1999 Environmental Report

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On The Cover: The 1999 Ford Focus has an 85 percent recyclability potential by weight. It is designed for quick and easy dismantling. To find out more about the Ford Focus and Ford’s recycling efforts, turn to the Materials Conservation section of this report.
Ford Motor Company is dedicated to providing ingenious environmental solutions that will position us as a leader in the automotive industry of the 21st century. Our actions will demonstrate that we care about preserving the environment for future generations.
Environmental Policy

A Better Environment
Driven by You
Driven by Us

At Ford Motor Company, dedication to personal mobility and the environment is a way of business. It is a mind-set found throughout the Ford team from employees on the factory floor to senior corporate executives to the Board of Directors. Indeed, Ford’s commitment to the environment is alive more than half a century after the passing of founder Henry Ford.

That Mr. Ford played a pivotal role in helping to put the world on wheels is universally known. Perhaps less well-known was Mr. Ford’s passion for agriculture, nature, conservation— the Earth. He was a man of many interests, and those same interests remain part of the culture at Ford. To remain a viable company that provides a livelihood for more than 360,000 employees and 1,700 production suppliers who in turn employ hundreds of thousands of people, Ford must design, manufacture and sell cars and trucks that meet customers’ needs. And we must do this while meeting the needs of the environment. We believe this is possible. We believe we can have a Better Environment, Driven By You.

It must also be Driven By Us. We believe that better ideas—ingenious solutions—have made and will continue to make personal mobility compatible with the environment.

Commitment Begins With an Environmental Policy

In 1989, Ford confirmed its commitment to protecting the environment by issuing an environmental policy. The policy guides our way of doing business. To ensure that the environmental policy is implemented, it is signed by the chief executive officer.

Management and the Board of Directors Put the Policy in Action

Management actively supports the implementation of the Ford Environmental Policy. To ensure this commitment at the highest levels, the Ford Board of Directors formed the Environmental and Public Policy Committee in 1997. This Committee of the board reviews all the company’s environmental policies and practices. The chairman of the committee is William Clay Ford Jr., great-grandson of Henry Ford. An enthusiastic conservationist, Bill Ford continues the legacy of the Ford commitment to use wisely the “material blessings” his great-grandfather so passionately cherished.

Continuing with the strategy to integrate policy and product environmental approaches on a global basis, the company established the Environmental Strategy Review Committee in 1998. Its charter is to design an overall environmental leadership strategy and oversee its implementation. Leading the effort are co-chairs Jacques Nasser, Chief Executive Officer, and Peter Pestillo, Chief of Staff. This senior management committee brings an environmental perspective to Ford’s product development and manufacturing operations.
Helen Petrauskas, vice president, Environmental and Safety Engineering, is responsible for translating the committee’s environmental strategy into action and directing day-to-day environmental activities.

Among the important efforts overseen by the Ford team is implementation of the Ford Environmental System in over 140 facilities and sites (including all manufacturing facilities) around the world. This comprehensive environmental management program uses ISO 14001 – a widely recognized international standard – as its guideline.

The management team also set about the task of developing an Environmental Pledge. Indeed, once the committee finished its work, Nasser, in his weekly note to employees via the company Intranet, asked for their reaction and comments on the pledge.

Employees Also Put the Policy in Action
Employees at Ford plants around the world have access to, and are aware of the company’s environmental policy. Ford employees are familiar with the environmental aspects of their jobs. This commitment to environmental sensitivity is essential in the Ford Environmental System. And Ford employees are using it to improve the environmental performance of our facilities.

For instance, engineers and other employees at Ford facilities around the world participate in recycling teams, volunteer groups dedicated to identifying and implementing new ways to increase recycling.

Ninety-Five Years Old and Still Learning
Ford Motor Company and its team, composed of management and employees, prepare to take the company into the new millennium and its second century by building upon lessons learned today. We have learned how to more efficiently run our facilities thanks to the Ford Environmental System. We are learning about alternative fuel and power technologies through our deep involvement in compressed natural gas (CNG), liquefied petroleum gas (LPG, or propane), ethanol and other liquid fuels as well as electric-vehicle and fuel-cell technologies. These are just two examples among many of how the learning continues at Ford.

Putting the environmental policy into action touches every aspect of our business. It is giving shape to our company, our business strategies and practices. We believe our environmental performance ultimately contributes to the well-being of the company and to shareholder value.
Environmental Policy

The Ultimate Goal: Continuous Environmental Improvement

Continuous improvement is the engine that drives the Ford Environmental System. It also is the foundation of ISO 14001 certification. To remain certified, the company - that is, each of its facilities - must undergo yearly audits to ensure adherence to ISO guidelines and to measure progress against targets for improvement. This discipline of setting hard metrics for improvement is becoming a way of doing business. Indeed, the culture of the Ford Environmental System, which is driven by the methodology and reporting structure of ISO 14001, is becoming the mind-set at Ford.

Consequently, we are beginning to set performance targets on both a regional and global scale. Our 1998 Manufacturing Business Plan Targets exemplify this new way of doing business. The accompanying charts detail our objectives to:

- Certify all of our manufacturing plants worldwide to the ISO 14001 standard by year-end 1998. This objective has been achieved.
- Achieve 90 percent returnable container usage in our facilities by 2001. We achieved this goal in 1998, ahead of schedule.
- Reduce paint shop emissions to 60g/m² by 2005.
- Phase out all PCB transformers by 2010.
- Reduce energy usage by 1 percent per year.

The spirit at Ford is to document our efforts at continuous improvement clearly and consistently. This includes documenting not only our successes but also instances in which we fall short of our goals.

Our efforts at continuous improvement seek to develop environmental solutions that make personal mobility compatible with the environment.
Ford Motor Company Health and Environmental Policy

Sustainable economic development is important to the welfare of the company, as well as to society. To be sustainable, economic development must provide protection of human health and the world’s environmental resource base. It is Ford’s policy that its operations, products, and services accomplish their functions in a manner that provides responsibly for protection of health and the environment.

Ford is committed to meeting regulatory requirements that apply to its businesses. With respect to health and environmental concerns, regulatory compliance represents a minimum. When necessary and appropriate, we establish and comply with standards of our own, which may go beyond legal mandates. In seeking appropriate ways to protect health or the environment, the issue of cost alone does not preclude consideration of possible alternatives, and priorities are based on achieving the greatest anticipated practical benefits while striving for continuous improvement.

Ford’s policy of responsibly protecting health and the environment is based on the following principles:

Protection of health and the environment is an important consideration in business decisions. Consideration of potential health and environmental effects – as well as present and future regulatory requirements – is an early, integral part of the planning process. Company products, services, processes, and facilities are planned and operated to incorporate objectives and targets that are periodically reviewed to minimize the extent practical the creation of waste, pollution and any adverse impact on health and the environment. Protection of health and the environment is a companywide responsibility. Management of each activity is expected to accept this responsibility as an important priority and to commit the necessary resources. Employees at all levels are expected to carry out this responsibility as part of their particular assignments and to cooperate in company efforts.

The adoption and enforcement of responsible, effective and sound laws, regulations, policies and practices protecting health and the environment are in the company’s interest. Accordingly, we participate constructively with government officials, private organizations, and concerned members of the general public. Likewise, it is in our interest to provide timely and accurate information to our publics on environmental matters involving the company.
In 1908, Ford Motor Company built its first electric vehicle. As advances in fuel and emission technologies ushered in an era of cleaner vehicles, the company began to manufacture more environmentally friendly automobiles. Ford has been a leader in alternative-fuel vehicles for more than three decades.

Today, the commitment to conservation and the environment continues. Bill Ford believes that to be successful in the 21st century, automakers must respond to environmental concerns. As he puts it, "We need to make it easy for people to say, 'I'm an environmentalist and an auto enthusiast.'" To this end, Ford is dedicated to preserving nature for tomorrow while making automobiles today.

Since its founding in 1903, Ford Motor Company has reflected Henry Ford's legacy as an industrialist and conservationist. Mr. Ford believed that industry and nature should coexist and together serve humanity. His efforts at using agricultural products such as soybeans in the manufacture of automotive components and his interest in the study of birds were notable at the time.

As the company grew and built factories to meet customer demand for its popular Model T, Mr. Ford also set aside land to grow crops for use in company products. In 1915 the coil cases of the Model T were partially made of wheat gluten. In the 1930s, the company replaced some steel with plastic made of soybeans as a lighter and environmentally friendly material. By 1935, 2 pounds (0.91 kilograms) of soybean products went into every Ford car.
Ford Motor Company

is the world’s second-largest corporation and conducts business on six continents to meet automotive and financial services needs. Ford is best known as a major producer of cars and trucks. It also is engaged in a number of other businesses including automotive components, vehicle leasing and rental, land development and financial services.

Ford Automotive Operations (FAO) is the largest producer of trucks and the second-largest producer of passenger cars and vehicles worldwide. FAO operates manufacturing facilities in 38 countries. In 1998, FAO sales and revenue totaled $119 billion, and the company sold 6.8 million cars, trucks and commercial vehicles around the world. FAO employs more than 231,000 people at its plants, testing facilities, research and development facilities and offices worldwide. FAO produces passenger cars, trucks, engines, transmission castings and forgings and metal stampings at 105 manufacturing facilities around the world.

Visteon Automotive Systems, an enterprise of Ford Motor Company, employs 73,600 people at 78 plants (including joint venture production facilities) and 37 technical centers and sales offices in 21 countries. Visteon had revenue totaling $18 billion in 1998. Visteon specializes in chassis systems, climate-control systems, electronic systems, exterior systems, glass systems, interior systems and powertrain control systems.

Ford Motor Credit Company, an indirect and wholly owned subsidiary of Ford Motor Company, is the world’s largest automotive financing company. With more than 8 million customers in 36 countries, Ford Credit is the world leader in vehicle leasing. Over 11,000 dealerships worldwide use Ford Credit financing, resulting in $145 billion in assets. In 1998, Ford Credit issued a record 2.8 million new contracts in North America. With nearly 16,000 employees at 290 locations, Ford Credit conducts business in 32 currencies and 21 languages. Ford Credit provides services including retail leasing and financing for new and used vehicles, wholesale financing, mortgages, capital loans for dealers and automotive insurance.

Ford Motor Land Services Corporation, a wholly owned subsidiary of Ford Motor Company, provides real estate strategies and services to Ford activities worldwide. Established in 1970 as a master real estate developer, Ford Land has evolved into a full-range provider of global corporate real estate services. These services include construction, engineering, architecture, space planning, purchasing, sales, leasing, development and facilities management, environmental protection and energy efficiency.

The Hertz Corporation, a majority-owned subsidiary of Ford Motor Company, is the world’s largest car, truck and equipment rental and leasing company. Hertz has more than 24,800 employees at 6,100 rental locations in over 140 countries. Hertz conducts business with commercial accounts, including Fortune 500 companies as well as millions of individual customers. Net income in 1998 rose 45 percent to $300 million, resulting from $4 billion in revenue.
Environmental Management

Protecting the Environment Is Everyone’s Job

Implementing an ISO 14001-certified environmental management system on a global scale is not only an example of good corporate citizenship. It is also a good business strategy, enabling Ford plants around the world to share their best environmental practices, systematically reduce waste and achieve greater operational efficiency.

