Nancy Homeister
Manager, Fuel Economy Regulatory Strategy and Planning

Automotive Product Portfolios in the Age of CAFE
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Sustainability Technology Strategy

Pillars

Quality
From virtual design and testing to assembly line process, Ford vehicles are designed and built for quality.

Green
Ford produces vehicles that are fuel efficient AND fun to drive. No need to sacrifice one for the other.

Safe
Accident avoidance or protection in an accident – either way our safety systems provide peace of mind.

Smart
Thoughtful design and purposeful technology that provide convenience, entertainment and enhance the overall vehicle experience.

Drive quality.

Drive green.

Drive safe.

Drive smart.
Economically Feasible
Socially Responsible
Environmentally Friendly
Science – Stabilizing Atmospheric CO₂ Levels

- 650PPM: 2.4-5.5 °C
- 550PPM: 1.9-4.4 °C
- 450PPM: 1.4-3.1 °C

STABILIZATION AT 450PPM

ATMOSPHERIC CO₂ CONCENTRATION (PPM)

YEAR
Global Fleet CO₂ Model is used to estimate Emissions Reduction Requirement of the Light Duty Fleet

**Inputs**
- Sales volume
- Vehicle miles driven
- Vehicle fuel consumption
- Vehicle retirements
- Fuel CO₂ information
- Emission reduction per stabilization trajectory

**CO₂ Reduction Model**
- Proportionally applies emissions reduction to all sectors and regions
- Factors in things that impact year-over-year emissions output (old / new vehicle mix, bio fuel availability)

**Outputs**
- “New fleet” targets that are required to move the “overall fleet” glide path in line with the required emissions reduction trajectory

![Graph showing emissions reduction over time](image)
Balancing Multiple Objectives

Challenge/Opportunity
Balance Societal Safety, Environment, Climate, and Energy Goals, while Driving Innovation Toward an Optimal Customer Experience

ENVIROMENT
(Clean Air Act)
Protect Human Health and Welfare
California Low Emissions Vehicle Program (LEV II/LEV III)
Federal EPA Tier II/Tier III
ZEV Mandate

CLIMATE
Stabilize Global Warming
EPA & State GHG Standards
Low Carbon Fuel Standard
Cap and Trade

ENERGY
(Energy Independence and Security Act)
Reduce Dependence on Foreign Oil
One National Program
NHTSA Corporate Average Fuel Economy (CAFE)
Renewable Fuels Standard (RFS)

Complementary Measures?

SAFETY
Fundamental Technologies in Place

- Significant number of vehicles with EcoBoost engines
- Diesel use as market demands
- Battery management systems – begin global migration
- Aero improvements
- Dual clutch and 6 speed automatic transmissions replace 4 & 5 speeds
- Increased unibody applications
- Introduction of additional small vehicles
- Stop/Start systems (micro hybrids) introduced
- Add Hybrid applications
- Flex Fuel Vehicles
- CNG Prep Engines available where select markets demand

Fully Implement Fundamental Technologies; Introduce Significant Weight Savings

- EcoBoost engines available in nearly all vehicles; engine displacement reduction aligned with vehicle weight savings
- Electric power steering - High volume
- Additional Aero improvements
- Six speed automatic transmissions - High volume
  - Introduce substantial weight reduction; 250 – 750 lbs
  - Increased application of Stop/Start
  - Increased use of Hybrid Technologies
- Introduction of PHEV and BEV
- Vehicle and powertrain capability to leverage available renewable fuels
  - Develop fuel cell stack technology

Expand Weight Savings, Hybrids and Plug-ins

- Intro 2nd Gen EcoBoost and Advanced Tech Diesel
  - Efficient HVAC for Hybrid/Plug-in/All-Electric vehicles
  - High volume 6+ speed automatic transmissions
  - Continued weight reduction actions via advanced materials
- Volume expansion of Hybrid and PHEV technologies
- Evolve All-Electric and Plug-in vehicle ecosystem
- Optimize engines/vehicles for higher octane/alt fuels
  - Continue to develop/pilot fuel cell vehicles

Leverage Hybrids and Introduce Alternative Energy Sources

- 2nd Gen EcoBoost and Adv Tech Diesel high volume
  - Continued efficiencies in electrical architecture and intelligent energy management
  - Lightweight materials models proliferate to global platforms
  - Next gen Hybrid and Plug-in technologies
  - Continued leverage of All – Electric vehicles
  - Engines capable of operating on fuels with increased renewable hydrocarbons
  - Fuel cells implementation timing aligned with fuels and infrastructure availability
Ford Has Delivered Continuous Improvement in Fuel Efficiency in All Vehicle Segments
High Value Vehicle and Powertrain Technologies Are Implemented Systematically across Vehicle Nameplates to Maximize Engineering Efficiency and Minimize Technology Cost
Ford believes offering a range of affordable, fuel-efficient vehicles is the best way to reduce CO₂ emissions while meeting customer needs.

