

2009 Grand Prize of Minister of Economy, Trade and Industry

**Realized 50% Reduction in Energy by [Own Development of Manufacturing Technology] and [Entire Company/Exhaustive Activity]**


Denso Corporation  
Executive Director, Sojiro Tsuchiya

1. Company outline



**Founded:** December 16, 1949  
**Capital:** 187.4 billion yen  
**Revenue:** Group 3142.7 billion yen  
 Single 1939.8 billion yen  
**Current profit:**  
 Group 35.3 billion yen  
 Single 65.1 billion yen  
**Number of employees:**  
 Group 119,919  
 (Working personnel base) Single 36,768  
**Number of subsidiaries:** 187  
 (Japan: 68, North/central/south America: 38,  
 Europe: 33, Australia/Asia: 48)  
**Number of equity method subsidiaries:** 32  
 (Japan: 13, North/Central/South America: 5,  
 Europe: 3, Australia/Asia: 9, Other: 2)  
 As of March 31, 2009

**Major products: Car parts**



- Air-conditioning-related products**  
Car cooler, car heater, car air-con, compressor, sensors for air-con, etc.
- Car body-related products**  
Combination meter, wiper motor, wireless door lock, IC flasher, horn, etc.
- Power train-related products**  
Engine management system (EMS), electronic control diesel system, starter, alternator, radiator, etc.
- Drive/safety-related products**  
Anti-lock brake system (ABS), traction control system, cruise control system, airbag sensing system, etc.

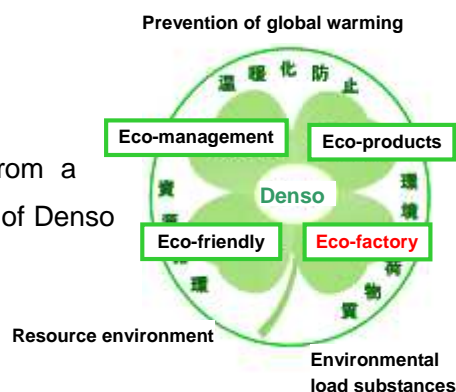
2. How to deal with environmental protection and characteristics/contents of energy-saving activities

[How to deal with environmental protection]

Denso positions a motto [Care for nature and co-exist with society] as the corporate philosophy, promotes energy saving, and engages in activities placing a premium on the environment. In 2005, the company crafted and disclosed [Denso Eco-vision 2015] as a road map toward realization of a [sustainable car society].

<Environmental policy of Denso Eco-vision 2015>

1. Eco-management: Enhance environmental business from a global viewpoint by consolidating all wisdom and power of Denso group.



2. **Eco-factory**: Reduce global environmental burden (**Prevention of global warming, effective use of resources**)
3. **Eco-products**: Develop new technologies and products in consideration of environment (like eco-cute).
4. **Eco-friendly**: External association/communication and enhancement of information transmission

#### **<How to deal with energy saving in factory/office>**

Since the reduction in CO<sub>2</sub> is critical to the prevention of global warming, the company sets the CO<sub>2</sub> reduction target until 2010 and is engaged in energy-saving activities. In order to achieve the target, the company sets [**Development of energy-saving technologies, exhaustive improvements, introduction of highly efficient facilities, utilizing natural energies**] as the items that should be importantly addressed. Each department draws up energy-saving plans and executes them.

#### **Target of Eco-vision (CO<sub>2</sub> for 2010)**

- 10% reduction in CO<sub>2</sub> emissions compared with 1990 (Denso)
- 40% reduction in CO<sub>2</sub> intensity compared with 1990 (Denso)
- 20% reduction in CO<sub>2</sub> intensity compared with 2000 (Denso group consolidated)

#### **[Characteristics of energy-saving activities]**

- Denso develops, designs, and produces manufacturing facilities on its own and promotes energy-saving technologies of manufacturing facilities in conjunction with product development.
- Denso develops [Entire company/Exhaustive activities] for energy-saving development, improvement and management.

