal Climate Legislation

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Washington, DC

Transportation – State and Federal GHG Reduction Options

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Key Points

1. Federal leadership; single national FE standard needed
 - Cannot accept patchwork of standards
2. Industry needs certainty for effective product planning
 - Long term approach with long term goals important
 - Consideration of lead-time is critical for industry
 - Phase-in of stringency levels
3. Sustainable market incentives needed
 - It is very clear that market (customers) will not pay incremental cost for technology
 - Role for Federal government to assist states

Where We Are Today

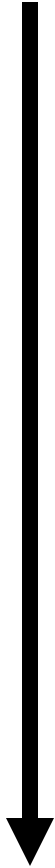
- For many years, nothing substantive has happened at Federal level on motor vehicle fuel efficiency requirements
 - CAFÉ has had an impact, but it reached a stringency plateau and no substantive market incentives have existed to complement significantly greater stringency
- Nation needed a kick start – California has helped move that process along
 - Regrettably, attorneys and our courts, not engineers and scientists, have been driving policy
- We have a new Administration committed to a national GHG reduction program, including motor vehicles
- Need to find a pathway for a single Federal program with long term goals
 - Federal motor vehicle FE program and State measures, such as market-based incentives for high FE vehicles, feebates, preferential parking, or variable registration fees could be complementary

Challenges

- Fuel economy technology, since the initial Federal CAFÉ standards began to take effect, has been specified and real efficiency has improved. But the gains have been masked or absorbed by other attributes more highly valued by the customer, such as performance, comfort, utility, and safety
- Need consistency in structure of standards; and in hindsight, a single number, not attribute-based is probably the best approach
 - Need assurance of continuance of programs in future established today
 - Federal government needs to retain authority
- Increased fuel prices have had an impact, but when they stabilize or crash, the effects are diminished.
- Low carbon fuels seem to be on the distant, NOT near horizon

