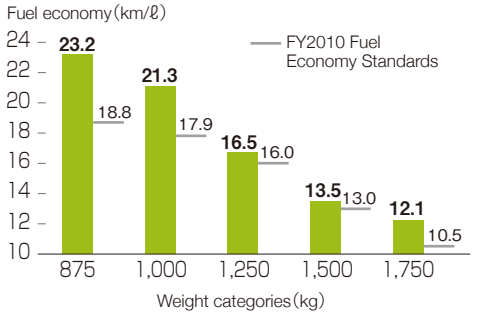
Development of Environment-friendly Vehicles

Basic Concept

SUBARU is engaged in environment-friendly technological development in various fields to achieve the proposition of the medium-term management plan: “integration of running performance and global environment”.

◆Status of SUBARU’s Compliance with the FY2010 Fuel Economy Standards for Gasoline-powered Passenger Cars



Improving Fuel Economy

Thought toward Improving Fuel Economy

Automobiles emit carbon dioxide (CO_2) proportional to the amount of fuel consumed. By improving fuel economy, CO_2 will be reduced resulting in the better conservation of limited energy resources and the prevention of global warming. SUBARU, while utilizing the advantages of AWD and high power engines, has been working to improve fuel economy by developing technologies that make engines more fuel efficient, reduce transfer loss in the drivetrain and reduce vehicle weight and running resistance, and we are in the process of introducing vehicles which meet the Japanese FY2010 Fuel Economy Standards, the target for gasoline vehicles.

Objective of Improving Fuel Economy

Expand the scope of vehicles which meet the FY2010 Fuel Economy Standards

Current Status in Meeting FY2010 Fuel Economy Standards

Gasoline-powered passenger cars meeting the FY2010 Fuel Economy Standards accounted for 92% of the total production, clearing the FY2010 Fuel Economy Standards in all the weight categories.

Gasoline-powered mini trucks met the Standards in all weight categories in FY2001, and then all models met the Standards in FY2002 and thereafter.

SUBARU will expand the scope of vehicles which meet the FY2010 Fuel Economy Standards upper 15%.

Approaches for Improving Fuel Economy of EXIGA

Improving the Engines

The EXIGA is equipped with the 2.0-liter DOHC engine employed on the new FORESTER and has the cooling water temperature setting modified to keep the oil temperature which changes with water temperature higher. The resulting reduction in friction of the sliding pitons has led to the top-class gas mileage satisfactory to economy-sensitive families who are our targeted customers. With this good fuel economy, the running and environmental performances are balanced at a higher level.

Improving the Draivetrain

On the 2-liter NA engine model was employed a light and compact direct-control 4AT with sport shift. The optimally set gear ratios for both fuel economy and drivability in combination with the refined line-pressure control reduced fuel consumption.

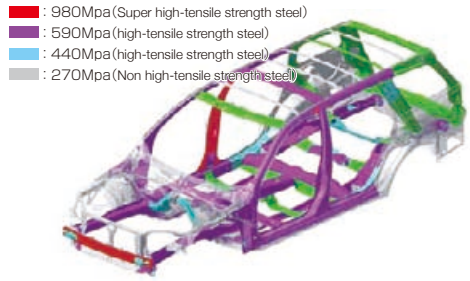
In addition of the 4AT for AWD models, a new 4AT exclusively for FWD models was developed for higher fuel economy.

For the 2-liter turbo engine models, like the LEGACY, the dynamic 5AT was mounted for better fuel economy, speed-shift quality and drivability, which come from the reduced internal friction due to optimum oil pressure and the expanded slip-lockup zone. Together with the improvement in performance focused on low speeds on the turbo engine, an optimal final gear ratio was set higher than

that on the LEGACY, which made it possible to enhance the fuel economy and quietness at high-speed cruising.