**[Contents of energy-saving activities]**

	Contents of activities	Advancement Creativity	Versatility Prevalence	Continuity Sustainability	Outline of activities
<b>Development</b>	a. development of energy-saving technology	○			In a bid to greatly reduce CO <sub>2</sub> , we set a long-term development theme and promote it.
	b. CS3 (Compact, Slim, Simple, Speed)	○			Develop manufacturing technology to completely eliminate every waste in manufacturing facilities.
	c. Energy JIT (Just in Time)	○			Activity to decrease inactive losses like standby energy
<b>Mechanism of improvement</b>	d. PEF activity (Perfect Energy Factory)		○		[Exhaustive] activity by setting improvement common items and using total inspection list
	e. Exhaustive co-generation		○		Self power generation improvement (37%) by CO <sub>2</sub> -friendly gas co-generation, 13 units for whole company
	f. Natural energy development utilizing own technology	○			Micro water/wind power generation (8 units) utilizing own product (alternator)
	g. Winter physical training activity for energy-saving		○		Take big reduction in manufacturing as a chance and pinpoint the activity to reduce fixed energy.
	h. Program CDM (Gained CO <sub>2</sub> emissions right by own technology)	○			Promote abroad the air energy-saving technology developed by us, gained UN approval.
	i. Energy-saving support activity for domestic/abroad subsidiaries		○		Extracted CO <sub>2</sub> 10% reduction plan by PEF audit (115 items) on domestic/abroad group subsidiaries
	j. DECOpon (Denso eco point system)			○	Enlightenment by eco point system in which employees can participate
<b>Management</b>	k. Bearing energy cost (Beneficiaries bear energy costs.)			○	Raise awareness of energy-saving by getting energy users to pay for it.
	l. Evaluation and visualization of energy-saving performance and enthusiasm			○	Activate each department's energy-saving activity by internal energy-saving assessment system.
	m. Management indexing CO <sub>2</sub>			○	Put CO <sub>2</sub> target achievement status in major indexes of company administration for evaluation.

**3. Energy-saving management system**

In December 1992, Denso established [Environment Committee] as a supreme decision-making organization for the environment business. Business leaders, overseas regional managers, and environment business managers of group subsidiaries attend it twice a year to create policies, assess progress status of activities, and discuss issues and solutions. In 2008, positioning the global warming measures as the company's priority issue,

the executive director of CGO [Manufacturing Environment Load Reduction (energy-saving, resource-saving, factory environment, logistics)] established **[CO<sub>2</sub> Special Project Room]** as his own-controlled organization. As the comprehensive manager, the executive director is in charge of internal and group's CO<sub>2</sub> management, whole company comprehensive management of energy-saving budget, decision of investment cases, and development of energy-saving technology for manufacturing processes and facilities. In order to promote the activity, the CO<sub>2</sub> Special Project consists of three working groups from the viewpoint of strengthening and enhancing the company's energy-saving characteristics.

- a. Energy working group (continued): Develops exhaustive improvements in manufacturing activities that most consume energy.
- b. Energy Technology Working group (strengthened): Mainly Manufacturing Engineering Department designs and develops energy-saving manufacturing facilities on its own.
- c. Negotiating Working group (new): Spreads and promotes internally and externally our company's energy-saving technology and mechanism and energy-saving property of co-generation.

