



Automotive News

GREEN CAR

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“The Rest of the Car” Panel Discussion

Michael Ableson, Executive Director

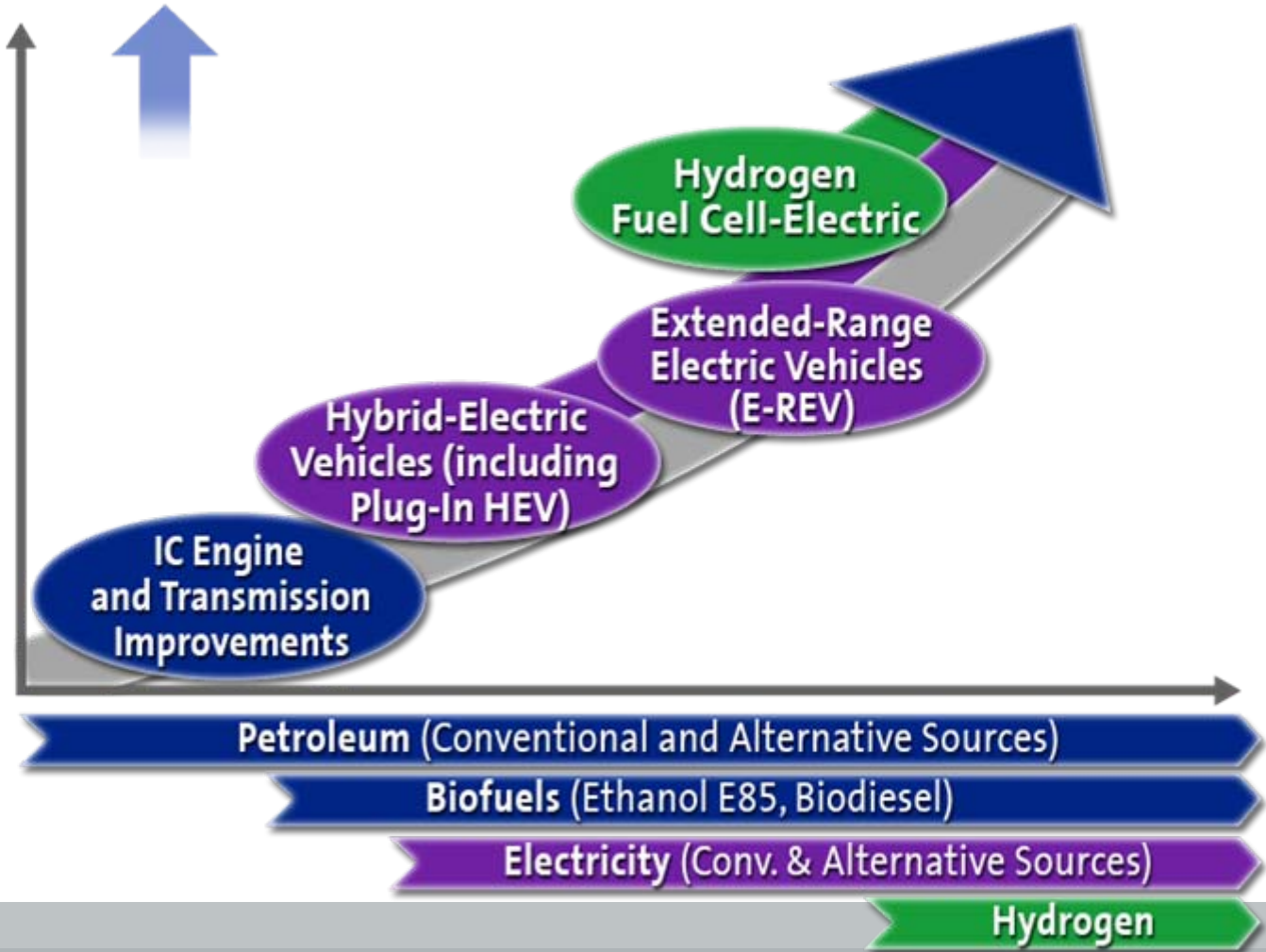
Global Advanced Vehicle Development, General Motors



The Future ...