In March 1996, the Ford Lima Engine Plant in Lima, Ohio, started a 10-month process to implement the Ford Environmental System, a companywide effort to methodically reduce the impact of manufacturing on the environment. Within a year of putting the system in place, Lima Engine had:

- Reduced its consumption of water by nearly 200,000 gallons (757,000 liters) per day.
- Eliminated its production of boiler ash, the largest single component of the plant’s solid waste stream.
- Increased the use of returnable packaging from 60 percent to 99 percent on its newest engine product.

Implementation of the Ford Environmental System also enabled Lima Engine to be among the first four Ford manufacturing plants in North America to receive certification to ISO 14001, the only internationally recognized environmental management system standard that can be certified by independent auditors.

In the spring of 1996, Lima Engine made a plantwide commitment to implement the Ford Environmental System. The effort was steered by a cross-functional team that included members from all the plant’s operating areas. Environmental performance no longer was solely the responsibility of environmental engineers. Every one of the plant’s 2,100 hourly and salaried employees had a role.

Analyzing Plant Interactions with the Environment

One of the first items on the agenda was a study of Lima Engine’s environmental aspects — plant activities, products or services that interact with the environment. This represented a major undertaking for a 40-year-old, 2.4 million-square-foot facility that builds more than 900,000 engines a year.

Eventually, Lima Engine identified 30 significant environmental aspects, ranging from wastewater discharge and material handling to solid waste disposal. Objectives and targets were established to control, improve or further study these aspects.

Water usage was one of 30 significant environmental aspects identified by Lima Engine when it began to implement the Ford Environmental System in the spring of 1996. During the last two years, the consumption of water has been reduced significantly, illustrating the ISO 14001 philosophy that “those things that are effectively measured and monitored can be effectively managed.”
After developing facility-level environmental policy and management programs, the cross-functional team defined how departmental work teams would implement the Ford Environmental System.

By summer, the focus shifted to developing procedures and writing work instructions. The wealth of individual employees’ environmental knowledge was documented. This step ensured that each employee had immediate access to up-to-date and approved environmental procedures and work instructions.

In the fall of 1996, the employee education and awareness effort at Lima Engine shifted into high gear. Everyone received a pocket card summary of the company’s environmental policy. Pocket-size flip books were distributed to make key information readily available on the ISO 14001 standards, including environmental policy, aspects, legal requirements, objectives and targets, environmental management program, structure and responsibility, training, communication, documentation, operational control, emergency preparedness, monitoring and measurement, corrective and preventive action, records, audits and management review.

Training on the standards was provided during weekly safety training sessions and at individual worksites. Videos, posters and newsletter articles promoted the advantages of the Ford Environmental System and ISO 14001 certification. Lima Engine’s internal auditors checked how well the Ford Environmental System was understood, implemented, and documented. After corrective and preventive actions were taken in response to the internal audits, plant management reviewed the Ford Environmental System, as it had throughout the spring and summer. A pre-assessment review was completed in late fall.

All that remained was a plant visit by the Vehicle Certification Agency (VCA), the independent auditing organization that would conduct the ISO 14001 certification review.

North America’s First ISO 14001-Certified Automotive Plants

In December 1996, Lima Engine received ISO 14001 certification, along with the Van Dyke Transmission Plant in Sterling Heights, Michigan, the North Penn Electronics Plant in Lansdale, Pennsylvania, and the Oakville Assembly Plant in Oakville, Ontario. These four Ford plants became the first automotive manufacturing facilities in North America to receive ISO 14001 certification.

To achieve this milestone, Lima Engine invested more than $220,000 in direct training costs and devoted more than 5,600 employee hours to meetings, training, internal audits and third-party audits.

Three critical factors made a difference in Lima Engine’s ISO 14001 certification. The first and most important factor was teamwork. Everyone in the plant made a personal commitment to the environment as Ford employees and as members of the community.

The second success factor was that Lima Engine was already registered to ISO 9001, the international quality management system standard. Many ISO 14001 standards are closely related to ISO 9001, especially in policy development, document control, record keeping, training, auditing, monitoring and measurement. Both sets of ISO standards emphasize continuous improvement.

Lima Engine’s third success factor was leveraging the power of the corporate intranet — the Ford Web — and using information technology to develop, document, and disseminate the Ford Environmental System. By putting the system on the Ford Web, Lima Engine reduced its need for paper documentation.
Lima Engine is sharing its “environmental intelligence” over the Ford Web, giving other Ford plants around the world a head start on their own system development and ISO 14001 certification efforts.

Using Upstream Planning to Reduce Downstream Waste Volume
Prior to this year’s launch of Lima Engine’s newest product — the AJ-30 V-8 engine for the new Lincoln LS8 — Lima Engine sent to landfills as much as 40 percent of the packing material that came with engine parts. With the start of production on the new V-8 engine, the amount of discarded packing material on this line has been reduced to less than 1 percent. Engine packing material now can be reused many times and eventually recycled. This is a result of Design for Environment (DFE) decisions made during product development to reduce the impact of manufacturing processes on the environment.

The employees of Lima Engine are proud of the Ford Environmental System and their ISO 14001 certification. The plant has forged close ties with environmentally related organizations in the surrounding community. A Lima Engine representative serves on the North Central Ohio Solid Waste Management District Policy Committee and the Allen County Local Emergency Planning Committee. Neighbors from the community have visited the plant and seen how the Ford Environmental System supports waste minimization, pollution prevention and emergency response.

The Goal and the Accomplishment: Implement the Ford Environmental System and Certify All Manufacturing Sites to ISO 14001 by the End of 1998
Lima Engine is an example of how much time and effort go into implementing the Ford Environmental System and achieving ISO 14001 at the local level. At the global level, this effort was repeated by more than 200,000 plant employees in 26 countries around the world. It reflected the corporate commitment to have the Ford Environmental System in place and ISO 14001 certification in all manufacturing sites by the end of 1998.

In March 1996, the Ford Halewood Assembly and Transmission Plant in Liverpool, England, became the first major automotive manufacturing site in the world to receive ISO 14001 certification. The Saarlouis Body and Assembly Plant in Germany followed in April 1996. In July 1997, the Ford Lio Ho Assembly, Engine and Casting manufacturing complex was the first ISO 14001-certified automotive facility in Taiwan.

In December 1997, Ford was the first automaker to have all its facilities ISO 14001 certified in Australia. The first passenger car plant in Mexico to receive ISO 14001 certification was the Ford Hermosillo Stamping and Assembly Plant, where the Ford ZQ, Ford Escort and Mercury Tracer are produced.

Ford is the first automotive company to implement a worldwide environmental management system and receive ISO 14001 certification for its manufacturing sites. No matter where Ford manufacturing facilities operate, no matter what Ford products are made, the message expressed by the Ford Environmental System is universal: Protecting the environment is everyone’s job.
For 1999, All Ford Sport Utility Vehicles and Windstar Minivans Are Low-Emission Vehicles

Ford is committed to minimizing the environmental impact of its products. For the 1999 model year, one in five vehicles Ford sells in the United States – more than 800,000 vehicles – is expected to be among the lowest emission gasoline-powered sport utilities or minivans available.

As 1997 drew to a close, Ford’s senior leadership faced some tough decisions about the 1999 model year. Working against tight deadlines, engineers were able to configure all of Ford’s popular sport utility vehicles (SUVs) and the Windstar minivan to achieve low-emission vehicle (LEV) status before federal regulations mandate the change – a major feat.

The special catalysts and other equipment mandated for the transformation cost millions of dollars. The decision was made to move ahead. Despite the additional cost, starting with the 1999 model year, all Ford sport utility vehicles – including the Ford Explorer, Mercury Mountaineer, Ford Expedition and Lincoln Navigator – and the Ford Windstar minivan are being sold as LEVs. Windstar has been further calibrated to achieve even stricter, ultra-low-emission vehicle (ULEV) standards in California.

Customers will pay no price premium for the improvements.

The decision shows the degree to which Ford is committed to reducing the environmental impact of its products while meeting customer needs and desires. With the 1999 model year, Ford is expected to be North America’s top producer of gasoline-powered LEVs. Not coincidentally, it also is the top Original Equipment Manufacturer (OEM) producing alternative-fuel vehicles (AFVs). The company sold 90 percent of the AFVs sold in the United States in 1997.

The LEV Story

Ford’s decision to offer its SUV lineup and Windstar as LEVs will have a significant environmental impact as the cleaner LEVs replace older vehicles. LEVs emit only half of the smog-forming hydrocarbon emissions produced by the typical vehicles in their class. Versions of 10 other Ford vehicles are certified as LEVs under California’s strict guidelines – Ford Escort, Taurus, Crown Victoria, Mustang, F-Series and Ranger; Mercury Tracer, Sable and Grand Marquis; and Lincoln Town Car. In Germany, all gasoline-based Focus vehicles are meeting D4 levels (ULEV).

Ford has a larger range of D4 emission-level vehicles than the competition.

To achieve LEV status, Ford engineers made a variety of calibration and emissions hardware changes. Expedition and Navigator rely on upgraded catalysts and increased precious metal loading, among other changes. To help Ford’s largest SUVs achieve LEV standards even in high altitudes, engineers changed the air/fuel ratio and spark advance during warmup to ensure that closed-loop feedback air/fuel control is reached as soon as possible.

The LEV commitment also extends to an upcoming SUV – smaller than the Explorer – expected to debut in 2000 as both a Ford and Mazda product.
Ford's Alternative Fuel Vehicle Leadership Continues

Ford already sells the widest variety of AFVs available in the United States today. The company plans to offer an alternative-fuel option on most of its truck lines by 2001 – compressed natural gas (CNG), liquefied petroleum gas (LPG, or propane), ethanol or electric.

Ford is offering 11 North American alternative-fuel products for the 1999 model year:
- Bi-fuel Natural Gas F-Series Pickup
- Dedicated Natural Gas F-Series Pickup
- Bi-fuel Propane F-Series Pickup
- Bi-fuel Natural Gas Econoline van/wagon
- Dedicated Natural Gas Econoline van/wagon
- Bi-fuel Propane Econoline van/wagon
- Bi-fuel Natural Gas Contour sedan
- Dedicated Natural Gas Crown Victoria sedan
- Taurus E-85 Flexible Fuel Vehicle
- Ranger E-85 Flexible Fuel Vehicle
- Ranger Electric Vehicle

The company also has developed a compressed natural gas super ultra-low emission vehicle (SULEV) Expedition test fleet. These vehicles will produce 85 percent fewer smog-forming emissions than the present California standard. The SULEV Expedition joins two other Ford SULEVs already on sale – dedicated natural gas versions of the F-250 pickup and Econoline van that were the world’s first internal combustion trucks to win the designation as SULEVs.

In Europe, Ford plans to introduce a natural gas and propane bi-fueled Transit van in early 1999 – the first of a range of new European AFVs running on compressed natural gas or liquefied petroleum planned over a three-year period.

In another advance, to support consumer acceptance of electric vehicles, in the U.S. the company is offering a nickel metal hydride battery option on the Ford Ranger Electric Vehicle for the 1999 model year. This greatly enhances the EV’s range. Ford also is testing an electric vehicle fast-charging system that can charge a battery pack in minutes, rather than hours. Both innovations make the Ranger EV more practical and are working examples of Ford’s commitment to provide environmentally friendly vehicles with real-world applications. In Europe, Ford has purchased a controlling interest in PIVCO, the company which developed a two-passenger EV with plastic body technology and zero emissions. This vehicle will be introduced in Nordic countries before the end of 1999.
A Focus on Recycling

Reduce, Reuse and Recycle is a Ford mission. The new Ford Focus and other Ford products demonstrate that Ford is serious about protecting the environment and managing waste.