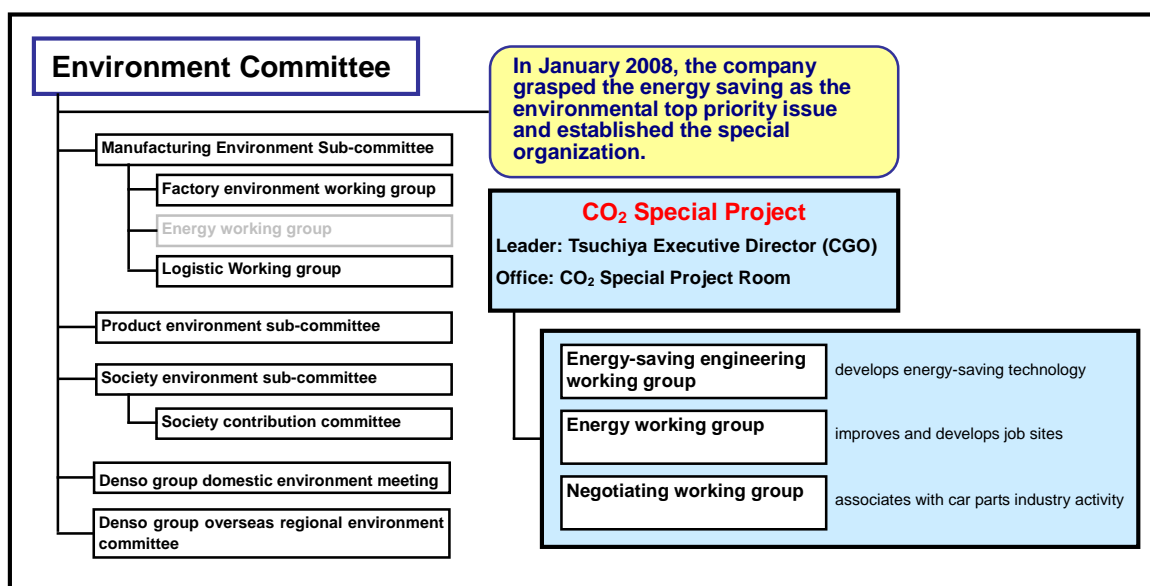


Fig. 1 [Environment Committee and CO<sub>2</sub> Special Project Room]

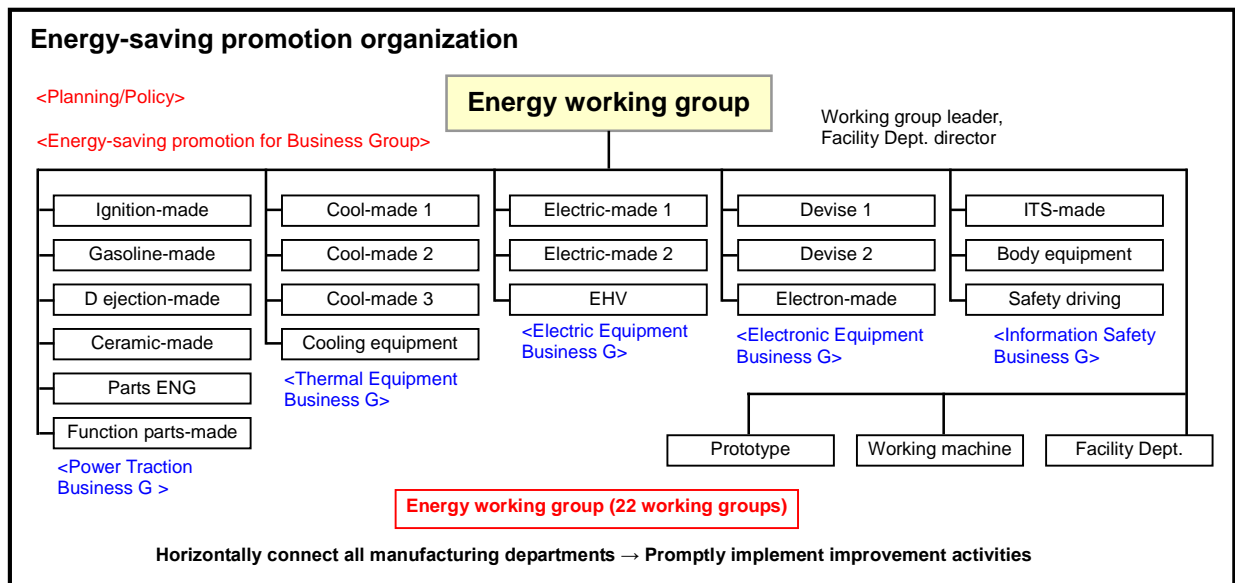
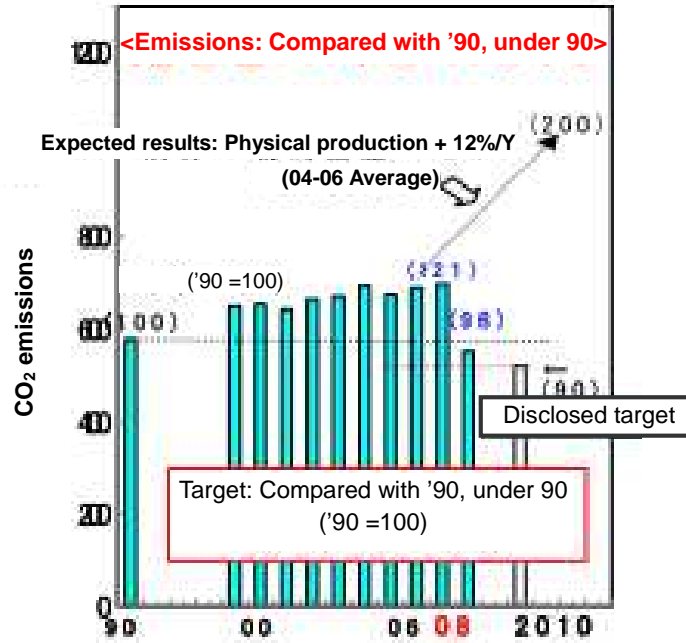