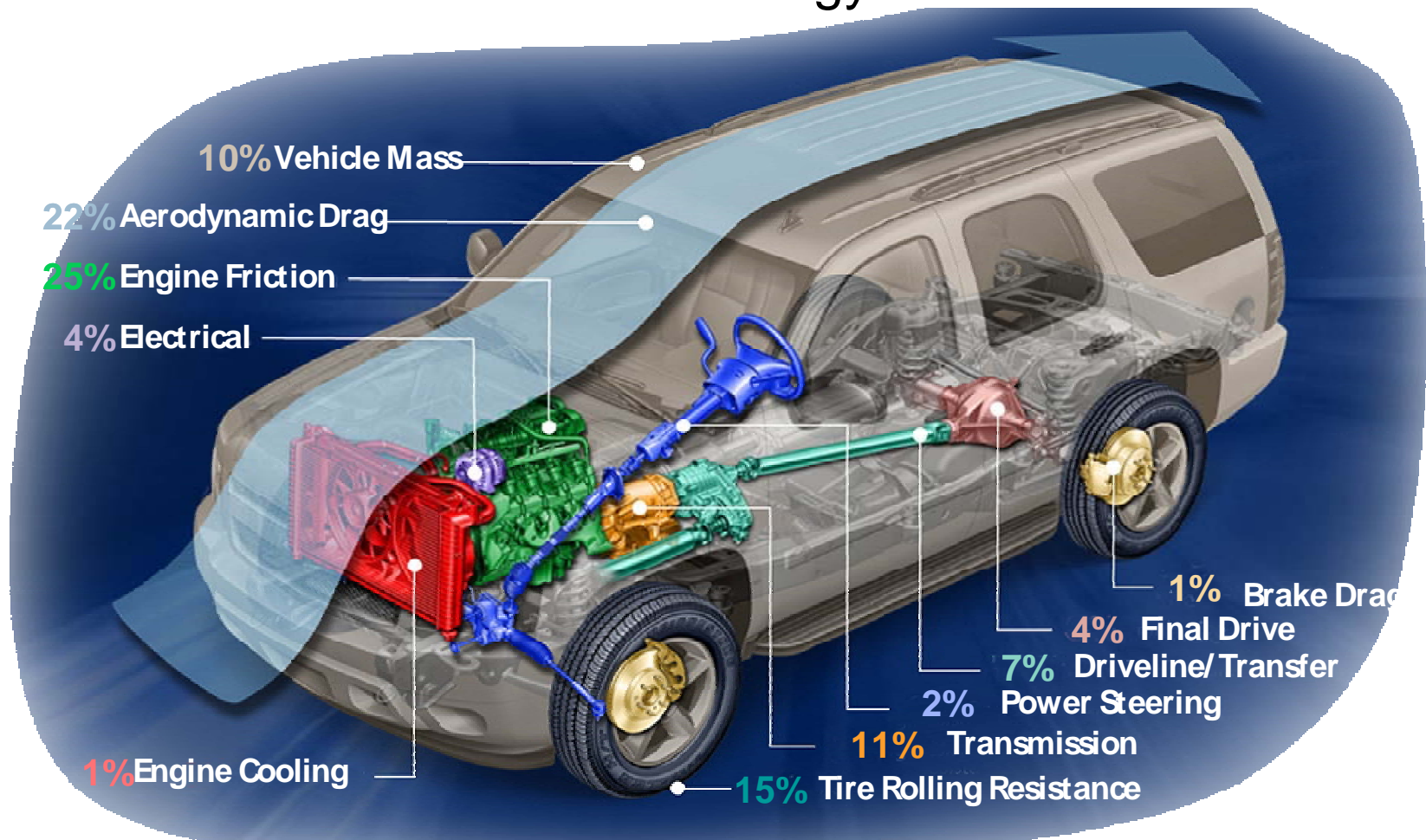
Improve
Vehicle
Fuel Economy
and
Emissions