Old blue jeans, plastic bottle caps and other discarded items are important parts of an extraordinary vehicle that is heralding a new era for Ford Motor Company in Europe.

And, the recently introduced 1999 Ford Focus goes beyond the competition in design, package, driving dynamics, comfort, fuel economy and cost of ownership. Ford Focus was made with recycling in mind – and demonstrates creative uses for salvaged materials by incorporating them into new components such as heater/air-conditioner housings, sound deadening materials and fuse boxes.

The shredded cotton from old denim jeans, for example, is used to fashion Ford Focus’ underhood sound deadening components, while shredded plastic bottle caps are incorporated into the heater bodies.

This level of environmental compatibility was carefully considered from the beginning of the vehicle’s development. Ford Focus has an 85 percent recyclability potential by weight and has been designed for quick and easy dismantling.

One example is the bumper. While plastic bumpers on other vehicles traditionally have featured multiple materials and adhesives, the Ford Focus bumper uses only one. This eliminates the need to separate multiple material types when the vehicle is dismantled – and actually encourages recycling by trimming both the time and cost often associated with the process.

As with all European Ford vehicles, no CFCs are used in refrigerants on Ford Focus, and all friction materials and insulation are asbestos-free.

This innovative vehicle is being manufactured at plants in Valencia, Spain and Saarlouis, Germany. Both are certified to ISO 14001 standards by independent auditors. Like all Ford facilities, the Focus plants have implemented the Ford Environmental System, based on ISO 14001, which addresses environmental aspects such as air, noise, water, waste and emergency response procedures.

Materials Conservation: a Continuing Commitment

The Ford Focus is but one example of Ford’s dedication to recycling in its products and manufacturing processes. Worldwide, Ford products annually use more than 4 billion pounds (1.8 million metric tons) of recycled materials.
Ford is the first company to have issued worldwide automotive recycling guidelines to its suppliers and engineers. For every new product, Ford creates internal recyclability and recovery goals, as well as objectives for the use of recycled materials. The mission: to maximize the use of materials recovered from end-of-life products and to minimize the amount of waste coming from end-of-life vehicles.

From Old Carpets to New Cars
Ford has developed many other innovative applications for recycled materials. For instance, grille opening reinforcements on some trucks are made in part from plastic soft drink bottles. Painted grilles on Ford Econoline vans and Ford F-Series pickups are fashioned from old computer housings and telephones. Splash shields on several vehicles are made from spent battery casings. Air cleaner assemblies on 3 million North American-made vehicles and engine fan modules on the popular Ford Windstar use recycled carpet – an industry first.

Examples of this trend are at work in Europe at two Visteon plants, where virgin material sources have been replaced with new grades that are of 25 percent recycled content. At the Charleville Plant in northern France, 2,000 tons (1,814 metric tons) of soft drink bottle tops are recycled per year to make the heating and air-conditioning components for the Ford Focus, Fiesta, Mondeo and Ka. At the Enfield Plant in London, telephone and business machine housings are used to manufacture instrument clusters for the Jaguar X Series and the Ford Fiesta, Ka, Escort and Focus.

The company has been recognized by the Society of Plastics Engineers as the first automaker to recycle salvaged plastic parts from previous models into new vehicles. Ford uses the materials salvaged from plastic bumpers to mold new taillight housings and to make guide brackets and bumper reinforcements for the Mercury Mystique and Ford Contour.

Ford also was the first automobile manufacturer in Europe to install 100 percent recycled batteries made from old ones. Working with two suppliers, Ford of Europe recently introduced the batteries in Britain on the Ford Fiesta and Escort.

In the U.S. and Europe, Ford is pioneering new technologies aimed at identifying other potentially recyclable materials. The company also has formed Recycling Action Teams (RAT) in the U.S. and Europe that find new uses for old materials.
New Tires, Less Trash

Turning salvaged tires into more than 1 million new ones isn’t a simple task.

That is why Ford has reason to celebrate. With help from its suppliers, the company has passed this milestone with an innovative approach to one of the most challenging obstacles in vehicle recycling.

The result is a recycled tire that is as sturdy and functional as any other, yet which helps reduce the number of tires in landfills and dumps. It was created by tire chemists and engineers who for several years have worked to blend more than ten rubber compounds with special compounds that enhance the recycled rubber.

By the close of the 1998 model year, 1.2 million recycled tires were rolling on one of Ford’s highest-volume vehicle models, the Ford F-Series pickup. The 1999 Ford Windstar Limited minivan is the next vehicle in the Ford vehicle lineup to be equipped with the recycled-content tires.

The recycled tires on Ford vehicles contain 5 percent recycled materials. They meet or exceed stringent internal performance standards as well as federal safety guidelines. While promoting environmental stewardship, the recycled tires also have the traction, durability, wear, rolling resistance and handling of tires made from virgin sources.

Old tires have other purposes, too. Ford is working with a supplier to create parking brake pedal pads, air deflectors and splash guards from recycled tires. Tens of thousands of used tires from Ford vehicles are cushioning the feet of Ford plant employees who assemble those vehicles, thanks to a new recycling process that turns old tires into ergonomic floor mats.

All these products have great implications for the future of recycling because they demonstrate that consumption of virgin raw materials can be drastically cut or reduced during the manufacture of many products.

The results are less waste and quality vehicles that are more environmentally responsible.
Ford’s Total Waste Management Program: A Break with Tradition Yields Significant Environmental Benefits

A key requirement of Total Waste Management (TWM) is to separate the disposal fee from the amount of waste generated and relate it to plant production. We want to pay suppliers to help us conserve materials and create less waste.

When the St.Thomas Assembly Plant in Ontario became one of the first Ford facilities to convert its traditional methods of waste management in 1996, skeptics took note.

After all, the Total Waste Management program amounted to a radical change in Ford dealings with its waste management suppliers, who had grown accustomed to a traditional “pay-by-the-load” way of doing business. Pay a waste management supplier the same money to dispose of less waste? The concept would never work, the skeptics said.

At St.Thomas, Ford Material Handling, Environmental Quality, Purchasing and plant personnel teamed up with just one on-site Total Waste Management contractor, Browning-Ferris Industries, to champion a broad assault on solid waste. The plan included replacing disposable packaging with returnable containers, increasing metal scrap recovery activities and introducing conveniently positioned recycling stations along the assembly line.

In the three years since launching the program, the plant has nearly halved the amount of non-hazardous solid waste it sends to landfill. By 1997, the St.Thomas plant, which produces the Ford Crown Victoria and Mercury Grand Marquis sedans, was diverting 90 percent of the non-hazardous solid waste generated at the plant – more than 22,122 short tons (11,000 metric tons) – from landfill disposal. In recognition of this achievement, St.Thomas earned the Recycling Council of Ontario’s Gold Award for outstanding waste reduction, reuse and recycling efforts.

Today, building upon the success of St.Thomas and reflecting a deep commitment to the conservation and recycling of materials, Ford is taking an industry lead on waste management by introducing its Total Waste Management Program at some 80 facilities around the globe. In its first full year of operation, the program resulted in significant waste management and disposal cost savings. For example, at Ford’s Hermosillo, Mexico plant alone, the amount of waste per vehicle produced has dropped from nearly 17.6 pounds (8 kilograms) to less than 9 pounds (4 kilograms) per vehicle today. In addition, costs will decrease yearly through supplier-driven continuous process improvement efforts.

A Bold New Way of Doing Business

TWM is built on two simple, yet revolutionary, concepts – assigning the responsibility for managing all of the waste at a facility to a single professional waste management supplier, then setting up an incentive-driven payment plan that encourages promoting the “reduce, reuse and recycle” philosophy.
Most Ford plants historically and inefficiently dealt with 15 to 20 smaller waste management companies, each with different methods of operation and fees. Now, a single supplier is responsible for removal of all waste generated at a facility, including handling, transportation, recycling and environmentally sound disposal. With Ford overseeing the program, the supplier also provides professional services and support, including analytical testing, record keeping, waste-container management, training and waste metrics reporting.

While the program is tailored to reflect the needs of individual facilities, Ford promotes global consistency by using a Ford-specific waste classification system that identifies 131 waste stream types. “Waste” is broadly defined as anything that leaves the plant that is not on a car, truck or component. It includes chemical wastes, sludge and general refuse; commodity wastes such as cardboard, wood pallets, metal scrap, glass cullet and plastic scrap sent off-site for reclamation, reuse or recycling; and wastewater discharges, air emissions and “asset sales” such as retired equipment and machinery.

To encourage waste-management suppliers to take an active role in reducing waste, the payment plan was restructured to offer them tangible incentives for reducing waste. In addition, rather than paying by the drum or load, Ford now pays waste management suppliers on a scale that doesn’t reward them for quantity increases, but rather, by agreed units of production, such as the number of trucks and cars produced, or by a pre-established monthly fee.

TWM is part of Ford’s progressive three-part approach to waste management. Step 1: Avoid waste by using efficient production processes. Step 2: Reduce unavoidable residuals in terms of quantity and toxicity. Step 3: Recycle residual wastes, with disposal to landfills used only as a last resort.

Innovation Pays Off
Ford Automotive Operations’ packaging engineers are at the forefront of Ford’s “reduce, reuse and recycle” campaign by taking an aggressive approach to limiting packaging coming into the plant and finding recycling opportunities for obsolete equipment and materials. In the last two years, the amount of incoming packaging material, including corrugated cardboard and plywood, has been reduced by nearly 163 million pounds (74 million kilograms) by replacing it with reusable plastic packaging. In addition, Ford is recycling materials used in the returnable containers, including 4.8 million pounds (2.2 million kilograms) of plastic packaging material. At Cleveland Casting and Windsor (Ontario) Casting, obsolete steel containers are recycled as raw materials for engine blocks and cylinder heads.

In addition to the environmental benefits and cost savings, the Ford Total Waste Management program has helped Ford improve the quality and consistency of waste management services globally by promoting continuous process improvement. At Ford’s Norfolk, Virginia, Oakville, Ontario, and St. Thomas, Ontario plants, the waste management suppliers serve on integration teams which have spearheaded many improvements in managing paint-related processes and waste. TWM also frees Ford environmental engineers to focus on local environmental issues and overall program direction, as well as preparing reports for government compliance, reviewing new program environmental impacts and launching waste-minimization team efforts.
The P2000 project is an outgrowth of Ford's participation in the Partnership for a New Generation of Vehicles (PNGV) program. PNGV is a collaboration among the domestic automakers, the U.S. government and others to produce fuel-efficient breakthroughs in vehicle technology.

The P2000 Program helps Ford keep its pledge to make ingenious use of materials to pursue high-volume, energy-conserving vehicles at an affordable price – without sacrificing comfort, performance or safety.

The P2000 Program is developing advanced vehicles and powertrains for future use that will be environmental, perform similarly to today’s vehicles and be affordable. This technology program started with the P2000, a lightweight, fuel-efficient sedan that is functionally similar to the Ford Taurus. P2000 was followed by P2000 Prodigy and P2000 SUV.

The P2000, Ford’s revolutionary family car prototype, using a conventional powertrain system weighs only 2,000 pounds (908 kilograms) – 40 percent lighter than today’s comparably sized Taurus. P2000 is powered by the advanced 1.2-liter DIATA compression ignition engine, which is believed to be the lowest emission, highest power density, direct-injection engine ever attempted in the auto industry. P2000 with the DIATA engine in a hybrid electric vehicle (HEV) configuration is projected to achieve over 70 miles per gallon (gasoline equivalent).