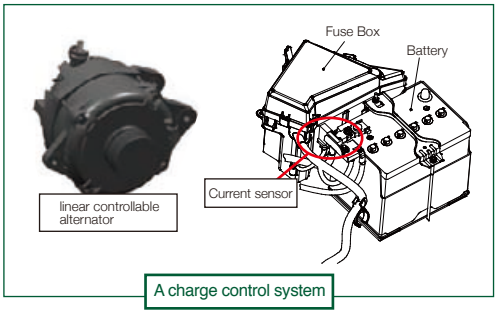
Lightweight body

The body framework is basically carried over from the base structure nurtured with the current LEGACY, IMPREZA and FORESTER. Not only pursuing the absolute body rigidity which has been the conventional performance index, we also focused on optimizing the rigidity balance (body framework mode). Furthermore, the review of joint structures, effective partial reinforcements and application of high-tensile sheet metals (the first case of 980 MPa-class steel used for body framework) led to curbing weight increase without sacrificing the necessary strength. Also, the use of CAE *1 analyses helped to give the vehicle enough rigidity and crash performance, while keeping a good balance between the vehicle performance including durability, strength, driving stability, noise and vibration, and lightweight body. With all these combined, the model exhibits agility and better fuel economy for its high performance.



Approaches to Enhancement of Practical Fuel Economy

We are also working hard to improve the fuel economy under practical use by customers. For instance, in order to have both pleasant drive and interior environment, the characteristics of the engine and transmission were improved and the engine load was lessened through optimal control of the air conditioner for fuel saving. A charge control system was newly employed on the EXIGA. The battery condition is monitored on a real-time basis by a current sensor to control the amount of generation most suitably under given driving conditions by a linear controllable alternator for better fuel economy. Such efforts will be carried on to use practically less fuel for the sake of the environment.



Approaches to Assisting Eco-drive

Communication among Driver, Car and Environment

SUBARU is also positively engaged in developing eco-drive assist devices as an interface to promote communication between a driver and his or her car. We are spreading the ECO driving assist equipments, the Eco Gauge and Shift-up Indicator (for MT-equipped vehicles) as same as them added on the Legacy marketed in 2006. The new released car in 2008, EXIGA also has the ECO gauge.

The further improvement will be continued for Eco driving assist equipments.

*1 CAE
Computer-aided engineering

■ Eco Gauge

The needle of the Eco Gauge swaying to the "+" direction indicates an economic driving condition to the driver. About 5% saving in fuel economy (in-house testing) can be expected by consciously controlling the accelerator to keep that condition.


Eco Gauge for EXIGA

■ Shift-up Indicator

When an economic engine rpm is reached, the indicator starts blinking, prompting the driver to shift up.

Shift-up Indicator

Improved Fuel Economy

■ Mini- Class Vehicles

SUBARU were presented with the “e-nenpi (Good Fuel Economy) Award 2008-2009” in honor of the fact that they were ranked first in the new vehicle category for average fuel economy ranking for the year (Jan. thru Dec. 2008) by IRI Commerce and Technology, Inc. which provides the “e-nenpi*2 (Good fuel economy)” service for managing information on personal vehicles via cellular phones. R2 has received the top Award for 3rd times and R1 & STELLA also were presented as the top 5 vehicles in this time.

SUBARU’s vehicles, such as the R1, the R2 and the STELLA, have been topping the list of the “Top 10 Fuel Economy Gasoline Powered Mini Cars” for 3-years since 2006,(announced by the Ministry of Land, Infrastructure, Transport and Tourism) .

■ Small Class Vehicles

The FWD 4AT model (weighing 1,520 kg or over) of the new EXIGA with a 2-liter DOHC engine performed 25 percent better than the 2010 target fuel economy standards and ranked in the top three of “the best 10 of fuel efficient cars in 2008” in the 1,516-1,765 kg weight category (excluding manual transmission models), which was announced by the Ministry of Land, Infrastructure, Transport and Tourism.

