Environment

During 2008 we:

- **Made a new fuel-economy commitment**
- **Reduced facility CO_2 emissions**
- **Reduced water use and waste**

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This section reports on the environmental impacts of our operations, including those from our products, our manufacturing processes and our facilities and properties. For a high-level view of impacts throughout our value chain, please see Our Value Chain and Its Impacts.

Assessing Materiality

The materiality analysis used to plan this report identified eight environment-related issues as among the most material. Five are the same as those for last year's report:

- Low-carbon strategy
- Vehicle greenhouse gas emissions
- Fuel economy
- Cleaner technologies
- Public policy: GHG/fuel economy regulation

Three new issues emerged as highly material in this year's materiality analysis:

- Low-carbon fuels, which replaced clean and alternative fuels as a key issue in the materiality analysis done for last year's report, reflecting an increasing focus on the life-cycle carbon footprint of fuels
- Vehicle electrification, which emerged as a new issue in this year's materiality analysis
- Emissions trading and the cost of carbon, also a new issue in this year's analysis, reflecting the establishment of carbon markets in some regions and their likely future establishment in others

The analysis also revealed a global theme of increasing expectations regarding, and regulation of, a range of environmental issues associated with our products and manufacturing facilities. These issues include energy and water use (due to rising costs and concerns about long-term availability); tailpipe emissions and end-of-life management (due to increasing regulation); and product materials use (due to opportunities to improve the environmental performance of vehicles and cut costs through "cradle-to-cradle" solutions).

Precautionary Principle

The precautionary principle is the idea that if the consequences of an action are unknown, but are judged to have some potential for major or irreversible negative consequences, then it is better to avoid that action. We do not formally apply the precautionary principle to decision making across all of our activities. However, it has influenced our thinking. For example, in addressing climate change as a business issue, we have employed this principle.

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In This Report:

Materiality Analysis

Our Value Chain and Its Impacts

Progress

In 2008, Ford made significant progress on the environmental aspects of its products and operations. For example:

- Ford committed that, beginning with the 2010 model year, all new or significantly redesigned vehicles will be best in class or among the best in class for fuel economy in their segment. All of the 2010 model year vehicles released in North America as of May 2009, as well as many 2009 model year vehicles, meet this commitment.
- For the 2008 model year, the Corporate Average Fuel Economy (CAFE) of Ford's cars and trucks increased by 2.9 percent relative to 2007. Preliminary data for the 2009 model year show a 4.0 percent improvement in CAFE compared to 2008.
- Ford is developing a comprehensive sustainable materials strategy to maximize the effectiveness and broaden the implementation of sustainable materials in our vehicles. One of the key goals of this strategy is to identify and globally implement materials technologies that improve environmental and social performance and lower costs. We also continue to expand our use of recycled and renewable materials.
- For the fourth consecutive year, Ford was honored with an Energy Star Sustained Excellence Award from the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE). This award recognizes Ford's continued leadership in and commitment to protecting the environment through energy efficiency.
- Ford reduced facilities CO_2 emissions by over 44 percent from 2000 to 2008 and facilities CO_2 per vehicle by 24 percent from 2000 to 2008.
- Ford continued its leadership in facility greenhouse gas (GHG) reporting in 2008. In China, we became the first automaker to release a GHG emissions report; the report covers emissions from our Chongqing facility. In the U.S., we were the first automaker to join The Climate Registry, a voluntary carbon disclosure project that links several state-sponsored GHG emissions-reporting efforts, including the California Climate Action Registry and the Eastern Climate Registry.
- Ford continued to reduce water use and waste sent to landfill in 2008. We reduced global water use by 24 percent and landfilled waste by 22 percent, relative to 2007.

2008 Year-Over-Year Environmental Performance Metrics

Metric	2008 Target	2008 Actual	2009 Target
Energy Use			
Facility energy efficiency (Global)	3% improvement	12% increase [1]	3% improvement
Facility energy efficiency (North America)	3% improvement	4.5% improvement [2]	3% improvement
Energy use	No specific goal; continue use reductions	33.7% compared to 2000 levels	No specific goal; continue use reductions
Emissions			
VOC emissions from painting at North American assembly plants	Maintain 24 gms/sq meter	Maintained 24 gms/sq meter	Maintain 24 gms/sq meter
Water Use			
Water use (Global)	3% reduction	24% reduction	6% reduction
Waste Production			
Landfill waste (Global)	5% reduction	22% reduction	10% reduction

1. Energy efficiency is calculated in million Btus (mmBtu) per unit. For our global efficiency calculation, the energy use is not adjusted for variances in production or weather. We experienced a reduction in global energy efficiency due to a 17 percent reduction in production during 2008. Plants in shutdown mode reduced but did not entirely eliminate their energy use. Although our energy use per vehicle produced was less efficient in 2008, we reduced global energy consumption by seven percent due to significantly lower production volumes.
2. This is a percent improvement in our North American energy efficiency index, which is normalized based on an engineering calculation that adjusts for typical variances in weather and vehicle production. The Index was set at 100 for the year 2000 to simplify tracking against our target of one percent improvement in energy efficiency. Therefore, the 4.5% improvement in 2008 is based on a year 2000 baseline.

Environmental Management

Ford has an environmental Policy and environmental Directives that apply to our operations globally (see our Code of Conduct Handbook). All Ford manufacturing facilities and our product development function are certified to ISO 14001, the leading global standard for managing environmental issues. In addition, we have asked our preferred "Q1" suppliers of production parts to certify their facilities. These commitments place our most significant potential environmental impacts under one comprehensive environmental management system.

In this section, we report on the systems we use environmental management systems we use in our manufacturing, product development, and with our supply chain to insure environmental issues are addressed.

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Manufacturing

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Ford's manufacturing management sets environmental targets annually for all of our facilities. We develop these targets through a comprehensive process that considers past performance, future regulation trends, environmental technology advances, financial conditions and other relevant factors. The global targets are then translated into regional- and facility-level targets, which differ depending on the relevant regulations and financial and production constraints in each region. Within our powertrain operations, for example, goals are set by determining the highest-performing powertrain plant for each environmental performance metric. Then each "best-in-class" plant's performance becomes the new goal that every powertrain plant is required to meet.

In 2005, we began to implement an Environmental Operating System (EOS) at our North American assembly plants. As a counterpart to our Quality Operating System, the EOS provides a standardized, streamlined approach to maintaining compliance with all legal and Ford internal requirements. The EOS drives compliance responsibility to the operations level by assigning compliance-related tasks to the appropriate personnel and tracking the completion of those tasks.

The EOS is integrated with other key management systems at the plant level, including ISO 14001. The EOS provides information, standardized tools and processes to support the ISO 14001 requirement to identify and manage compliance issues. The EOS has been fully implemented throughout U.S. and Canadian manufacturing operations, and is currently being implemented in the rest of our global operations.

Ford has moved to group ISO 14001 certification for its plants in North America. All powertrain plants share a single group certification. Likewise, assembly plants, stamping plants, Ford Customer Service Division facilities and South American plants each have their own group certification. Instead of being audited yearly by a third party, each plant is now audited every three years. Group certification saves time and money, with no degradation in plant environmental performance.

In 2007, we implemented the Global Emissions Manager database (GEM), which provides a globally consistent approach for measuring and monitoring environmental data. This system helps us track our efforts to reduce water consumption, energy use, carbon dioxide emissions and the amount of waste sent to landfill. The data GEM provides and the level of analysis it allows also helps us set more effective environmental management targets and develop more specific strategies for improving environmental performance. We are continuing to add metrics and tracking systems to GEM to further enhance our environmental management objectives.

RELATED LINKS

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Operations

External Web Sites:
ISO 14001

Product Development

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In Ford's Global Product Development System, environmental objectives – including targets for fuel economy, vehicle emissions, the use of recycled materials and renewable materials, and restrictions on substances of concern – are defined at the outset of the design process for every new Ford vehicle. We track our progress toward these targets throughout the product development process. The targets are broken down from the vehicle level to the supplier or component level, and they enter into each contractual agreement signed between Ford and its suppliers. As part of our One Ford global integration process, we are developing targets for a range of vehicle attributes, such as fuel economy, quality and safety, which will make our vehicles either leaders or among the leaders with competitor vehicles in the same segments. We develop these competitive vehicle attribute targets for every vehicle program to deliver on key customer demands and Ford strategies by using a range of consumer data, internal brand data and competitor vehicle data. Based on this process, we have determined that beginning with the 2010 model year, all of our new vehicles will be the best in class or among the best in class for fuel economy in their segment. We have already begun to implement this product attribute leadership; as of May 2009, all of our 2010 model year vehicles released in 2009, and many of our 2009 model year vehicles, meet this commitment. For examples of our 2009 and 2010 vehicles that meet this commitment, please see "Delivering More Fuel-Efficient Vehicles."

We use our Design for Environment (DfE) tool to bridge the gap between product development and environmental management. DfE uses simplified life-cycle assessments and costings, substance restrictions, checklists and other tools to identify and reduce significant impacts. We are continuing to broaden the range of issues we consider in our product development process as we move from Design for Environment to Design for Sustainability (DfS). Ford of Europe's Product Sustainability Index is incorporating DfS principles, in order to improve each vehicle's environmental, social and economic performance.

RELATED LINKS

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- Delivering More Fuel-Efficient Vehicles
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Suppliers

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ISO 14001 certification is expected of all "Q1," or preferred, production suppliers as well as nonproduction supplier facilities if the supplier has a manufacturing site or a nonmanufacturing site with significant environmental impacts that ships products to Ford.

We are continually improving our systems for influencing the integration of sustainability throughout our supply chain. We began this process by requiring all of our Q1 suppliers to obtain ISO 14001 certification for implementing and following an environmental management system in their facilities. In 2006, we attained our goal of having 100 percent of our Q1 production suppliers gain ISO 14001 certification for facilities supplying Ford. We also encourage our suppliers to extend the benefits of improved environmental performance by requiring their own suppliers to implement environmental management systems as well.

We also work in cross-industry forums to encourage common approaches to the supply chain challenges of our industry. Since 2007, for example, we have been a member of the Suppliers Partnership for the Environment, an innovative partnership between automobile original equipment manufacturers, their suppliers and the U.S. Environmental Protection Agency. This partnership works to create new and innovative business-centered approaches to environmental protection and provides a forum for small, midsize and large automotive and vehicle suppliers to work together, learn from each other and share environmental best practices.

In 2006, we introduced our Aligned Business Framework (ABF), a strategy for working more closely with key suppliers to lower costs and improve quality. As part of this framework, ABF suppliers commit to managing and assuring proper working conditions and responsible environmental management in their facilities and in their supply chain.

Our work with ABF suppliers to date has focused on providing support and resources to help them align with Ford's Code of Basic Working Conditions and implement supporting process, including responsible environmental management systems. Ford has committed to providing suppliers with a range of support and assistance based on our experiences in this area. During the fourth quarter of 2008, we held two sustainability sessions in Troy, Michigan, which were attended by senior management from Ford and our ABF suppliers. Topics covered in these meetings included internal training development guidance and discussion of key emerging environmental and sustainability topics of interest to Ford and our suppliers. We are now working with these suppliers to improve environmental performance as well.

RELATED LINKS

In This Report:
Supply Chain
Suppliers
Code of Basic Working Conditions

External Web Sites:
ISO 14001

Design for Life-Cycle Sustainability

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We use a life-cycle approach to assess and minimize the total environmental impacts of our vehicles – from raw materials extraction and transportation through manufacturing and use to end of life. This approach considers and works to minimize environmental impacts upfront in product design decisions. Called Design for Sustainability, the approach is integrated and holistic, to ensure that we achieve a balance between environmental, social and economic aspects in our product development process.

We are continuing to advance how we apply DfS principles. For example, we have developed a Product Sustainability Index tool, which is currently in use in our European product development operations. This tool helps us assess and find opportunities to reduce the impacts of our products over their entire life-cycle. We are increasing our use of sustainable materials and eliminating undesirable materials. We are also working to reduce greenhouse gases and other emissions from our facilities and vehicles by developing cleaner and more energy-efficient production processes, improving the efficiency of our packaging and transportation logistics and introducing cleaner and more fuel-efficient vehicles. Downstream in our value chain, we are working with drivers to educate them on ways to increase fuel economy and reduce vehicle emissions through our eco-driving program. Upstream, we are working with our suppliers to increase the sustainability of our products throughout the supply chain.

The remainder of this Environment section reports on our efforts to improve the sustainability of our products, operations and supply chain. For more information on our development of fuel-efficient vehicle technologies, please see the Sustainable Technologies and Alternative Fuels Plan.

RELATED LINKS

In This Report:

- Product Sustainability Index
- Operational Energy Use and Greenhouse Gas Emissions
- Logistics
- Delivering More Fuel-Efficient Vehicles
- Sustainable Technologies and Alternative Fuels Plan
- Supply Chain

Quantifying Our Environmental Impacts

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The first important step in improving the life-cycle impacts of our products is to understand the environmental aspects of our products and the potential environmental impacts associated with them.[1] The stages of a vehicle's life-cycle include materials production, parts fabrication, vehicle assembly, vehicle operation (including fuel production), maintenance and repair, and end-of-life disposal and recycling. While estimates vary depending upon the specifics of the vehicle analyzed, one cooperative, multi-industry analysis of a typical family sedan (a spark-ignited, gasoline-powered, Taurus-class family sedan weighing 1,532 kilograms (kg)) found that during its life-cycle:

- 960 gigajoules of energy are consumed
- 21,000 kg of hydrocarbon are consumed
- 60,000 kg of carbon dioxide are emitted

In that study, it was assumed that the vehicle was driven a total of 120,000 miles at an average metro/highway fuel efficiency of 22.8 mpg. The study also found that:

- Vehicle operation consumes 86 percent of the life-cycle energy
- Vehicle operation generates 87 percent of the life-cycle CO_2
- Vehicle production generates 65 percent of the particulates and 34 percent of the life-cycle sulfur dioxide

This is consistent with a recent review of life-cycle studies, in which it was found that the operational stage generally accounts for 80 to 90 percent of the total energy consumption and CO_2 emissions of conventional gasoline-powered vehicles, depending on the vehicle's material composition, average fuel efficiency and lifetime drive distance. For example, a 2006 life-cycle assessment study of the Ford Galaxy and S-MAX, confirmed that the vehicle's use-phase consumes more energy and produces more CO_2 emissions than the vehicle's other life-cycle phases. Other impact categories are mainly dominated by the mining and materials production phases.

1. *Environmental aspects* is a term used in the ISO 14001 framework to denote elements of an organization's activities, products and services that can interact with the environment. *Potential environmental impacts* include any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products or services. Local Ford facilities use corporate lists of environmental aspects and potential impacts to identify and amplify those aspects that apply to their operations.

Product Sustainability Index

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Ford's European operations have been leading our efforts to incorporate the principles of designing for sustainability and the use of a life-cycle management approach. Ford began integrating Design for Environment principles into the product development process in the early 1990s. Initially we focused on designing our vehicles to facilitate end-of-life disassembly and recycling by taking into account the accessibility of parts to be disassembled, the type and number of different fasteners used and the marking of parts for easy identification. Based on several studies, however, it became clear that focusing on a single life-cycle phase (e.g., end of life) leads to sub-optimizations and potentially increased impacts in other life-cycle phases. Since then, we have shifted our focus to include a more comprehensive life-cycle approach to improving the sustainability of our vehicles. This focus incorporates the material and component production phase and the use phase, as well as effects on the end-of-life phase. In 2002, we began to use a holistic Design for Sustainability approach that incorporates social and economic aspects as well as environmental aspects[1] into our life-cycle analysis and design approach.

In 2006, Ford of Europe introduced the Product Sustainability Index, or PSI, a tool that incorporates a life-cycle analysis of the environmental, social and economic aspects of its vehicles from the earliest stages of their development. Ford's PSI tracks eight product attributes identified as key sustainability elements of a vehicle. These are: life-cycle global warming potential (mainly carbon dioxide emissions); life-cycle air-quality potential (other air emissions); the use of sustainable materials (recycled and renewable materials); vehicle interior air quality (including allergy certification from TÜV Rheinland, a product testing organization); exterior noise impact (drive-by noise); safety (for occupants and pedestrians); mobility capability (seat and luggage capacity relative to vehicle size); and life-cycle ownership costs (full costs for the customer over the first three years).

This index was launched in the development of the 2006 Ford S-MAX and Galaxy, and was used to develop the 2007 Mondeo, 2008 Kuga and 2009 Fiesta. As a result of using the PSI assessment system, all of these models have shown improvements in environmental, social and/or economic performance when compared to the previous models. The chart below shows specific performance and areas of improvement for each model. The PSI will be used on all future products developed by Ford of Europe. Detailed reports on the PSI analysis for these vehicles can be downloaded from Ford of Europe's Web site.

