Growing Green: Sustainability at Ford

John Viera
Global Director
Sustainability and Vehicle Environmental Matters

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"Ford is committed to offering customers affordable, environmentally friendly technologies in vehicles they really want. We are focused on providing solutions that can be used not for hundreds or thousands of cars, but for millions of cars because that is how Ford can truly make a difference."

-Alan Mulally
President & CEO
Ford Motor Company
Technology Innovation Pillars

**Technology Strategy**

**Anticipate – Innovate – Incorporate**

**Sustainability “GREEN”**
- Improve fuel economy; reduce CO2 emissions to leadership levels
- More renewable, recycled materials
- Improved In-Vehicle Air Quality

**Safety “SAFE”**
- Achieve public domain targets and 3rd Party Recommended Buys
- Safety technology / feature content equal or better than competition
- Breakthrough features for family safety

**Design “SMART”**
- Design leadership on each new program
- Exciting interiors: leadership in comfort / convenience, infotainment technology
- Global platforms with right proportions
- Improve emotional appeal

**Capabilities & Enablers – "QUALITY"**
Process to Manage Sustainability for Our Products

- **SCIENCE**
  - Stabilization Approach

- **GOVERNMENT**
  - Regulatory Trends

- **CONSUMER**
  - Market Trends

- **COMPETITIVE**
  - Industry Trends

**Product CO₂ Strategy**
- Deliver Vehicle Contribution to CO₂ Stabilization

- **Technology Plan**
- **Policy Positions**
- **Cycle Plan**
- **Marketing and Communications Plan**

**Sustainable Mobility Governance Team**
Science – Stabilizing Atmospheric CO₂ Levels
2008 CO₂ Emissions from Energy Consumption

- On-road cars (32%) and light-duty trucks (27%), as a portion of the transportation sector (33%), contribute about 20% of US and ~11% of global CO₂ emissions.
- Vehicles are significant source of GHGs but are often perceived to be the major source.
Ford’s Sustainability Framework for CO₂ and Technology Migration Development

**Inputs:**
- Targeted CO₂
- Atmospheric Glide path

**Outputs:**
- Vehicle / Technology Migration Plan
- Vehicle / Fuel Strategic Alignment
- Well-to-tank Plan: Reduce fossil CO₂ contribution from fuel sources

**Flowchart:**
1. CO₂ Reduction Model
   - Auto Industry: Vehicle fleet CO₂ requirements
2. Technology Optimization Model
3. Fuel Development Cost Minimization Strategy
   - Energy Industry: Low-fossil-carbon fuels glide path

**Key Notes:**
- **CO₂ Reduction Model**
- **Technology Optimization Model**
- **Fuel Development Cost Minimization Strategy**
Ford’s Path to Sustainability

**Near Term**
- Begin migration to advanced technology

**Mid Term**
- Full implementation of known technology

**Long Term**
- Continue leverage of Hybrid technologies and deployment of alternative energy sources

- **Near Term**
  - Advanced Gasoline Engines
  - Hybrids
  - Natural Gas/LPG

- **Mid Term**
  - Electrified Vehicles
  - Weight Reduction

- **Long Term**
  - Fuel Cells
  - Hydrogen Powered Engines
Ford Strategy: Leverage Global Platforms
Introduction of EcoBoost Technology

- Gasoline Direct Injection
- Turbocharging
- “Downsizing & Boosting”
Ford’s Strategy Is To Electrify Global Platforms With All 3 Electric Solutions – To Drive Choice Of Top Hats, Scale And Affordability.
“Saving even a few pounds of a vehicle’s weight . . . could mean that they would also go faster and consume less fuel. Reducing weight involves reducing materials, which, in turn, means reducing cost as well.”