Furthermore, all models of the new released 2.0-liter DOHC Vehicle, EXIGA passed the +20% Standard of FY2010.

Cleaning Exhaust Gas

Basic Concept of Cleaning Exhaust Gas

Substances such as carbon monoxide (CO), hydrocarbons (HC), and nitrogen oxides (NOx), which are emitted from automobiles, are one of the causes of air pollution in metropolitan areas where there is intensive motor traffic. In order to improve the state of the air, SUBARU is gradually launching low emission vehicles (certified by the Ministry of Land, Infrastructure,Transport and Tourism) that meet standards stricter than the regulations.

Goal of Cleaning Exhaust Gas

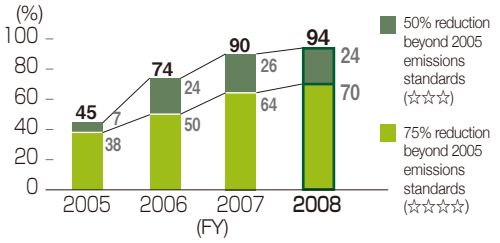
Low Emission Models Which Outperforms the FY2005 Emission Standards by 75% Reduction to Be Expanded with further technical developments.

Status of Achieving Low Emissions

The fully remodeled New EXIGA series is all certified as low-emission vehicles which meet the 2005 Standards by the Ministry of Land, Infrastructure, Transport and Tourism with at least 50% below the Standards (☆☆☆), while 70% of these production models achieved the Standards with at least 75% reduction (☆☆☆☆). Thus, the vehicles certified as low emitting totaled 94% of the whole non-mini production.

SUBARU will keep going forward for the dissemination of low emission vehicles.

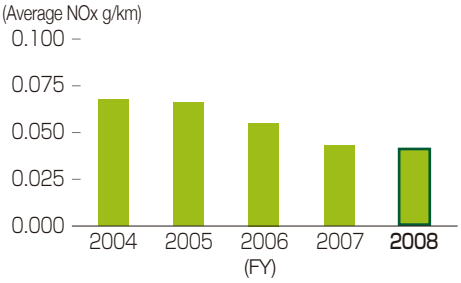
◆Trends in Percentages of Low Emission Gasoline-powered Passenger Cars



Trends in NOx Averages

By launching low emission vehicles which meet the standards represented by the low emission vehicle certification standard into the market, SUBARU has been able to reduce the average amount of NOx emitted by SUBARU vehicles every year as shown in the chart below.

◆Trends in NOx Averages of SUBARU Vehicles



* ·The figures calculated from the regulation values (10/15mode and 11 mode) at the time of shipment.
·About vehicles which are not for the current test mode, calculations were made with regulation or conversion values for the current mode.
·The current test mode is a combined mode of the 10/15 mode and 11 mode.

Clean Energy Vehicles

Basic Thought for Development of Clean Energy Vehicles

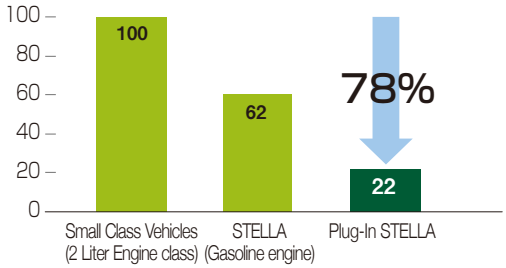
Clean energy vehicles have such features as emitting fewer Green House Gas (carbon dioxide) and air pollutants (carbon monoxides, hydrocarbons, nitrogen oxides, etc.) and have less environmental impact than gasoline engine vehicles. However, there are technical problems related to cost and drivingrange. SUBARU has been developing clean energy vehicles such as electric vehicles that have the performance and utility close to gasoline engine vehicle. Also, we are positively working on developing next generation batteries.

SUBARU is involved in the R&D of for future practical use to electric vehicles for hybrid vehicles and fuel cell electric vehicles.