PSI Assessed Models Performance[2]

Select a PSI Factor >

Measurement Method

Emissions of CO_2 and other greenhouse gases from raw material extraction to material, part, and vehicle production, driving period (150,000 km; incl. air conditioning) and final recycling/recovery (i.e., full vehicle life-cycle, cradle-to-cradle)

	Performance*	Better/worse than previous model
2006 Ford S-MAX 2.0L TDCi with DPF	39 metric tonnes CO_2	Similar
2006 Ford Galaxy 2.0L TDCi with DPF	40 metric tonnes CO_2	Similar
2007 Ford Mondeo 2.0-liter TDCi Diesel with DPF	37 metric tonnes CO_2	Better
2008 Ford Kuga	37 metric tonnes CO_2	No previous model
2009 Ford Fiesta ECOnetic, Diesel	21 metric tonnes CO_2	Better
2009 Ford Fiesta, Petrol	30 metric tonnes CO_2	Better

RELATED LINKS

In This Report:

Improving Vehicle Interior Air Quality and Choosing Allergy-Tested Materials

On Ford.co.uk:

Product Sustainability Index Vehicle Reports

Vehicle Web Sites:

Ford Fiesta
Ford Mondeo
Ford Kuga
Ford Galaxy
Ford S-MAX

* 1 metric tonne = 1,000 kg

Measurement Method

Summer smog-related emissions from raw material extraction to material, part, and vehicle production, driving period (150,000 km; incl. air conditioning) and final recycling/recovery (i.e., full vehicle life-cycle, cradle-to-cradle)

	Performance	Better/worse than previous model
2006 Ford S-MAX 2.0L TDCi with DPF	37 kg ethene	Similar
2006 Ford Galaxy 2.0L TDCi with DPF	37 kg ethene	Similar
2007 Ford Mondeo 2.0-liter TDCi Diesel with DPF	35 kg ethene	Better
2008 Ford Kuga	35 kg ethene	No previous model
2009 Ford Fiesta ECOnetic, Diesel	22 kg ethene	Better
2009 Ford Fiesta, Petrol	32 kg ethene	Better

Measurement Method

Use of recycled and natural materials

	Performance	Better/worse than previous model
2006 Ford S-MAX 2.0L TDCi with DPF	18 kg of non-metals	Better
2006 Ford Galaxy 2.0L TDCi with DPF	18 kg of non-metals	Better
2007 Ford Mondeo 2.0-liter TDCi Diesel with DPF	7.5% of non-metals	Better
2008 Ford Kuga	6% of non-metals	No previous model
2009 Ford Fiesta ECOnetic, Diesel	8.5% of non-metals	Better
2009 Ford Fiesta, Petrol	9% of non-metals	Better

	Performance	Better/worse than previous model
2006 Ford S-MAX 2.0L TDCi with DPF	Substance management, TÜV-tested pollen filter efficiency and allergy-tested label	Better
2006 Ford Galaxy 2.0L TDCi with DPF	Substance management, TÜV-tested pollen filter efficiency and allergy-tested label	Better
2007 Ford Mondeo 2.0-liter TDCi Diesel with DPF	Substance management; TÜV-tested interior and pollen filter efficiency	Better
2008 Ford Kuga	TÜV-tested interior and pollen filter efficiency	No previous model
2009 Ford Fiesta ECOnetic, Diesel	TÜV-tested interior and pollen filter efficiency	Better
2009 Ford Fiesta, Petrol	TÜV-tested interior and pollen filter efficiency	Better

Measurement Method

dB(A)

	Performance	Better/worse than previous model
2006 Ford S-MAX 2.0L TDCi with DPF	71 dB(A)	Better
2006 Ford Galaxy 2.0L TDCi with DPF	71 dB(A)	Better

2007 Ford Mondeo 2.0-liter TDCi Diesel with DPF	69 dB(A)	Similar
2008 Ford Kuga	72 dB(A)	No previous model
2009 Ford Fiesta ECOnetic, Diesel	69 dB(A)	Better
2009 Ford Fiesta, Petrol	72 dB(A)	Similar

Measurement Method

Complex method, structural stability, occupant safety, and pedestrian safety; active safety elements, etc. including Euro NCAP stars

	Performance	Better/worse than previous model
2006 Ford S-MAX 2.0L TDCi with DPF	Euro NCAP safety rating: 5 stars for adult occupant protection, 4 stars for child protection and 2 stars for pedestrian protection	Better
2006 Ford Galaxy 2.0L TDCi with DPF	Euro NCAP safety rating: 5 stars for adult occupant protection, 4 stars for child protection and 2 stars for pedestrian protection	Better
2007 Ford Mondeo 2.0-liter TDCi Diesel with DPF	Euro NCAP safety rating: 5 stars for adult occupant protection, 4 stars for child protection and 2 stars for pedestrian protection	Better
2008 Ford Kuga	Euro NCAP safety rating: 5 stars for adult occupant protection, 4 stars for child occupant protection and 3 stars for pedestrian protection	No previous model
2009 Ford Fiesta ECOnetic, Diesel	5-star Euro NAP rating for adult occupant safety; electronic stability control available for all versions	Better
2009 Ford Fiesta, Petrol	5-star Euro NCAP rating for adult occupant safety; electronic stability control available for all versions	Better

Measurement Method

Mobility service (including seats, luggage) to vehicle size; measured as vehicle shadow in m² and luggage areas in liters

	Performance	Better/worse than previous model
2006 Ford S-MAX 2.0L TDCi with DPF	10.25 m² shadow area, 1171 l luggage, 5 seats	Better
2006 Ford Galaxy 2.0L TDCi with DPF	10.4 m² shadow area, 435 l luggage, 7 seats	Similar
2007 Ford Mondeo 2.0-liter TDCi Diesel with DPF	9 m² shadow area, 530 l luggage, 5 seats	Better
2008 Ford Kuga	9.5 m² shadow area, 410 l luggage, 5 seats	No previous model
2009 Ford Fiesta ECOnetic, Diesel	7.5 m² shadow area, 295 l luggage compartment	Better
2009 Ford Fiesta, Petrol	7.5 m² shadow area, 295 l luggage compartment	Similar

Measurement Method

Sum of vehicle price and 3 years' service (fuel cost, maintenance cost, taxation) minus residual value

	Performance	Better/worse than previous model
2006 Ford S-MAX 2.0L TDCi with DPF	Approx. €22,100	Better
2006 Ford Galaxy 2.0L TDCi with DPF	Approx. €23,200	Better
2007 Ford Mondeo 2.0-liter TDCi Diesel with DPF	Approx. €18,300	Better
2008 Ford Kuga	Approx. €19,100	No previous model

2009 Ford Fiesta ECOnetic, Diesel	Approx. €13,000	Similar
2009 Ford Fiesta, Petrol	Approx. €11,000	Better

The PSI assessment system has been reviewed and certified by outside experts. One study, conducted by experts in the area of life-cycle science and sustainability, found the PSI to be a design and analysis step that provides a full sustainability assessment and meets the requirements of ISO 14040, the international life-cycle assessment standard. PSI assessments of the 2006 S-MAX and Galaxy vehicles were certified by the International Organization for Standardization (ISO) for life-cycle assessment improvements. This certification process also verified the overall PSI methodology.

1. ***Environmental aspects*** is a term used in the ISO 14001 framework to denote elements of an organization's activities, products and services that can interact with the environment.
2. PSI-rated models are only available in Europe.

Products

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As a customer- and product-driven company, our vehicles are the foundation of our business. Our products are also a major focal point of our environmental impacts and our efforts to reduce those impacts.

This section reports on the environmental aspects1 of our products, from their design through their use to the end of their life-cycle. Specifically, we report on:

- The fuel efficiency of our products and product related greenhouse gas emissions
- Tailpipe emissions including hydrocarbons, nitrous oxides, carbon monoxide and particulate matter that can contribute to smog formation and other air pollution issues.
- Sustainable materials including our efforts to increase our use of recycled and renewable materials, to improve vehicle interior air quality, and to eliminate substances of concern.

1. ***Environmental aspects*** is a term used in the ISO 14001 framework to denote elements of an organization's activities, products and services that can interact with the environment.

By the end of 2009, Ford will be using soy foam seats on more than 1 million vehicles, reducing petroleum oil usage by approximately 1 million pounds per year.

Fuel Economy and Greenhouse Gas Emissions

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Our current fuel economy performance is discussed in this section. We are also pursuing the development of new technologies with fuel economy benefits for the future, including additional hybrids, plug-in hybrids, battery electric vehicles, advanced diesel engines, hydrogen-fueled internal-combustion engines, fuel cell vehicles and biofueled vehicles, as discussed in the Sustainable Technologies and Alternative Fuels Plan. Our climate change strategy and participation in public policy processes related to climate change and fuel economy are discussed in the Climate Change section.

Fuel Economy Performance – U.S.

For the 2008 model year, the Corporate Average Fuel Economy (CAFE) of our cars and trucks increased by 2.9 percent relative to 2007. Preliminary data for the 2009 model year shows a 4.0 percent improvement in CAFE compared to 2008, with a 2.2 percent improvement for cars and a 4.7 percent improvement for trucks.

In 2008, Ford committed that beginning with the 2010 model year, all of the new vehicles will be best in class or among the best in class for fuel economy in their segments. Many of Ford's 2009 model year vehicles already meet this promise. For examples of Ford's 2009 and 2010 model year vehicles that are best in class for fuel economy, please see "Delivering More Fuel-Efficient Vehicles."

As seen in the Fuel Economy of U.S. Ford Vehicles by EPA Segment graphic, our 2009 U.S. vehicles are generally competitive with others in the industry in fuel economy, ranking better than average in three of nine categories, worse in two and the same in four.

For the 2009 model year, we offered six vehicles that get 30 mpg or better, based on highway fuel economy estimates. These vehicles include the Ford Focus (models of which get 35 mpg on the highway), Ford Escape Hybrid, Mercury Mariner Hybrid, and Volvo V50, C30 and S40. Compared to 2008, the number of 2009 vehicles that achieve 30 miles per gallon or better has increased.

In 2007, Congress passed legislation requiring the National Highway Traffic Safety Administration (NHTSA) to set standards to increase average fleet-wide fuel economy to 35 mpg by 2020. In March 2009, NHTSA issued CAFE regulations for the 2011 model year. As a result of President Obama's One National Standard announcement in May 2009, it is expected that the Environmental Protection Agency (EPA) and NHTSA will issue standards under a joint rulemaking in early 2010. The EPA will issue greenhouse gas standards under the Clean Air Act for the 2012–2016 model years, and NHTSA will issue rules setting CAFE standards for the same period. The EPA and NHTSA rules are to be aligned with each other so that they effectively amount to one standard.

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Fuel Economy Performance – Europe

In Europe, we have reduced the average carbon dioxide emissions of the vehicles we sell by 18.9 to 22.9 percent depending on the brand, compared with a 1995 baseline. We have achieved these reductions by introducing a variety of innovations, including an advanced common-rail diesel engine, available on many of our vehicles, and lightweight materials.

In 2007, we announced the Ford ECOnetic label, a new line of ultra-low-CO_2 alternatives for selected car lines that leverages several advanced fuel-saving technologies. The ECOnetic name was chosen because it links ecologically friendly technology to our "energy in motion" design philosophy, which combines driving quality and emotional styling. These cars use a combination of the latest common-rail diesel powertrains and other carefully selected features engineered to reduce CO_2 emissions to the absolute minimum. The technologies used include high-strength steels and other lightweight materials;

RELATED LINKS

In This Report:

Delivering More Fuel-Efficient Vehicles

Fuel Economy of U.S. Ford Vehicles by EPA Segment

On Ford.co.uk:

Ford ECOnetic vehicles

Vehicle Web Sites:

Ford Focus

Ford Escape Hybrid

Mercury Mariner Hybrid

Volvo V50

Volvo C30

Volvo S40

External Web Sites:

Corporate Average Fleet Economy

electric-power-assisted steering; an aerodynamics kit, including lowered ride height and aerodynamic details such as wheel covers and wheel deflectors; low-rolling-resistance tires; special low-viscosity transmission oil; and low-friction engine oils developed by Ford's fuel partner BP. The following table highlights the fuel economy and CO_2 improvements and other benefits of the ECOnetic models introduced thus far.

Benefits of Ford's ECOnetic Models[1]

	Fuel Economy [2]			
Model	MPG (US)	liters/100km	CO_2 Emissions	Other Benefits
2008 Ford Focus ECOnetic, with 1.6-liter Duratorq TDCi Diesel engine	54.7 mpg	4.3	115 kg/km	Best-in-segment CO_2 emissions for conventional powertrain
2009 Ford Mondeo ECOnetic, with 2.0-liter Duratorq TDCi Diesel engine	45.2 mpg	5.2	139 kg/km	
2009 Ford Fiesta ECOnetic, with 1.6-liter Duratorq TDCi Diesel engine	63.6 mpg	3.7	98 kg/km	Best-in-segment fuel economy; exempt from UK CO_2-based road taxes

We are also working to meet EU regulations for CO_2 emissions from passenger vehicles. In December 2008, the EU approved a regulation of passenger car CO_2 emissions that limits the industry fleet average to a maximum of 130 g/km, using a sliding scale based on vehicle weight. This regulation provides different targets for each manufacturer based on its respective fleet of vehicles, according to vehicle weight and CO_2 output. Limited credits are available for CO_2 off-cycle actions ("eco-innovations"), certain alternative fuels and vehicles with CO_2 emissions below 50 g/km. The specifics of these regulations will begin being issued in 2012. For manufacturers failing to meet targets, a penalty system will apply, with fees ranging from €3 to €95 for each g/km shortfall in the years 2012–2018, and €95 for each g/km shortfall for 2019. For 2020, an industry target of 95 g/km has been set. This target will be reviewed again in 2013.

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1. ECOnetic vehicles are only available in European markets.
2. These fuel economy numbers are calculated according to the European Fuel Economy Directive EU 93/116/EEC, which uses European drive cycles. They differ from fuel economy calculations developed in the U.S. or other regions of the world. However, the mpg figures are calculated using the U.S.-sized gallon, which is 20 percent smaller than a European gallon.

Tailpipe Emissions

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RELATED LINKS

In This Report:

Improving Fuel Economy

External Web Sites:

U.S. EPA Tier 2 Emissions Standards

California Air Resource Board Low Emission Vehicle Program

EPA Green Vehicles Guide

Vehicle tailpipe emissions, as currently defined by the U.S. Environmental Protection Agency, are primarily the result of incomplete combustion of fossil fuels, or impurities in the fuels. Regulated tailpipe emissions include hydrocarbons, nitrous oxides, carbon monoxide and particulate matter. These emissions contribute to smog formation and other air pollution issues, which are regulated in the U.S. by the EPA under the Clean Air Act.

United States

In the United States, Ford is completing the phase-in of the world's most comprehensive set of vehicle emissions requirements – the Tier 2 regulations of the U.S. Environmental Protection Agency. Tier 2 will be fully phased in with the 2009 model year.

The Tier 2 program began with the 2004 model year and coordinates the introduction of cleaner fuels with more stringent vehicle tailpipe emissions standards, in order to achieve near-zero emissions from cars and light trucks. These regulations significantly reduce targeted vehicle emissions, including nitrogen oxides and non-methane organic gases, to help reduce the formation of ozone and particulate matter. The Tier 2 regulations apply to all passenger cars, light trucks and medium-duty passenger vehicles.

The comprehensive Tier 2 emissions program was designed specifically to address national air-quality issues in aggregate and includes targeted improvements in vehicle fuels. Because of this comprehensive approach, the Tier 2 program is more cost-effective and flexible than the California program. We do not support the state-by-state adoption of the California's state standards.

The results from the EPA's mobile source control programs, including the Tier 2 program, are impressive. The integrated and systematic approach has enabled significant reductions in smog-forming tailpipe emissions from our vehicles. By meeting these regulations, Ford has eliminated nearly 24.5 million pounds of smog-forming emissions from our light-duty fleet over the 2004 to 2007 model years. Overall, the program is expected to result in an estimated reduction in oxides of nitrogen emissions (from all relevant mobile sources) of at least 1.2 million tons by 2010.

In 2008, we continued to improve the emissions of our truck fleet by introducing a cleaner F-150 Harley Davidson edition. By applying advanced combustion and after-treatment technology, this work truck was able to achieve emissions levels 30 percent cleaner than the EPA's final fleet average requirement and 69 percent lower than the previous model year.

For the California market, Ford is required to meet the state's stringent Low Emission Vehicle II (LEVII) emissions requirements for light-duty vehicles. Under the LEVII program, a PZEV, or Partial Zero Emission Vehicle, is associated with virtually zero vehicle emissions. Strictly speaking, PZEV vehicles are required to:

- Meet California's Super Ultra-Low Emission Vehicle exhaust emissions standard (SULEVII)
- Produce zero fuel system evaporative emissions
- Be emissions compliant for a full useful life of 150,000 miles

In practical terms, a PZEV operated over three weeks of average driving emits fewer smog-forming emissions than a new lawn mower operating for about 30 minutes. Put another way, grilling a quarter-pound hamburger emits more smog-forming emissions than a 60-mile commute in a PZEV.

Ford's 2008 model year PZEV products included the Ford Focus, Fusion, Taurus, Taurus X and Escape

Hybrid; the Mercury Milan, Mariner Hybrid and Sable; and the Volvo S40 and V50. For the 2009 model year, we will be offering PZEV versions of the Ford Focus, Fusion and Escape, and the Mercury Milan and Mariner.

In order to focus our resources most effectively in these difficult economic times, we have decided that, going forward, we will focus on technologies like EcoBoost™ that deliver fuel-efficiency and emission benefits across our entire U.S. vehicle lineup, instead of continuing to expand the number of PZEV-compliant versions we make specially for the California market.

Information about the performance of all Ford vehicles sold in the United States can be found at the EPA's Green Vehicles site.

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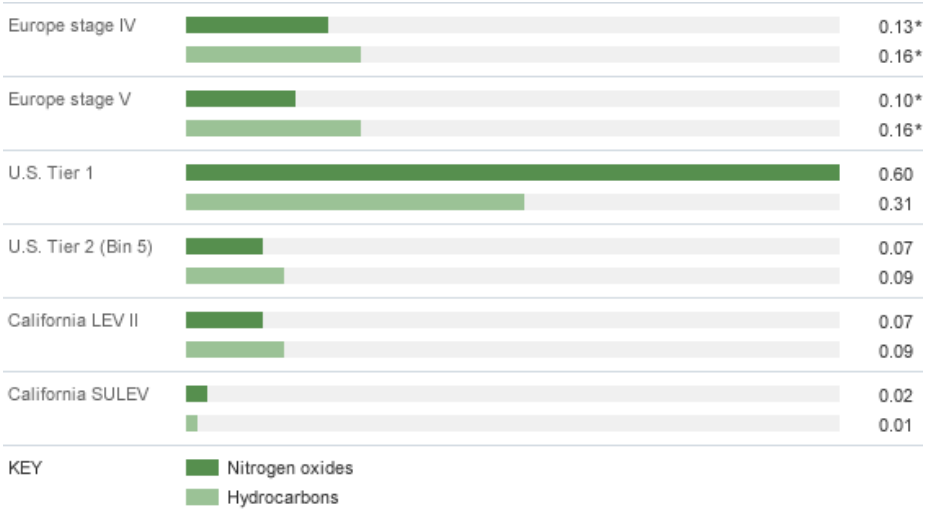
Europe

Since 1990, tailpipe emissions from Ford vehicles sold in Europe have been reduced by up to 90 percent via the development of improved engine technologies (specifically diesel engines) and high-tech exhaust gas treatment devices. Ford of Europe has introduced diesel particulate filter systems for an increasing number of its new vehicles, as well as for older diesel-powered Ford vehicles already in customers' hands.

Further air-quality improvements have been generated as we have introduced vehicles equipped with technology to meet the more-stringent Euro 4 and 5 emissions standard. All of our new passenger cars registered as of January 1, 2006, and all light-duty vehicles as of January 1, 2007, comply with the Euro 4 standard. We are now developing vehicles to meet the Euro 5 standard, which requires continued reductions in nitrogen oxide (NOx) emissions from both gasoline and diesel vehicles. All cars sold in Europe must meet the Euro 5 standards by September 2009 for new or significantly redesigned vehicles and by January 2011 for all vehicles. Trucks must meet the Euro 5 standard by January 2012. Ford has already begun introducing vehicles that meet the Euro 5 standard and will increase the number of Euro 5 vehicles in 2009.

Emissions Regulations in the U.S. and Europe

Chart Table



	Nitrogen oxides	Hydrocarbons
Europe stage IV	0.13*	0.16*
Europe stage V	0.10*	0.16*
U.S. Tier 1	0.60	0.31
U.S. Tier 2 (Bin 5)	0.07	0.09
California LEV II	0.07	0.09
California SULEV	0.02	0.01

* Standard for vehicles using gasoline as fuel

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Sustainable Materials

Print report

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Materials are an important element of a vehicle's life-cycle sustainability. Choices about materials can influence the safety, fuel economy and performance of the vehicle itself and can also have implications throughout the value chain. A material can be more or less sustainable based on a number of factors, including its origin (virgin, renewable or reclaimed), the resources used and emissions produced throughout its life-cycle, and its application.

Ford has been working for many years to increase the use of recycled and renewable materials and reduce the use of undesirable materials. Vehicles in North America typically are composed of 20 to 25 percent post-consumer recycled material by weight, primarily due to the extensive use of metals with recycled content. Therefore, Ford has concentrated its efforts on developing new uses for recycled materials in the non-metallic portions of the vehicle, which are typically composed of virgin materials. While the amount of recycled content in each vehicle varies, we are continuously increasing the amount of recycled material used in each vehicle line. As described in the section on Design for Life-Cycle Sustainability, we use tools such as Design for Sustainability and life-cycle assessment and life-cycle costing to help make beneficial materials choices.