_Henry Ford, 1923_
Emerging Lightweight Material Opportunities

**Body Structures**
- Near Term: Increase AHSS, Aluminum
- Future: Magnesium, Carbon Fiber Composites, Natural Fiber Plastics

**Powertrain Materials**
- Near Term: Aluminum
- Future: Magnesium, High Temp Plastics

**Interiors**
- Near Term: AHSS, Aluminum, BioBased Plastics

**Closures**
- Near Term: AHSS, Aluminum
- Future: Magnesium & Reinforced Plastics

**Chassis Systems**
- Near Term: AHSS, Al
- Future: Mg, CF
Ford’s Sustainable Materials Strategy

• Vision
  – Ford Motor Company will ensure that our products are engineered to enable sustainable materials leadership without compromise to Product Quality, Durability, Performance or Economics.

• Key Positions
  – Recycled and renewable materials must be selected whenever technically and economically feasible. We will encourage the best green technologies to meet the increasing demand for these materials.

  – When we use recycled and renewable materials, there will be no compromise to Product Quality, Durability & Performance or Economics.

  – We will enhance technologies, tools and enablers to help validate, select and track the use of these materials in our products.

  – The use of recycled and renewable content is increased year by year, model by model where possible.
Eliminate Undesirable Substances and Materials

• Ford was the first in Auto industry developed the Restricted Substance Management Standard (1984) which has been used to manage substances used in Ford vehicles and plants for nearly 30 years.

• Ford was among the 7 OEMs who developed the International Material Data System to collect all substance/material/part info for our vehicle.

• Ford have been leading/supporting industrial efforts in developing Global Automotive Declarable Substance List, Registration, Evaluation, Authorization and Restriction of Chemicals (REACH, EU new low) Automotive Industry Guidelines, etc.
**Sustainable Materials**

Sustainable Materials – Materials with lower environmental impact, which provide performance equivalent to existing materials. This includes materials manufactured with recycled content and/or renewable feed stocks.
Ford’s Sustainable Materials Strategy

Reduce, Reuse and Recycle
What goes into a vehicle at the beginning of its lifecycle and what comes out of it at the end contribute greatly to its environmental friendliness. That’s why Ford is committed to maximizing the use of recycled, renewable and recyclable content in its vehicles, while enabling maximum end-of-life vehicle recycling. This Reduce, Reuse and Recycle commitment is part of Ford’s broader global sustainability strategy to reduce its environmental footprint and accelerate the global development of advanced fuel-efficient vehicle technologies.

What comes out
About 85 percent of the materials used on Ford vehicles are recyclable. Approximately 95 percent of the materials from all vehicles retired from use annually are recoverable, according to international Organization for Standardization guidelines.

• Dismantled, reconditioned and sold on the used auto parts market when possible:
  • Starter
  • Alternator
  • Engine
  • Transmission
  • Steering wheel column
  • Fuel tank
  • Seats
  • Stereo
  • Fenders
  • Doors
  • Drained for reuse when possible:
  • Fuel
  • Coolant
  • Windshield fluid
  • Batteries recycled or sold on the used auto parts market when possible
  • Tires reused when possible, or shredded, cleaned and processed into playground surfaces and garden mulch

The end-of-life process
Once all of the salvageable material is removed from a vehicle at the end of its useful life, the remaining structure is flattened and pulverized into fist-sized pieces at the rate of one car every 45 seconds. Industrial-strength magnets are used to separate the ferrous (iron and steel) from non-ferrous (aluminum) metals and the recovered ferrous metals are recycled to produce new steel. The steel industry recycles more than 14 million tons of steel from end-of-life vehicles each year. Following the removal of all recyclable materials, the remaining non-recyclable ASR (auto shredder residue), which includes plastics, rubber, foam, fabric and glass, is disposed of in landfills.