We will pursue relentlessly to further raise the energy density for electric vehicles which can run at least range of 200km, through making the next-generation battery “nano V Battery” (TM registration pending for approval) practicable from now on.

Electric vehicle
Plug-in STELLA

◆The CO_2 emission per 1Km run of Plug-In STELLA is compared to other type of vehicles supposing Small Class Vehicles' =100

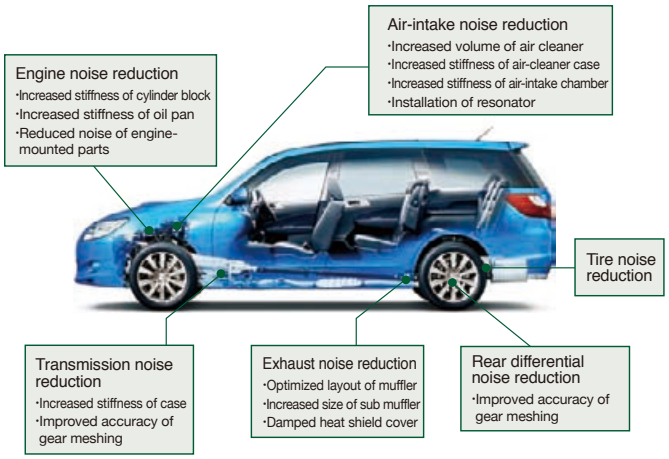


Noise Reduction

Development of Technology to Reduce Traffic Noises

Another area SUBARU is actively involved is the development to effectively reduce vehicle noises from such prime sources as tires, engine and intake and exhaust systems. The NEW EXIGA launched in June, 2008 has such technologies applied to meet the acceleration noise level set in the Safety Standards with good margin.

◆The Main Countermeasures Employed to Reduce the Noise the NEW EXIGA Generates



◆Trends in Sales Numbers of Vehicles certfied as Good Fuel Economy and Low Emission *1

The Sales numbers in FY2008

		Passenger vehicle		Truck		total of vehicle (rate)
		Standard-sized car Small-sized car	mini car	Standard-sized car Small-sized car	mini car	
Vehicles certfied as Good Fuel Economy and Low Emission	75% reduction beyond 2005 emissions standards☆☆☆☆	45,931	42,964	0	0	88,895 (48.0%)
	50% reduction beyond 2005 emissions standards☆☆☆	30,899	0	0	488	31,387 (16.9%)
total		76,830	42,964	0	488	120,282 (64.9%)
					total of Sales	185,321 (100%)

For more detail about our approaches toward the Car tax system for Environment-friendly cars in SUBARU,please see our website.
http://www.SUBARU.jp/information/topics/2009/tax/〔Japanese Only〕

*1
Vehicles which achieved in advance the 2010 fuel economy standard based on the Energy Saving Act and were certified as low emission vehicles according to the low-emission vehicle certification procedure.

How to Make Effective Use of Limited Resources

Basic Concept

SUBARU has established the Automotive Recycle System of SUBARU (ARSS*1) as part of active efforts to recycle and properly dispose of end-of-life vehicles (ELVs*2), according to the Japanese End-of-Life Vehicles Recycling Law (hereinafter referred to as the ELVs Recycling Law*3) . The recycling ratio of ASR in FY2008 was 77.7%, satisfying the Japanese legal standard required for FY2015 (The recycling ratio of ASR: 70% or higher).

Efforts in the Design Stage

Emphasis on Design Allowing Easy Recycling

We will keep on producing Cars considering Recycling, in order to make good use of limited resources.

■Recycling Market Research

The Recycling Design Project Team members continuously visit dismantlers, shredding companies, and waste disposers in various parts of Japan to exchange views on the current and future market trends for actual ELV treatment. The results are used to determine the principles for designing automobiles with due consideration for recycling and extract specific subjects for future research.