For many years, Ford has a had a Voluntary Recycled Content Usage Policy, which sets targets for the use of non-metallic recycled content for each vehicle and increases targets year by year. We are now developing a comprehensive sustainable materials strategy to maximize the effectiveness and broaden the implementation of our efforts in these areas. One of the key goals of this strategy is to identify and globally implement materials technologies that improve environmental and social performance and lower costs. To accomplish this, we are working with our commodity business planners and materials purchasers to communicate opportunities for the purchase of sustainable materials, develop and test pilot applications for new materials, and implement successful sustainable alternatives across multiple parts and vehicle lines. This process will standardize and broaden the use of sustainable materials in our vehicles. We are also developing global materials specifications, which will further facilitate the incorporation of sustainable materials where they meet performance requirements.

In 2008, for example, we developed a comprehensive resin strategy that requires the use of recycled plastics for all underbody and aerodynamics shields, fender liners and splash shields, stone pecking cuffs and radiator air deflector shields manufactured in North America. These parts will now be made out of post-consumer recycled waste from detergent bottles, tires and automotive battery casings. Many Ford vehicles already use recycled materials for these applications, including the Ford Flex, Focus, Fusion, Edge, Ranger, F-150 and Explorer; the Mercury Milan; and the Lincoln MKZ, MKX and Navigator. This recycled materials resin strategy will save money and reduce landfill waste. We estimate that Ford saved $4 to $5 million in 2008 by using these recycled materials and diverted between 25 and 30 million pounds of plastic from landfills.

RELATED LINKS

In This Report:

Design for Life-Cycle Sustainability

Vehicle Web Sites:

Ford Flex
Ford Focus
Ford Fusion
Ford Edge
Ford Ranger
Ford F-150
Ford Explorer
Mercury Milan
Lincoln MKZ
Lincoln MKX
Lincoln Navigator

Choosing More Sustainable Materials

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We are working to improve the sustainability of our vehicles by using more sustainable materials. This includes increasing the use of recycled, renewable, recyclable and lightweight materials. Recycled materials incorporate post-consumer and/or post-industrial waste materials; renewable materials are made from plant-based materials; and lightweight materials use special materials and/or designs that provide the same or better performance as other alternatives with less weight.

Recycled Materials

We have focused our efforts to increase recycled materials on non-metallic parts, which traditionally have little or no recycled content. As described previously, we are mandating the use of post-consumer recycled materials in multiple exterior black parts as part of our comprehensive resin strategy. These materials were used in the underbody system of the 2009 Ford Flex, which won the Society of Plastics Engineers 2008 Vehicle Engineering Team Award for use of innovative materials. The Flex's recycled plastic underbody system uses approximately 20 pounds of post-consumer recycled waste per vehicle, while reducing costs by 10 to 40 percent. We are also using post-consumer recycled carpeting in many exterior parts that use nylon resins, including air cleaner housings, engine fans, fan shrouds, HVAC temperature valves, engine covers, cam covers and carbon canisters.

All of Ford's European vehicles use recycled polymers, where these are seen as contributing to a sustainable material supply and providing a more sustainable solution. In the Ford Focus, for example, the battery tray is made of 50 percent recycled materials, the carpets contain approximately 20 percent recycled content, the air conditioning housing contains 20 percent recycled content and the fan shroud contains 25 percent recycled content.

We are also using recycled materials for interior and surface parts. This can be much more challenging than using recycled materials for underbody, subsurface and exterior black parts, because it is difficult to get the necessary appearance and performance when using recycled materials. In the U.S., we are continuing to expand our use of recycled seat fabrics and seat components that meet all appearance and performance requirements. The following table highlights these latter efforts.

Seat-Related Recycled Materials Achievements[1]

Vehicle	Material	Partner	Benefits
2010 Taurus SHO	100% post-consumer yarns for seat fabric	Miko Fabrics	▪ Reduces waste ▪ Reduces energy consumption 64% ▪ Reduces CO_2 emissions 60%
2010 Lincoln MKZ	100% post-consumer yarns for seat fabric	Miko Fabrics	▪ Reduces waste ▪ Reduces energy consumption 64% ▪ Reduces CO_2 emissions 60%
2010 Ford Fusion and Mercury Milan Hybrids	85% post-industrial yarns and 15% solution-dyed yarns in seat fabric	Milliken	▪ Reduces energy use ▪ Reduces CO_2 emissions ▪ Reduces the use of dyes and chemicals ▪ Reduces water use ▪ Decreases the use of foreign oil
2008-2009 Ford Escape and Mercury Mariner Hybrids and	100% post-industrial recycled yarns in seat fabric	Interface	▪ Uses 600,000 gallons less water* ▪ Produces 1.8 million lbs less CO_2

RELATED LINKS

In This Report:

Sustainable Materials

Sustainable Technologies and Alternative Fuels Plan

Vehicle Web Sites:

Ford Expedition

Ford F-150

Ford Focus

Ford Escape

Mercury Mariner

Lincoln Navigator

Lincoln MKS

Lincoln MKT

Ford Mondeo

Ford Kuga

gas vehicles	equivalents* ■ Reduces electricity use by 7 million kWh*

* Based on an annual volume of 80,000 vehicles

By the 2009 model year, the seat fabrics in new or redesigned vehicles will have least 25 percent post-industrial recycled content. In addition, many of our non-woven headliner fabrics now contain 50 to 75 percent recycled yarns, depending on their color.

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Renewable Materials

We are also actively researching and developing renewable material applications that will reduce our overall use of petroleum products, while providing superior performance. For example, research scientists at Ford's Research and Innovation Center in the U.S., Ford's Research Center in Aachen Germany, and Ford of Brazil are focused on developing automotive foams, plastics and composites derived from renewable resources.

Since 2002, our researchers have led the development of **soy-based polyurethane foams** for automotive applications. The manufacture of soy foam reduces carbon dioxide emissions, decreases dependency on oil and increases the utilization of renewable, agricultural commodities. In 2007, Ford was the first automaker to implement this innovative technology (on the seat cushions and seat backs of the Ford Mustang), and we have since migrated its use to the Ford Expedition, F-150, Focus and Escape, the Mercury Mariner, and the Lincoln MKS and Navigator. In these vehicles, soy polyol replaces a portion of the standard petroleum-based polyol. Within a year, Ford will be using soy foam seats on more than one million vehicles, which will reduce petroleum oil usage by approximately 1 million pounds annually. Life-cycle analyses show a net decrease of 5.5 pounds of CO_2 per pound of soy oil used, resulting in a net decrease of greater than 5.3 million pounds of CO_2 and 1 million pounds of petroleum conserved annually for the vehicles on which we have already implemented soy foam. The soy foam used on the Mustang alone is expected to deliver a CO_2 reduction of 605,000 pounds annually.

Ford has been recognized for this innovative technology through multiple awards, including the United Soybean Board Excellence in New Uses Award (2006), the Society of Plastics Engineers' Environmental Division Award (2008), the Society of Automotive Engineers' International Environmental Excellence in Transportation Award (2008), and the Society of Plastics Engineers' Automotive Division Innovation Award in the Environment category (2008).

Ford has licensed its soy foam technology to two companies – John Deere and Sears Manufacturing – that are investigating soy foam for seating applications in their agricultural equipment products. Soy foam not only uses a sustainable, agricultural crop but offers the potential for cost savings and stability from petroleum-product price swings. Ford continues to collaborate with the United Soybean Board, which has sponsored research grants for new applications using soy products. For example, Ford scientists are currently assessing the use of soy meal and flour as a filler in synthetic rubber applications.

We are using **engineered wood technology**, which is both a recycled and a renewable resource, on several interior applications in North American vehicles. This wood has been recycled and reassembled and then is stained to give it a warm, rich appearance. In addition, the use of engineered wood eliminates many of the extra processing steps necessary in producing real wood automotive trim parts, and the processing required is more environmentally friendly. For example, water-based stain can be used instead of solvent-based, and a solvent wash to remove oils is not needed. Additional bleaching and sealing operations are also eliminated, which greatly reduces the production of volatile organic compounds. Engineered wood technology also uses input materials more efficiently, so less waste material is sent to landfills. Engineered ebony wood was implemented on the 2008 Lincoln Town Truck, the 2008 and 2009 Navigator and the 2008 MKX. This technology will also be used on the 2009 MKS.

We are also using renewable materials on our European vehicles. For example, the Ford Mondeo uses a mixture of **50 percent kenaf plant fiber and 50 percent polypropylene** in the compression-molded interior door panel. The average Ford vehicle sold in Europe uses between 10 and 20 kilograms of renewable materials, depending on the vehicle size class.

In addition, Ford researchers are developing new implementations of other renewable materials, such as **corn-based, compostable and natural-fiber-filled plastics** for automotive applications. These materials will help to reduce the resource burden and waste generated by our vehicles and will help to reduce the weight of vehicles and improve their fuel economy.

For example, we are developing a **sustainable replacement for the fiberglass** now used

between the headliner of a vehicle and the roof sheet metal. The replacement material is bio-based, reduces weight, improves acoustics and neutralizes odor.

We are also developing **natural-fiber composites** as a potential substitute for the glass fibers traditionally used in plastic automotive components to make them stronger. For example, we are assessing the possibility of substituting up to 30 percent of the glass-fiber reinforcement in injection-molded plastics with sisal and hemp natural fibers. These parts have competitive mechanical and thermal properties and good surface appearance, and can be cost competitive. These natural-fiber reinforced parts also reduce vehicle weight significantly and reduce life-cycle CO_2 emissions, compared to glass-fiber-reinforced parts.

Finally, we are investigating ways to use **plastics made entirely from sustainable resources** such as corn. These bio-based materials could have multiple benefits, including reduced dependency on petroleum, reduced CO_2 emissions and the ability to compost instead of landfill materials at end of life. Ford researchers have made considerable inroads with polylactic acid (PLA) – a biodegradable plastic derived completely from the sugars in corn, sugar beets, sweet potatoes and other vegetables. When plastic parts made from PLA reach the end of their useful life, they can biodegrade in 90 to 120 days. By contrast, traditional petroleum-based plastics are projected to remain in landfills for up to 1,000 years. We are also assessing bio-yarns to make plant-based fabrics.

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Lightweight Materials

We are also actively pursuing the development of cutting-edge materials to reduce the weight of our vehicles and improve their fuel economy without compromising safety or performance. For example, we are using nanotechnology to develop advanced lightweight materials that will allow us to decrease vehicle weight without sacrificing strength, safety or performance. Much of this work focuses on developing the ability to model material properties and performance at the nanoscale, which will allow us to develop better materials more quickly and with lower research and development costs. For example, Ford researchers recently implemented **virtual aluminum casting technology**, which uses nanoscale modeling of one commonly used aluminum alloy to improve the performance and reduce the costs of lightweight aluminum engine blocks. We are continuing our work with Boeing and Northwestern University, begun in 2007, to expand nanoscale modeling to other alloy types. This research will allow Ford to develop and implement better lightweight materials and significantly reduce the research, testing and prototyping costs and time required to bring these new materials to production vehicles. This technology will also advance Ford's goal of utilizing more recycled and recyclable materials by improving our ability to incorporate recycled aluminum without compromising the materials' performance characteristics.

In addition to this modeling work, Ford is experimenting with **nano-filler materials** in metal and plastic composites to reduce their weight while increasing their strength. For example, we are developing the ability to use nano-clays that can replace glass fibers as structural agents in reinforced plastics. Ford researchers are also investigating **new types of steel** that are 10 times stronger than current steels, **strengthening foams** that are strong enough to stabilize bodywork in an accident but are light enough to float on water, and **surface coatings** that reduce engine friction and remain intact even under the most adverse conditions.

Ford is also increasing the use of **aluminum and magnesium** to reduce vehicle weight. For example, we are currently working on a liftgate that combines a lightweight, die-cast magnesium inner panel with two stamped aluminum outer panels. The new liftgate represents a weight savings of more than 20 pounds, which in turn may allow for the use of smaller-displacement engines and lighter-weight suspensions and chassis components. This liftgate is planned to launch on the 2010 Lincoln MKT.

In Europe, we launched a **lightweight liftgate inner panel** on the 2009 Ford Kuga, which reduced weight compared to a steel liftgate inner panel by 40 percent and reduced costs by 10 to 20 percent. This liftgate inner panel was a finalist for the Society of Plastics Engineers' 2008 Chassis/Hardware/Powertrain Innovation Award. Ford researchers in Europe are also developing **alternative (copper-based) wire harness** technologies that will enable significant weight reduction.

For more information on our weight-reduction activities, please see the Sustainable Technologies and Alternative Fuels Plan.

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1. The vehicles referenced in this table are available only in the United States.

Improving Vehicle Interior Air Quality and Choosing Allergy-Tested Materials

Another focus area for our materials improvements efforts is interior air quality and allergy testing. In Europe, Ford has established design guidelines for materials and filtration and is migrating those guidelines across its product line. Through this initiative, Ford offers its customers products that address the growing societal concern about allergies. Ford of Europe vehicles were the first vehicles worldwide to be awarded an "allergy-tested interior" certification by TÜV Rheinland, the Germany-based organization that controls and approves quality standards for industrial and consumer products. To obtain this certification, materials used in the manufacture of the vehicle interior must meet strict requirements focused on three key areas: measuring and meeting in-vehicle air concentration of volatile organic compounds, minimizing the risk of allergic reactions and high-efficiency air filtration. The requirements for minimizing the risk of allergic reactions include ensuring that no substances with allergenic potential (e.g., latex, nickel, chromium VI) are used for components that are likely to have contact with people's skin. It also includes the use of an efficient pollen filter to protect passengers against allergenic particles in the outdoor air.

Seven of Ford's European models have met these requirements – the new Fiesta, the European Focus (including the Focus Coupe-Cabriolet), the C-MAX , Kuga, S-MAX, Galaxy and Mondeo. In February 2008, the Berlin-based European Center for Allergy Research Foundation awarded Ford with its quality certificate, as an additional recognition for the Company's "allergy tested interior vehicle" initiative.

To build upon our success and maximize the effectiveness and implementation of material improvements, Ford established a global cross-functional Product Action Team focused on vehicle interior air quality and allergen reduction. Consistent with our One Ford global integration process, the team is committed to investigating and developing comprehensive global approaches and strategies to address issues relating to vehicle interior air quality. In North America, we plan to implement the same high-efficiency filtration specifications as in Europe across most of our product line within the next four to five years. These filters are designed to reduce pollen and other allergy-related particles.

RELATED LINKS

Vehicle Web Sites:

- Ford Fiesta
- Ford Focus
- Ford Focus Coupé-Cabriolet
- Ford Focus C-MAX
- Ford S-MAX
- Ford Kuga
- Ford Galaxy
- Ford Mondeo

External Web Sites:

- TÜV Rhineland
- European Centre for Allergy Research Foundation

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Eliminating Undesirable Materials

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For more than 20 years, our Restricted Substance Management Standard has spelled out materials to be avoided or eliminated in Ford operations and in the parts and materials provided by suppliers. This and other materials management tools are helping us to meet and exceed customer expectations and ensure compliance with regulations.

Eliminating Mercury

Ford has decreased the use of mercury-containing components, which can pose problems at the end of a vehicle's life. In 2001, we eliminated mercury-containing switches, which accounted for more than 99 percent of the mercury used in our U.S. vehicles. Since that time, we have continued to focus on mercury reduction by working to eliminate this substance in the remaining mercury-containing components, including high-intensity discharge headlamps, navigation system screens and family entertainment system screens. Currently the Lincoln Navigator, Ford Mustang, Ford Flex, Lincoln MKS and Lincoln MKZ have mercury-free high-intensity discharge headlamps. Ford vehicles with mercury-free navigation system screens including the Ford Flex, Econoline, Escape, Edge, Expedition, Explorer, Sport Trac, F-Series and Super Duty; the Mercury Mariner and Mountaineer; and the Lincoln MKS, MKX and Navigator. The 2010 model year Flex and Lincoln MKT have mercury-free headrest family entertainment system screens.

In addition, we have helped to forge a collaboration between the U.S. Environmental Protection Agency, states, auto dismantlers, auto scrap recyclers, steelmakers and environmental groups to recycle mercury switches from end-of-life vehicles. This effort was rolled out across the United States in 2007 and now has more than 7,500 participants joining the effort from the recycling industry. On February 29, 2008, the EPA and its partners celebrated the collection of the one-millionth mercury auto switch at an auto dismantler's site in Georgia. By the end of 2008, more than 2 tons of mercury from these switches had been recovered. An online database tracks the number of participants in the program as well as the number of switches collected by state.

Eliminating Chromium and Lead

Hexavalent chromium – "hex chrome" for short – is a corrosion coating (used, for example, on nuts, bolts and brackets in cars and trucks) that the U.S. Occupational Safety and Health Administration lists as a potential lung carcinogen. We did not wait for global regulations banning the use of hex chrome to take effect – we phased out its use worldwide. By 2007, Ford eliminated all hexavalent chromium-containing parts in Europe and North America. Replacement coatings have been thoroughly tested to ensure that they meet Ford's performance requirements.

In North America, Ford also has completed the transition from lead to steel wheel weights on light-duty vehicles. We are also working on implementing steel weights on Ford's F-450, F-550 and F53 heavy-duty trucks. In addition, Ford's Customer Service Division no longer offers lead wheel weights for sale to dealers, but offers steel wheel weights in their stead.

Ford has joined the EPA and other stakeholders in a commitment to reduce the use of lead in wheel weights through participation in the National Lead-Free Wheel Weight Initiative. Through this initiative, Ford has shared our experience with lead wheel weight phase-out with aftermarket wheel balancers and encourages all stakeholders to discontinue the use of lead in wheel weights.

Ford of Europe phased out the use of lead wheel weights in new and serviced vehicles in mid-2005.

RELATED LINKS

In This Report:

Materials Management Tools

Vehicle Web Sites:

Ford Mustang
Ford Flex
Ford Econoline
Ford Expedition
Ford Explorer
Ford Explorer Sport Trac
Ford F-150
Ford F-series Super Duty
Mercury Mariner
Mercury Mountaineer
Lincoln MKS
Lincoln MKX
Lincoln Navigator

End of Life

ENVIRONMENT
- Progress
- Environmental Management
- Design for Life-Cycle Sustainability
- **Products**
  - Fuel Economy and Greenhouse Gas Emissions
  - Tailpipe Emissions
  - Sustainable Materials
  - **End of Life**
- Operations
- Supply Chain
- Data
- Case Studies

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Automobiles are one of the most highly recycled consumer products in the world. All vehicles contain parts and materials – particularly iron, steel and aluminum – that can be recovered at the end of their useful lives. In North America, about 95 percent of vehicles that go out of registration are processed by a dismantler or scrap metal recycling facility, with 82 to 84 percent of the vehicle by weight recovered for reuse, remanufacturing or recycling.

In theory, end-of-life vehicles are nearly 100 percent recoverable. In practice, however, the cost in energy and labor to recover the final fractions often exceeds the value of the materials, and recent, independently reviewed environmental studies suggest that such efforts also offer no value to the environment. Ford focuses on achieving the highest economically viable and environmentally sound recovery percentage through a number of means, including selection of materials, labeling and providing information to dismantlers on materials and methods for treatment.