Fig. 2 Energy working group

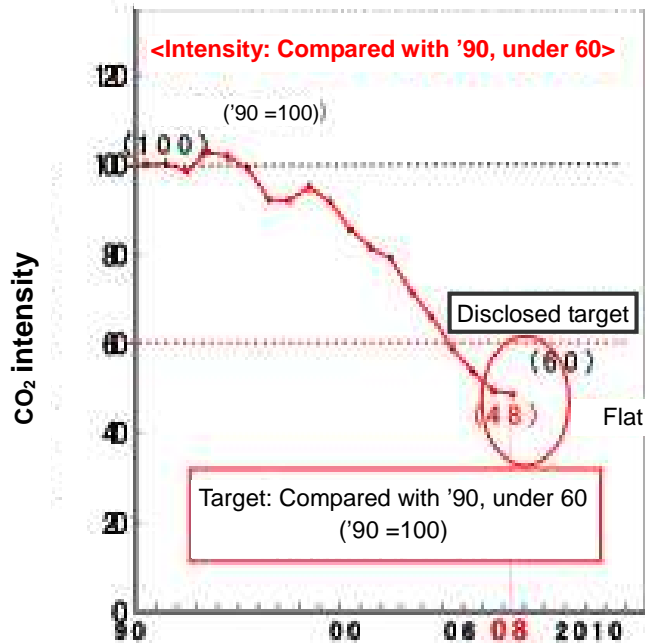
#### 4. Background and needs of energy-saving activity

In response to the growing global warming since the Kyoto Protocol was ratified in 1997, Denso set in 2000 the CO<sub>2</sub> reduction target for 2010 in [Denso Eco-vision 2005] and has been actively engaged in energy saving. Furthermore, in 2005 Denso crafted [Denso Eco-vision 2015] and added the intensity target to visualize the results of energy-saving activities. Also, the company added and set the consolidated CO<sub>2</sub> intensity target to promote the whole Denso group's activities and expanded the activities. In 2007, the company launched [CO<sub>2</sub> Special Project] to further strengthen energy-saving activities toward achieving the target in consideration of The Kyoto Protocol binding period (2008-2012) and focused on R&D of energy-saving technologies and enhanced associations with both internal and external organizations.