The P2000 Prodigy is an aerodynamically improved version of P2000. The Prodigy power plant is either the HEV or fuel cell. This lightweight sedan will continue to perform and carry loads similar to current vehicles, yet will use less energy to accomplish those tasks.

The P2000 SUV is a lightweight sport utility vehicle. It has variable vehicle height to allow operation in rough terrain and improved aerodynamics at highway speeds. Its power plant can be an advanced and downsized (due to reduced weight) internal combustion engine or a highly efficient fuel cell providing electric power for electric motors to propel the vehicle.

A Lightweight Laboratory

Engineers included a vast array of lightweight advancements in the P2000. The revolutionary vehicle contains only about 500 pounds (227 kilograms) of steel and other ferrous materials, compared with more than 2,000 pounds (908 kilograms) in today’s midsize vehicle. In addition to aluminum – the major component for the body and engine – other lightweight materials include carbon fiber, magnesium, titanium and plastic composites.

Each P2000 component is designed to reduce weight without compromising safety, strength, stiffness or durability. The advances include use of stronger aluminum alloys for further weight reduction; sheet metal that is thicker where needed, thinner and lighter-weight where not; expanded application of magnesium for transmission cases, pedals, mirrors and other components; and use of structural composites in the instrument panel. These P2000 lightweight actions also lead to secondary weight savings, as components such as engines and springs are downsized while maintaining function.

DIATA Engine is Clean, Economical and Lightweight

DIATA is an acronym for Direct Injection, Aluminum, Through-bolt Assembly – three keys to producing a clean, economical, lightweight engine.
To strengthen the aluminum engine, DIATA uses 16-inch through-bolts rather than conventional short studs. The through-bolts go all the way through the engine. This effectively holds the entire engine in compression, which improves performance, durability, and emissions while providing the same rigidity as heavier engines.

The engine can run on conventional diesel fuel, Fischer-Tropsch, natural gas-derived diesel, or dimethyl ether.

This double-overhead cam, 16-valve, four-cylinder engine produces nearly 74 horsepower (55 kilowatts) in its current evaluation stage. In conjunction with its advanced direct-injection fuel system, DIATA has a thermal efficiency (ratio of power output to amount of fuel consumed) that is about 35 percent better than conventional gasoline engines.

The DIATA’s common-rail fuel injection system is calibrated for precise fuel control in a variety of operating conditions. The fuel-injection nozzle is positioned in the cylinder’s center, which improves efficiency and reduces emissions.

Although the DIATA engine is tailored for P2000, it is designed to power any lightweight Ford vehicle. Additionally, the technologies are transferable to other engine sizes and vehicle lines.

**Hybrids and Fuel Cells on the Horizon**

P2000 Program vehicles also have been configured in hybrid and fuel cell versions.

Ford researchers have concluded that low storage requirement (LSR) hybrids have great potential to maximize the fuel economy benefits while maintaining affordability. LSR hybrids replace the conventional engine flywheel, starter and alternator with a starter/alternator packaged between the existing engine and transmission.
When combined with a high-power battery, the starter/alternator allows for very quick (0.2 second) engine restart. The engine can be shut down when the vehicle is decelerating or at rest and can restart without the driver even knowing it was shut off. During braking and cruising, the starter/alternator produces electric energy to recharge the battery. For improved performance, the starter/alternator assists the engine during acceleration.

The result is an extremely fuel-efficient vehicle that drives like a conventional car or truck.

Fuel cells also hold promise as a replacement for the conventional internal combustion engine.

A fuel cell produces electricity by combining hydrogen and oxygen in an electrochemical reaction. Fuel cells require no combustion, unlike a conventional gasoline- or diesel-powered engine. The only emission from hydrogen fuel cells is water vapor.

Fuel cell powered vehicles may also operate on methanol. This is accomplished by use of a reformer, a self-contained chemical factory on the vehicle, that converts liquid methanol fuel into a hydrogen-rich gas mixture for use by the fuel cell.

Fuel Cell Electric Vehicles are similar to battery-powered electric vehicles except that fuel cells replace batteries. As with batteries, fuel cells emit no carbon dioxide, although carbon dioxide and other emissions may be created in vehicle manufacturing and fuel production.

Ford took a major step toward producing a viable fuel cell vehicle by forming a global alliance with Ballard Power Systems (of Canada) and the former Daimler-Benz AG. The alliance is aimed at becoming the world's leading commercial producer of fuel cell-powered drive trains and components for cars, trucks and buses.

As part of the alliance, Ford is the majority shareholder in EcoStar Electric Drive Systems Company, a joint enterprise formed to develop electric drive systems for fuel cell-powered vehicles.

EcoStar is one of three new ventures announced last April when Ford, Ballard and the former Daimler-Benz AG formed their alliance. Under the agreement, Ballard is responsible for fuel cell development, while DaimlerChrysler is responsible for fuel cell systems.
A Focus on Fuel Efficiency

Ford has made significant progress in improving the fuel efficiency of its products in recent years, and nowhere is that progress more evident than in the new Ford Focus and Ka models.

The Focus, Ford's new face in Europe, features the most fuel-efficient lineup of engines in company history. Four lightweight, high-efficiency DOHC, 16-valve petrol engines develop 75, 100, 115 and 130 PS from 1.4, 1.6, 1.8 and 2.0 liters, respectively. Class leading fuel economy is common to all engines - with gains of up to 25 percent compared with their predecessors. The fuel economy of its five engines ranges from 47.9 miles per gallon (4.9L/100KM) for the Endura DI to 27.6 miles per gallon (8.5L/100KM) for the Zetec E 2.0-liter engine. In the case of the Ford Focus, low rolling resistance tires contribute to the fuel efficiency gains. A fifth engine available in 1999, the all-new Endura DI, is a 1.8-liter direct-injection turbo diesel with an estimated 25 percent fuel economy improvement over other turbo diesels.

To reach breakthrough fuel economy targets for the Ford Focus, engineers turned to advanced combustion and catalytic converter technology, including high-compression ratios, knock-sensing and low idle speeds. The Endura DI - Ford's first direct-injection turbo diesel specifically designed for passenger cars - is equipped with an exhaust gas recirculation (EGR) system and beats European emissions limits for new vehicles scheduled for 2001.

Ford engineers have made the Ka 30 percent more fuel efficient than the comparably sized 1976 Ford Fiesta. The Ka is one of Europe's most economical gasoline vehicles.

Ford Focus and Ka reflect Ford's commitment to fuel economy research and development.

The company has improved fuel economy throughout its product lineup by using advanced powertrain technologies such as direct injection and variable valve timing, lightweight materials, aerodynamics, and pioneering vehicle construction technologies. At the same time, today's Ford vehicles also feature improved utility, comfort, safety and reduced emissions levels.

Ford also is enlisting drivers in the effort to improve fuel economy. In cooperation with several German dealers, Ford is running an "eco-driving" pilot program to train consumers how to improve fuel economy without compromising driving dynamics. Early results show that drivers who follow the eco-driving suggestions can improve the fuel efficiency of a Ford Mondeo by an average of 25 percent.

On another front, a Ka prototype vehicle, the Step 1, has achieved 84 miles per gallon (2.8L/100KM) with a three-cylinder, turbocharged, direct injection 1.3-liter diesel. Step 1 also has a lightweight body and components, including carbon fiber closures, instrument panel and seat frames as well as an aluminum back axle and aluminum brake disc calipers.

Ford also has formed a broad-based strategic alliance with Mobil Corporation to encourage development of breakthrough fuel and vehicle technologies that will produce major gains in fuel efficiency and significant reductions in emissions.
Saving Water

Implementation of the Ford Environmental System at the Oakville Assembly Plant is saving a significant amount of water. Similar results are expected in Ford manufacturing facilities around the world during rollout of the Ford Environmental System using ISO 14001 as a guideline.

Even Where Water is Plentiful, Conservation is Important

The Ford Oakville Assembly Plant in Canada is near Lake Ontario, one of North America’s Great Lakes. Here, Ford assembles the Windstar, the first minivan to receive the U.S. government’s five-star front crash test rating on both the driver and front-passenger sides - the highest rating the government awards on frontal crash tests conducted under its New Car Assessment Program. The 1999 Ford Windstar also is certified in California as an ultra-low-emission vehicle - the world’s strictest standard. It is America’s cleanest gasoline-powered minivan.

The Great Lakes account for one-fifth of the world’s freshwater supply. Under the Ford Environmental System, the goal is to conserve this vital resource. Yet, it is necessary to use water from the lake in a variety of manufacturing processes throughout the plant. As the Oakville Assembly Plant adopted the Ford Environmental System – using ISO 14001 as a guideline – water usage was identified as an environmental opportunity.

Reverse Osmosis Saves Water From Chemical Treatment

Before painting, deionized water is used to wash and remove impurities such as excess phosphate from the surface metal on Windstar. This water must be super clean and exhibit low conductivity. To achieve this, a reverse osmosis system is used. In this process, the lake water is forced against a membrane that separates the water into two units: permeate and concentrate. The permeate is the fresh water that passes through the membrane; it possesses low conductivity, making it ideal for rinsing the minivan bodies.

The concentrate, or remaining water, is discharged into the lake. No chemicals are added to the water that goes into the reverse osmosis system. By using reverse osmosis, less water passes through the regional wastewater treatment plant, reducing the amount of chemicals needed to treat the water and lessening the plant’s environmental impact.

The Ontario Ministry of the Environment has scrutinized and approved the process and the municipality of Halton strongly supports it.

Resource Conservation – Water

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Annual Wastewater Treatment Plant Flow, Oakville Assembly Plant Water Conservation Project

Since its initiation in July 1998, the Water Conservation Project at the Oakville Assembly Plant has resulted in a dramatic reduction in water consumption month to month resulting in a significant total savings projected for the year.

1998 Monthly Wastewater Treatment Plant Flow
Oakville Assembly Plant Water Conservation Project

Looking to Future Goals
Water conservation at Oakville is a direct result of the Ford Environmental System. In addition, as the system comes on line at more facilities worldwide, Ford will further reduce water usage. The goal for 1999 is to have a global water conservation objective and specific plans at all Ford plants.

Less Water, Fewer Chemicals, Lower Costs
The reverse osmosis system is reducing the flow of wastewater to the Oakville Municipal Wastewater Treatment Plant by 127 million gallons (481 million liters) per year. That is enough water to satisfy the annual freshwater needs of more than 1,200 households in Oakville. Because of these water savings, there has been a 20 percent reduction in chemicals used to treat Oakville’s water. This reduction in water and chemical usage results in a significant cost savings as well as making a major environmental contribution.

Additional Water Conservation Results at Select Facilities Around the World
• Ford is saving 16 million gallons (60 million liters) of water annually at its Halewood Assembly Plant (U.K.) through improved paint shop processes.
• At Ford’s Chihuahua Engine plant (Mexico), dynamometer water is recycled, resulting in a 66 percent reduction in the discharge of process water.
• At Ford’s Cuautitlan facility (Mexico), treated process water was used to create a man-made pond habitat and to irrigate surrounding land.
• At Ford’s Atec Electronics plant (Mexico), treated process water is used to irrigate surrounding recreational fields for employee use.
• Chicago, Illinois (U.S.) stamping facility saved 1 million gallons (3.8 million liters) of water per year by installing ultrafiltration equipment that allows the reuse of die-cleaning solution.
Rebirth of a Forest

Ford is committed to protecting the world’s rich and diverse ecosystems through forest, land and habitat conservation.