In the EU, automakers are required by EU Directive 2000/53/EC to ensure a cost-free take-back of vehicles (that they put on the market) at the end of their lives. This directive also requires that end-of-life vehicles (ELVs) are treated in an environmentally responsible manner. Since 2002, Ford has been at the forefront of providing return networks in the EU member states that have established regulations. Ford now has ELV take-back and recycling networks for Ford brand vehicles in 16 EU markets and participates in collective ELV recycling systems in another 10. For example, Ford was the first major manufacturer in the UK to put in place a comprehensive plan that met the European Commission's ELV directive. By working with Cartakeback.com, Ltd., we now have a network of more than 150 facilities providing unrivalled convenience to the last owner for the professional take-back, receipt and treatment of end-of-life vehicles. That network successfully achieved an 85 percent recycling and recovery achievement for all vehicles processed during 2007.

In May 2007, Ford became one of the first European automakers to be certified in compliance with ELV requirements by demonstrating to external authorities that the Ford processes properly manage the reusability, recyclability and recoverability aspects of vehicles. In 2008, the Ford Fiesta, Focus, Focus Convertible, C-MAX and Kuga were certified as reaching a recyclability of 85 percent and a recoverability of 95 percent.

Ford has also participated in research into alternative treatments for end-of-life vehicles. Most of the plastic, foam and other non-metal vehicle materials end up being shredded. Most of this "auto shredder residue," or ASR, ends up going to landfill. We have been working to assess the environmental impacts of burning ASR for energy. Together with other European automotive manufacturers, we sponsored a fully ISO 14040-compliant life-cycle assessment that showed that – from a purely environmental point of view – using recycling ASR for energy recovery is as beneficial as recycling it. However, we are also working on technologies that will facilitate the recycling of shredder residue materials. For example, working with Argonne National Laboratory through USCAR's Vehicle Recycling Partnership, we have developed a technology for recovering end-of-life vehicle materials from shredder residue. This partnership moved auto shredder residue recovery closer to commercialization.

In Europe, we have helped to pioneer a technology that turns used tires into rubber granules which, when mixed with asphalt, form a tough, flexible road surface. A road was constructed on Ford's Dagenham estate using this recycled material, and the new material is being carefully evaluated for possible use on roads throughout Europe.

RELATED LINKS

In This Report:
- Sustainable Materials
- Choosing More Sustainable Materials
- Eliminating Undesirable Materials

Vehicle Web Sites:
- Ford Fiesta
- Ford Focus
- Ford Focus Coupé-Cabriolet
- Ford C-MAX
- Ford Kuga

External Web Sites:
- Cartakeback.com
- Argonne National Labs Vehicle Recycling Research
- USCAR

Operations

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We have adopted a rigorous and holistic approach to reducing the overall environmental impacts of our manufacturing facilities. We have established global facility environmental targets that address the range of our environmental impacts, including energy use, emissions, water use and waste generation.

Every facility uses a detailed scorecard to report against environmental targets, so we can track and accelerate improvements. Progress toward the targets is reviewed throughout the year by senior management and CEO Alan Mulally at regular Business Plan Review meetings. In addition, these targets become part of the performance review metrics for every plant manager and regional manufacturing manager, as well as others in the management hierarchy up to the Group Vice President of Manufacturing and Labor Affairs. Our 2008 and 2009 targets and progress are shown in the Year-over-Year Environmental Targets chart.

To facilitate performance tracking, we also launched the Global Emissions Manager database, or GEM, in 2007. This industry-leading database provides a globally consistent approach for measuring and monitoring environmental data, which helps us track and improve our efforts to reduce water consumption, energy use, carbon dioxide emissions and the amount of waste sent to landfill. GEM also provides a library of environmental regulations relevant to each plant, significantly increasing the efficiency of tracking and meeting those regulations.

This section reports on our facilities' environmental performance, including energy use and greenhouse gas emissions, other emissions (including volatile organic compounds), water use, waste reduction, land use, compliance and remediation.

Ford has reduced global energy consumption by 33.7 percent and global water consumption by 56 percent since 2000.

RELATED LINKS

In This Report:

Sustainability Governance

Sustainability Management

Operational Energy Use and Greenhouse Gas Emissions

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Operational energy use and greenhouse gas emissions are inextricably linked. The majority of our facilities' energy comes from fossil fuel sources; hence operational energy use is a significant source of our companywide GHG emissions. Our efforts to reduce energy use and increase the use of renewable energy are also part of our strategy to reduce our GHG emissions and overall climate impacts. (See the Climate Change section for a discussion of our climate change strategy and product goals.)

We have been a leader in facilities-related GHG and energy-use reductions, public reporting of our GHG emissions, and participation in GHG reduction and trading schemes.

- In 2008, we were the first automaker to join The Climate Registry (TCR), a voluntary carbon disclosure project that links several state-sponsored GHG emissions-reporting efforts, including the California Climate Action Registry and the Eastern Climate Registry. As TCR members, we must demonstrate environmental stewardship by voluntarily committing to measure, independently verify and publicly report GHG emissions on an annual basis using TCR's General Reporting Protocol.
- We were the first automaker to participate in GHG reporting initiatives in China, Australia, the Philippines and Mexico. In late 2007, Ford of Mexico was recognized by the Mexican government for four consecutive years of participation in that country's voluntary GHG reporting program. Ford's first report was used as the template for subsequent reporting in that program.
- We voluntarily report GHG emissions in the United States and Canada.
- We are the only automaker participating in the Chicago Climate Exchange, North America's first GHG emissions-reduction and trading program.
- We were the first automaker to join the UK's Emissions Trading Scheme, which required us to agree to GHG emissions targets for all of our UK-based operations. This system was predecessor to the current mandatory European Union Emission Trading Scheme.
- Since 2005, GHG emissions from our European manufacturing facilities have been regulated through the EU Emission Trading Scheme. These regulations apply to nine Ford and Volvo facilities in the UK, Belgium, Sweden, Spain and Germany.

Our participation in these reporting, emissions-reduction and trading schemes has played an important role in accelerating our facilities' GHG emissions reductions activities.

Ford has reduced global energy consumption by 33.7 percent since 2000 and reduced energy consumption per vehicle by 10.4 percent during the same period. In 2008, Ford improved energy efficiency in its North American operations by 4.5 percent, resulting in savings of approximately $16 million. We measure energy efficiency in North America using our Energy Efficiency Index1. To drive continued progress, we have set targets to improve our facility energy efficiency by three percent globally and three percent in North America in 2009.

We reduced our total facilities-related carbon dioxide emissions by approximately 45 percent, or 4.3 million metric tons from 2000 to 2008. During this same period, we reduced facilities-related CO_2 emissions per vehicle by 24 percent. We have set a target to reduce our North American facility GHG emissions by 6 percent between 2000 and 2010 as part of our Chicago Climate Exchange commitment. The Company has also committed to reduce U.S. facility emissions by 10 percent per vehicle produced between 2002 and 2012, as part of an Alliance of Automobile Manufacturers program. Ford has already achieved a target to reduce absolute emissions from UK operations by 5 percent over the 2002–2006 timeframe, based on an average 1998–2000 baseline.

The U.S. Environmental Protection Agency and U.S. Department of Energy again recognized Ford's energy efficiency achievements by awarding us a **2009 Energy Star Sustained Excellence Award**, which recognizes Ford's continued leadership and commitment to protecting the environment through energy efficiency. This is Ford's fourth consecutive year winning this prestigious award. The Energy Star Sustained Excellence Award requires organizations to demonstrate proficiency through the management of projects and programs, data collection and analysis, and communication actions, including community outreach and active participation in Energy Star industry forums. Among the achievements recognized by the award is a 35 percent improvement in the energy efficiency of Ford's U.S. facilities since 2000, equivalent to the amount of energy consumed by 150,000 homes.

RELATED LINKS

In This Report:

Climate Change
Emissions Trading
Greenhouse Gas Emissions Reporting in China
Water Use
Waste Management
Minimum Quantity Lubricant Machining
Facilities-Related Emissions

External Web Sites:

EPA Energy Star
The Climate Registry
Chicago Climate Exchange
E.U. Emissions Trading Scheme

Since 2007, we have been using a **utility metering and monitoring system** to collect incoming electricity and natural gas consumption data for all Ford plants in North America. We use this near-real-time information to create energy-use profiles for all Ford facilities and to improve decisions about nonproduction shutdowns and load shedding, which involves shutting down certain pre-arranged electric loads or devices when we reach an upper threshold of electric usage. During 2008, this metering and monitoring system was essential in helping us to minimize energy use during extended production slowdowns and production shutdowns. Using this tool and other best practices, Ford's manufacturing facilities reached record lows in energy use.

Ford continues to use **energy performance contracts** to upgrade and replace infrastructure at its plants, commercial buildings and research facilities. Through these contracts, Ford partners with suppliers to replace inefficient equipment, funding the capital investment over time through energy savings. Projects have been implemented to upgrade inefficient lighting systems, paint-booth process equipment and compressed air systems, and to significantly reduce the use of steam in our manufacturing facilities. Since 2000, Ford has invested more than $220 million in plant and facility upgrades.

Ford has also established a three-year global effort to **consolidate and redesign its data centers** using best practices identified by the DOE and EPA's Energy Star program. First, we are consolidating data centers to dramatically reduce the number of managed facilities and their total energy demand. By 2010, we will have consolidated 20 existing centers into just six, a reduction of 70 percent. We are also "virtualizing" 2,000 servers into just 100 physical servers. These consolidations will result in a 90 percent reduction in power needs and a 95 percent reduction in cooling needs.

During this process we are also changing the layout of our remaining data centers to maximize their energy efficiency. By directing conditioned air into equipment racks, as opposed to cooling entire server rooms, expensive chilled air is used much more efficiently, and the load on building cooling equipment is reduced. We have also developed and implemented global data center design specifications, so that all new and remodeled data centers will meet high energy-efficiency standards. This three-year data center initiative is projected to yield $35 million in operational cost efficiencies.

We are also implementing a **network-controlled system on air compressors** used in the powerhouses of our powertrain and vehicle assembly plants. This industry best-in-class system can significantly reduce energy consumption. It allows for the real-time collection of key usage data through an enterprise-wide, Web-based data management tool. This data can then be used to determine the overall efficiency of each system and identify savings opportunities. The savings opportunity reports are generated automatically and sent to plant managers, who can then initiate corrective actions. The system also allows for remote troubleshooting of the equipment, which can extend equipment life and reduce maintenance costs. The system is also being used for remote operation of equipment at select facilities. As of January 2009, we had installed these systems at 29 plants on 181 compressors.

In 2008, we implemented a range of **energy-saving measures** at our Chicago Stamping Plant. For example, we replaced metal halide light fixtures in work bays with high-efficiency fluorescent fixtures. We also installed special controls on the plant powerhouse and wastewater treatment equipment, which will increase energy and process efficiency. These automated systems can schedule equipment startup and shutdown to match production schedules and can notify plant personnel and equipment suppliers of operational problems and equipment failures. Similar systems have been installed at our Walton Hills and Buffalo Stamping Plants.

In addition, we are implementing a **new paint process** that eliminates the need for paint to cure after the prime coat. This technology, called "three wet," reduces CO_2 emissions by 15 percent and volatile organic compound emissions by 10 percent. In addition to these environmental benefits, this process maintains industry-leading quality and reduces costs. The paint formulation contains new polymers and other additives to prevent running and sagging during the three-wet application process. Ford's laboratory tests show that this high-solids, solvent-borne paint also provides better long-term resistance to chips and scratches than water-borne paint. In part due to the quality benefits of the three-wet process, Ford tied for first place in the 2008 Global Quality Research System automotive quality survey for paint durability[2]. The process is also expected to reduce costs per vehicle, because it allows the elimination of a spray booth and an oven, and the attendant energy costs required to run them.

We completed the installation of a full production enamel line using the three-wet process at the Ohio Assembly Plant, which started production in March 2008. Ford is currently installing the three-wet paint process in three other assembly facilities globally: the Chennai plant in India, the Craiova plant in Romania and the Cuautitlán Assembly Plant in Mexico. Multiple facilities in North America are being evaluated for three-wet conversion, as refurbishment actions are being planned in line with the corporate business plan.

At our Twin Cities and St. Thomas Assembly plants in 2008, we implemented a new **paint pre-treatment technology** that significantly reduces energy use, energy costs, water use and waste production. This technology uses zirconium oxide instead of zinc phosphate, which allows the pre-treatment process to operate at room temperature instead of an elevated temperature. The new

process also requires fewer steps, further reducing energy consumption. The technology has already resulted in a $150,000 savings in energy costs at each plant.

In 2008, Ford also began implementing a new **parts washing system** developed in partnership with our supplier ABB Robotics. This technology reduces the amount of energy used in the parts washing process by more than 60 percent and reduces energy costs by approximately 90 percent. For more information, please see the Minimum Quantity Lubricant machining case study.

We are also capturing our own waste products and turning them into fuel. We have implemented **"fumes-to-fuel" technology** – which captures emissions from the painting process and uses them to generate electricity – in paint shops at three of our manufacturing facilities. This process cuts down on fossil fuel use and the resulting CO_2 emissions, as well as reducing emissions from our paint shops. For more information, please see the Volatile Organic Compounds section.

In Europe, our Cologne Merkenich Development Center implemented a **heat-energy reclamation joint venture** with the local utility RheinEnergie. In early 2009, the Cologne facility was connected to one of RheinEnergie's boiler houses via a 2.6 km pipe. This pipe transfers what was formerly waste heat to a heat exchanger, which then reuses that heat to produce electricity. This system reduces CO_2 emissions from the Cologne site by 191,000 metric tons per year. Ford and RheinEnergie signed an agreement to maintain this heat-exchange partnership for at least 10 years.

In 2008, Ford continued to participate in **legislative and regulatory processes** concerning renewable energy portfolios and energy efficiency strategies. Ford participates in these processes at the local, state and federal level by advocating for the use of energy efficiency as part of the long-term solutions for meeting electric generation needs and reducing greenhouse gas emissions. We also advocate for the use of programs such as the EPA's Energy Star Industrial Focus Groups as a model for developing strategies to benchmark industrial energy efficiency. Ford supported Michigan's and Ohio's new renewable portfolio standards, which include requirements for energy efficiency.

1. The Index is "normalized" based on an engineering calculation that adjusts for typical variances in weather and vehicle production. The Index was set at 100 for the year 2000 to simplify tracking against energy efficiency targets.
2. The Global Quality Research System is undertaken for Ford by the RDA Group.

Renewable Energy Use

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Ford is highly involved in the installation, demonstration and development of alternative sources of energy. Examples of installed technologies include a photovoltaic array and solar thermal collector at the Ford Rouge Visitors Center. The adjacent Dearborn Truck Plant has a living roof system, which uses a thick carpet of plants to reduce the need for heating and cooling, while also absorbing rainwater. In addition, a geothermal system installed at the Lima Engine Plant provides process cooling for plant operations, as well as air tempering for employee comfort. This system uses naturally cooled 40°F water from two abandoned limestone quarries located on the plant site. The installation cost was comparable to that of the traditional chiller and cooling tower design it displaced. This award-winning project eliminates the emission of 4,300 metric tons of carbon dioxide each year. We are also investigating the expansion of our existing reclaimed landfill gas installation at the Wayne Assembly Plant.

In the UK, construction was completed in 2004 on London's first wind power park, at Ford's Dagenham complex. The wind turbines provide 100 percent of the electricity required for our new Dagenham Diesel Centre. This is equivalent to the electricity needs of more than 2,000 homes and saves 6,500 metric tons of CO_2 from being released into the atmosphere each year. In 2007, Dagenham began the process of adding a third wind turbine in order to remain 100 percent wind powered, following the installation of a new 1.4/1.6-liter Duratorq TDCi engine line. The third wind turbine – which is subject to planning approval, would have the capacity to produce 1.8 megawatts of green electricity for Ford's Dagenham Diesel Centre – the equivalent of powering 1,000 homes. The Dagenham facility has also reduced its gas and electricity bills by 12 percent, by reducing the use of energy-intense operations such as the generation of compressed air for handheld tools on the production line. High-energy-use equipment was scientifically optimized on Dagenham's new engine assembly line; it requires 70 percent less energy per engine than other manufacturing lines. In 2007, Dagenham was nominated for a national "Award for Excellence" by a UK organization called Business in the Community, for the facility's CO_2 reduction, energy efficiency and other environmental actions.

In Germany, Ford is now sourcing renewable electricity to cover the full electric power demand of its manufacturing and engineering facilities in Cologne, including the electricity needed to assemble its Fiesta and Fusion models. Through this initiative, the Company will reduce its CO_2 emissions by 190,000 metric tons per year. The green electric power is recognized as coming from a fully renewable, environmentally friendly source; it is generated by three hydropower plants in Norway and Sweden, owned by Vannkraft AS (Norway) and Fortum AB (Sweden), and provided to Ford through the Cologne-based energy infrastructure service provider RheinEnergie AG.

In Wales, Ford's Bridgend engine plant was the first site retrofitted with one of the largest integrated, grid-connected solar/photovoltaic installations at a car manufacturing plant in Europe.

In 2008, renewable energy contributed less than 1 percent of our total energy use. We hope to increase this percentage in the future.

Water Use

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In 2000, Ford launched a water-reduction initiative and set a target of 3 percent year-over-year reductions in water use. From 2000 to 2008, Ford's global manufacturing operations reduced water consumption by more than 56 percent, or approximately 9.5 billion gallons. We reduced global water use approximately 24 percent from 2007 to 2008 alone.

When the initiative began, many facilities had little ability to track their water usage. Ford engineers thus developed a patented Water Estimation Tool (WET), a software program that helps facilities to predict their water usage. They then paired WET with WILD (Water Ideas to Lessen Demand), a list of practical ideas for reducing water use depending on where and when use is the greatest. Our facilities made good progress for several years, meeting or exceeding the 3 percent year-over-year water reduction goal that applied to all facilities. To encourage continued progress, Ford environmental engineers are developing "single point lessons" that document practices demonstrated to save water. These lessons are cascaded for mandatory implementation in all facilities and are included in facility business plans. Single point lessons implemented thus far include leak identification, cooling tower optimization and vehicle water testing.

Water use at each facility is also tracked in the Global Emissions Manager database, our global emissions management and tracking system. Water use is included in GEM in a monthly tracking scorecard reviewed by senior management.

In 2008, we piloted the use of a new water management tool developed by the World Business Council for Sustainable Development. This tool can be used to track water use, develop water management metrics and reporting systems, and assess water-related risks for individual facilities. A team of graduate students from the Kellogg School of Management at Northwestern University worked with Ford to analyze our global water use and water risks using this tool. Using water consumption data from our global manufacturing facilities, this project allowed Ford to evaluate water risks to its operations and prioritize actions to reduce those risks. Water risks include the impact of changing water supplies on facilities in drought-prone areas, the number of employees who live in areas with limited access to clean water and the number of suppliers in water-scarce areas.

Ford facilities have used these tools and innovative engineering to cut water use. For example, we implemented a new environmentally improved, anti-corrosion, pre- treatment technology at our Twin Cities and St. Thomas assembly plants. This technology uses a zirconium oxide vehicle bath instead of zinc phosphate treatment, which eliminates heavy metals, including zinc, nickel and manganese. It also has the potential to decrease the use of water and the production of hazardous waste. For more information on the waste and energy benefits of this technology, please see the Operational Energy Use and Greenhouse Gas Emissions and Waste Management sections. We are currently studying opportunities to implement this technology globally.

In 2008, we began implementing a new parts washing system – described further in a case study – that completely eliminates a former oily wastewater stream and reduces total wastewater by 95 percent.