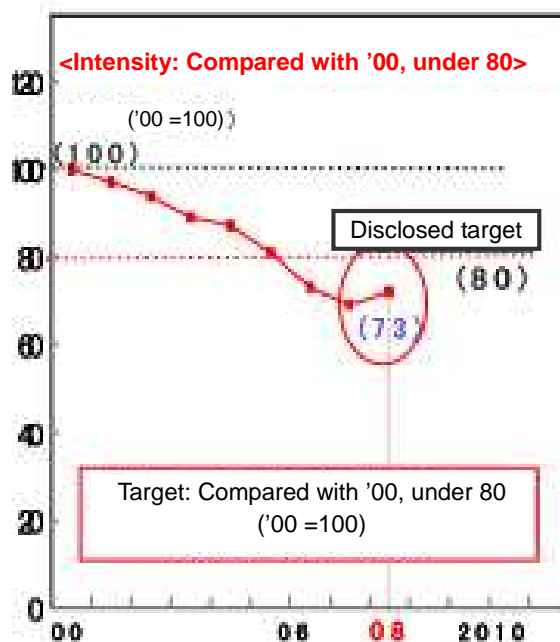
[Independent Target]



CO<sub>2</sub> intensity = CO<sub>2</sub> emissions/production sum  
 (physical)



**[Consolidated Target]**



In 2008, the car industry was forced to drastically cut production due to the economic turmoil, and subsequently, the CO<sub>2</sub> emissions sharply decreased. However, the reduction by intensity remained flat, threatening the target achievement. Therefore, we had to strengthen energy saving.

To become more flexible in adapting to changes, we have crafted [Environment 3-year Policy] toward keeping [environment behavior] and future growth. We are also aiming at the full pursuit of environment efficiency. Thus, we set the target of further improving the CO<sub>2</sub> intensity and are in the middle of executing short and long term measures in addition to the previous activities.

<Short term> Winter physical training for energy saving

<Long term> Energy JIT activity

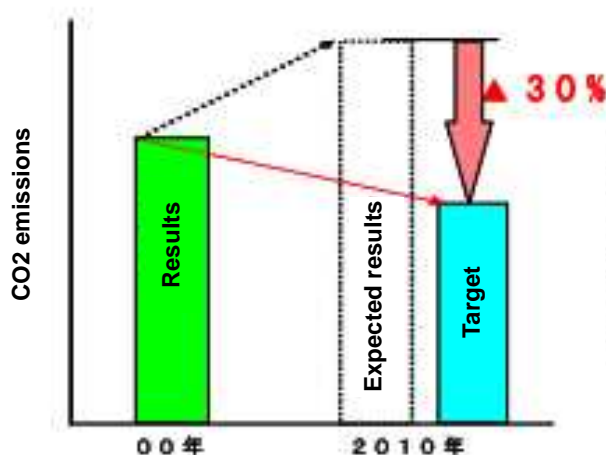
**5. Contents of major activities**

**(a) Development of energy-saving technology**

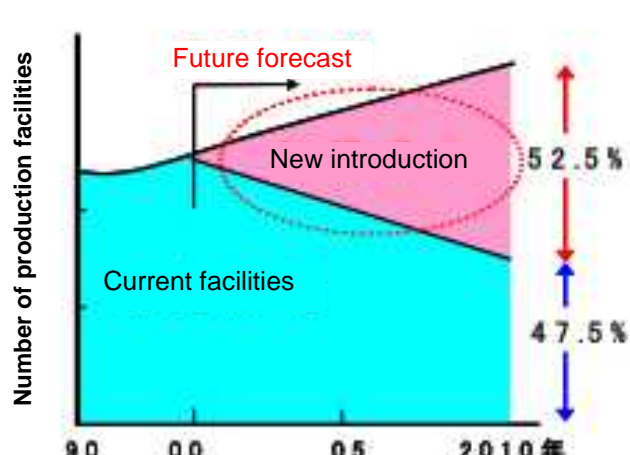
In 2000, when we set the CO<sub>2</sub> reduction target for 2010 in [Denso Eco-vision 2005], the production increase of 12% per year was expected. Therefore, we presumed the CO<sub>2</sub>

reduction target for 2010 could not be achieved simply by extending the conventional activities. Subsequently, we assumed energy reduction of more than 30% was necessary for the newly introduced facilities.