In the charred and bruised remains of what once were lush Mexican forests, 3 million tender new trees are beginning to thrive.

The trees are being planted as part of a national reforestation effort recently launched by Ford, its dealers in Mexico, and the Mexican government following fires that left 296,000 acres (120,000 hectares) of forests and 1,186,000 acres (480,000 hectares) of grass fields dead or dying. The fires choked the skies above Mexico for months with black smoke. They affected everything from the quality of soil and water to the availability of electricity.

By donating $1 million from vehicle sales to fund reforestation, Ford of Mexico and its dealers are helping to grow and nourish new trees at 10 natural protected areas throughout the Mexican Republic which were the most severely affected by the fires.

Protecting a Rich Ecosystem

The reforestation project isn’t the first conservation partnership between Ford and the Mexican government. Ford has joined in to save the peninsular Pronghorn (Berrendo) antelope, an endangered creature indigenous to Mexico’s Baja peninsula. This scope also has expanded to include a global strategic alliance with Conservation International, a field-based organization that protects biologically rich ecosystems like those found in Mexico and Brazil.

The impact of the recent fires, however, makes the reforestation effort in Mexico the most urgent example of the need for private sector conservation efforts in the area. The damage continues to ripple through the region’s ecosystem. The forest plays a key role in the area’s ecological balance – contributing to the purification of air and water; stabilization of the climate; regulation of temperature and the force of wind and waves; control of droughts and flash floods; pollination of harvest and natural vegetation and control of potential agricultural plagues; among others. Without a healthy forest, the complex biodiversity of the area is at risk – as are basic human requirements such as clean water and air, and fertile soil.

Workers from several Ford plants soon will hike to the most ravaged areas to plant trees and work the soil themselves. They will help hundreds of countrymen and farmers hired to restore lands once fertile with trees, foliage and wildlife. Schoolchildren in Mexico from the 171 Ford-funded Ford Schools are planting some trees in their own neighborhoods as a lasting reminder of the importance of conservation.

And Ford executives and dealers throughout Mexico are helping the government persuade other businesses to donate time and money to the effort.
A Global Legacy

This is but one example of the long history of environmental activism at Ford. Henry Ford, an avid conservationist, replaced wood with steel in his early automobiles out of concern for natural resource preservation. In 1933, 2 pounds (0.91 kilograms) of soybean products went into every Ford car— in the paint, horn button, gearshift knob, door handles, accelerator pedal and timing gears. He believed industry should preserve forests and mines, drawing its materials instead from the fields and farmlands.

Today, Ford’s global commitment to conservation remains just as strong. Ford has established wildlife habitats at plant sites throughout the world and encouraged community programs to educate employees and the public on the importance of preserving endangered species, lands and other wildlife environments.

In May 1994, Ford became the first car manufacturer in Germany to initiate a vehicle retirement program to promote cleaner air—the “Clean and Safe” campaign. The program takes vehicles without a current catalytic converter off the market by offering incentives to purchase or lease new Ford products. As a result, more than 300,000 vehicles have been taken off the road and recycled. These vehicles have generated 290,000 tons (263,000 metric tons) of recycled metal—more than enough to build 20 Eiffel Towers. The improved fuel economy of new Ford products also promotes air quality—avoiding release of 110,000 tons (99,792 metric tons) per year of carbon dioxide, CO₂. As part of this environmentally responsible program, Ford also planted 300,000 new trees.

Through each effort, Ford has reinforced its continuing commitment to the protection of the world’s forests and habitats and to the environmental richness and diversity of the global community.
Environmental Impact Management

Ford is Significantly Reducing Carbon Dioxide and Other Emissions by Reducing Its Energy Consumption

Ford is surpassing its internal goal of reducing facility energy consumption by 1 percent per year.

Conservation, improved efficiency and application of new technologies - such as solar energy - decrease the use of fossil fuels.

One of the innovative ways Ford is conserving energy and natural resources is through the development and use of solar power.

The Bridgend Engine Plant in Wales is the site of the largest integrated and grid-connected solar installation in an automotive manufacturing facility in Europe - and the first of this type in an automotive plant in the world. The plant produces Jaguar V-8 engines and four-cylinder Zetec engines used in the Ford Mondeo, Focus and Escort.

Wales might seem an unusual location for a solar energy project, because of frequent cloud cover and shorter periods of bright sunlight than available closer to the equator. However, Bridgend was chosen because its northern latitude provides a more demanding test of solar energy technology than a sunny location.

On the roof of the 1.5 million-square-foot (139,000-square-meter) facility are 26 solar units, each consisting of 1,540 photovoltaic cells that convert sunlight into electricity. The solar cells generate a peak output of approximately 100 KW and an annual capacity of 110,000 KW-hours, which is equal to the power needs for lights over an area of approximately 108,000 square feet (10,000 square meters).

Solar power generation is emission-free. By not burning fossil fuels to generate electricity, the Bridgend solar installation will prevent the discharge of 4,400 U.S. tons (4 million kilograms) of CO\textsubscript{2} into the atmosphere over the 30-year life of the plant.

The Bridgend solar project is notable for several reasons:

- The solar installation was put in an existing, large plant as a pilot for retrofitting other Ford facilities. The Bridgend Plant was built in 1980, and the solar installation was added in 1998.
- Each solar unit is mounted on the south side of a roof light. The north-facing side allows natural daylight into the plant. Previously the roof was enclosed, allowing no natural light into the plant.
- An intelligent lighting system measures the level of natural light entering the plant and automatically adjusts the artificial lighting level of the fluorescent lighting installation.
- The project was funded jointly by Ford, the European Union and the UK's Department for Trade and Industry to evaluate the practical application of solar technology in a manufacturing environment.

Sunlight is converted into electricity in this solar unit made of 1,540 photovoltaic cells. This is one of 26 roof lights installed at the Bridgend Engine Plant, taking up eight percent of the roof and providing partial power for the plant's lighting needs.
The Bridgend solar project also is notable as an example of Ford’s pursuit of technological innovation. Ford encourages breakthrough thinking and provides enabling funds for engineering teams to take risks and develop new manufacturing methods and material uses. New technologies that lessen environmental impact include water-based ceramic paint, a shredded-tire recycling system and catalytic incinerators.

Because of its commitment to innovation, Ford is making major strides in energy conservation.

The company’s internal goal is to reduce overall energy consumption by 1 percent every year.

In 1997, Ford’s worldwide energy consumption was cut by 4.6 percent, from 116.2 trillion BTUs (122,600 trillion joules) to 110.8 trillion BTUs (116,900 trillion joules).

Reducing energy consumption by 5.4 trillion BTUs (5,698 trillion joules) is a significant accomplishment, equivalent to the power generated by burning 650 million tons (590 billion kg U.S.) of coal — enough to meet the residential electric needs of a city of 140,000 people for a year.

Reduced energy use translates into reduced emissions of CO₂, which is caused by burning fossil fuels such as coal and oil.

In 1997, Ford’s emission of CO₂ per vehicle produced was reduced 4 percent.

Improving energy efficiency is a significant task, particularly as increased amounts of energy often are required to reduce emissions from manufacturing plants.

For example, the paint shops in Ford’s North American assembly plants today emit approximately 80 percent fewer volatile organic compounds (VOCs) per vehicle produced than in the 1970s. The decrease was brought about through changes in paint formulation and the use of control equipment to capture and eliminate the VOCs. However, operation of control equipment requires large amounts of energy. In fact, the paint shop typically accounts for 60 percent of the energy used in an assembly plant.
Ford is reducing its energy consumption by replacing old equipment with energy-efficient equipment, implementing more stringent maintenance, and developing innovative ways to conserve energy—such as energy suggestions coming from employee Energy Teams—from turning off fans and lights on weekends to reducing leaks of compressed air to capturing and using methane generated in landfills.

In addition, Ford is shifting to more environmentally responsible energy sources such as natural gas. Burning natural gas in place of coal reduces CO$_2$ emissions by 43 percent to produce the same amount of energy. Since 1986, Ford has replaced coal-fired boilers with natural gas boilers in 15 plants in the United States, reducing CO$_2$ emissions by 274,000 tons (249 million kg) annually.

Ford is committed to using energy as efficiently as possible to produce cost-effective, high-quality products.

The company has reduced its energy consumption significantly and is making further reductions through continuous improvement of existing processes and by pursuing new technologies.
New Lives for Old Manufacturing Facilities

Like the environment itself, Ford facilities are constantly reborn. Through its environmental impact management efforts, existing plants are rebuilt to become more efficient -- or transformed for entirely new uses.

The Windsor Engine Plant has been rebuilt as one of the most environmentally responsible automotive manufacturing facilities in the world.

In 1993, Ford rebuilt its Windsor Engine Plant in Canada to produce its new family of Triton™ truck engines. New technologies were put in place for manufacturing and environmental management.

The walls, roof, and even the floor of the plant, built in the 1920s, were stripped, leaving only a frame of steel girders. Concrete from a building demolition traditionally would be sent to a landfill. Instead, the concrete was cleaned and crushed to become granular fill under the new plant floor.

As part of the construction, a new buffer zone was created next to the plant. In a generous land exchange, Ford gave the city of Windsor, Ontario, its 63-acre (25.5-hectare) test track, which the city is developing into a park with soccer and baseball fields. In exchange, the city purchased 7 acres (2.8 hectares) of residential land adjacent to the plant and landscaped it with trees, hills and flowers.

Special precautions were taken to ensure that the nearby Detroit River remained unaffected during demolition, reconstruction and ongoing plant operations. An on-site wastewater treatment plant is designed to intercept any inadvertent release of oil or chemicals. There is no connection from anywhere in the plant to the municipal storm sewer except for rainwater drainage from roads and the plant roof. Consequently, runoff to the Detroit River is managed carefully.

Windsor Engine is a model of recycling efficiency. From engine blocks to spark plugs, all shipping containers and pallets are returned to suppliers to be used again and again.

Another example of environmental efficiency can be seen in the handling of petroleum products, which are traditionally transported in steel or plastic drums. Recycling drums is difficult and costly because of the oil residue that remains, so the use of 55-gallon (208-liter) drums has been almost eliminated at the Windsor Engine Plant. Petroleum products are distributed using portable carts which are constantly refilled from a 110,000-gallon (416,000-liter) oil storage facility referred to as “The Tank Farm.”

Ford is globally committed to eliminating the use of chlorofluorocarbons (CFCs), a refrigerant believed to break down the Earth’s ozone layer. At Windsor Engine, the coolant in the air-conditioning system is lithium bromide mixed with water. The solution is nontoxic and has no effect on the ozone layer.

The reconstruction of Windsor Engine shows how brownfield redevelopment is giving new life to old manufacturing facilities, at the same time protecting the environment and maintaining jobs.
Ford worked closely with state and local environmental officials to plan and carry out environmental remediation, which resulted in the removal of PCBs, asbestos and lead paint and cleanup of soil and groundwater.