RELATED LINKS

In This Report:

Operational Energy Use and Greenhouse Gas Emissions

Waste Management

Innovative Parts Washing System

External Web Sites:

WBCSD

Facilities-Related Emissions

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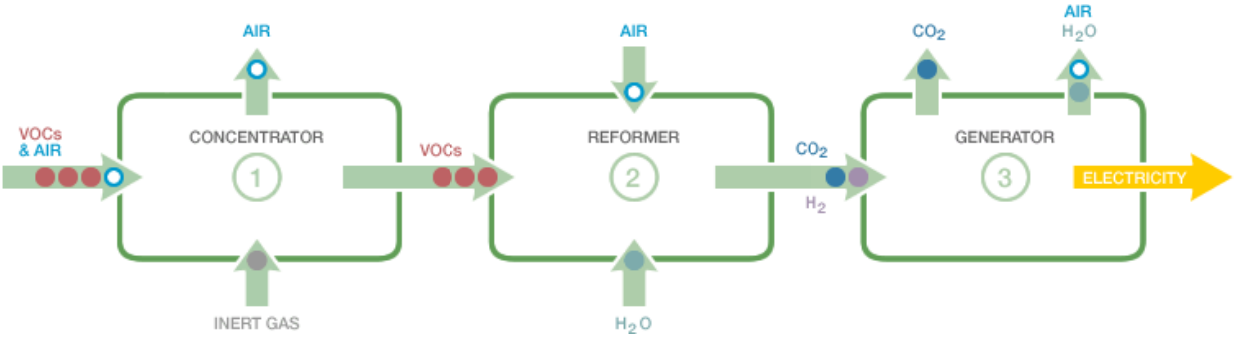
We report on a variety of facilities-related emissions in the Environment data section. In this section, however, we put particular emphasis on reducing our emissions of volatile organic compound (VOCs), because they are a significant aspect of Ford's manufacturing operations due to the large number of paint shops we operate. For more information on greenhouse gas emissions from facilities, please see Operational Energy Use and Greenhouse Gas Emissions.

Since 2000, Ford's North American operations have cut volatile organic compound emissions associated with the painting process (by far our largest source of VOC emissions) by 25 percent. In 2008, these operations emitted 24 grams of VOCs per square meter of surface coated. Because the control equipment used to reduce VOC emissions consumes significant amounts of energy, we have worked to identify innovative approaches to painting operations that meet cost, quality and production goals while allowing us to reduce energy use significantly and maintain environmental compliance.

As one element of this approach, Ford developed an innovative "fumes-to-fuel" system in partnership with Detroit Edison. Initially tested at the Dearborn Truck Plant, the system concentrates fumes containing VOC emissions from solvent-based paint and uses them as fuel to generate electricity. The Dearborn Truck Plant system fed the concentrated fumes into a fuel cell.



Generating electricity from paint fumes

Move over the numbers above to see what happens at each stage.

1 Concentrator

Strips air from paint fumes, leaving concentrated volatile organic compounds (VOCs)

2 Reformer

Ford-patented process converts VOCs to hydrogen gas

3 Generator

Uses hydrogen gas as fuel for fuel cell or conventional power plant to make electricity

In March 2007, a beta-test version of the fumes-to-fuel system was installed as a pilot project at Ford's Michigan Truck Plant. This system used a specially designed Stirling Cycle Engine that was more cost-effective than a fuel cell. The engine produced about 50 kilowatts of electricity to help power the facility. The only byproducts of the system, which cut electrical use by one-third to one-half, were small amounts of water vapor, CO_2 and nitrogen oxides (NOx). The Stirling Engine also produces heat during combustion, which may serve as another useful source of energy in the future.

RELATED LINKS

In This Report:

Waste Management

Operational Energy Use and Greenhouse Gas Emissions

Environment: Data

In 2008, we began full-scale implementation of a fumes-to-fuel system at our Oakville, Ontario, plant. This version is initially using a 120 kilowatt internal-combustion engine; it will migrate to a 300 kilowatt fuel cell in 2009. Once the system is complete, it is expected to reduce CO_2 emissions from the plant by 88 percent and eliminate nitrogen oxide (NOx) emissions as compared to traditional technology. At full production, the Oakville fumes-to-fuel system will generate approximately 1,500 kilowatt-hours of energy per day.

We are also reducing VOCs by eliminating painting entirely on some plastic parts, using "mold-in-color" plastic technology. Mold-in-color plastics are injection molded with high-gloss metallic color already incorporated. By eliminating the need to paint some molded plastic parts, this technology has the potential to significantly reduce paint-related VOC emissions. Mold-in-color also reduces costs and improves quality. In its first implementation, it saved $10 per vehicle, because there was no need to prime or paint the plastic parts after they were molded. The mold-in-color technology meets or exceeds all quality and performance requirements. For example, it performs significantly better than traditional painted parts in chipping and scratching. Because the color goes all the way through the part, chips and scratches do not show. This technology was introduced on the 2008 F-250 and Super Duty wheel lip moldings. We are working on other applications, including both exterior and interior plastic parts.

We are also reducing VOC emissions with an innovative paint process called "three wet." This process reduces VOC emissions by 10 percent and has other environmental, financial and quality benefits. For more information on "three wet," please see the Operational Energy Use and Greenhouse Gas Emissions section.

We are further reducing the VOC emissions associated with our paint shops by using new paint processes and materials. We recently introduced a new paint "purge" process at the Kentucky Truck Plant that significantly reduces VOC emissions. Purging is the process of cleaning out the lines and nozzles of automatic paint spray applicators between color changes or after downtime. This process uses a new purge material that is VOC-free, eliminating tons of VOC emissions to the air as well as solid and hazardous wastes. In addition to the environmental benefits, this process has resulted in significant cost savings without compromising paint quality.

Waste Management

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Ford's environmental goals include reducing the amount and toxicity of manufacturing-related wastes and ultimately eliminating the disposal of waste in landfills. Manufacturing byproducts include both hazardous and nonhazardous wastes. Ford has chosen to target eliminating the landfill of hazardous waste first, because this provides the quickest and most cost-effective benefits to human health and the environment.

In 2006, as part of our effort to continually improve our hazardous and nonhazardous waste reduction efforts, we began switching our data collection over to the European waste classification system. This system is a good fit for our waste streams and will allow improved benchmarking and comparison. This change was also part of our Global Emissions Manager database launch. Our data-collection process improvements are helping our facilities continue to develop new methods of reducing and better managing waste.

In 2008, Ford facilities globally sent more than 88,000 metric tons of waste to landfill, a decrease of more than 22 percent compared to 2007. Also in 2008, Ford facilities globally generated more than 47,000 metric tons of hazardous waste, a decrease of more than 10 percent from 2007.

We are committed to reducing waste at all of our facilities. For example, in 2007 we implemented a new paint line purging process at our Kentucky Truck Plant that replaces the former purge solution with a VOC-free material. This new material eliminates a formerly hazardous waste stream. Since implementation, this process has eliminated 74 tons of VOCs from the plant's waste stream. It has also eliminated more than 260,000 gallons of hazardous waste. The now nonhazardous waste stream is used by Waste Management, Inc., in a bioreactor to facilitate its landfill-gas-to-energy recovery process. This new purge process also reduces VOC air emissions from the paint process.

In 2008, we implemented a new paint primer technology at our Twin Cities and St. Thomas Assembly plants. This technology reduces a hazardous sludge waste stream and eliminates a hazardous wastewater stream; it also has the potential to reduce water usage.

Managers at all of our plants continually strive to increase their waste recycling.

In 2008, for example, the Lima Engine Plant in Lima, Ohio, achieved continued improvements in its recycling program. The plant recycled 11,185 tons of scrap metal, 13 tons of cardboard, 6 tons of office paper and 14 tons of wood and wooden pallets. This recycling program saved enough timber resources to produce more than 3.7 million sheets of newspaper and enough power to fulfill the annual needs of more than 3,350 homes. It also avoided the generation of 6,390 metric tons of greenhouse gas emissions.

In Europe, our Dagenham facility has prevented more than 12,600 metric tons of waste from being sent to landfills for disposal, via waste reduction and increased recycling. For example, metal filings and other waste from the machining process are squeezed dry of lubricants and then sold as briquettes for recycling. In addition, 20,000 square meters of floor concrete removed to install new engine lines was reused in the flooring of the new production line.

Similarly, when we redesigned our Michigan Proving Grounds in 2008, we saved 130,000 tons of asphalt and concrete from going to the landfill by reusing it to resurface the new track. For more information on the sustainability of this redevelopment effort, please see the Michigan Proving Ground Green Redevelopment case study.

RELATED LINKS

In This Report:

Facilities-Related Emissions
Water Usage
Green Construction at the Michigan Proving Grounds
Logistics

Sustainable Land Use

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Our activities have the potential to affect land use, nature and biodiversity, directly and indirectly. Our real estate portfolio includes properties for manufacturing and office use. The construction and operation of these facilities have direct impacts on land. The extent of these impacts depends on the size of each facility and whether it is a "greenfield" site (involving new construction) or a "brownfield" site (one previously used for industrial purposes). One example of our efforts to redevelop brownfield sites is the Fairlane Green retail center in Allen Park, Michigan, which we developed on a former landfill site. Ford's productive reuse of this landfill is providing amenities, jobs and taxes on a site that would otherwise have remained dormant. In May 2008, this redevelopment received the Phoenix Award for excellence in brownfield redevelopment.

Ford's most significant potential impacts on land and biodiversity are indirect, occurring elsewhere in our value chain or arising from the use of our vehicles. Indirect impacts include the extraction of raw materials to make vehicle parts, habitat fragmentation from road construction, localized pollution from vehicles and the potential effects of climate change on biodiversity.

Many of our facilities have taken steps to improve biodiversity and wildlife habitat on their lands, as follows.

Creating Wildlife Habitat

Ford has created wildlife habitats at many of its facilities. Wildlife habitats on Ford facilities range in size from five to more than 100 acres and include ecosystems as diverse as wetlands, woodlands, prairies, meadows and forests. Ford employees, often in partnership with local civic and education groups, develop and maintain the habitats, which host dozens of native plant and wildlife species. At many of the facilities, employees and other volunteers have built nature trails, erected bird and bat houses and planted wildflower gardens, in addition to establishing wildlife habitats. These facilities have also developed community education programs to encourage broader understanding of the importance of corporate wildlife sanctuaries. We are committed to maintaining our existing wildlife habitat sites and to creating new sites as possible in the future. For example, we have created large natural reserves at our facilities in Valencia, Spain, and Kocaeli, Turkey.

Sustainable Landscapes

A highly visible example of Ford's commitment to sustainability can be seen on more than 200 acres of Ford-owned land throughout southeast Michigan, which is adorned with sunflowers, wildflowers, prairie plants and other non-turf grass plantings. This landscaping provides habitat for wildlife; for example, fox, wild turkeys and coyote have been spotted on Ford properties. This landscaping also reduces mowing and other maintenance costs. By replacing what would otherwise be traditional turf grass, the Company saves approximately 30 percent on the costs of labor, gas and fertilizer.

Green Buildings

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Ford is a leader in green building, committed to the sustainable design of our facilities and landscapes using the basic principles of resource effectiveness, life-cycle assessment, health, safety and environmental performance. Ford is a member of the U.S. Green Building Council and a supporter of its green building rating system, known as LEED® (Leadership in Energy and Environmental Design). The LEED system includes a series of standards used for certifying buildings as "silver," "gold," or "platinum." It is recognized as the industry standard for green building. Ford employees who are involved in the design, operation and maintenance of commercial and manufacturing facilities have obtained LEED-Accredited Professional certification, which demonstrates their proficiency in the application of the LEED rating systems. Having this expertise in-house will continue to strengthen our knowledge and the speed at which we apply environmentally sustainable technologies and processes at our facilities.

We have also developed partnerships with our building-related service providers to help educate them and exchange information on the concepts of sustainable design. For example, we held had training sessions on site selection, water efficiency, energy-use reductions, sustainable materials and resources, and indoor environmental quality.

Energy Star Building Awards

Six of Ford's commercial facilities were awarded with an Energy Star Building Label from the U.S. Environmental Protection Agency in 2008. The awards recognize that the buildings are in the top 25th percentile for energy efficiency compared to a national database of similar buildings. As part of this award, each facility received a brass Energy Star plaque to display the achievement in their building lobby and communicate energy awareness to tenants and visitors.

Green Housekeeping Program

Ford promotes the use of environmentally friendly products in the operation and maintenance of its facilities. One example of this is the continued expansion of our "green housekeeping" program. Through this program, we are working with our Tier 1 suppliers and contractors to promote the use of environmentally friendly cleaning practices and water-based products that help to reduce the impact of facility operations on the environment. Our cleaning service providers use highly concentrated water-based chemicals with more efficient packaging, which significantly reduces product waste and the amount of fuel required to ship products. These green housekeeping practices are now in use throughout our North American manufacturing locations and commercial office buildings.

Ford Rouge Center

Ford's largest green building initiative is the redevelopment of the 600-acre Ford Rouge Center in Dearborn, Michigan, into a state-of-the-art lean, flexible and sustainable manufacturing center. The focal point of the center, the Dearborn Truck Plant, boasts a 10.4-acre living roof, part of an extensive stormwater management system that includes bio-swales and porous pavement to slow and cleanse the water. The Dearborn Truck Plant also features abundant skylights to maximize daylight in the facility. The Rouge Center features 100 acres of sustainable landscaping to help restore soils and support wildlife habitat.

Rouge Visitor Center (LEED-Gold)

The redeveloped Ford Rouge Center includes the LEED-Gold certified Rouge Visitor Center, a 30,000-square-foot facility featuring two multi-screen theaters and an observation deck. The facility uses rainwater for plumbing and irrigation, solar panels to produce energy and "green screens" of shading vines cover some parts of the building to reduce energy use.

Fairlane Green (LEED-Gold)

Ford has developed a 1-million-square-foot green retail center on its 243-acre industrial waste landfill in Allen Park, Michigan, earning the national Phoenix Award for excellence in brownfield development. In addition, Fairlane Green Phase I received the nation's first LEED-Gold certification for a core and shell retail development for its use of retention ponds for irrigation, sustainable landscaping and white roofs, and for the preservation of natural areas. The buildings feature high-efficiency heating and cooling systems, added insulation and weather sealing, and efficient windows and doors.

RELATED LINKS

External Web Sites:

Leadership in Energy and Environmental Design (LEED)

U.S. EPA Energy Star

Product Review Center (LEED-Silver)

Ford's Product Review Center in Dearborn showcases Ford's latest products and green building principles. The LEED-Silver-certified building incorporates an innovative system to recycle water for irrigation and cooling, large windows to maximize daylight and extensive use of local and recycled materials.

Compliance

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Manufacturing Plant Notices of Violation

Ford received 14 notices of violation (NOV) from government agencies in 2008. Twelve of the NOVs received were in the United States, one was in Brazil and one was in the Philippines. Four of these NOVs were related to the Sterling issue described below. The issuance of an NOV is an allegation of noncompliance with anything from a minor paperwork requirement to a permit limit, and does not necessarily mean that the Company was in noncompliance or received a penalty.

The Michigan Department of Environmental Quality (MDEQ) issued four Letters of Violation to the Sterling Axle Plant between April 17, 2008, and October 7, 2008, and has commenced a civil administrative enforcement proceeding against the Company. The Letters of Violation arise from the plant's disclosure of several potential violations of its air permits. We are working with the MDEQ to resolve the enforcement proceeding, and the plant has taken steps to correct and prevent recurrence of the potential violations.

Offsite Spills

In 2008, offsite spills occurred at eight Ford manufacturing facilities in the United States. All required reporting and cleanup was completed in a timely fashion.

Fines and Penalties Paid

In 2008, Ford paid approximately $2 million in fines or penalties globally pertaining to environmental matters in our facilities. The vast majority of this was paid in an administrative settlement with the Ohio Environmental Protection Agency (Ohio EPA) pertaining to the Cleveland Casting Plant. The U.S. Environmental Protection Agency had issued "Maximum Available Control Technology" regulations for foundries; these rules imposed more stringent air emission limitations on the iron melting operations at the Cleveland Casting Plant. To comply with the regulations required a significant investment to design and install new plant equipment and systems by April of 2008. Changing market conditions resulted in a decision to idle the Cleveland Casting Plant in 2010. This meant that Ford would be unable to recover the substantial costs associated with the new equipment and systems; the installation of such systems only makes sense if they are expected to be in operation for many years. Ford initiated negotiations with the Ohio EPA to allow the plant to continue operating without installing the additional equipment. An acceptable settlement was reached that allows the Cleveland Casting Plant to continue to operate through 2010.

Remediation

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Ringwood Mines Landfill Site

Ford Motor Company continues to address concerns raised in connection with Ford's prior disposal activities at the Ringwood Mines landfill site in New Jersey, including the adequacy of the prior investigation and cleanup of waste disposed by Ford. The Ringwood site was used for decades for the legal and illegal disposal of a wide variety of wastes by the Borough of Ringwood and other parties. Ford used the site to dispose of waste materials (primarily cardboard, wood wastes and paint sludge from the former Mahwah Assembly Plant) from 1967 to the middle of 1971. Ford previously participated in remediation activities at the site in the 1980s and 1990s. In September 2004, Ford entered into an Administrative Order on Consent and Settlement Agreement (AOC) with the U.S. Environmental Protection Agency regarding additional environmental activities at the Ringwood site. The EPA also requested the Borough of Ringwood's assistance in completing work at the site, and the EPA issued a Unilateral Administrative Order to the Borough regarding the Ringwood site. Ford is conducting further remedial work at the site pursuant to the AOC, all under the direction of the EPA and the New Jersey Department of Environmental Protection.

Edison Assembly Plant Concrete Disposal

When the Edison Assembly Plant was demolished, concrete from the site was crushed and reused by several developers as fill material at 10 different off-site locations. The New Jersey Department of Environmental Protection (DEP) later asserted that some of these locations may not have been authorized to receive the waste, due to low levels of contaminants in the concrete. In March 2006, the DEP ordered Ford, its supplier MIG-Alberici, Inc., and the developer Edgewood Properties, Inc., to investigate, and, if appropriate, remove contaminated materials from the development sites. Ford has substantially completed the work at a number of locations, and Edgewood is completing the investigation and remediation at several locations that it owns. Pursuant to the Administrative Consent Order, in January 2008 Ford paid approximately $460,000 for oversight costs, penalties and environmental education projects, and donated emissions reduction credits to the State of New Jersey. In April 2008, the DEP solicited public comments on the settlement. The DEP recently finalized the settlement without any material changes. Edgewood Properties has sought judicial review of the settlement. As previously reported, the New Jersey Attorney General's office also issued a grand jury subpoena and civil information request in March 2006. We fully cooperated with the Attorney General's office to resolve this matter, and it has closed its investigation of Ford.

Supply Chain

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As part of our life-cycle approach to sustainability, we work to improve the environmental, social and economic impacts "upstream" of our own manufacturing plants, including the impacts of transportation and logistics and the activities of our thousands of global suppliers. We work with our suppliers in a variety of ways to manage the impacts that occur when they provide us with goods and services.

In this section we discuss how we manage materials throughout our supply chain, our strategies to improve the logistics of parts transportation and packaging, and our other supply chain sustainability efforts.

Ford is working with suppliers to achieve parts packaging made from 100 percent recycled, renewable or recyclable materials.