■Efforts to Improve Recyclability

<Advances in Wire Harness Dismantling>

Because a large amount of copper is used in a wire harness, if the wire harnesses can be removed before the ELVs are shredded, the collection and separation of iron and copper will be enhanced and their value in terms of resource recycling will increase. SUBARU is conducting studies for a harness layout and automobile structure that make it possible to effectively collect more copper and in a shorter time. We worked on the establishment of harness design guidelines with ART*4 in FY2008.

Advances in wire harness dismantling

<Easier Material Identification>

It is most important that the material of each part can be recognized easily when we recycle. SUBARU started to identify the type of material on plastic parts in 1973 even before guidelines for the industry were established. Material identifications had been attached on the rear side of each part before. However, the position was changed, as we believed we could avoid such wasteful actions as dismantling a part to confirm the material type. SUBARU has changed the identification positions on all car models, including the LEGACY, the IMPREZA, the STELLA and the EXIGA since 2001.

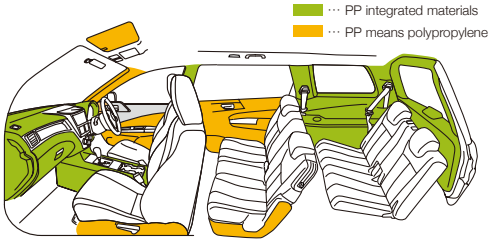
An example of the material indication: "PP" means polypropylene

Now the material type can be seen without dismantling the bumpers.

<Using Materials that are Easy to Recycle>

We are using olefin resin*5, which is extremely easy to recycle, as the resin material for the interiors and exteriors of most new and remodeled vehicles. In particular, we are using integrated materials dedicated for use with bumpers for bumpers and integrated materials dedicated for use with interiors for interior parts.

◆Using Integrated Materials for Interior Parts: Olefin Resin in the NEW EXIGA



*1 ARSS: Automotive Recycle System of SUBARU

*2 ELV: End of Life Vehicles

*3 The Japanese End-of-Life Vehicles Recycling Law to recycle and properly dispose of end-of-life vehicles (enforced in Jan 1st, ,2005)

*4 ART: Automobile shredder residue Recycling promotion Team
Automobile Shredder residue Recycling promotion Team is separated 2 team; one is ART team operated by Nissan, Matsuda, Mitsubishi, Fuji Heavy Industries, and other 12 companies. Another is TH team operated by Toyota, Honda, Daihatsu and others.

*5 Olefin resin means the general term of PP (polypropylene) and PE.(polyethylene)

■Efforts to Improve Proper Disposal

ELVs Recycling Law also regulates the proper disposal of substances with environmental impact, particularly fluorocarbons (refrigerants for air conditioners) and airbags. Concerning future vehicle development, SUBARU recognizes the essential need to produce vehicles that can be disposed of more easily.

<Reduction of Fluorocarbons Used in Air Conditioners>

SUBARU uses a substitute fluorocarbon, HFC134a, for refrigerants in air conditioners, which does no harm to the ozone layer, but which is still believed to accelerate global warming. We are conducting active countermeasures to reduce the amount of HFC134a and the leakage while using air conditioners and also research into substitute refrigerants other than fluorocarbons.

<Advances in Airbag Disposal>

Airbags and pretensioner seatbelts contribute significantly to reducing the shock to drivers and passengers in automobile accidents. On the other hand, the vast majority of automobiles are put out of service with unused airbags. Because automobile manufacturers are asked to dispose of airbags and similar products under the ELVs Recycling Law, we are conducting research into the optimal structure for airbags, including related components, that will make it safer and easier to activate them in automobiles and subsequently dispose of them.

Reduction of Substances of Environmental Concern

Based on the Japan Automobile Manufacturers Association's voluntary action programs, we have been working to reduce the four substances of environmental concern (lead, mercury, cadmium and hexavalent chromium) and are partially moving ahead of schedule. In FY2008, elastomer glue for Power train was changed lead-free, while applying lead-free soldering afresh to part of car navigation system for rear seats and its remote control in addition to the airbag sensors, antenna, speakers, seat belts and door mirrors of which soldering were already switched lead-free, thus gradually widening the use of non-lead solder.