Displace
Petroleum



Energy Usage

Fullsize SUV Mechanical Energy Loss Breakdown



Energy Usage

Impala Mechanical Energy Loss Breakdown



Effective Vehicle Integration for Improved Fuel Economy

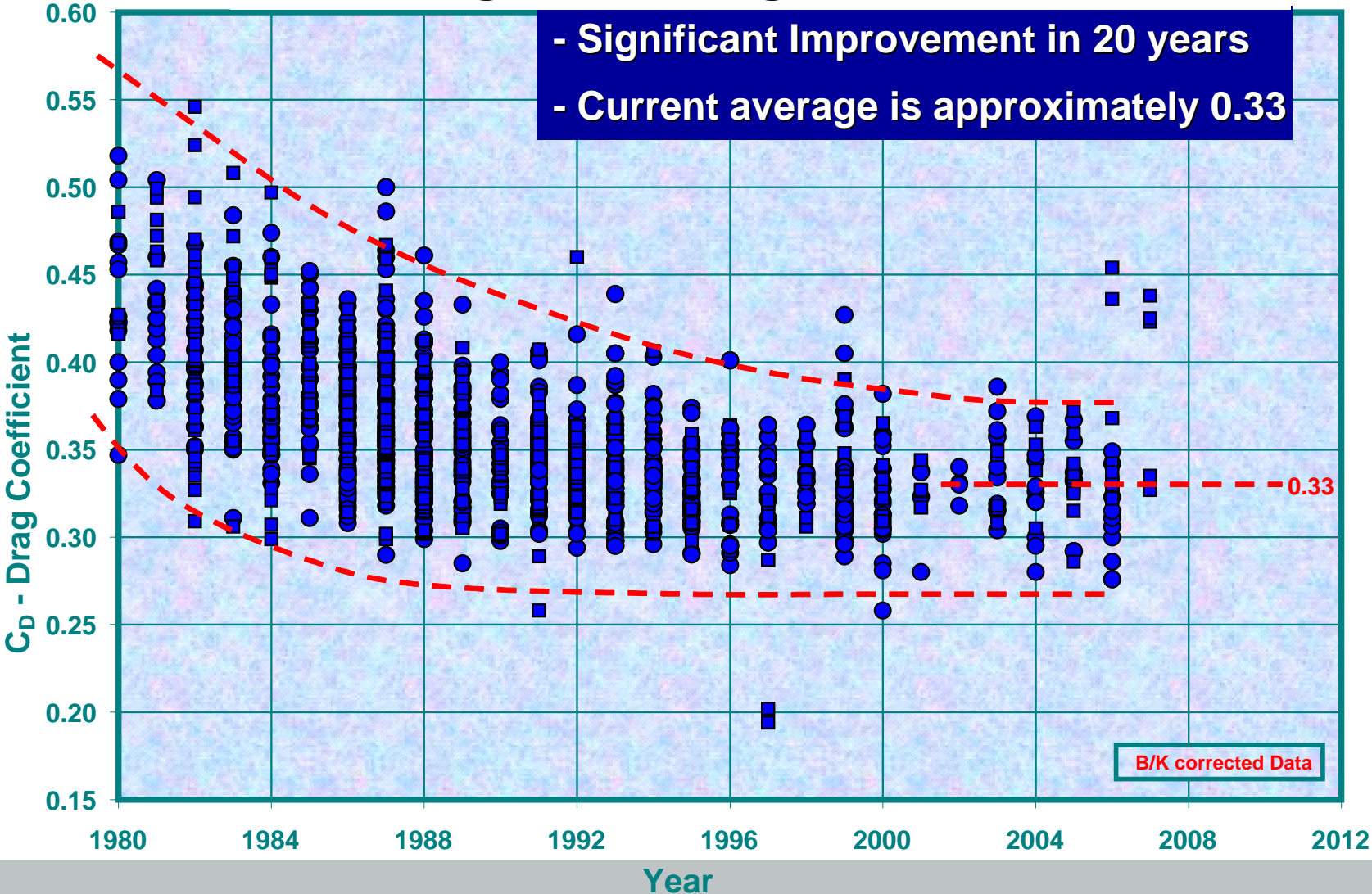
- **Aerodynamics**
 - Lowest drag with class leading design and perceptual quality
 - Lowest frontal area
- **Mass**
 - Mass efficiency in every component/system
 - Minimum vehicle size to meet competitive need
- **Chassis/HVAC**
 - Lowest tire rolling resistance while meeting vehicle dynamics requirements
 - Minimize parasitic losses (EPS, low drag brakes, high efficiency HVAC, etc)
- **Electrical**
 - High efficiency, low losses, Optimized battery charging
- **Controls system optimization**

Segment Leading Fuel Economy requires comprehensive reduction of energy losses with vehicle level optimization during the early stages of design and throughout vehicle development.