RELATED LINKS

In This Report:

Suppliers

Materials Management Tools

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To manage materials across the vehicle life-cycle, Ford has developed a comprehensive set of processes and system tools called Global Materials Management. These processes and tools assist us in communicating materials requirements to suppliers, and in tracking the materials they use in the parts they manufacture. These tools include the Global Material Approval Process (GMAP), which handles all materials processed in Ford's plants; Global Material Integration and Reporting (GMIR), a materials tracking tool for our engineers and suppliers; and the International Material Data System (IMDS), a reporting system used by multiple automakers.

The IMDS was developed by seven auto manufacturers in 1997 to handle the tracking, review and reporting of all vehicle components and service parts from all suppliers. The IMDS, which now has 24 automotive companies as official members, is a Web-based system used internationally by suppliers to report on the substances and materials contained in parts for our vehicles. Ford has cooperated with other automakers to align reporting requirements for restricted substances and analyze the data provided. This helps us to identify substances and materials of concern and target them for elimination.

To further help our suppliers manage their materials and substance data, Ford developed and launched GMIR. Through the GMIR Supplier Portal, Ford lists all the parts that require reporting and suppliers post the materials they use and their certification status. Thus the system allows every supplier to monitor its reporting status and understand which parts are required to be reported. This two-way communication helps clarify a very complex materials management task and saves time and money for Ford and its suppliers. Thanks largely to the GMIR Supplier Portal, in 2008, Ford gathered more materials data from its suppliers than any other automaker. Ford uses the information obtained through GMIR to populate the IMDS. Ford vehicle programs reached an average of 91 percent of parts reported in IMDS in 2008. Based on the data reported, Ford was able to certify that all affected vehicles meet end-of-life directives in the EU and Japan.

For nondimensional materials (such as paint and adhesive) that are directly shipped to Ford plants, Ford launched GMAP – another electronic tool aimed at simplifying the global materials approval process. The GMAP process allows suppliers to use electronic transactions to submit their Material Safety Data Sheets and composition data. Internally, Ford approvers communicate their decisions of approval or rejection electronically. This new process saves time and ensures better-quality data for complying with government regulations and Ford policies.

In addition, Ford has developed systems to track and manage the use of chemicals in response to the REACH chemicals management legislation implemented by the European Union in 2007. REACH stands for Registration, Evaluation, Authorisation and Restriction of Chemical substances. The goal of the REACH legislation is to improve the protection of human health and the environment through better and earlier identification of the intrinsic properties of chemical substances. All manufacturers operating in Europe must provide information on the properties and safe handling of their chemical substances to a central database in Helsinki. In addition, the legislation calls for the progressive substitution of the most dangerous chemicals, once suitable alternatives have been identified. REACH provisions will be phased in over 11 years.

Ford has made great progress in complying with REACH. For example, we created a REACH manager position and formed a REACH task force to manage relevant activities, including conducting REACH inventory studies and generating all required reports for customers and consumers. Based on these studies, we have pre-registered 16 required substances from our own operations in the REACH database. We have also worked extensively with our suppliers to ensure their compliance with REACH thus far. Ford's existing Global Materials Management system will make it much easier for our suppliers to comply with these requirements. In addition, we ensured that all of the substances identified by the REACH legislation as "Substances of Very High Concern" are included in our own Restricted Substances Management Standard. This ensures appropriate reporting from our suppliers. As a result, Ford has the highest supplier response rate in the auto industry; all REACH-affected suppliers have committed to following REACH requirements through Ford's Global Materials Management system.

RELATED LINKS

In This Report:
- Sustainable Materials
- Choosing More Sustainable Materials
- Eliminating Undesirable Materials
- Suppliers

External Web Sites:
- IMDS
- REACH

Logistics

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Ford's physical logistics operations provide the safe and efficient transport of parts from our supply base to our manufacturing plants and of finished vehicles from the end of our assembly lines to our dealerships. Though logistics account for a relatively small percentage of total vehicle life-cycle emissions, we are working hard to maximize the efficiency of these operations to reduce both costs and environmental impacts. This work is managed by Ford's Material Planning and Logistics organization (MP&L), which is responsible for the design and operation of our transportation networks and for engineering high-quality and efficient packaging to protect materials while in transit.

Ford operates two sets of freight networks: one handles the collection and delivery of inbound parts and materials, while the other handles the delivery of outbound finished vehicles. The inbound freight networks are highly integrated. We move a large majority of parts ourselves, rather than having them delivered by suppliers, in order to give us greater control of the process. Material for all of our plants is collected together and then redistributed from centrally located transfer facilities closer to final destinations. Collection routes are planned so that trucks can collect smaller quantities from suppliers close to each other in a single journey. The effect of these strategies is to minimize the number and length of journeys required. Shipping quantities and collection frequencies are regularly reviewed, with the aim of further optimizing the networks.

In 2008, we integrated transatlantic freight into the domestic networks operated by Ford of Europe and Ford North America. In addition, in mid-2009 we will begin to use a single freight forwarding approach for the Asia Pacific region. The synergies that result from both of these projects will mean greater sharing of trucks and warehousing for stock awaiting export, which will further improve the efficiency of our transportation logistics.

We are also working to maximize the use of rail, river and short sea transport for inbound parts and materials, to reduce fuel costs, emissions and road congestion. To increase overall transport efficiency, we have implemented contracts that encourage our freight carriers to carry third-party freight on return journeys, rather than returning home empty. We are also working with rail companies to find ways to combine road and rail freight. In Europe, for example, we have begun using a truck/rail system that allows us to drive truck trailers directly on to special railcars. The trucks are carried by rail across France and then driven the final distance to our plants in Northern Europe.

Air freight is only used in emergency situations because of its relatively high cost and environmental impacts. Close attention has been paid to reducing the use of air freight. Between 2007 and 2008, for example, Ford of Europe decreased its use of premium air freight by close to 9 percent.

Ford MP&L has established a global team to specifically address the climate change impacts of transportation logistics. During 2008, the team focused on reducing carbon dioxide emissions caused by inbound freight. The team has been working to develop a methodology for calculating CO_2 emission levels and to identify and promote actions to reduce freight-related CO_2 in the long term. As part of this effort, Ford has partnered with the delivery company DHL International to support Masters' students at the University of Cologne in developing a practical calculation method for road and rail freight emissions. This project builds upon the CO_2 calculation methods used previously in our European operations. We are also working with UTi Worldwide, a global supply chain logistics company, to develop an approach for calculating CO_2 emissions associated with ocean freight. These efforts will enable a full computation of Ford's freight-related CO_2 emissions during 2009.

In North America, we have been working on practical applications for alternative fuel and engine technologies in our logistics activities, and have carried out a number of trials. These projects will help to both save fuel and reduce CO_2 emissions. In North America, for example, we have been collaborating with Georgia Tech University to produce a best practices handbook for truck carriers, to be published in early 2009. We plan to distribute this handbook globally, along with other best practices identified by Ford of Europe during a 2008 environmental awareness survey of their European carriers.

We also carefully manage outbound vehicle shipments. We use rail- and sea-based transport wherever possible to reduce the need for long truck runs. By avoiding road-based transport, we help to reduce congestion, fuel consumption and exhaust emissions, including CO_2. We locate our vehicle holding centers to optimize transportation efficiency by taking into account the proximity of ports, rail hubs and trunk roads.

RELATED LINKS

In This Report:

Suppliers
Our Value Chain and Its Impacts
Climate Change
Waste Management

Packaging is the other primary activity managed by our logistics operations. Packaging directly impacts a number of environmental aspects[1], including materials usage, waste and freight. Ford MP&L's Packaging Engineering department focuses on designing, procuring and optimizing packaging. Over the years, this group has confirmed that the best general strategy to eliminate material waste and optimize freight efficiency is to use durable (returnable) packaging for all but the longest supply chains. In Europe, we have developed contracts with third-party packaging providers to manage returnable packaging. As part of this strategy, returnable packaging is pooled and used where required rather than always having to be returned directly to the parts suppliers.

Over the years, we have developed a standard range of packaging that not only protects parts and makes them easy to handle at the assembly line, but also allows maximum storage density during transportation, thereby minimizing transport requirements. We review the packaging of production trial parts to assess opportunities to increase packing density prior to the full-volume launch of a product.

We are now working globally to share best practices between regions and to drive consistency in packaging for future global vehicle programs. The latest packaging guidelines, published in April 2009, require that supplier-provided packaging supports corporate sustainability goals by seeking a neutral or positive environmental footprint through zero waste to landfill and use of 100 percent recycled, renewable or recyclable materials.

1. ***Environmental aspects*** is a term used in the ISO 14001 framework to denote elements of an organization's activities, products and services that can interact with the environment.

Supply Chain Sustainability

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We are working with our core suppliers to improve the sustainability of their products and processes. Much of our work with core suppliers thus far has focused on helping them align with Ford's Code of Basic Working Conditions. However, we are also encouraging our suppliers to improve other aspects of their environmental and social sustainability. In 2008, for example, we held two sustainability sessions in Troy, Michigan, which were attended by senior management from Ford and our core Aligned Business Framework suppliers. Topics covered in these meetings included internal training development guidance and a review of key emerging environmental and sustainability topics of interest to Ford and our suppliers.

We are also working with our suppliers to increase their use of sustainable materials and eliminate undesirable materials. While Ford has already made great strides in using more sustainable materials (as discussed in the Sustainable Materials section), we can expand these efforts by systematically working with our suppliers on sustainable materials. Towards that end, we are developing Commodity Business Plans and other materials purchasing strategies that require the use of sustainable materials. For example, we developed a purchasing strategy for recycled plastics resins and Commodity Business Plans for relevant parts that require the use of post-consumer recycled plastics. Beginning in 2009, all underbody aerodynamics shields, splash shields, stone pecking cuffs and radiator air deflector shields manufactured in North America will have to be made from the approved recycled plastics.

In Europe and North America, we have added environmental requirements to the formal agreements we make with our suppliers. These requirements cover a range of issues, such as reducing materials of concern, using Design for Sustainability principles, increasing the use of sustainable materials and using materials that will improve vehicle interior air quality. We ask suppliers to use recycled materials whenever technically and economically feasible. All recycled materials are evaluated in-house to guarantee they deliver appropriate mechanical properties and the same level of performance that would be obtained with virgin materials.

RELATED LINKS

In This Report:

Code of Basic Working Conditions
Suppliers
Sustainable Materials

Data

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- **Fuel Economy and CO_2 Emissions**
  - Ford U.S. Corporate Average Fuel Economy
  - Ford U.S. CO_2 Tailpipe Emissions per Vehicle (Combined Car and Truck Fleet Average CO_2 Emissions)
  - European CO_2 Performance, Passenger Vehicles – Percent of 1995 Base
- **Tailpipe Emissions**
  - Ford U.S. Average NOx Emissions
  - Ford U.S. Average NMOG Emissions
  - Ford U.S. Average Vehicle Emissions
- **Operational Energy Use and CO_2 Emissions**
  - Worldwide Facility Energy Consumption
  - Worldwide Facility Energy Consumption per Vehicle
  - Worldwide Facility CO_2 Emissions
  - Worldwide Facility CO_2 Emissions per Vehicle
  - Energy Efficiency Index
- **Water Use**
  - Global Water Use per Vehicle Produced
  - Global Water Use By Source
  - Regional Water Use
- **Emissions (VOC and Other)**
  - North America Volatile Organic Compounds Released by Assembly Facilities
  - Ford U.S. TRI Releases
  - Ford U.S. TRI Releases per Vehicle
  - Ford Canada NPRI Releases
  - Ford Canada NPRI Releases per Vehicle
  - Australia National Pollutant Inventory Releases (Total Air Emissions)
- **Waste**
  - Regional Waste to Landfill
  - Waste to Landfill per Vehicle
  - Regional Hazardous Waste Generation
  - Hazardous Waste Generated per Vehicle

Fuel Economy and CO_2 Emissions

DATA ON THIS PAGE

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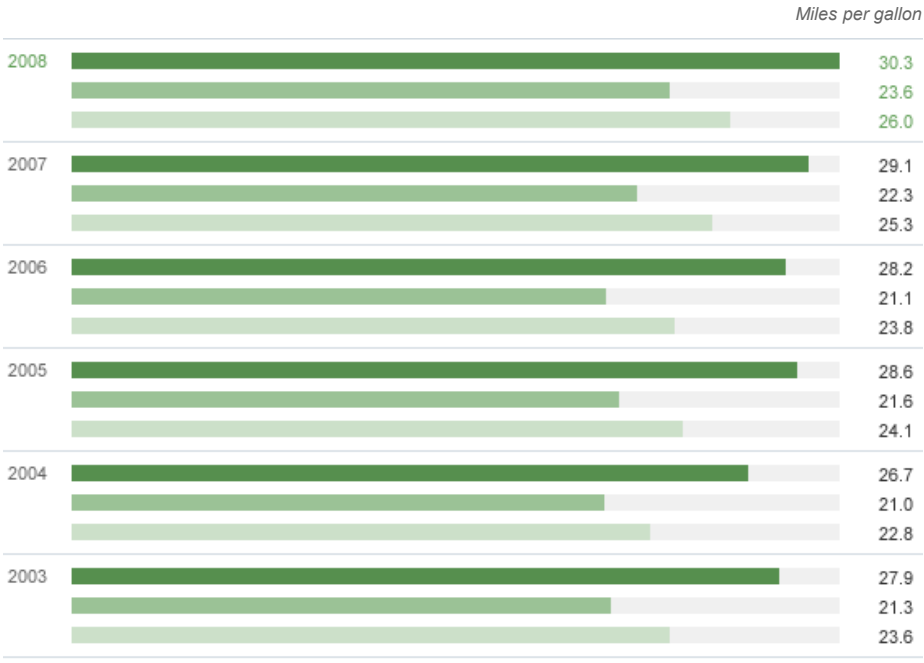
A. Ford U.S. Corporate Average Fuel Economy

Chart | Table



	2003	2004	2005	2006	2007	**2008**
Cars (domestic and import)	27.9	26.7	28.6	28.2	29.1	**30.3**
Trucks	21.3	21.0	21.6	21.1	22.3	**23.6**
Combined car and truck fleet	23.6	22.8	24.1	23.8	25.3	**26.0**

Reported to regulatory authorities (EPA)

see notes to the data

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B. Ford U.S. CO_2 Tailpipe Emissions per Vehicle (Combined Car and Truck Fleet Average CO_2 Emissions)

Chart | Table

Grams per mile

2003	2004	2005	2006	2007	**2008**
375	387	368	371	352	**340**

see notes to the data

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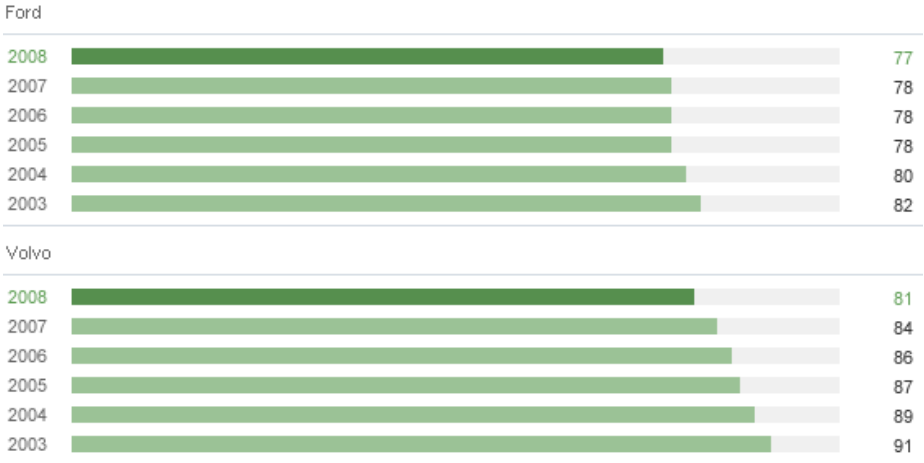
C. European CO_2 Performance, Passenger Vehicles – Percent of 1995 Base

Chart | Table

1995 base = 100 percent

Percent



	2003	2004	2005	2006	2007	**2008**
Ford	82	80	78	78	78	**77**
Volvo	91	89	87	86	84	**81**

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Notes to the Data

Chart A

See the Fuel Economy and Greenhouse Gas Emissions section for a discussion of our Corporate Average Fuel Economy (CAFE) performance. For the 2008 model year, the CAFE of our cars and trucks increased by 2.9 percent relative to 2007. Preliminary data for the 2009 model year indicates that the CAFE of our cars and trucks will improve by another 4.0 percent compared to 2008. Improvement is reflected in increasing miles per gallon.

Chart B

See the Climate Change section for a discussion of our CO_2 emissions performance. Improvement is reflected in decreasing grams per mile.