Denso is designing, developing, and manufacturing production facilities on its own. As the measure of the CO<sub>2</sub> reduction for 2010, we inaugurated the energy-saving fabrication study committee (Energy-saving Engineering Working group from 2008) with the responsibility to develop energy-saving technologies. The committee has been implementing the long-term CO<sub>2</sub> reduction as a planned theme.

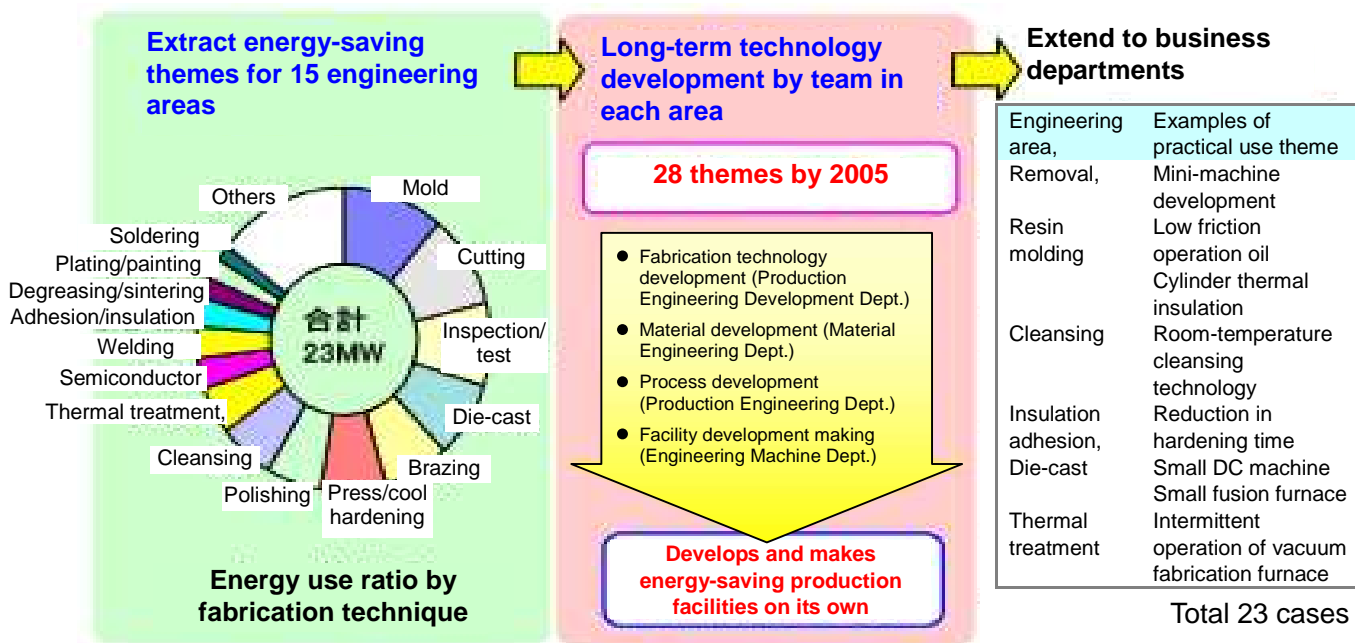


Difficult to achieve the target by extending the conventional technology



Forecast of production facilities structure for 2010

**Energy-saving activities (Technology development promotion)**

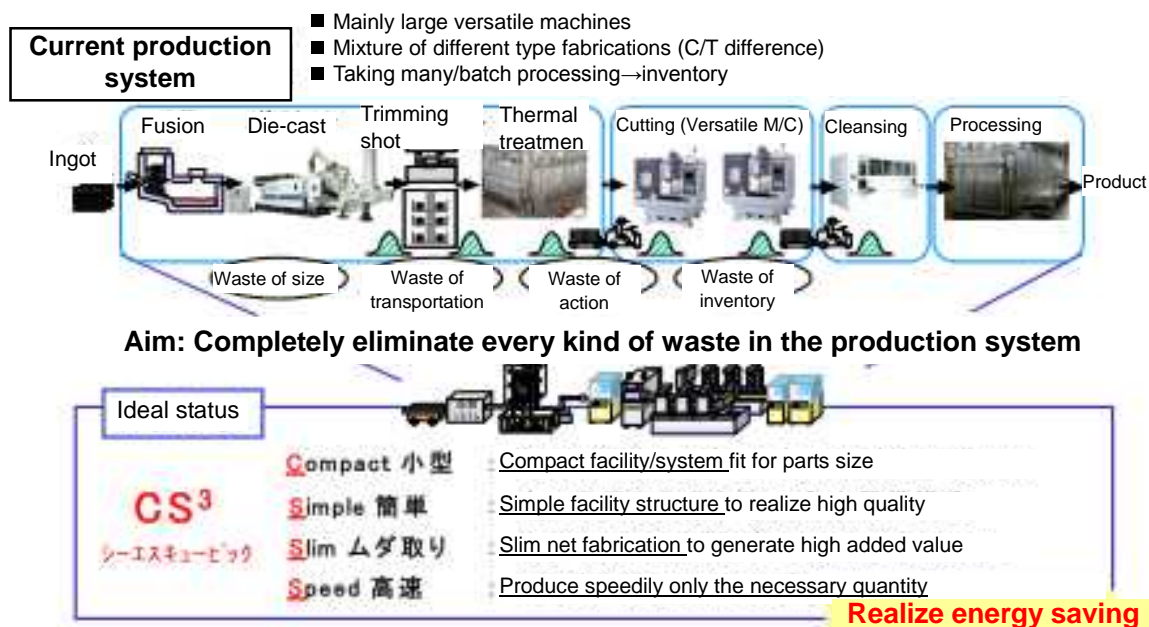