With regard to mercury, in addition to the combination panels not included in the action plan, the liquid crystal panels of navigation units for front seat passengers were made mercury-free.

◆Reduction Targets and JAMA's Voluntary Action Program for New Models

Substance	Target (period achieved)	Details of Reduction Efforts:
Lead	Since Jan. of 2006	Reduce the amount per vehicle produced to less than 1/10 the 1996 levels
Mercury	Since Jan. of 2005	Use prohibited except in a few applications (e.g., minute amounts in combination panels, discharge headlights and in the liquid crystal panels of GPS systems)
Hexavalent chromium	Starting in Jan. of 2008	Use prohibited
Cadmium	Since Jan. of 2007	Use prohibited

Reducing VOCs*1 in Vehicle Interiors Make the Environment in Vehicle Interiors More Comfortable

In order to reduce the use of VOCs such as formaldehyde and toluene, which can cause nose and throat irritation, we are revising whether to make changes to the components and adhesive agents used in vehicle interiors. In the NEW EXIGA of FY2008, we achieved the goals set by JAMA*2 by reducing the concentration of the 13 substances defined by the Ministry of Health, Labor and Welfare in Japan to levels below the figures set in the guidelines for interior concentration. We have achieved the goals ahead of schedule in the NEW IMPREZA and the NEW FORESTER of FY2007 as well, and in the future, we will continue our efforts to reduce the levels of such substances to below the figures set in the guidelines to make the environment in vehicle interiors more comfortable.

*1 VOC
Volatile Organic Compounds:
Volatile Organic Compounds means the Organic Compounds easy to volatilize in natural temperature, like formaldehyde and toluene. They are recently supposed to be one of primary factors of the Sick house syndrome which causes the stimulation on eyes ,noses, throats when enter new houses or buildings.

*2 Voluntary target:
to reduce interior concentration of the 13 substances identified by the Ministry of Health, Labor and Welfare to levels equivalent to or lower than the figures stipulated in the guidelines for new vehicle models (produced and sold in Japan in 2007 and afterward) under the Voluntary Approach in Reducing Cabin VOC Concentration Levels initiated by JAMA.

Processing of End of Life Vehicles (ELV)

Approaches to "Total Recycling of Resources"

– Information Disclosure on Removal of Copper Containing Automotive Parts in End of Life Vehicles–

SUBARU has formulated the "Information on Removal of Copper Containing Parts in End of Life Vehicles" to further bolster the recycling rate of ELV, which is open to the public in the website of ART. (Japanese only)

Currently, a method called "Total Recycling of Resources" is employed as a means to improve the recycle rate without generating ASR in recycling cars.

This involves throwing stripped end of life vehicles into an electric furnaces or the like to melt its iron contents for re-commercialization as construction materials and others. Parts, the source of ASR, are burned in the furnace to be used as heat source (thermal recycle), eliminating the landfill process.

Before implementing this "Total Recycling of Resources", minimizing the copper content in the stripped vehicle scraps is required to keep quality in the resulting steel products. For this minimization, how to remove copper containing parts efficiently and thoroughly becomes the vital issue.

The focus of the "Information on Removal of Copper Containing Parts in End of Life Vehicles" is on the disclosure of information, where "the wiring harness" occupying major parts of copper is laid out on, on past production vehicles which currently constitute the most part of ELV population.

Formulating the information on the LEGACY domestically sold in 1994 and the VIVIO domestically sold in 1993 was released for public review in May, 2008.

In December, 2008, the information related to the FORESER (launched in Japan in 1997) and the IMPREZA (launched in Japan in 1992) was disclosed, to the public, thus covering many of SUBARU vehicles to be scrapped as ELV.

◆Front Wiring Harness