Tailpipe Emissions

ENVIRONMENT
- Progress
- Environmental Management
- Design for Life-Cycle Sustainability
- Products
- Operations
- Supply Chain
- Data
  - Fuel Economy and CO_2 Emissions
  - Tailpipe Emissions
  - Operational Energy Use and CO_2 Emissions
  - Water Use
  - Emissions (VOC and Other)
  - Waste
- Case Studies

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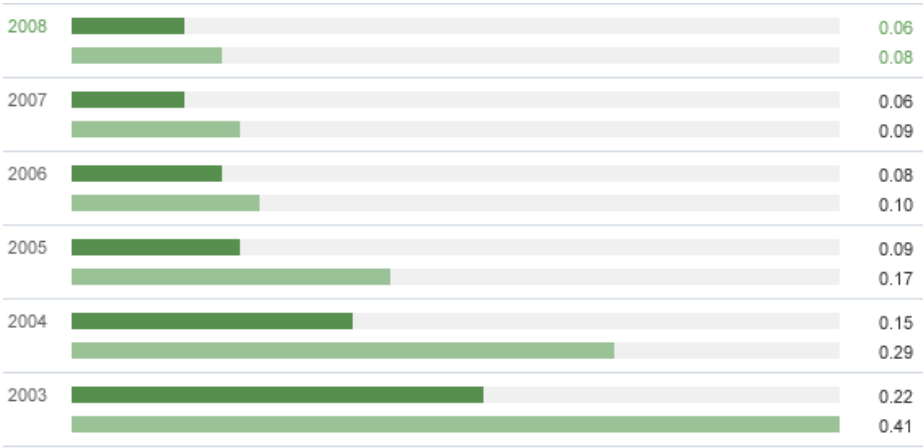
A. Ford U.S. Average NOx Emissions

Chart | Table

Grams per mile



	2003	2004	2005	2006	2007	**2008**
Passenger cars	0.22	0.15	0.09	0.08	0.06	**0.06**
All light duty	0.41	0.29	0.17	0.10	0.09	**0.08**

Reported to regulatory authorities (EPA)

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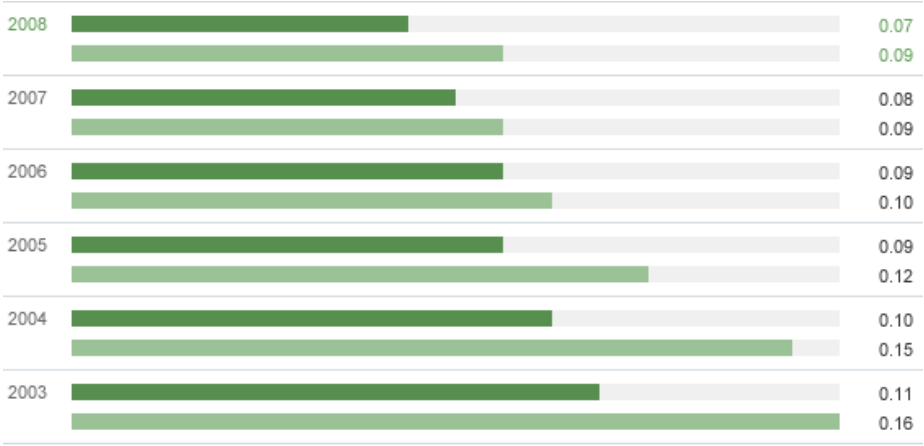
B. Ford U.S. Average NMOG Emissions

Chart | Table

Grams per mile



	2003	2004	2005	2006	2007	**2008**
Passenger cars	0.11	0.10	0.09	0.09	0.08	**0.07**
All light duty	0.16	0.15	0.12	0.10	0.09	**0.09**

Reported to regulatory authorities (EPA)

see notes to the data

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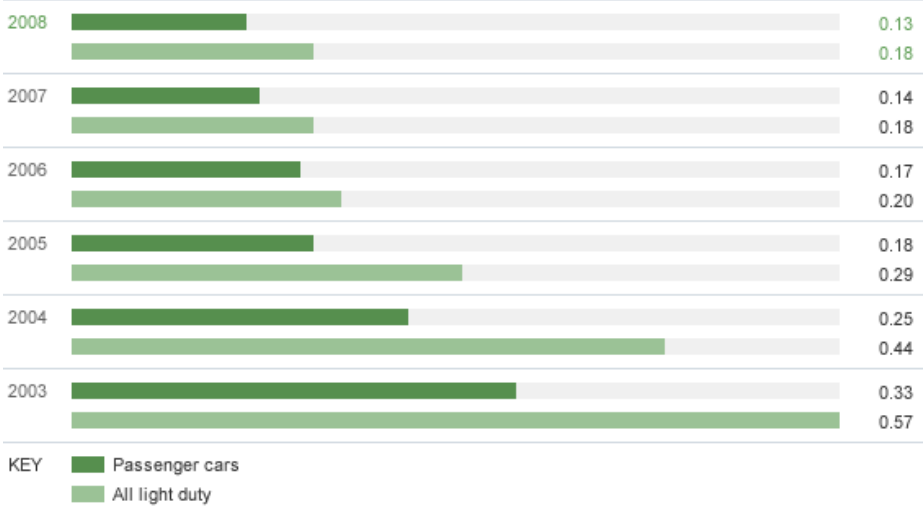
C. Ford U.S. Average Vehicle Emissions

Chart | Table

Grams per mile



	2003	2004	2005	2006	2007	**2008**
Passenger cars	0.33	0.25	0.18	0.17	0.14	**0.13**
All light duty	0.57	0.44	0.29	0.20	0.18	**0.18**

Reported to regulatory authorities (EPA)

see notes to the data

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Notes to the Data

Chart B

NMOG = Non-Methane Organic Gases

Chart C

Average vehicle emissions are the smog-forming pollutants from vehicle tailpipes, characterized as the sum of [(NMOG + NOx emissions) x volume] for all products in the fleet.

Operational Energy Use and CO_2 Emissions

ENVIRONMENT
- Progress
- Environmental Management
- Design for Life-Cycle Sustainability
- Products
- Operations
- Supply Chain
- **Data**
  - Fuel Economy and CO_2 Emissions
  - Tailpipe Emissions
  - **Operational Energy Use and CO_2 Emissions**
  - Water Use
  - Emissions (VOC and Other)
  - Waste
- Case Studies

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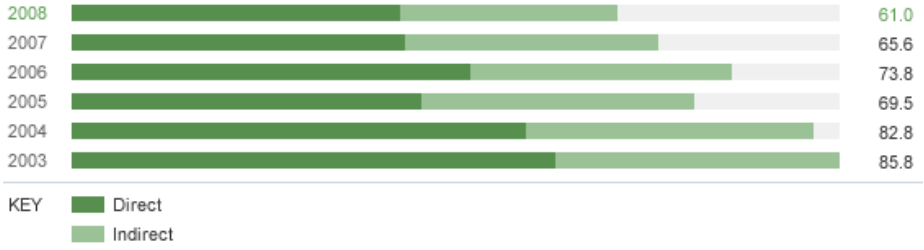
A. Worldwide Facility Energy Consumption

Chart | Table

Trillion British Thermal Units



	2003	2004	2005	2006	2007	**2008**
Direct	54.0	50.8	39.0	44.6	37.3	**36.7**
Indirect	31.8	32.0	30.5	29.2	28.3	**24.3**
Total	**85.8**	**82.8**	**69.5**	**73.8**	**65.6**	**61.0**

Data managed through the Global Emissions Manager database

see notes to the data

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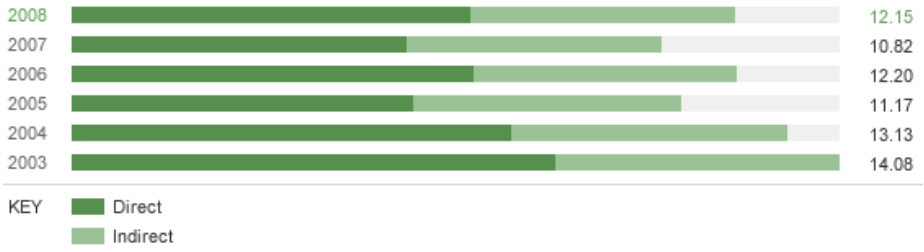
B. Worldwide Facility Energy Consumption per Vehicle

Chart | Table

Million British Thermal Units per vehicle



	2003	2004	2005	2006	2007	**2008**
BTUs/vehicle direct	8.86	8.06	6.27	7.37	6.15	**7.31**
BTUs/vehicle indirect	5.22	5.07	4.90	4.83	4.67	**4.84**
Total	**14.08**	**13.13**	**11.17**	**12.20**	**10.82**	**12.15**

Data managed through the Global Emissions Manager database

see notes to the data

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C. Worldwide Facility CO_2 Emissions

Chart | Table

Target: Various regions are developing mandatory targets, and this makes it difficult to set a global corporate target for greenhouse gas emissions. Voluntary manufacturing greenhouse gas emission targets apply (see Commitments and Requirements). Our energy efficiency index target also has the effect of driving reductions in CO_2 emissions.

Million metric tonnes

	2003	2004	2005	2006	2007	**2008**
Direct	2.9	2.8	2.7	2.3	2.0	**1.9**
Indirect	5.4	5.5	5.3	4.4	4.1	**3.5**
Total	**8.3**	**8.3**	**8.0**	**6.7**	**6.1**	**5.4**

Third-party verified (North America and EU)[1]

Reported to regulatory authorities (EU). Voluntarily reported to registry or other authority (U.S., Canada, Mexico, Australia, Philippines, Chongqing, China).

see notes to the data

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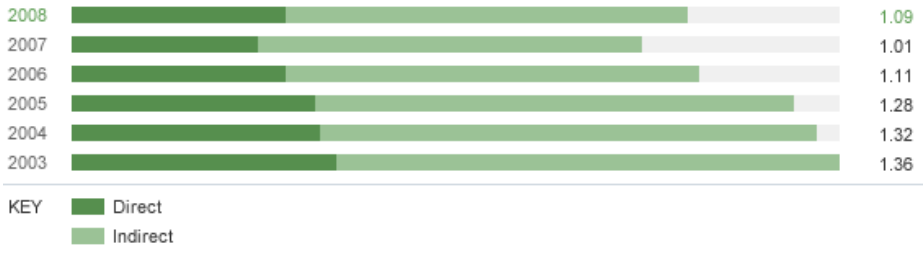
D. Worldwide Facility CO_2 Emissions per Vehicle

Chart | Table

Target: Various regions are developing mandatory targets, and this makes it difficult to set a global corporate target for greenhouse gas emissions. Voluntary manufacturing greenhouse gas emission targets apply (see Commitments and Requirements). Our energy efficiency index target also has the effect of driving reductions in CO_2 emissions.

Metric tonnes per vehicle



	2003	2004	2005	2006	2007	2008
Direct	0.47	0.44	0.43	0.38	0.33	**0.38**
Indirect	0.89	0.88	0.85	0.72	0.68	**0.71**
Total	**1.36**	**1.32**	**1.28**	**1.11**	**1.01**	**1.09**

Data managed through the Global Emissions Manager database

see notes to the data

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E. Energy Efficiency Index

Chart | Table

Percent

2003	2004	2005	2006	2007	2008
91.7	87.8	83.4	78.4	74.4	**69.9**

see notes to the data

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Notes to the Data

Chart A

Data have been adjusted to account for facilities that were closed, sold or new. This data does not include Automotive Components Holdings (ACH) facilities.

Chart B

Energy consumption and CO_2 emissions per vehicle divides energy used or CO_2 emitted by the number of vehicles produced. Averaging energy and CO_2 emissions by the number of vehicles produced yields a somewhat imperfect indicator of production efficiency. When the number of vehicles produced declines, as it has since 2000, per-vehicle energy use tends to rise because a portion of the resources used by a facility is required for base facility operations, regardless of the number of vehicles produced.

We believe that the long-term trend of declining per-vehicle energy use and CO_2 emissions indicate that more efficient production since 2000 is offsetting the tendency of these indicators to rise during periods of declining production. This interpretation is reinforced by our Energy Efficiency Index, which focuses on production energy efficiency and which has been steadily improving. Our Energy Efficiency Index target also has the effect of driving reductions in CO_2 emissions. These data do not include ACH facilities.

Chart C

Data have been adjusted to account for facilities that were closed, sold or new.This data does not include Automotive Components Holdings (ACH) facilities.

1. Sixty-one percent of Ford's global facility GHG emissions are third-party verified. All of Ford's North American GHG emissions data since 1998 are externally verified by The Financial Industry Regulatory Authority (FINRA), the auditors of the NASDAQ stock exchange, as part of membership in the Chicago

Climate Exchange. In addition, all of our European facilities impacted by the mandatory EU Trading Scheme are third-party verified.

Chart D

Energy consumption and CO_2 emissions per vehicle divides energy used or CO_2 emitted by the number of vehicles produced. Averaging energy and CO_2 emissions by the number of vehicles produced yields a somewhat imperfect indicator of production efficiency. When the number of vehicles produced declines, as it has since 2000, per-vehicle energy use tends to rise because a portion of the resources used by a facility is required for base facility operations, regardless of the number of vehicles produced.

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Chart E

The Index, which covers energy use in North America, is "normalized" based on an engineering calculation that adjusts for typical variances in weather and vehicle production. The Index was set at 100 for the year 2000 to simplify tracking against our target of 3 percent improvement in energy efficiency.

Water Use

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A. Global Water Use per Vehicle Produced

Chart | Table

Cubic meters per vehicle produced

2003	2004	2005	2006	2007	2008
32.1	26.3	26.3	25.7	23.7	**25.6**

Data managed through the Global Emissions Manager database

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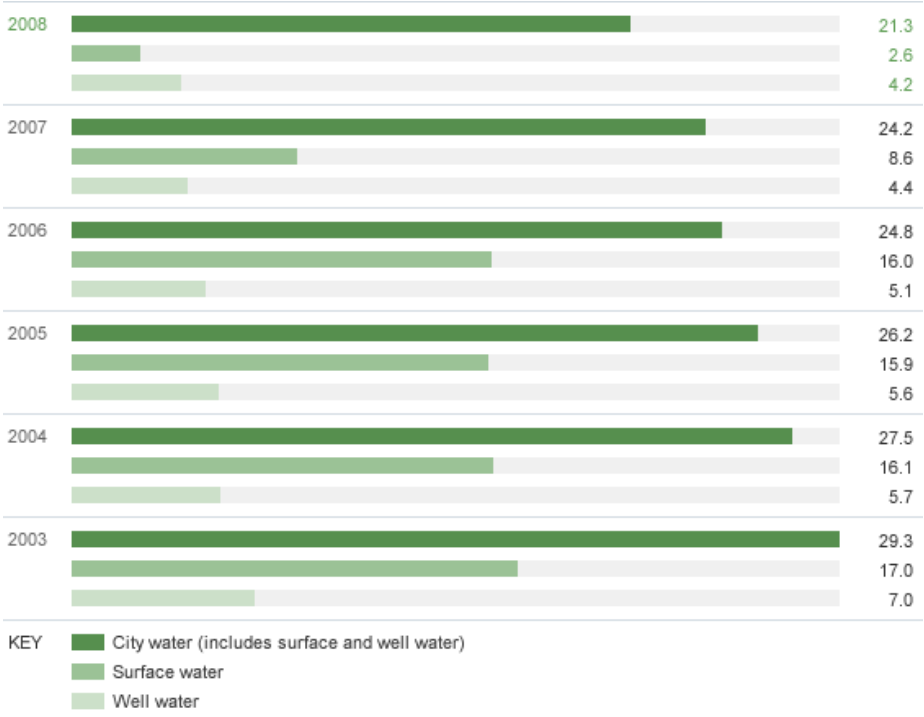
B. Global Water Use by Source

Chart | Table

Million cubic meters



	2003	2004	2005	2006	2007	**2008**
City water (includes surface and well water)	29.3	27.5	26.2	24.8	24.2	**21.3**
Surface water	17.0	16.1	15.9	16.0	8.6	**2.6**
Well water	7.0	5.7	5.6	5.1	4.4	**4.2**

Data managed through the Global Emissions Manager database

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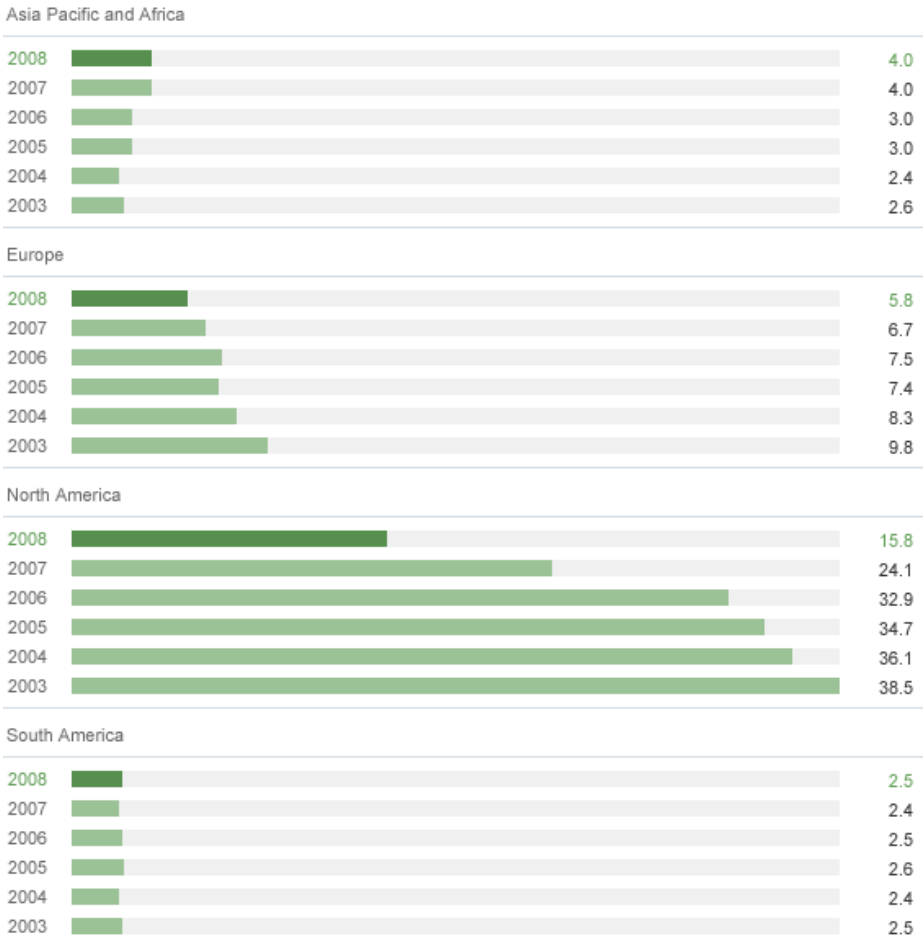
C. Regional Water Use

Chart | Table

Premier Automotive Group is now included in Europe

Million cubic meters



	2003	2004	2005	2006	2007	**2008**
Asia Pacific and Africa	2.6	2.4	3.0	3.0	4.0	**4.0**
Europe	9.8	8.3	7.4	7.5	6.7	**5.8**
North America	38.5	36.1	34.7	32.9	24.1	**15.8**
South America	2.5	2.4	2.6	2.5	2.4	**2.5**

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Emissions (VOC and Other)

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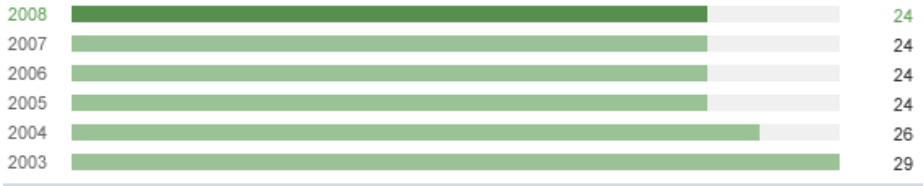
A. North America Volatile Organic Compounds Released by Assembly Facilities

Chart | Table

2009 target = 24

Grams per square meter of surface coated



2003	2004	2005	2006	2007	2008
29	26	24	24	24	**24**

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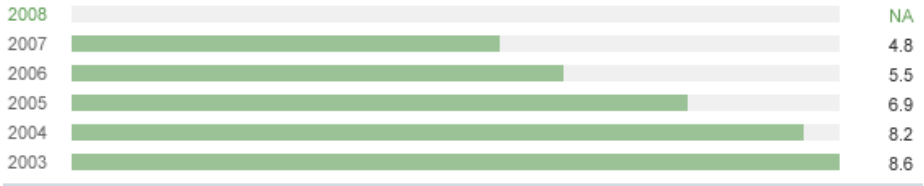
B. Ford U.S. TRI Releases

Chart | Table

Million pounds



2003	2004	2005	2006	2007	2008
8.6	8.2	6.9	5.5	4.8	**NA**

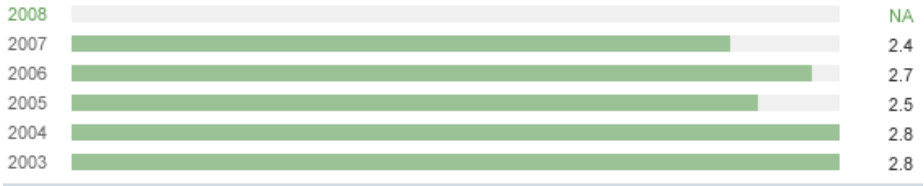
Reported to regulatory authorities (EPA)

see notes to the data back to top

C. Ford U.S. TRI Releases per Vehicle

Chart Table

Pounds per vehicle



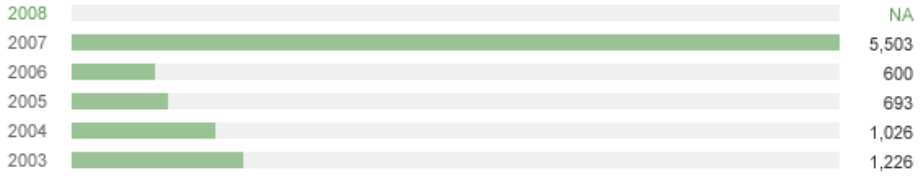
2003	2004	2005	2006	2007	**2008**
2.8	2.8	2.5	2.7	2.4	**NA**

see notes to the data back to top

D. Ford Canada NPRI Releases

Chart Table

Metric tonnes



2003	2004	2005	2006	2007	**2008**
1,226	1,026	693	600	5,503	**NA**

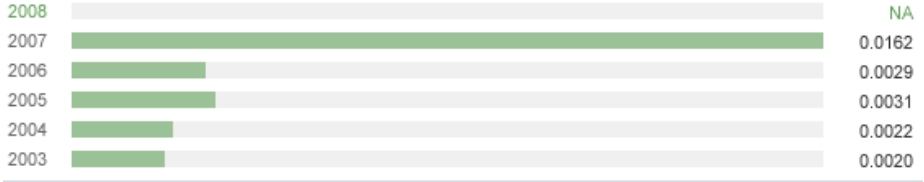
Reported to regulatory authorities (Environment Canada)

see notes to the data back to top

E. Ford Canada NPRI Releases per Vehicle

Chart Table

Metric tonnes per vehicle



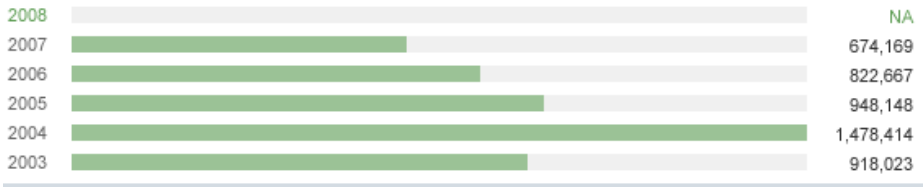
2003	2004	2005	2006	2007	**2008**
0.0020	0.0022	00031	0.0029	0.0162	**NA**

see notes to the data back to top

F. Australia National Pollutant Inventory Releases (Total Air Emissions)

Chart | Table

Kilograms per year



2003	2004	2005	2006	2007	**2008**
918,023	1,478,414	948,148	822,667	674,169	**NA**

Reported to regulatory authorities (NPI)

see notes to the data back to top

Notes to the Data

Chart B, Chart C, Chart D, Chart E and Chart F

Releases reported under the U.S. Toxics Release Inventory, Canadian National Pollutant Release Inventory and Australian National Pollutant Inventory are all in accordance with the law, and many of them are subject to permits. Data are the most recent reported to authorities.