From 2000 until 2005, the company pursued technology development using 23 themes and put them into practical use. The CO<sub>2</sub> reduction effect by those developments is 18,000 tons of CO<sub>2</sub> from the development of a small fusion furnace. Since 2006, 31 additional themes have been planned as measures to enhance CO<sub>2</sub> reduction. As a result of the development cases up to FY2007, 9,300 tons of CO<sub>2</sub> reduction was achieved.

**(b) CS<sup>3</sup> (CS cubic = Compact, Slim, Simple, Speed) activities**

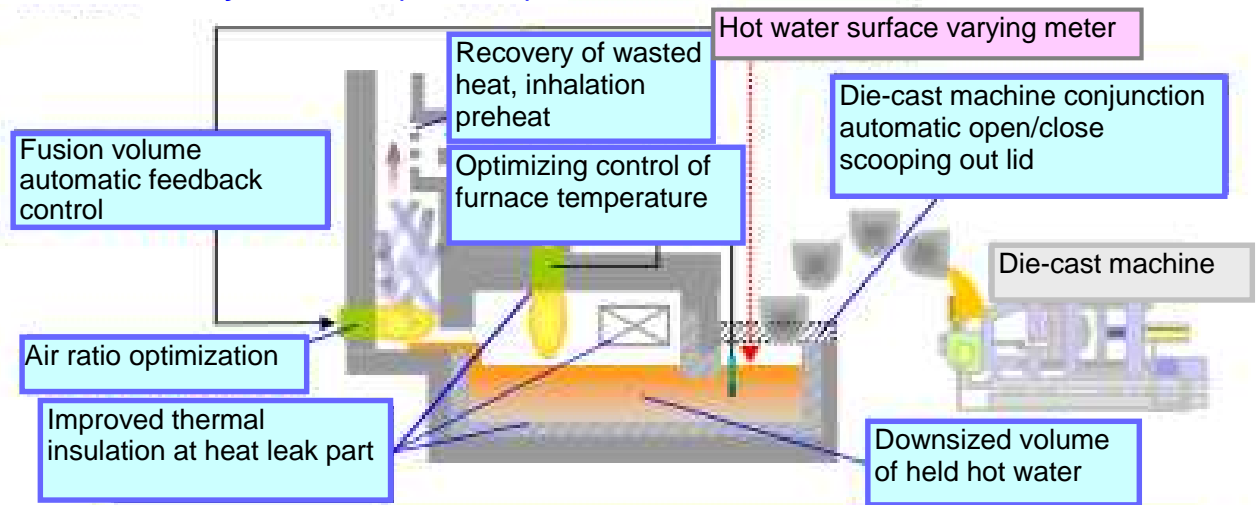
Production technology development to completely eliminate every kind of waste that may occur in production facilities