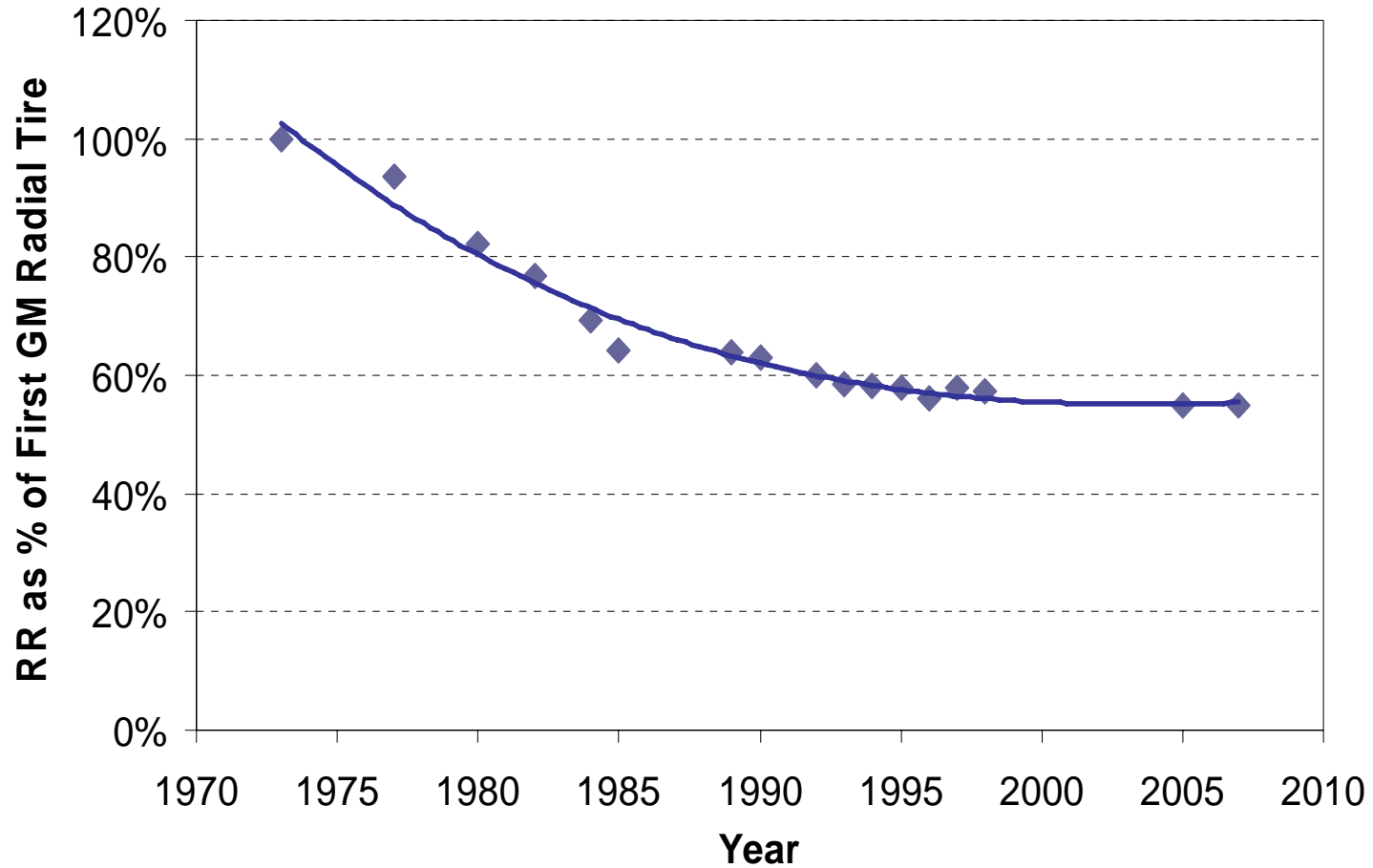


Aerodynamics

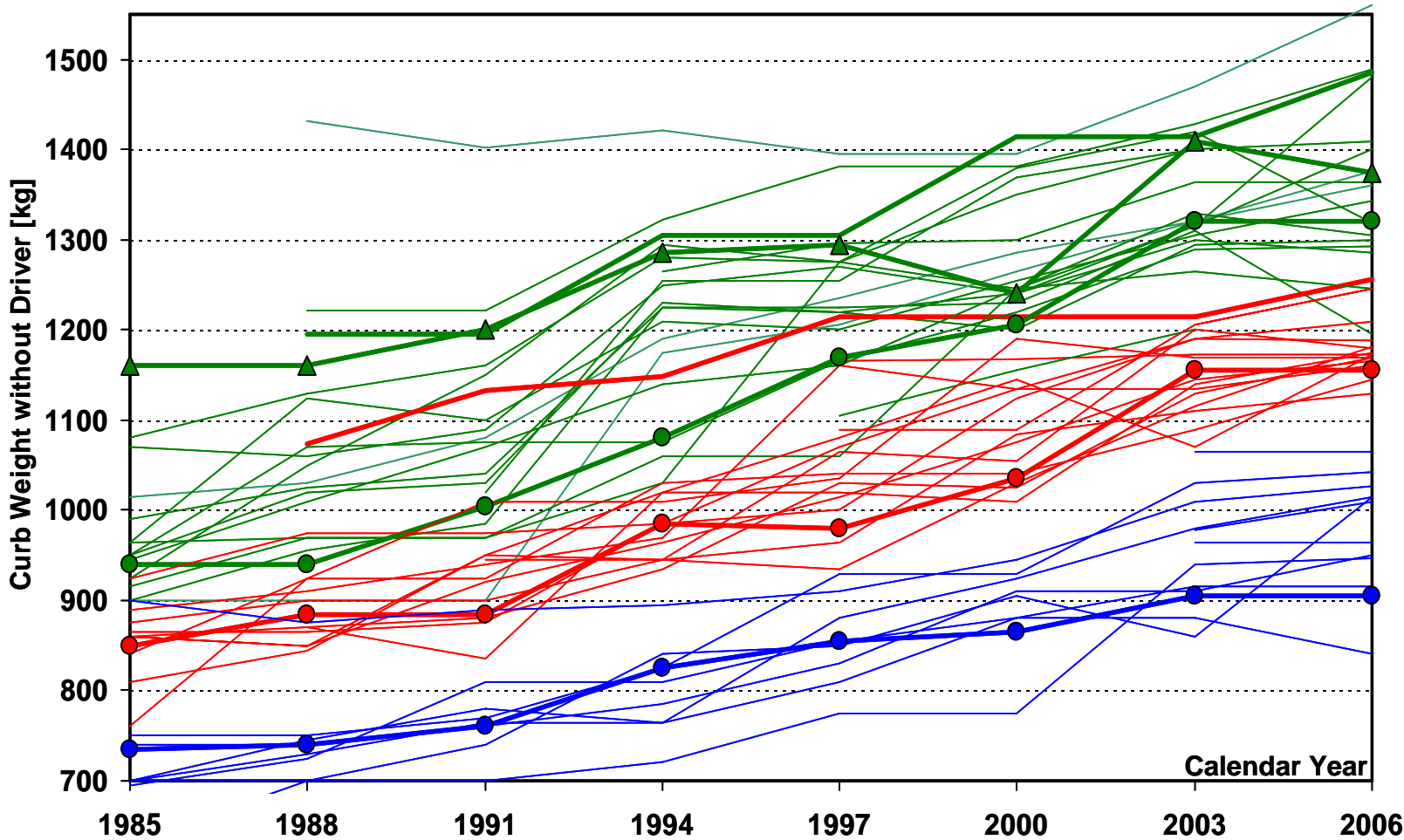
Passenger Car Drag Coefficient Trend



Tire Rolling Resistance



Mass



Mass

- Mass is countervailing trend – it has increased while most other losses have decreased over time.
- Mass Compounding (1.1 – 1.5)
- Extra mass results in larger engine size to achieve competitive acceleration and drive quality
- Important developments in new materials
 - Lighter materials help weight reduction efforts (aluminum / HSS)
 - Renewable materials (plastics / composites) help to reduce our dependence on petroleum

Battery Powered Vehicles

- Effect of losses is exacerbated when operating off of battery power.
- Total energy available from battery is less than that available from gas tank.
- Impact of electrical loads and losses – when you're running a vehicle on electric power, you are draining down your "primary power source."
- Batteries add significant mass; therefore, efficiency in the rest of the vehicle is even more critical.
- Battery range (especially at highway speeds) is very sensitive to vehicle aerodynamics.



Equinox Fuel Cell Vehicle

Performance

- Range 168 miles
 - 2008 EPA combined city & highway
 - Fuel capacity of 4.2 kg at 700 bar
- Acceleration 0-100 kph in 12 seconds
- Top speed 160 km/h (100 mph)
- Payload capacity of 340 kg (750 lbs.)
- Freeze durable over the vehicle life
- FMVSS Tested

Content

- Single speed electric motor traction system
- Cruise control
- Navigation radio with fuel cell graphic energy display
- Front wheel drive
- 17 inch aluminum wheels
- Regenerative braking
- 2 front bucket seats (heated) and 2 passenger rear bench with center console
- ABS, traction control and stability control
- Driver, passenger and roof rail air bags
- OnStar

Timing

- Deployment began late 2007 and scheduled to run through 2010



EQUINOX FUEL CELL 



Participants of Project Driveway

- **There have been nearly 72,500 hand raisers to this program by signing up on our Project Driveway website.**
 - Almost 10,000 people are on the waiting list.
 - You have to live in a zip code where a hydrogen fueling station is available.
 - Currently more than 800 people are involved in the “on-line blogging” community.
- **As of October 2008, there are more than 90 of the 100 vehicles on the road.**
- **About 2900 individuals have driven the Equinox, either in short drives (media, special events) or as part of a three-month Project Driveway loan.**



***“I have driven the Future,
and it runs on Hydrogen.”***
***By: Matt Mackey
Project Driveway
Participant***





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