As much of the old plant as possible was reused, and portions that could not be reused were recycled. More than 12,000 tons (10.9 million kilograms) of scrap metal, 800,000 square feet (74,000 square meters) of roof deck – the equivalent of 14 American football fields or 10 soccer pitches – and 90,000 cubic yards (69,000 cubic meters) of concrete and asphalt were recycled from the old plant and used as material for the new mall. Of the original 2.1 million square feet (194,000 square meters) of space in the assembly plant, 1.5 million square feet (139,000 square meters) were refurbished.

Today, visitors to the mall can still see the original steel-frame structure, which was reinforced to meet California’s strict earthquake-resistant building codes.

The mall has given a strong boost to the local economy, providing 4,000 new jobs, $150 million in annual sales and $3 million yearly in added tax revenue. The mall also has encouraged other developments on the parking lots and underdeveloped acreage that surrounded the original plant, including an office building and two hotels. Ground was broken in 1998 for a 75-unit apartment building and a 384-home subdivision.

As its facilities are reborn, Ford strives to find ingenious solutions and make the most efficient use of resources. With the rebirth of each facility – whether as a new-generation plant or for new uses – Ford tries to improve the environment and the vitality of local communities.
Greenhouse Gases

Greenhouse gases are one of the most talked-about environmental issues.

The "greenhouse effect" is a naturally occurring phenomenon that allows the Earth to be warm enough to sustain life. Gases in the atmosphere act like a blanket to trap infrared radiation, or heat, emitted by the sun, thus maintaining temperatures at the Earth's surface.

Many people are concerned that increasing amounts of man-made greenhouse gases may be warming the Earth too much and altering its climate. Man-made CO₂ comes primarily from deforestation and burning fossil fuels such as coal, oil and natural gas. Methane and nitrogen oxide come from a variety of sources, including mining, farming and waste disposal.

We know that atmospheric concentrations of greenhouse gases have increased. But important interactions with clouds, ocean circulation, aerosols and the natural cycles of greenhouse gases are not well understood, nor can they yet be reflected reliably in the computer models used to predict climate change. Further research is needed to improve the accuracy and reliability of the models and to further scientific understanding of climate systems and the causes and effects of climate change.

Ford wants to be a leader wherever possible. That means pursuing and funding scientific research projects, and that means working on environmental programs and developing technology that have the promise of lowering CO₂ emissions.
The goal of the PNGV is to develop a family sedan capable of achieving 80 miles per gallon (2.9 L/100 KM) while also providing the performance, comfort, safety features and affordability of today’s cars. A working prototype is targeted for 2004.

The PNGV’s goal is to improve fuel economy, reduce emissions from gasoline engines and lead to breakthroughs for new fuels and technologies.

Research

Half of the research conducted in Ford’s worldwide scientific laboratories concerns environmental issues.

In addition, Ford sponsors environmental research at universities around the world. One of the largest programs is the Cooperative Mobility Research Program at the Massachusetts Institute of Technology, one of the few research programs that looks beyond technology to evaluate the impact of economics and government policy.

Other Ford-sponsored research is under way at Harvard University, Carnegie Mellon University, Columbia University, the University of Michigan and Stanford University – and outside the United States at the University of Mainz in Germany, University of Reading in the United Kingdom, Tsinghua University in China and the Indian Institute of Technology in India.

Ford’s Commitment

Ford is committed to furthering the understanding of the impact of greenhouse gases on the global climate and working with government and industry to develop effective, long-term solutions.

Ford Initiatives to Reduce Greenhouse Gases

Ford continues to make its gasoline and diesel engines more efficient, reducing the amount of CO₂ produced. Ford produces a wide range of alternative-fuel vehicles (AFVs) powered by electricity, ethanol, natural gas and other fuels. Some AFVs have the potential to emit up to 60 percent less CO₂ than gasoline-powered vehicles. However, before that can be accomplished on a wide scale, a fueling infrastructure must be developed and other problems must be solved.

Ford has produced AFVs for more than 30 years and has sold more than a million worldwide. Ford is the industry leader in AFV production volume, accounting for more than 90 percent of all AFVs sold in the U.S. in 1997. (See Product Stewardship for an overview of all of Ford’s AFVs.)

Vehicles of the Future

Ford is developing vehicles of the future that incorporate new technologies which can reduce CO₂ emissions.

One research vehicle is the P2000, a vehicle as large as a midsize family car. It is a testing platform for advanced powertrains, including fuel cells. (For a more detailed description of the P2000 and fuel cells, please see Energy Conservation in the Resource Conservation section.)

Partnership for a New Generation of Vehicles

P2000 is an outgrowth of Ford’s participation in the Partnership for a New Generation of Vehicles (PNGV), a research-and-development program involving Ford, General Motors, Chrysler, the U.S. government, universities and automotive suppliers.

The goal of the PNGV is to develop a family sedan capable of achieving 80 miles per gallon (2.9 L/100 KM) while also providing the performance, comfort, safety features and affordability of today’s cars. A working prototype is targeted for 2004.

The PNGV’s goal is to improve fuel economy, reduce emissions from gasoline engines and lead to breakthroughs for new fuels and technologies.
Clearing the Air

Ford Motor Company scientists in Dearborn, Michigan, and Aachen, Germany, are conducting major programs to gain an understanding of the impact of Ford products on the environment, with more than 50 percent of the research budget being spent on environmentally related technologies. More than 250 laboratory researchers are working on upwards of 70 environmental research projects using in-house research published in scientific literature, along with grants to worldwide university research groups for collaborative projects on environmental problems.

Two focuses of Ford’s environmental research are atmospheric chemistry and atmospheric modeling. The atmospheric chemists at Ford are interested in understanding the future of vehicle and manufacturing emissions, as well as biogenic emissions that enter the atmosphere, or how emissions are transformed and removed by atmospheric chemical processes. Research is specifically concerned with how human activities may be changing the atmosphere. A number of critical environmental issues are associated with a changing atmosphere, including photochemical smog, global climate change, airborne toxins, and stratospheric ozone depletion. At facilities in Dearborn, scientists are characterizing the low level of particulate emissions from gasoline and diesel exhaust and the relation of those emissions to engine performance and fuels. Ford scientists have developed a first-of-its-kind, fully integrated, on-board emissions analysis system that measures real-time gaseous engine emissions and corresponding engine...
operating conditions. By applying state-of-the-art technology to measure the size and chemical makeup of emissions, conclusions can be reached on their potential environmental impact, including emissions from the new reformulated vehicle fuels and fuel additives.

At Ford Forschungszentrum, a company research center in Aachen, Germany, an atmospheric science team is conducting research on diesel particle emissions and air quality impact. This work and that from Ford-sponsored university research projects in the U.S., Germany, China, Taiwan, Russia, South America and India are part of a global effort to better understand the relationship between particle air quality and human health and what might be done to minimize any negative impact on air quality.

To help determine the potential environmental impact of gaseous emissions, two complementary experimental facilities are used at Ford Dearborn, the Smog Chamber and the Laser Photolysis Laboratory.

A Smog Chamber is a large reaction vessel lab device which simulates the real atmosphere and allows the study of atmospheric chemical reactions that control the future of individual gaseous chemicals emitted into the atmosphere. A detailed identification of the stable products that are formed as materials are degraded, or oxidized, step by step by atmospheric chemical reactions, can be achieved. The Laser Photolysis Facility involves a high-tech approach to studying how fast atmospheric reactions actually occur and how these rates vary with temperature. This laboratory uses a high-power laser to break down compounds in very selective ways leading to the formation and detection of the short-lived chemical intermediates that are responsible for or result from the degradation of chemicals in the atmosphere.

Together, data from the Smog Chamber and the Laser Photolysis Facility are used to evaluate the impact of emissions on urban smog, climate change, stratospheric ozone depletion and concerns related to airborne toxic materials. These experimental facilities provide necessary information to incorporate chemical species into detailed models of the atmosphere.

Over the years, Ford has achieved several noteworthy accomplishments in the field of atmospheric chemistry. The search for suitable replacements for air-conditioner coolants, or CFCs, led the Dearborn research team into an investigation of the atmospheric degradation pathways of potential alternatives. Fuel components and additive materials proposed for use in gasoline and diesel fuels have also been researched in the Smog Chamber and Laser Photolysis Facility.

Another primary focus of Ford’s environmental research is atmospheric modeling. An atmospheric model consolidates knowledge of and information from different atmospheric processes to simulate an environment in which all processes are coexisting and influencing one another. Atmospheric modeling relevant to air quality must include information on emissions and meteorology and knowledge of chemical and transport processes under given emissions and meteorological conditions.
Ford scientists have advanced the role and understanding of ozone-forming reactivities of volatile organic compounds emitted into the atmosphere. Different organic compounds are oxidized to form ozone at different rates or reactivities. Reducing the emissions of the more reactive ones should improve air quality in an urban area, and alternative fuels and reformulated gasoline can be designed with improved air quality in mind.

Ford scientists also studied the statistical characteristics of air quality standards and have made recommendations to the U.S. Environmental Protection Agency to adopt a form of the standard that is consistent for both attainment designation and control implementation. The recommendation was adopted by the EPA in its latest promulgation of the National Ambient Air Quality Standards for ozone and particulate matter.

At Aachen, Ford scientists are busy constructing a new generation of the only major European air quality model that contains a description of processes for both ozone and aerosol. The aerosol module contains all the important physical and chemical processes affecting, among other aerosol species, ammonium, nitrate, sulfate, water, elemental carbon, and secondary organic aerosols. Aerosol processes and characterizations are major topics of research. Ford scientists also are directing air quality modeling development and applications to investigate the air quality impact of reformulated-gasoline usage.

Continuing in this tradition, Ford scientists have begun to study the contributions of various components which make up gasoline, specifically the aromatic fraction of particulate matter air quality, with regard to the formation of so-called secondary particles formed in the atmosphere from gases emitted from vehicle tailpipes.

The fact that Ford is the first U.S. auto manufacturer to pursue the characterization of the size, distribution, and chemistry of vehicle particle emissions is just the most recent example of Ford’s 30 years of leadership in the pursuit of the basic knowledge necessary to understand the impact of our products on the environment. A very important aspect of Ford’s approach to understanding the environment are informal interactions, featuring complementary research approaches on air quality.
issues with universities and research laboratories worldwide. Currently such exchanges involve the National Center of Atmospheric Research in the United States and Risø National Laboratory in Denmark; Massachusetts Institute of Technology, Georgia Tech and Indiana University in the U.S.; Oxford University and the University of Reading in England; the Universities of Wuppertal, Cologne, Mainz and Leipzig in Germany; Tampere University, Finland; and Kyoto University, Japan.

Ford supports research around the world. Twenty-eight individual projects are under way with 23 universities and institutes in 17 organizations in conjunction with the Ford China Research and Development Fund. This fund, established in 1993 between Ford and the National Natural Science Foundation of China (NSFC), is a collaboration between Ford, the NSFC, the State Science and Technology Commission, the Ministry of Machinery Industry (MHI) and the Chinese Academy of Sciences to promote collaborations in science and technology between Ford and the Chinese automotive industry. It was the first fund of its kind established between the Chinese government and a foreign company. One outcome of this research is the development of rare earth oxide-based catalysts. Ford is developing a joint venture with Chinese organizations to become full service suppliers of catalytic converters.

A joint program with the Department of Commerce and the University of Michigan, Dearborn, brings Russian scientists and engineers to Ford to work for six months. Twenty-four Russian scientists are on assignment at Ford working on a variety of research projects. In India, the establishment of the Henry Ford Technology Chair at the Indian Institute of Technology strives for improvements in automotive emissions research. Ford has also donated emissions equipment to the Automotive Research Association of India (ARAI) and has provided training to ARAI scientists in eight automotive technology areas.