These technology options span gasoline-powered through electrified powertrains.
A Clear Winner for Sustainable Transportation and Technology Will not be Determined in the Near Term. Internal Combustion Engines Will Continue to Dominate in this Timeframe.
EcoBoost

- Direct Injection + Turbo Charging
- Up to 20% fuel economy improvement
- Up to 15% reduction in CO2 emissions
- 90% of our nameplates will be equipped with EcoBoost in the 2013-2014 timeframe
EcoBoost Vehicles in 2011: 7
EcoBoost Vehicles in 2015: 15
TRIPLING PRODUCTION
250,000+ EcoBoost-Powered F-150s Sold
1.6 MILLION EcoBoost-Powered Vehicles Globally by End of 2013
"There's no overstating the importance of what Ford has done. Many have long envisioned new car showrooms where a desired model could be purchased with one of many distinctly different and efficient powertrains, selected to satisfy a buyer's particular needs and desires."

Ron Cogan, editor and publisher of the Green Car Journal
2013 Fusion Offers Customers the Power of Choice with a Broad Selection of Fuel Efficient Powertrains in the Midsize Car Segment
• In contrast to other OEMs, Ford is electrifying platforms – versus a single vehicle

• The Ford Electrification Strategy includes five new electrified vehicles
  – Focus Electric
  – C-MAX Energi
  – C-MAX Hybrid
  – Fusion Energi
  – Fusion Hybrid

• In addition, Ford is exploring a new hybrid system for light trucks and SUVs
Global C-Platform And Powertrain Strategy

Multiple “Top Hats” on a Single, Global, Large Volume Platform
• Uncertainty of technology advancement
• Uncertainty of cost / pay-back
• Uncertainty of consumer acceptance
• Uncertainty of confounding global issues:
  – Conflicting priorities
  – Exchange rates
  – Interest rates
  – Fuel prices and mix
2012-2016: Car and Truck Standards increase ~4% per year

2016-2021: Car Standards increase ~5%, Truck increases ~3.5%, per year

2021-2025: Car and Truck standards increase ~5% per year

Setting Standards out as far as 2025 Requires Re-evaluation Closer to Implementation
Fuel economy rates have increased by ~40% since the beginning of CAFE.

Today’s average light truck gets better mileage than an average 1970s compact car.

The One National Program will result in nearly double the fleet fuel economy by 2025.

These Requirements Present One of the Greatest Regulatory Challenges Ever Faced by the Auto Industry.
One National Program Mid-Term Review

- An assessment of the “appropriateness” of the 2022-2025 model year GHG regulations.
- To be completed before April, 2018.
- Was key to the industry agreement to the 2025MY standards.

All the Stakeholders Need to be Involved to Ensure a Thorough Review, Encompassing the Critical Elements Impacting the Industry and Market
Looking Forward – Other Policies

• Congestion mitigation
• Car-share programs
• VMT reduction policies
• Urban planning
• In vehicle warning systems (blindspot, collision)
• Wireless communication via Wi-Fi or short-range communications between vehicles

By reducing crashes, intelligent vehicles could ease traffic delays, which would save drivers both time and fuel costs. Congestion also could be avoided through a network of intelligent vehicles and infrastructure that processes traffic and road information. A traffic management center would send this information to intelligent vehicles, which could then suggest less congested routes to drivers.
EcoMode

- Coaches consumers in the art of eco-driving with real-time feedback
- Provides scoring & rewards
- Testing shows an average 24% fuel economy increase

MyFord Touch with EcoRoute

- Real-time feedback on vehicle fuel efficiency and performance
- Map-based navigation system that instantly calculates the most fuel efficient route
- Testing demonstrated fuel economy gains of up to 15%

SmartGauge with EcoGuide

- Unique cluster specifically designed for hybrid owners
- Coaching to maximize fuel efficiency – with feedback & rewards
- Configurable full-color LCD
New Focus Electric-exclusive app offering remote access connectivity through either a smart phone or a secure website.

- Provides ability to monitor and control select vehicle functions, including:
  - charge levels
  - locate charging stations (incl. surplus range beyond station)
  - pre-heat / cool
  - trip planning (single or multiple-stop routes)
Go Further