What goes in
A key goal in Ford’s sustainable materials strategy is to identify opportunities to use recycled or renewable material – in place of nonrenewable virgin material – in its vehicles. Here are some of the green materials Ford is using:

Recycled materials (non-metal)
• Post-consumer plastics made into:
  • Underbody shields
  • Battery tray
  • Carpets
  • Heater and air conditioning housing
  • Fan shroud
  • Replacement bumpers
  • Wheel arch liners
  • Air cleaner assembly
  • Roof lining
  • Instrument panel
  • Parcel shelf
  • Soundproofing
  • Insulation
  • Seat fabrics
• Post-industrial yarns made into seat fabrics
• Post-industrial cotton from blue jeans made into interior padding
• Post-consumer nylon carpeting made into resin for cylinder head covers

Renewable materials
• Soy-based polyurethane foams used for seat cushions, seatbacks and headliners
• Wheat straw and other plant fiber-reinforced plastic used for vehicle storage bins and interior door panels
• Engineering wood technology (recycled and renewable) used for interior trim
• Sugars made from corn, beet and cane under consideration for biodegradable plastic parts

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FOR MORE INFORMATION, GO TO MEDIA.FORD.COM
Opportunities for Recycled Materials

Laundry & Milk Bottles into:
- Windshield washer bottles
- Climate Control Air Ducts

Tires into:
- Aero deflectors
- Under hood covers

Battery casings into:
- Splash shields
- Rocker moldings

Post Industrial recycled bumpers

100% Recycled carpets & fabrics

Recycled Polyurethane foam components
1937 Ford was producing 300,000 gallons of soy oil a year for use in car enamels (Soybean Digest 1947).

1939 the Ford Motor Company was harvesting about 100,000 bushels of its own soybeans

The "Soybean Car" was unveiled by Henry Ford on August 13, 1941

‘Fordite’ material used in steering wheels contained wheat straw

"Someday you and I will see the day when auto bodies will be grown down on the farm."

– Henry Ford
It has always been a Ford conviction that agriculture and industry are natural partners. That is why Ford has pioneered the use of farm products as automobile materials.

Ford was the first car manufacturer to start growing its own timber. This was in 1919, when Ford purchased a large tract in Northern Michigan, to provide a dependable source of both hard and soft woods.

Ford was the first car manufacturer to acquire its own rubber plantations.

Ford was the first car manufacturer to provide its own tung oil for paints and enamels, by planting tung tree groves.

And perhaps the most striking example of this partnership of farm and factory is the Ford development of the soya bean. Ford was first to sow, harvest and use the "miracle bean" as a basic industrial material. The soya bean has long been an ingredient of synthetic resin enamels and plastic parts for Ford-built cars. This Ford "first" brought impetus to the plastics industry. It gave farmers a new "money crop".

Today many products go from farm to Ford, to contribute to the beauty, performance and economy of Ford-built cars and trucks. And these products benefit owners and farmers alike, because they bring new values on the one hand... new income on the other. Here is another of the Ford advances that mean so much to America.

"Firsts" from Ford... THE FORD SHOW... CBS, Tuesdays, 10-10:30 P.M., E.S.T. THE FORD SUNDAY EVENING HOUR... ABC, Sundays, 8-9 P.M., E.S.T.
Why Sustainable Materials? Why Now?

- Increased use of renewable feedstocks and agricultural products
- Increased use of recycled or waste bi-products
- Reduce dependence on foreign petroleum
- Improved material life cycle
- Improved performance in select functions
- Increased consumer awareness
Success of Soy-based Foam

**Applications:** Use of functionalized soy oil in urethane foam for automotive seating and headliner applications

**Status:** Ford is leader in technology and first OEM to launch in production; migration to other non-automotive applications

- Soy foam seats on all vehicle platforms in North America!!
- Over 5 million Ford vehicles on the road today have soy foam seats
- Escape has soy foam headliner
- 75% headrests contain soy foam
- Reduces petroleum usage by 4 million lbs annually & CO$_2$ by 17 million lbs
Future Green Chemistry Ideas for Foam

- Sustainable sources other than soy must be considered for regions where soy is not as plentiful.

- Recycling soy foams to keep them out of landfills at end of life.
Natural Fiber Reinforced Plastics

**Description:** Use of natural fibers such as hemp, coconut coir and cellulose in place of glass fibers for plastic reinforcement.