Tailpipe Emissions Control & FE Synergies

1968



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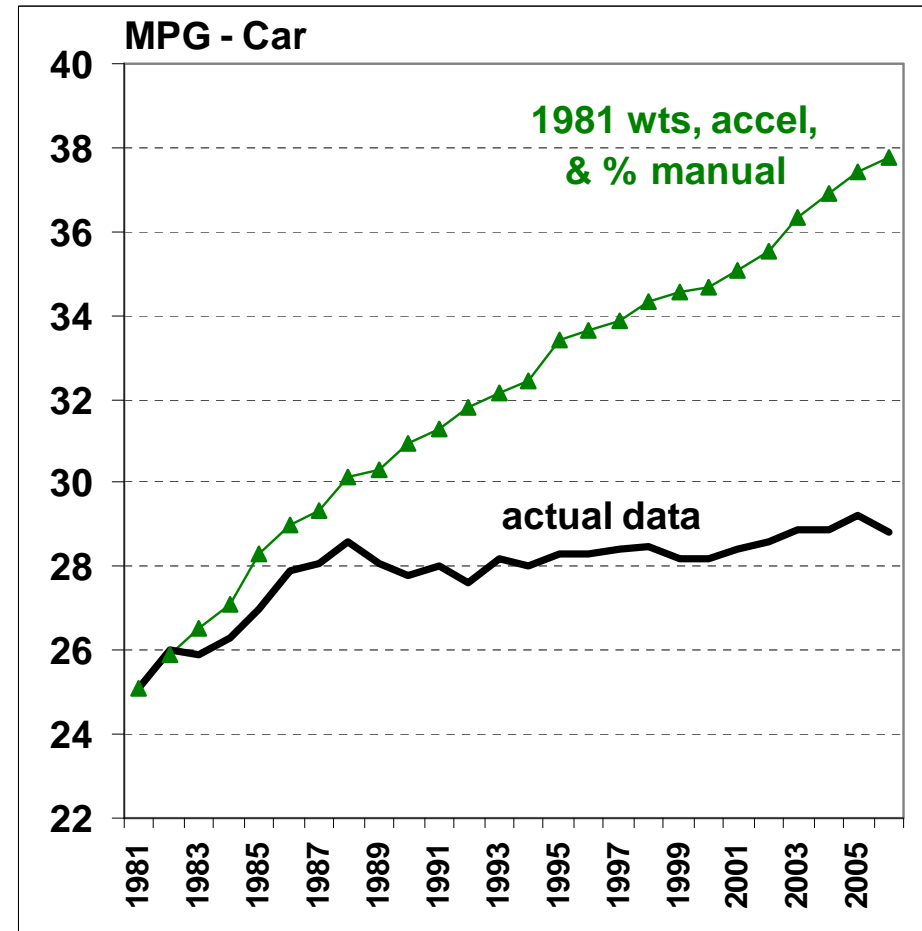
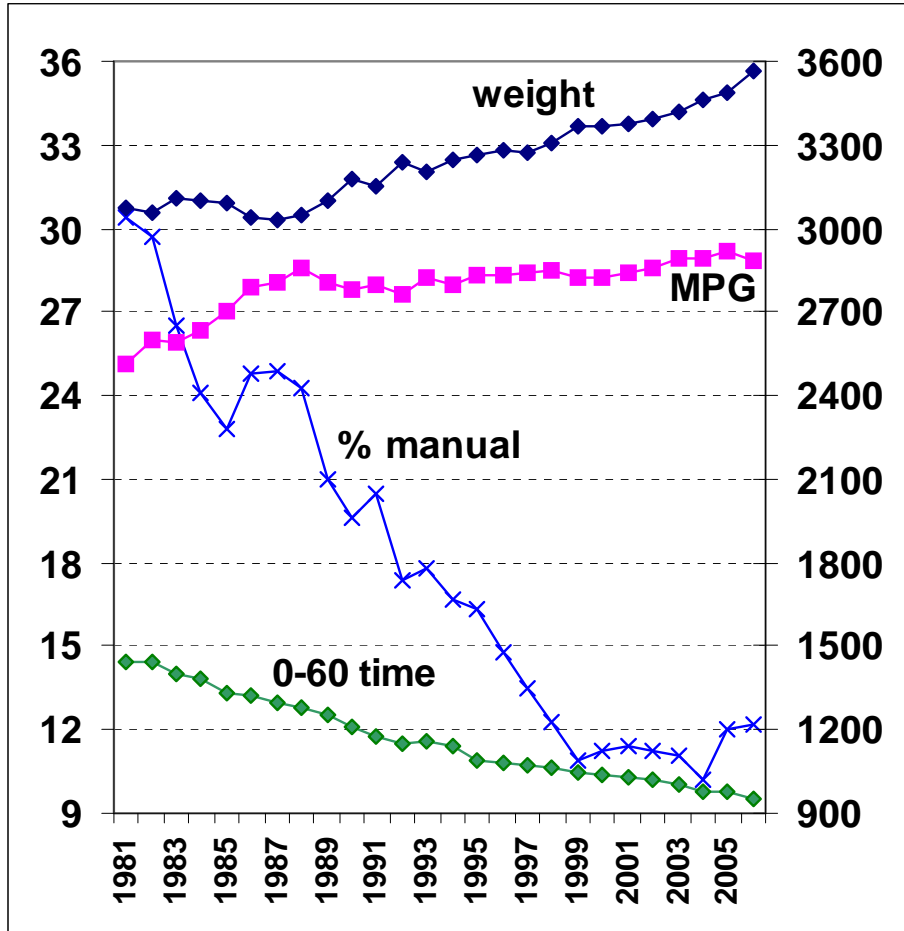
| Technology | Primary Target: CO, HC, NOx, PM | Primary Target: CO2 |
|--|---------------------------------|---------------------|
| Positive Crankcase Ventilator (PCV) | Yellow | |
| Air Injection Reactor | Yellow | |
| Exhaust Gas Recirculation (EGR) | Yellow | |
| Unleaded gasoline | Yellow | |
| 2-Way Catalytic Converters | Yellow | |
| 3-Way Catalytic Converters w/ Closed Loop Feedback | Yellow | |
| Carburetor shift to Fuel Injection | Yellow | |
| Advanced Electronic Controls | Yellow | |
| Onboard Diagnostics | Yellow | |
| Evaporative Emission Controls | Yellow | |
| Onboard Recovery of Gasoline Refueling Vapors | Yellow | |
| Engine friction reduction | | Green |
| Low viscosity lubricants (e.g., 0W-20) | | Green |
| Variable valve timing | | Green |
| Variable valve lift and timing | | Green |
| Cylinder deactivation | | Green |
| Engine accessory improvement (e.g., AC compressor) | | Green |
| Engine supercharging/turbocharging | | Green |
| Engine downsizing | | Green |
| Six-speed automatic transmissions | | Green |
| Continuously variable transmissions | | Green |
| Aerodynamic drag reduction | | Green |
| Improved rolling resistance | | Green |
| Vehicle weight reduction | | Green |
| Vehicle size reduction | | Green |
| Camless valve actuation | | Green |
| Variable engine compression ratio | | Green |
| Diesel | | Green |
| HCCI | Blue | Blue |
| Hybridization | Blue | Blue |
| Alternative fuels | Blue | Blue |
| Fuel Cells | Blue | Blue |