Waste

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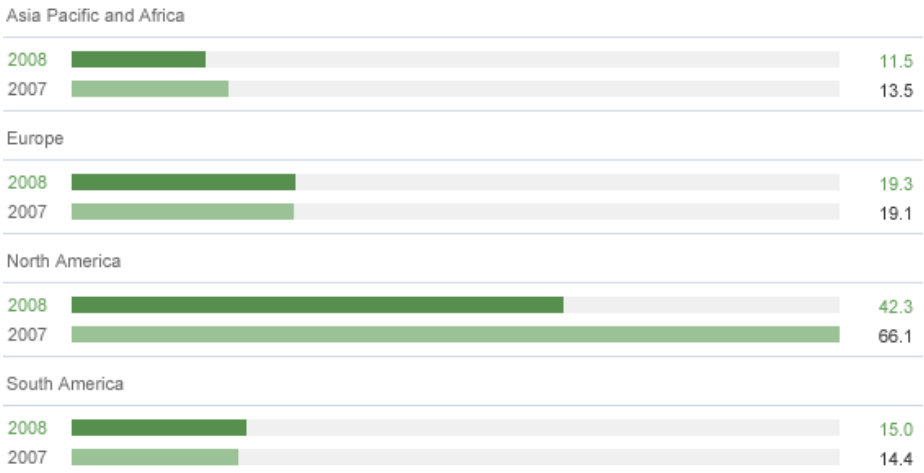
A. Regional Waste to Landfill

Chart | Table

Million kilograms



	2007	2008
Asia Pacific and Africa	13.5	**11.5**
Europe	19.1	**19.3**
North America	66.1	**42.3**
South America	14.4	**15.0**

Data managed through the Global Emissions Manager database

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B. Waste to Landfill per Vehicle

Chart | Table

Kilograms

2007	2008
18.87	**17.76**

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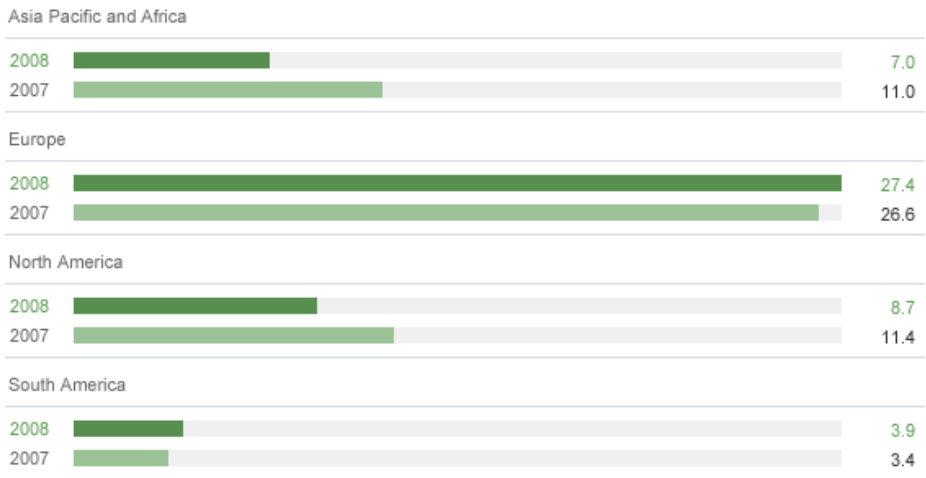
C. Regional Hazardous Waste Generation

Chart Table

Million kilograms



	2007	2008
Asia Pacific and Africa	11.0	**7.0**
Europe	26.6	**27.4**
North America	11.4	**8.7**
South America	3.4	**3.9**

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D. Hazardous Waste Generation per Vehicle

Chart Table

Kilograms

2007	2008
9.8	**10.0**

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Notes to the Data

Chart A, Chart B, Chart C and Chart D

Volvo is not included in this waste data

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Wastewater Treatment at the Dearborn Engine Plant

In 2007, the ultrafiltration wastewater treatment plant at our Dearborn Engine Plant had reached the end of its useful life. The plant team found they could significantly improve the environmental and economic performance of their treatment systems by changing their whole approach to wastewater treatment.

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Green Construction at the Michigan Proving Grounds

In 2008, Ford rebuilt the test track at our Michigan Proving Grounds in Romeo, Michigan. By recycling materials, we dramatically reduced construction waste and saved money and time.

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In 2008, Ford became the first automaker to release a greenhouse gas emissions report in China. This report is helping facility managers better understand their environmental footprint and develop strategies to reduce CO_2 emissions.

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In 2007, the ultrafiltration wastewater treatment plant at our Dearborn Engine Plant had reached the end of its useful life. At the time, the plant used ultrafiltration to process wastewater that contained heavy metals, suspended solids, free oils and stable oil-water emulsions. The plant also used a chemical batch process to treat wastewater that had a significant volume of surfactants, in addition to free and emulsified oils. A cross-functional planning team assessed these wastewater streams and treatment systems to see if they could find a more efficient process. The team found that they could significantly improve the environmental and economic performance of their wastewater treatment systems by in fact changing their whole approach.

Replacing the ultrafiltration plant was going to cost approximately $300,000, and the new system would require almost 40 person-hours a week to operate. However, the team found that they could eliminate the ultrafiltration system entirely, and reduce the wastewater sent to the chemical treatment system, if they separated their primary wastewater streams and treated them separately.

Previously, the process combined oily engine machining wastewater streams with soapy fuel tank wastewater, which resulted in large amounts of grease in the wastewater. The grease caused maintenance problems, required the use of large amounts of treatment chemicals and resulted in a high volume of low-quality wastewater residuals.

The team's analysis found that the soapy fuel tank wastewater did not need chemical treatment. Therefore, that wastewater stream could be treated separately using a simple physical device to remove floating and settling solids, thus reducing the need for the ultrafiltration system. Based on these findings, the team changed course. Instead of installing a new ultrafiltration system – the original impetus for the study – they installed a system to separate the soapy fuel tank wastewater and treat it separately.

This new process offers significant environmental and cost advantages. It reduced the volume of wastewater being treated with chemicals from 3 million gallons per month to less than 750,000 gallons per month – thus also reducing the labor required to operate the wastewater treatment plant. The new process also reduced the amount of chemicals required, increased the percentage of recyclable oil and reduced the amount of sludge, which requires landfill disposal. It also lowered wastewater storage volumes and increased storage capacity, thereby greatly reducing the possibility that an equipment malfunction could result in a wastewater spill to the environment or the city's wastewater treatment plant. The system saved the Dearborn Engine Plant $493,944 in the first year, after installation costs. It is expected to reduce annual wastewater treatment costs by $337,000.

The Dearborn Engine Plant received an Environmental Leadership Award from Ford's Environmental Quality Office (EQO) for developing and implementing this process. These awards are given by the EQO to recognize and promote ideas that are improving the environmental performance of Ford's manufacturing plants. Projects are judged on environmental leadership, environmental benefit and financial aspects.

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In 2008, Ford rebuilt the test track at our Michigan Proving Grounds in Romeo, Michigan. This five-mile track is used by our new product development teams to test vehicle quality and handling under real-world driving conditions. The test track is a critical tool in the vehicle development process, but after 52 years of use, it was ready for an overhaul. We needed a way to rebuild the track as quickly and cost effectively as possible, but we also wanted to minimize environmental impacts. So, rather than hauling away tons of demolition debris from the old track and trucking in new materials, we reused nearly every bit of existing material and sent whatever could not be repurposed to a recycling center.

In order to do this, the old track was broken into pieces and transported to an onsite crusher, which processed the asphalt and concrete into recycled aggregate appropriately sized for road construction. The recycled aggregate was then transported back to the track, laid down in an 8-inch thick layer, compacted in place and covered with four layers of asphalt. The bottom two road layers use 40 percent recycled asphalt pavement, or RAP, which is the maximum amount allowable under Michigan Department of Transportation guidelines. The third road layer uses 25 percent RAP, and the final layer is a virgin mix for optimal quality control. In addition, we inspected and reused most of the original track's guardrail.

This recycling process saved 130,000 tons of asphalt and concrete, and miles of guardrail from going to a landfill. The unusable steel beams from the guardrails were sent to a recycling center, and the wood posts were mulched. Overall, approximately 200,000 cubic yards of material were kept out of the landfill, the equivalent of the materials in a 12-story building.

Recycling the old road materials onsite also saved Ford approximately $12 million. And, it provided a new vehicle testing feature for free. Ordinarily, all of the asphalt millings from the demolition process would have to be cleaned up and disposed at the end of the job. But for essentially no cost, we left those millings in place for use as a vehicle dynamics testing area, where we will test vehicle handling and responsiveness in extreme driving conditions.

In addition, the entire rebuilding process was extremely fast and efficient. The test track is critical to the vehicle development process, so it was essential that the track reconstruction be completed quickly. Because materials were recycled and promptly repurposed, construction was significantly shorter than if new materials had been trucked in each day. The entire rebuilding process was completed in only five months.

The new test track will provide a world-class surface that will help product developers continue to improve vehicle quality and handling. It is also a testament to the environmental and financial benefits of taking a green approach to construction.

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In 2008, Ford became the first automaker to release a greenhouse gas emissions report in China. The report covers the Chongqing facility operated by Ford's joint venture in China – the Changan Ford Mazda Automobile Co., Ltd. (CFMA). The CFMA's innovative GHG monitoring and reporting activities demonstrate the Company's commitment to the overall sustainability of its manufacturing operations in China.

Our first GHG report for the Chongqing facility was submitted to China's State Environmental Protection Administration in April 2008. This report will be updated annually and will be publicly available.

The GHG report was developed using internationally accepted GHG emissions reporting standards developed by the World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD). The CFMA developed the report using their best-in-class energy monitoring system and the recently implemented Global Emissions Manager, a database used throughout Ford's global operations. This database can be used to calculate carbon dioxide emissions and create customized emissions reports.

The Chongqing report measures both direct and indirect GHG emissions from the use of natural gas, gasoline and electricity. Direct and indirect emissions are measured based on the WRI/WBCSD protocol. It includes data on energy intensity (i.e., tons of CO_2 per vehicle built) as well as total emissions. Emissions intensity is an important measurement because it allows us to track how efficiently we are using energy to make each vehicle. In 2007, we reduced our energy intensity by 34 percent compared to 2005 baseline and by 22 percent compared to 2006. This shows that the Chongqing CFMA facility is operating more efficiently and emitting lower emissions per vehicle produced than previously. In 2007, the total CO_2 emissions at this facility increased by 50 percent compared to 2005. However, this emissions increase was considerably lower than the 123 percent increase in production experienced over the same time period.

The Chongqing facility has implemented a range of energy-saving measures to continue to decrease energy intensity and total emissions. For example, the facility has installed:

- New power conditioning equipment in the welding and painting processes, resulting in annual electricity use reductions of 1 percent (approximately 288,000 kWh) in the welding process and a 1 percent (approximately 345,000 kWh) in the painting process
- Humidification control in the paint shop, which allows humidity (an important factor for paint quality) to remain constant throughout the year while varying the temperature (lower during winter and higher during summer). This system reduces the energy required for winter heating and summer air conditioning
- Heating and air conditioning controls that provide constant temperatures throughout the facility
- Automatic roll-up doors at each production station that reduce the amount of heat and air-conditioning losses to the outside
- Automated lighting controls throughout the facility – including on the street and in parking lots and workshops – which help ensure that lights are off when they are not needed

Ford's CFMA Chongqing facility is realizing a range of benefits from GHG reporting. First, the process of monitoring both overall GHG emissions and emissions per production unit helps the CFMA gain a better understanding of its environmental footprint. In addition, by accurately measuring energy consumption, we can raise awareness and direct our efforts to improve energy efficiency and reduce CO_2 emissions. This proactive approach will make the Company less dependent on critical energy resources, will minimize environmental impacts of manufacturing operations and will reduce the Company's operating costs.

The CFMA's Chongqing GHG report adds another element to Ford's leadership in GHG emissions tracking, reporting and reduction activities. Ford is undertaking similar initiatives at our facilities in Australia, Canada, Mexico, the U.S. and Europe.

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Innovative Parts Washing System

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In 2008, Ford's engine plants began implementing the latest generation of an innovative new parts washing system developed in partnership with our supplier ABB Robotics. Ford began developing this technology with ABB in 1999, and began installing the current generation in our transmission plants in 2004. The new robotics-based system represents a significant leap forward in efficiency and environmental impacts. It reduces energy and water use, wastewater effluent requiring treatment and noise, all while significantly improving quality, flexibility, productivity and cost.

In the past, parts washing has required a significant amount of energy and water, and has produced large amounts of wastewater requiring chemical treatment. The previous systems also took up a lot of floor space and were complex, unreliable and inflexible.

The new system cuts energy consumption by approximately 60 percent and energy costs by 90 percent. Part of this energy reduction comes from the fact that, unlike previous systems, the new system does not require any heat. It also requires a much smaller water pump, further reducing energy usage.

The robotic parts washing system also uses water more efficiently. It reduces wastewater generation by 95 percent compared to previous systems, which removed dirt chemically by spraying parts with high volumes of water and detergent at low pressure. This system, in contrast, cleans parts mechanically using very low water flow. The system uses a robotic arm to move the part in front of the spray nozzles, so it cleans parts more effectively. It uses approximately 10 to 15 gallons per minute of water, compared hundreds of gallons per minute with the previous system. Eliminating detergents also allows us to reuse the same wash water more times. The system uses smaller water tanks and low flow to further increase the efficiency of water use. In addition, the system generates little to no oily waste, which would require process waste treatment. It requires only a small amount of rust-preventive solution for cast iron parts or aluminum parts with powdered metal inserts.

The new system also improves exhaust emissions. Past systems, which required the use of detergent, emitted water vapor that contained some detergent. The improved system exhausts only water vapor.

In addition to these environmental benefits, the system improves the cleanliness of the parts by an order of magnitude, reducing the amount of residual contaminants by more than 70 percent. The new system increases productivity by facilitating the use of multiple washing units in parallel and reducing maintenance downtime. It also improves working conditions due to its reduced complexity, compact layout, inherently improved reliability and best-in-class noise levels.

We have already installed 34 of these new robotic washing machines. We have also incorporated this technology as standard for all engine and transmission final wash applications, ensuring that these improvements will be realized by all future vehicle programs.

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Ford is continuing its leadership in green manufacturing with an innovative parts cutting technology called Minimum Quantity Lubricant (MQL) machining. Ford was the first in the industry to implement this technology, which significantly improves environmental, quality and cost performance.

MQL is a major improvement over the traditional wet process used to machine metal parts. In MQL machining, the cutting tool is lubricated with a very small amount of oil sprayed directly on the tip of the tool as a finely atomized mist. The metal chips created during the machining process are then removed from the work-zone by a vacuum extraction system and recycled. Conventional wet machining, by contrast, requires pumping millions of gallons of metal-working fluids to cool and lubricate cutting tools and remove the metal chips from the machines. These fluids, typically a mixture of coolant and water, must be regularly treated to control their chemical composition, and they require special disposal to avoid contaminating the environment. Wet machining systems also require a large system of pipes, pumps, filters and tanks to circulate and store the fluids.

MQL is delivering significant benefits in environmental performance, quality, working condition and costs. Because the technology uses a small amount of oil instead of a coolant/water mixture, it saves hundreds of thousands of gallons of water per year. By eliminating the coolant/water mixture, MQL also eliminates the need to treat and dispose of an oily waste stream. It significantly reduces energy consumption, because it does not require the energy-consuming auxiliary machines like compressors, pumps and chillers used in a wet system. MQL also makes it easier to recycle the metal chips created during the machining process.

MQL also increases quality. In traditional wet machining systems, the coolant/water mixture can degrade over time, resulting in inconsistent performance. MQL provides more consistent results because it introduces new oil lubricant for each part. MQL also improves surface quality characteristics compared to wet machining.

An unexpected side benefit of MQL is an improvement in plant air quality. The vacuum system used to collect and transport metal chips created during the process also includes an air filtration system that cleans plant air. The air discharged from this vacuum system is as clean as air in an office environment. This system virtually eliminates oil mist from the work area, which can cause skin and respiratory irritation, further improving working conditions. The absence of water-based coolants also eliminates odors associated with wet machining systems.

Finally, MQL reduces costs. It reduces the amount of oil used per part to less than a tenth of the oil used in traditional wet machining methods; it uses less energy, thereby reducing energy costs; and it costs less to install in the first place because it does not require expensive auxiliary machinery like compressors and pumps. It has been shown to reduce per part costs by up to $1 per valve body or transmission case and to reduce initial facilities and tooling investment by up to 15 percent.

Ford is using MQL primarily in the production of valve bodies and transmission cases at our transmission plants. We have already implemented MQL at the Van Dyke and Livonia Transmission plants in North America. We plan to integrate MQL into all of our North American automatic transmission plants and possibly into manual transmission plants.

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