**Benefit:** Up to 30% weight reduction of part.

**Natural Fibers:**
- purified cellulose
- flax fiber
- jute fiber
- coconut coir
- Indian Grass
- hemp twine

**Components:**
- Box inner
- Edge end cap
- F-150 fender reinforcement
- Fusion tow impact shield

**Injection molding**

**Compression molding**
Wheat Straw Bio-Filled Polypropylene
Industry and World-First Usage in Quarter Trim Bins on 2010 Ford Flex

- Wheat Straw
- Extrusion Compounding
- Injection Molding
- Wheat Straw BioFilled Polypropylene Quarter Trim Bin

Reduces petroleum usage by some 20,000 pounds per year and reduces CO2 emissions by 30,000 pounds per year.
Retired U.S. Currency

• Benefits
  – Use of waste stream
    • 10,000 lb of retired paper currency shredded daily
    • Currently landfilled or burned
  – Weight / density reduction
  – Cycle time reduction

• Shredded currency fibers
  – Blend of linen and cotton
  – Good impact performance

• Implementation targets
  – Coin tray
  – Interior trim
Unique Technical Challenges

- **Automotive Interior** – challenging environment
  - high heat, humidity and sun load
  - performance maintained over lifetime of vehicle – 10 years/100,000 miles

- Some bio-polymers will degrade with exposure to heat & moisture
  - balance between durability & compostability

- **Solutions Ford is Researching**
  - Overcome performance and durability issues of biopolymers like PLA through the use of additives and blends with other plastics
  - Develop traditional polymers from renewable monomers and chemical feedstocks
Bio-based Monomer Technologies

• Producing traditional plastics (PP, PE, PA, PET, PBT) from bio-based feedstocks rather than petroleum
  – Utilize bio-chemical reactions
  – Good long term durability
  – Material can be used in existing processes
  – Known performance and attributes
  – Reduce dependence on foreign petroleum
    • Local supply
    • Multiple material sourcing possible
  – Improved carbon footprint
The Need for Domestic Rubber Crops

• The U.S. is totally dependent upon NR imports from tropical countries – and consumes about 1.2 million MT/yr (of 10 million MT total NR)

• NR production is dependent upon one genetically-narrow plant species, *Hevea brasiliensis* (clones) – we need biodiversity

• Synthetic rubber is derived from petroleum with escalating costs

*Data courtesy of OARDC*
Possibilities for Sustainable Rubber?

- Partnering with OSU – OARDC to develop Russian Dandelion and Guayule as a domestic, sustainable source for rubber
- Potential use as a rubber modifier in TPO or bio-based plastic materials for interior trim applications
Recycled Content

Recycled materials:
- Reduce the use of petroleum based virgin plastics
- Improve environmental footprint
- Divert waste from landfills
Recycled Fabrics and Carpet

- In 2009, Ford required all fabrics have a minimum of 25% recycled content.
- Explorer uses 25% recycled PET fiber in all interior fabrics.
- Focus Electric uses 100% recycled PET fabric (REPREVE).
Recycled Bottles to Make Carpet

Each person could recycle enough bottles in one year to provide carpeting for about 15 new Escapes.

Based on 180,000 YTD sales, more than 4 million plastic bottles could be diverted from landfills by putting them in the all-new Ford Escape.
Recycled Clothing for Sound Absorption Materials

- Vehicles contain ~ 2 pairs of blue jeans as sound-dampening material to eliminate road, wind and powertrain noise.
- Diverting scrap from the textile industry from landfills:
  - The textile scrap gets shredded and processed into the backing of interior panels and carpeting.
Recycled and Renewable – Together!

- Gaskets and Seals compounded from recycled tires and soy
- Used 2.2 million pounds of rubber from recycling 210,000 tires, and 150,000 pounds of soy.
- Lighter weight than the prior gaskets
Driving Green Solutions For All