} Significant Vehicle Change

- Majority of emissions control technology not visible to customer
 - Compliance highly driven by standards; level playing field... not much risk
- Fuel efficiency measures much more visible to customer
 - Much greater risk proposition for manufacturers; and a lot of technology is already in fleet
 - Customers unwilling to sacrifice comfort and convenience
- Points out lead time consideration as big challenge in achieving significant near term gains in new fleet

Since 1987, technological advances have been used to improve attributes other than fuel economy

Car Data from EPA's 2006 FE Trends Report



Fuel efficiency has increased by about 1.3% per year since 1987

However, this has all been used to increase other attributes whose value is more certain, such as performance, comfort, utility, and safety

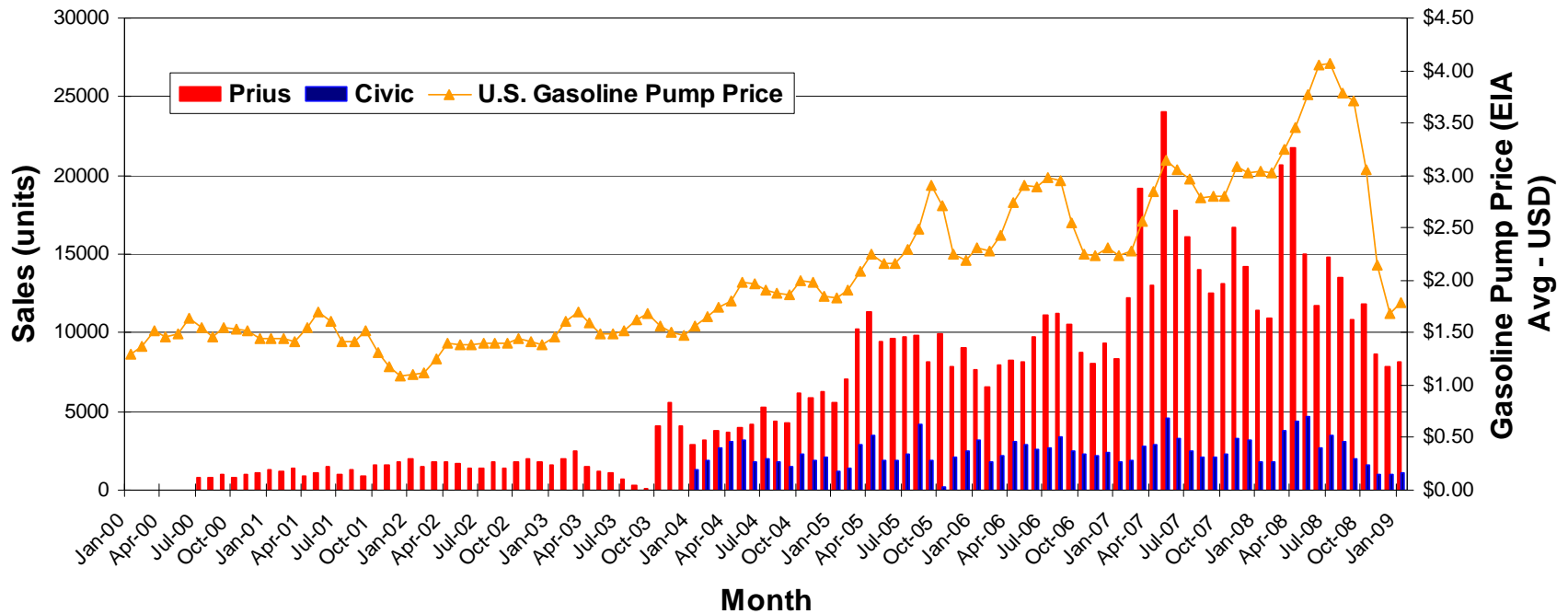
Customer Purchase Decision Considerations