Work is also under way with South American scientists to provide assistance for vehicles to meet new emission standards using local fuels.

In Japan, joint development programs with Mazda and key technology-based companies are working on catalysts and emissions systems.

Design for Environment (DFE) training is available to Ford engineers worldwide. DFE provides product and manufacturing engineers a process to systematically consider environmental improvement opportunities in each new program or project. Additionally, Ford is conducting investigations in the area of Life Cycle Assessment (LCA), both internally and through industry associations. A generic Taurus-sized vehicle was inventoried within the framework of the United States Automotive Materials Partnership (USAMP). Examples of some of the LCAs conducted in the Company in 1998 include: recycling of battery housings, natural reinforced undershields, conversion of coal to automotive fuels, and the use of magnesium in automotive components.

These ventures are enabling scientists to understand the impact of Ford products on the environment and to provide better ideas to lessen the impact.
Recognition for Environmental Leadership

Ford is recognized for the outstanding efforts it makes to provide for a better future with a cleaner environment. Following are some of the major awards given to employees by the company and to Ford Motor Company by manufacturers and civic and governmental organizations in recognition of the company’s concern for the environment.

1997 Henry Ford Technology Awards
The annual Henry Ford Technology Awards Program is part of the company’s effort to provide greater management attention to, and recognition of, exceptional technical contributions by employees. In 1997, awards were given for the Ford Modular Fuel Pump, which helps to improve emissions, increase gas mileage, and reduce costs; the HDPE fuel tank, which provides weight and cost reduction, and increased capacity; and Control System Concept for Engine Starting, which reduces emissions.

1997 Governor’s Award for Pollution Prevention – Ford Van Dyke Plant, Sterling Heights, Michigan, U.S.
The Governor’s Award for Pollution Prevention was awarded to the Indianapolis Plant for voluntarily replacing old, oil-lubricated machines with new dry machines. The switch has eliminated 18 tons (16,300 kilograms) of emissions per year. It also alleviates odor problems and avoids the disposal of 50,000 gallons (189,250 liters) of used oil a year.

1997 Michigan Clean Corporate Citizen Award – Ford Van Dyke Plant, Sterling Heights, Michigan, U.S.
The Van Dyke Plant was recognized with Michigan’s Clean Corporate Citizen Award. This award from the Michigan Department of Environmental Quality recognizes exemplary environmental performance in environmental management, pollution prevention and regulatory compliance.

1997 Industrial Pollution Control and Industrial Safety & Hygiene – Ford Lio Ho Engine Plant, Chung Li, Taiwan
Ford Lio Ho received the award for its excellence in active promotion of Industrial Pollution Control and Industrial Safety & Hygiene from the Industrial Development Bureau of Economic Affairs.

The 1997 Horner Award
The Horners Livery Company of London awards the highest honor that can be achieved in the plastics industry. Ford received this award for development of a handheld instrument that identifies recyclable plastic to expedite sorting for recycling. Ford is the first motor manufacturer to receive this award.

1997 Gas Research Institute Partnership Award
The Gas Research Institute Partnership recognized Ford for its leadership and innovation in technologies that positively impact the market for natural gas.

1997 Michigan Clean Corporate Citizen Award – Ford Van Dyke Plant, Sterling Heights, Michigan, U.S.
1998 Vision for America Award – Keep America Beautiful
Keep America Beautiful, Inc. presented Ford the Vision for America award. This award recognizes American corporations that have demonstrated a commitment to and leadership in environmental, civic and social stewardship.

1998 British Design Council
Ford was recognized by the British Design Council with a commemorative exhibit of the handheld instrument that identifies recyclable plastic in the Millennium Dome.

1998 National Award on Industrial Waste Minimization – Ford Lio Ho Engine Plant, Chung Li, Taiwan
The 1998 National Award on Industrial Waste Minimization recognized the Lio Ho Engine Plant as an Outstanding Plant and recognized Jesse Chiou, manager of the Environmental & Special Programs Office, with its Outstanding Personnel award.

1997 Governor’s Award for Outstanding Achievement in Pollution Prevention – Ohio Assembly Plant, Avon Lake, Ohio, U.S.
The Ohio Assembly Plant was honored for its strong pollution prevention program, which included the use of water-based or low VOC cleaning solvents, recycling of metal drums, cardboard, and wood, and other achievements.

1997 Society of Plastics Engineers
The Society of Plastics Engineers honored Ford with its most prestigious award. Ford’s Carpet to Car Parts program, which keeps 27 million square feet (2.5 million square meters) of carpet out of landfills a year, won the most innovative use of plastic in the environmental category and the overall grand prize.

Patents
Worldwide in 1997, Ford Motor Company was awarded 220 patents for innovations related to the environment.

1998 Intellectual Property Owners Association National Inventor of the Year Award – Ford Research Engineers
The IPO award recognizes America’s most outstanding inventors. Four Ford employees, Jeffrey Hepburn, Robert McCabe, Bela Povinger and Raymond Willey, received the Distinguished Inventors award for two patents. The Ford engineers developed an Ultra-Efficient Catalyst System and an Engine Control Strategy for a Motor Vehicle Powered by Natural Gas. These inventions reduce engine emissions.

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Good Corporate Citizens

Monk seals sleep peacefully on the open beaches of the Aegean sea today due to the research and conservation efforts of the Foça (Turkey) Pilot Project (FPP). Sightings of the seals, endangered from eroding habitats and illegal fishing, increased from 41 in 1994 to 202 in 1997. The FPP was the recipient of the 1998 Grand Prix of the Henry Ford European Conservation Awards (HFECA), which seek to bring together international, governmental and individual expertise on a variety of environmental initiatives. Begun in 1983, the awards are named in honor of Henry Ford.

William Clay Ford, Jr., great-grandson of Henry Ford and chairman of the conservation awards, lauded the FPP for “outstanding demonstration of successful conservation in action combining scientific research, public awareness, practical preservation measures and liaison with the Turkish government and other organizations to ensure the total protection of this important European mammal.”

Ford recognizes major environmental initiatives like FPP and encourages stakeholders, inside and outside of the company, to become involved in these initiatives in a variety of ways.

In 1997, Ford established a broad strategic partnership with Conservation International (CI). Through this strategic effort, Ford supports research on the biodiversity of the fragile Amazon Basin. Ford and CI also are partners in conservation projects that span the ecosystems of the Amazon, Pantanal and Atlantic Coastal forests. The Henry Ford Brazilian Conservation Awards, with CI, reward lifelong conservationists for their achievements in this region.

Ford of Mexico donated Ranger 4x4 trucks for site surveys and field studies of the Berrendo, a species of antelope indigenous to northern Mexico. The Berrendo is in danger of extinction, and the goal of this partnership with the Mexican Ministry of Environment, Natural Resources and Fisheries is to at least double the number of Berrendos in a five-year period. Working together to preserve the biological equilibrium in the area is a “Project of Conservation and a Project of Life.”

The Wildlife Habitat Council and Ford have created “Wildlife at Work” sites in the United States, England, Canada, Brazil and Mexico. This program encourages community efforts to create wildlife sites and educational programs on the importance of preserving endangered species.

At Zoo Atlanta, a coalition that includes Ford, area businesses, governmental agencies and Emory University promotes the preservation of tropical rain forests and endangered species with the theme of “Conservation...Because Extinction is Forever.” The Kansas City Zoo conducts educational outreach programs using the same theme.

Ford of Spain and the Department of Agriculture and Fisheries have teamed up to protect Spain’s natural parks with Ford Natural Routes. Detailed guides on wildlife and walking routes have been established at five parks.

“Earthquest, The Challenge Begins” is an interactive traveling exhibit visiting three U.S. cities each year that shows children how everyday choices impact the environment.
"Clean and Safe," initiated by Ford of Germany in 1994, takes vehicles without a current technology catalytic converter off the market by offering incentives. More than 300,000 cars have been recycled into 290,000 tons (263,000 metric tons) of metals. The improved fuel economy of the replacement vehicles reduces 110,000 tons (99,792 metric tons) per year of carbon dioxide CO$_2$ from being released into the atmosphere.

Ford continues in its pledge to be an environmental leader into the 21st century by conducting breakthrough worldwide research, including more than 35 scientific projects with European universities and institutes through Ford Forschungszentrum, Aachen, Germany.

A cooperative effort between Ford, the Massachusetts Institute of Technology and economists, scientists and policy makers from around the globe evaluates the economic and societal aspects of ground mobility.

Donations of vehicle emissions test equipment to the Automotive Research Association of India, along with the establishment of the Henry Ford Technology Chair at the Indian Institute of Technology, promote emissions research in this part of the world. The company also partners with four American universities in researching vehicle recycling.

By supporting environmental initiatives that involve employees worldwide in their communities and through partnership with outside research, conservation and educational organizations, Ford's commitment is to be actively involved in the company pledge to be an environmental leader.
Ford operates over 140 facilities and sites worldwide which are subject to literally thousands of pages of permits, standards and other regulatory requirements. Despite the size and complexity of the business, the Company has an outstanding compliance track record.

Ford’s Policy - Do More Than What’s Required

Company policy calls for continual improvement in protecting health and the environment. The goal is to prevent pollution and, at a minimum, comply with all regulatory requirements. This policy also encourages our operations in all parts of the world to take actions which go well beyond legal mandates.

Cleaner Products  In the United States, for example, Ford is the only full-line producer to be voluntarily making all of its 1999 model year sport utility vehicles and the Ford Windstar minivan comply with the more stringent Low Emission Vehicle smog emissions standards — at no extra cost to customers. These vehicles will be cleaner than most passenger cars on the road today. Ford also was one of the first to announce plans to voluntarily provide cleaner cars under the U.S. EPA’s National Low Emission Vehicle Program - a program which Ford helped develop.

Cleaner Plants  Ford is the auto industry’s worldwide leader in adopting, voluntarily, the environmental management system standards developed by the International Organization for Standardization. These standards, known as ISO 14001, provide a framework for integrating environmental improvement into everyday business operations. They form the core of the Ford Environmental System. All Ford manufacturing facilities have been certified by independent third parties to the ISO requirements by year-end 1998.

It Starts With Each Facility and Each Employee

At Ford, it’s everyone’s job to protect the environment. Each major facility has its own environmental engineer who is supported by divisional and corporate environmental specialists. Each facility conducts an annual self-assessment of its compliance efforts and takes appropriate action. Periodic audits of the environmental management system also are performed by independent third parties. The Company also has a number of employee training programs to ensure that employees understand emergency preparedness, response and other requirements.

Committed to Let You Know

Ford is committed to providing the public with timely and accurate information on environmental matters involving the Company and playing a constructive role in developing future regulatory goals. As part of its community outreach programs, for example, Company experts attend citizen meetings to involve neighbors in the environmental aspects of new plant projects. And this report, which includes TRI and compliance data, is available on the web to ensure greater public access.
Ford’s Track Record

United States – Table 1 includes data relating to the Company’s compliance with various U.S. federal and state environmental requirements for the 1996 and 1997 calendar years. It should be emphasized that these data are but one measure of the Company’s overall effort to comply with regulatory requirements.