- Customer consideration of fuel economy in the purchase decision has not changed significantly in 2001-2007 timeframe
 - In 2007, it ranked 19th in purchase reason importance
 - Reliability, Durability, and Manufacturer's Reputation received the highest rankings
- The relative importance of fuel economy in market surveys changed in 2008.
 - In 2008, surveys revealed fuel economy was ranked 8th in importance
 - The market price increase of gasoline apparently was influential in this change in importance

This is a very interesting trend to watch and monitor. Nevertheless, this is not indicative of the customer's willingness to pay for better fuel economy or how much they are willing to pay. For example, sales of high fuel economy vehicles such as HEVs have dropped significantly more than the overall sales of new cars since the price of fuel has dropped on average to below \$2.00/gallon

Toyota Prius and Honda Civic Hybrid U.S. Sales

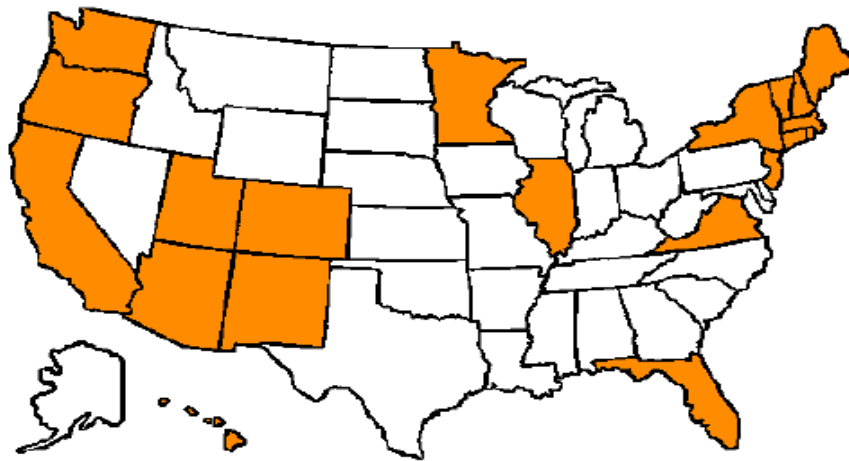
Fuel price is a good lever to shift vehicle choice and reduce VMT.



Total N.A. Hybrid Electric Vehicle Sales January 2000 – January 2009: 1,238,060

| Hybrid Model | N.A. Launch Date | Total N.A. Sales | Peak Sales Month |
|-------------------|------------------|------------------|------------------|
| Toyota Prius | July, 2000 | 682,949 | May, 2007 |
| Honda Civic | January, 2004 | 147,636 | May, 2008 |
| Toyota Camry | April, 2006 | 133,231 | March, 2008 |
| Ford Escape | October, 2004 | 77,208 | May, 2007 |
| Toyota Highlander | January, 2006 | 73,962 | April, 2006 |
| Lexus RX400h | January, 2006 | 54,209 | March, 2006 |
| Honda Accord | December, 2004 | 27,089 | September, 2005 |

Challenges of State vs. National Policy



States with GHG Emissions Targets

- Majority of auto OEM fleets today are 50-state compliant for conventional emissions
- Individual states also have their own NMOG fleet average requirements
- Presents a significant administrative reporting burden; it is possible to comply
- Cost differential between federal and CA-177 cars not that significant
- Only specialty vehicles remain isolated to CA-177 States

- Individual fuel economy compliance requirements create much greater challenges
 - The national fleet for individual manufacturers would be similar but the fleet mix would be different in each state. Auto manufacturers cannot efficiently provide different fleet mixes to individual states.
 - Individual fleet mix is actually much different in individual States even today
 - Naturally driven by market and different customer base - demographic
 - If compliance driven, only choice is to provide differential incentives to try and shift mix. Significant challenge!
 - Management of non-compliance risk also a challenge.