During 1997, seven “notices of violation” (NOVs) were received compared with 23 in 1996. A NOV is typically issued by a federal, state or local government enforcement agency and may contain allegations ranging from minor paperwork violations to the failure to achieve air emissions or water discharge permit limits. While some NOVs may lead to the imposition of a civil penalty, many are resolved with an agreement by the Company to take corrective action. In 1997, Ford paid $260,000 in civil penalties, versus $135,000 in 1996.

Major Matters – During the 1996-97 period, the Company agreed to pay a civil penalty of more than $25,000 in each of two matters. In 1996, the U.S. EPA notified the company of an alleged violation of federal rules governing the use of cleanup...
solvents at the Chicago Assembly Plant. The matter was settled by paying $135,000 and agreeing to implement a new control plan to reduce the use of cleanup solvents at the plant by 30 percent.

In 1997, the company agreed to settle claims by local authorities alleging air emissions violations at the Wayne, Michigan, Assembly Plant. The authorities claimed that the plant had (1) exceeded the allowable limits for volatile organic compounds while certain emissions-control equipment was being repaired and (2) improperly routed exhaust gas from certain landfill gas generator units. The company agreed to pay $250,000 to settle the matter. Importantly, the total emissions of both the Chicago and Wayne assembly plants have been historically, and continue to be, well below the total allowable emissions in the plants’ permits.

During 1997, the company also received and responded to an information request from the U.S. EPA regarding the emissions performance of certain 1997 model-year Econoline vans. The EPA claimed that these vehicles, as well as certain 1991-1995 model-year Escorts, employed an engine control strategy that resulted in higher-than-permissible emissions of oxides of nitrogen. The company denied any wrongdoing and subsequently settled the matter in 1998. The settlement required Ford to pay a

Table 1

<table>
<thead>
<tr>
<th>U.S. Federal/State Requirements</th>
<th>Year</th>
<th>Number of Violations</th>
<th>Number of Penalties</th>
<th>Penalty Assessments</th>
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<td>4</td>
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<td>Waste Disposal Requirements</td>
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<td>Violation Prevention Requirements</td>
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<td>U.S. CERCLA, Superfund Act</td>
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$2.5 million civil penalty, spend $1.5 million on supplemental environmental projects, recall the Econoline vans (estimated cost $1.3 million) and retire 2,500 tons (metric) of nitrogen oxide emissions credits (estimated cost $2.5 million). In a similar agreement with the State of California, the company agreed to recall the California Econoline vans (the cost of which is included in the above description of the federal settlement) and pay a $350,000 civil penalty.

Outside the United States - Table 2 includes data relating to the company’s compliance with various air, water, and waste environmental requirements in countries outside the United States for the 1996 and 1997 calendar years.

Major Matters – In November 1997 the Cardiff Crown Court imposed a fine of £10,000 (approximately $16,000) on Ford of Britain as a result of a discharge into the River Ewenny by the Bridgend plant in September 1995. Ford Britain also was required to pay the United Kingdom’s environmental agency’s costs of £11,000 (approximately $17,600) and to pay for the restocking of fish in the river.

Reportable Oil Spills/Chemical Releases - As can be seen from Table 3, the company did not have any reportable oil spills or chemical releases in 1997.
Environmental Releases

Ford Manufacturing Plant Emissions

Although there are environmental releases that are a normal part of the motor vehicle production process, Ford strives to minimize or eliminate these releases. Most of the releases are subject to regulatory permits that assure protection of public health and the environment. Additionally, public reporting of these releases is required in some countries, as indicated by the data below.

United States

In 1986, the United States enacted legislation requiring certain manufacturing facilities to report the quantity of designated substances released, treated, recycled, and used for energy recovery. This requirement is known as Toxic Release Inventory (TRI) reporting. All Ford manufacturing plants in the United States must file these reports. The first reporting year for TRI was 1987. Since then, many changes have been made in both the content and format of TRI reporting, including addition and deletion of chemicals from the list and the addition of information regarding pollution prevention activity.

The following chart below shows that almost two-thirds of the Company’s 1997 TRI reportable materials were recycled, treated, or used for energy recovery, while only about one-third actually was “released” to the environment.

TRI releases as reported in the charts and tables here, include the following:

- fugitive air emissions (i.e., releases from maintenance processes, etc.)
- air emissions from stacks
- discharges to bodies of water
- discharge of metals and metal compounds to Publicly Owned Treatment Works (POTW), typically municipal sewer systems
- land disposal, both on-site and off-site
- underground injections, both on-site and off-site

From 1988 to 1997, Ford reduced its total TRI releases by 47 percent. On a per vehicle basis, TRI releases decreased by 46 percent.
Canada
In Canada, 1993 marked the first year of reporting for the National Pollutant Release Inventory (NPRI). Manufacturing facilities are required to report environmental releases of certain listed substances.

NPRI releases, as reported in the charts and tables here, include the following:
- Fugitive air emissions (i.e., releases from maintenance processes, etc.).
- Air emissions from stacks.
- Air emissions from storage and handling of chemicals.
- Discharges to bodies of water.
- Land disposal, both on-site and off-site.
- Underground injections, both on-site and off-site.

From 1993 to 1997, Ford reduced its total NPRI releases by 52 percent.

Voluntary Initiatives

WasteWise
Ford is a partner in the United States Environmental Protection Agency’s WasteWise program. This voluntary program targets the reduction of municipal solid waste. WasteWise program partners commit to reducing waste and establish waste reduction goals. Partners are required to report their progress to the U.S. EPA annually.

U.S. Auto Project
Ford participates in the United States Automotive Pollution Prevention Project (U.S. Auto Project), a voluntary pollution prevention and resource conservation partnership between Ford Motor Company, Chrysler Corporation and General Motors Corporation. The project began in 1991 with an agreement among Ford, Chrysler, General Motors, the American Automobile Manufacturers Association (AAMA) and the Michigan Department of Environmental Quality (MDEQ) on a voluntary pollution prevention action plan to reduce the use, generation and release of persistent toxic substances that adversely affect water quality in the Great Lakes. These substances are known as Great Lakes Persistent Toxic Substances. A similar program exists in Canada.

In 1995, the project expanded from a regional Great Lakes focus to a national focus and was renamed the U.S. Auto Project. The scope was widened to include other substances in addition to the Great Lakes Persistent Toxic Substances. An Advisory Group representing diverse stakeholder interests (including regulatory agencies, environmental interest groups, universities, etc.) was established in 1994 to provide advice and support to the U.S. Auto Project.

The U.S. Auto Project is focused primarily on reducing the release of specific persistent substances and for working with suppliers and providing information and technology transfer on environmental improvement techniques. Based on the number of vehicles produced, Ford’s reportable releases of these persistent substances have been reduced by 42 percent in the U.S. since 1991.
New manufacturing processes that use water-based cleaning to replace chlorinated solvent cleaning have been major factors in reducing the release of these substances. These voluntary programs have been expanded to include all Ford locations throughout the United States and Canada.

**Elimination and Reduction of Hazardous Materials**

**Company Policy on Restricted Substances**

Ford has a global “Substance Use Restrictions” standard, which is reviewed quarterly by Company experts and revised and re-issued annually. This standard informs Ford personnel and suppliers of certain substances which must be restricted in or excluded from products supplied to Ford or used in Ford facilities. The following are a few examples of Ford’s proactive approach to reducing or eliminating hazardous materials from its products and facilities.

**Elimination of Chromium in Pre-Paint Coating**

Chromium compounds were used, in conjunction with the phosphate coating, to chemically coat the metal surface of vehicle bodies prior to the painting process. By the end of 1997, most Ford facilities globally had converted to a chromium-free pre-paint coating process.

**Elimination of Mercury Switches**

Mercury-containing switches are being eliminated from Ford vehicles, as part of a voluntary commitment to the Michigan Mercury Pollution Prevention Task Force.

**Reduction of Lubricating Oil Use Through the Introduction of “Dry” Machining**

Several Ford component-manufacturing facilities have installed machining equipment that does not require lubricating oil. Use of these “dry” machines eliminates emissions, odors, and disposal of the waste oil.

**Elimination of PCB Transformers**

Ford is voluntarily removing PCB transformers from its facilities and offices, with the goal of eliminating all PCB transformers by year-end 2010.
<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Total Air Release</th>
<th>Total Water Release</th>
<th>Total Landfill Disposal</th>
<th>Total Other</th>
<th>Total Public Discharge (POTW)</th>
<th>On-Site Energy Recovery</th>
<th>On-Site Land Disposal</th>
<th>Off-Site Recycling</th>
<th>Off-Site Treatment</th>
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<tr>
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<tr>
<td>6. Copper (and its compounds)</td>
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<td>7</td>
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<tr>
<td>7. Di-(2-ethylhexyl) phthalate</td>
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<td>9. Ethylene glycol</td>
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<td>10. Naphthalene</td>
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<td>14. Trichloroethylene</td>
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**TOTALS:** 19,876 0 0 2,136 22,084 1,529 112 1,439 236 20,082 8,591 2,924

---

* Rounded to nearest thousand
* POTW Publicly Owned Treatment Works (Note that discharge of metals and metal compounds to POTW is included in the "Total Releases" figure.)
* Discharge to POTW is included in these numbers.
* Great Lakes Persistent Toxic Substances.
1997 United States Toxic Release Inventory Data

**CHEMICAL NAME**

**Total Releas**

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Total Releas in Thousands</th>
<th>Water Releas</th>
<th>Landfill Disposal</th>
<th>Total Releas</th>
<th>Discharge to POTW</th>
<th>On-Site Energy Recovery</th>
<th>Off-Site Recycling</th>
<th>Off-Site Treatment</th>
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<tbody>
<tr>
<td>1-Butyl-1,2,4-trichlorobutane</td>
<td>19,848</td>
<td>2,386</td>
<td>11,548</td>
<td>3,914</td>
<td>23,816</td>
<td>2,183</td>
<td>1,762</td>
<td>182</td>
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</table>

**TOTALS:** 17,946 2,386 15,564 3,914 23,816 2,183 1,762 182

**Notes:**
- **POTW:** Publicly Owned Treatment Works (Note that discharge of metals and metal compounds to POTW is included in the "Total Releases" figure).
- **On-Site Treatment:** Discharge to POTW is included in these numbers.
- **Great Lakes Persistent Toxic Substances.**
### 1996 Canada National Pollutant Release Inventory Data

**IN METRIC TONNES**

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<thead>
<tr>
<th>Chemical Name</th>
<th>Air Releases</th>
<th>Water Releases</th>
<th>Landfill Disposal</th>
<th>Total Releases</th>
<th>Discharge to WRP</th>
<th>Recycle/ Recovery</th>
<th>Energy Recovery</th>
<th>Intermittent Thermal</th>
<th>Off Site Injection</th>
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<td>1,2,4-Trimethylbenzene</td>
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**TOTALS**

1,314  57  485  1,857  16  0  0  50  0  0

**Rounded to nearest tonne**

**MSTP Municipal Sewage Treatment Plant**
## Chemical Name

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Air Releases</th>
<th>Water Releases</th>
<th>Landfill Disposal</th>
<th>Total Releases</th>
<th>Discharge to Air</th>
<th>Discharge to Water</th>
<th>Roche Recovery / Reuse</th>
<th>Energy Recovery</th>
<th>Incineration / Thermal</th>
<th>Other</th>
<th>Totals</th>
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<tbody>
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<td>1,2,4-Trimethylbenzene</td>
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<td>111</td>
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<td>Cadmium (and its compounds)</td>
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**Rounded to nearest tonne**

**MSTP Municipal Sewage Treatment Plant**