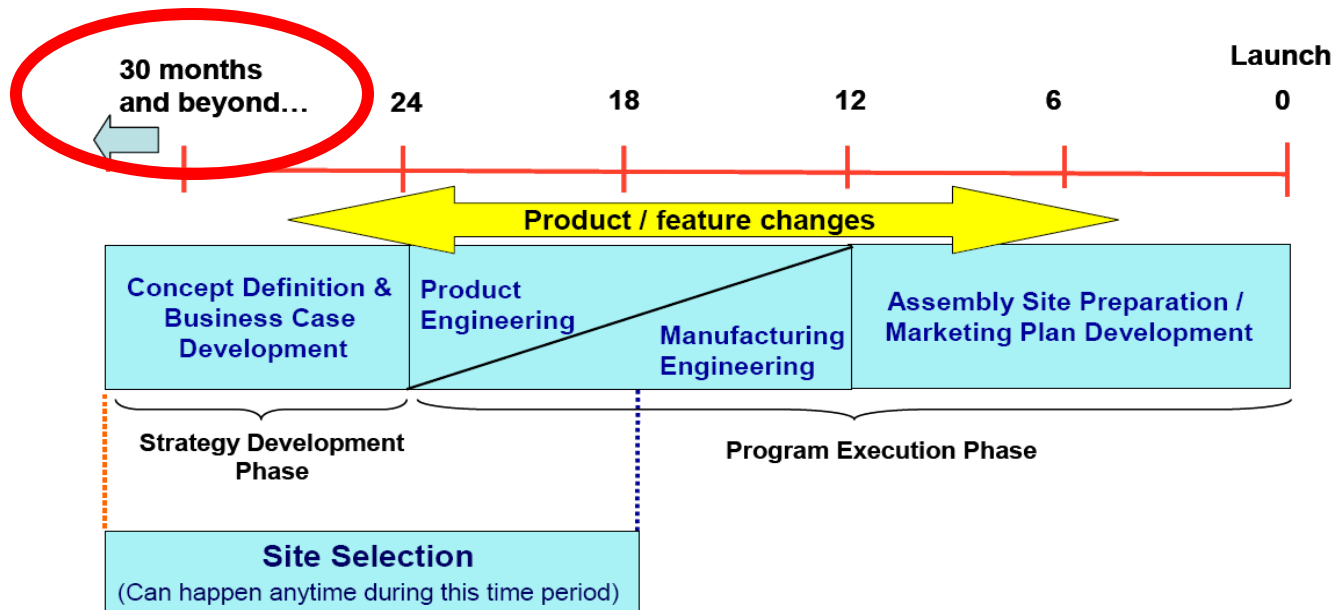
Customer and Producer Considerations

- Customers averse to sacrifice while still demanding the most from manufacturers
 - Have demonstrated **little willingness to pay for incremental costs** of new FE technology
 - Customers historically have discounted the value of and savings from FE improvements
- Manufacturers highly risk-averse in highly competitive market; can't drive purchase
 - **Market incentives needed** (feebates, fuel price, advanced technology incentives)
- Both customers and manufacturers have **no certainty of future** risks or costs
 - It can take years for significant market penetration of new technology to occur
 - Future fuel price is unpredictable
 - Specifying technologies just to improve fuel economy may not be valued by customer
- New market entrants have significant and different considerations
 - Limited investment capital
 - Sustainability a question (e.g., battery warranty coverage for PHEV start-ups)
 - No distribution or marketing experience
- Manufacturers need **significant lead time**
 - Most new technology begins with limited introduction
 - Typically introduced at launch of “full model change”
 - New development can take a minimum of 3 years for even minor changes
 - Limited by money, human resources, and tooling costs

Primer on Automotive Business Planning

**HOW
AUTOMAKERS
PLAN THEIR
PRODUCTS,**
Center for
Automotive
Research,
July 2007

Figure E-1. The Automotive Product Development Timeline



Source: Center for Automotive Research.

“Automobiles require long lead times for design, development and production planning (including tooling and supplier contracting). The process of developing a new program, whether for a new or redesigned vehicle or a powertrain, typically spans two and one-half years from concept to launch, as illustrated in Figure E-1.”

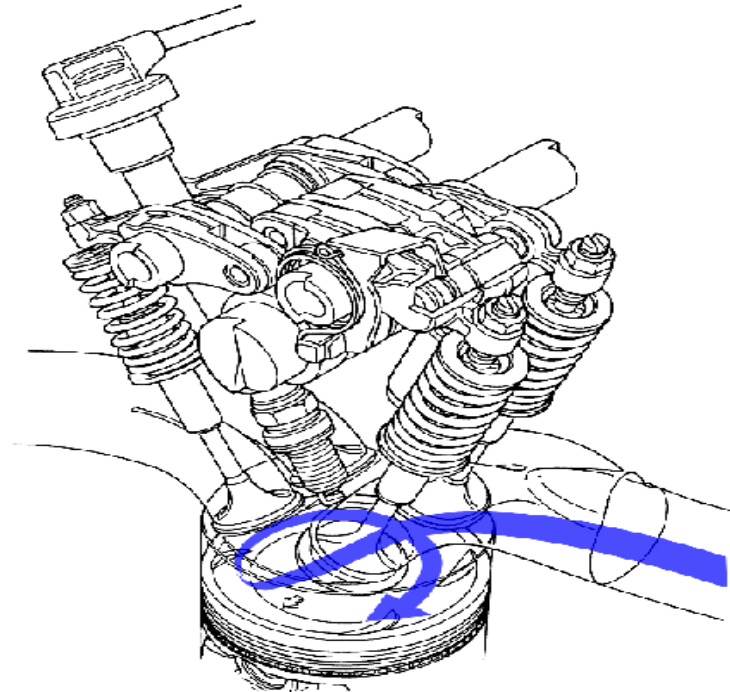
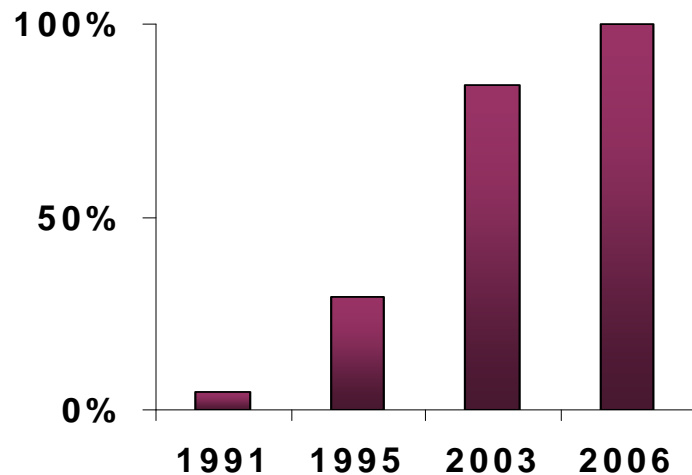
“because vehicle programs carry over a high level of components and engineering from other programs, product changes are almost always evolutionary. Moreover, intrinsic time lags—the two- to three-year lead time for product development, the even longer planning cycle for all of a company’s products, as well as the evolutionary nature of product change—represent constraints that must be respected.

“Any potential policy requirements must acknowledge these realities. Indeed, it is difficult for automakers to do too much too fast. They are constrained by money, human resource issues and tooling costs, to name but a few.”

Case Study: Honda VTEC Combustion

(Variable valve Timing and lift, Electronically Controlled)

- HIGHER EFFICIENCY
- LOWER EMISSIONS
- GREATER PERFORMANCE



- 1982: R&D initiated
- 1988: First (low volume) application – Acura NSX
- 2006: VTEC reaches 100% penetration – Honda Civic full model change

24 years after R&D initiated; 18 years after first market introduction in NA

Technology specification typically is targeted on individual Models at time of Full Model Change; every 4-6 years

Fuel Cell Stack Development : History

80's '99 '00 '01 '02 '03 '04 '05 '06

FCX-V2

FCX-V3



Start of Research on fuel cell technology

Improved performance & reliability

Material Innovation

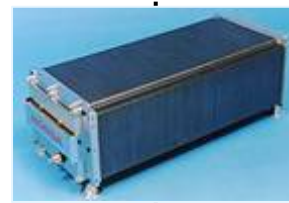
Design Innovation

1999

2001

2004

V Flow FC Stack



Methanol-fueled fuel cell stack on FCX-V2

Hydrogen-fueled (High-pressure hydrogen tank)
Series of public road tests as part of CaFCP

Compact High performance enhanced durability

Certified from EPA&CARB
Lease delivery starts

Honda FCX Clarity



Vehicle technology has progressed

- Need refueling infrastructure
- Need effective market incentives



- Supportive government policy helpful
 - National in approach
 - Consistency
 - Long term vision



Closing Thoughts

- Federal approach is overwhelmingly the best approach
 - Administratively preferable
 - Hopefully will put consideration of litigation to the side
 - Addresses a problem in a more global manner
 - Avoids market disruption and turmoil
 - Most cost effective
 - States can play an important role in support of federal program
 - Federal government can play a role in supporting states in other measures; i.e., market incentives
- Motor vehicle standards alone will not achieve meaningful reductions
 - Must be complemented and supported by market measures
- Level of stringency and long term approach must be addressed
 - States want assurance of reductions
 - Producers need:
 - certainty and targets for efficient planning
 - adequate lead-time, particularly for advanced technologies

The New 2010 Honda Insight HEV



Available in NA dealers in late-March 2009

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