**Development case**

Die-cast small fusion furnace: Energy is one-half, size is one-third. thermal efficiency is 44%.  
Achieved the maximum efficiency in the industry

**Thermal efficiency 21%→44% (2.1 times)**

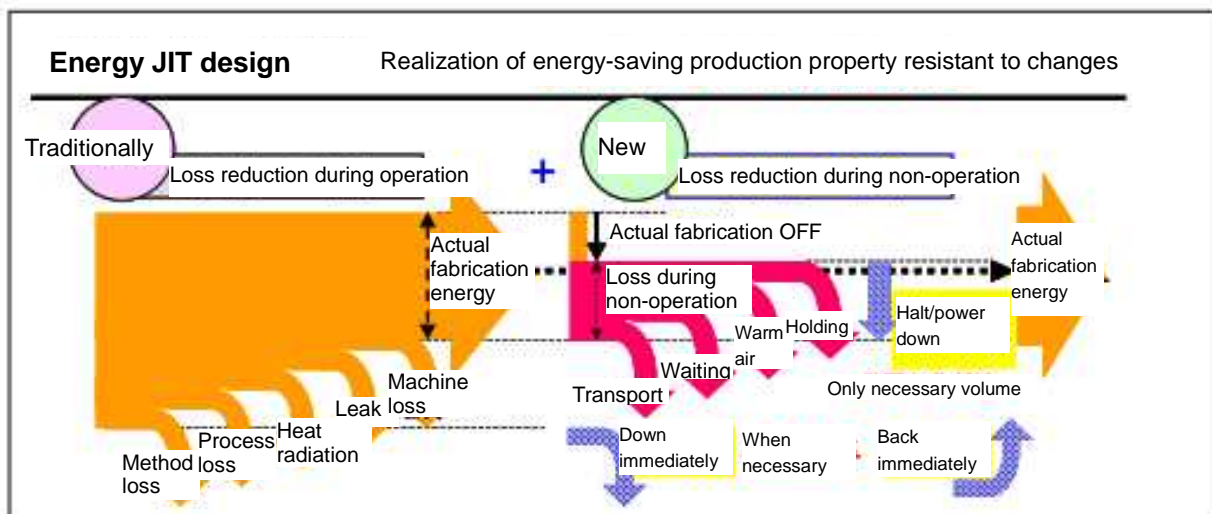


**Achieved the maximum efficiency in the industry while keeping quality of fused hot water**

Six related patents issued

**(c) Energy JIT (Just In Time) activity <Long-term issue: model running on trial>**

Denso has adopted the principles of JIT, which are [Only necessary things, only when they are needed, only necessary volume] for energy management and operation at factories and is engaged in [Energy JIT], which aims to make the factories more flexible to production changes. While the conventional energy-saving activities were aimed at eliminating waste in production, our [Energy JIT] is aimed at completely removing energy that is not contributing to production. [Energy JIT] varies in conjunction with production volume and consists of [Supply JIT] that optimally provides energy and [Production JIT] that makes the fixed energy being variable. It aims at improvement and development throughout from supply to production.



### <Production JIT>

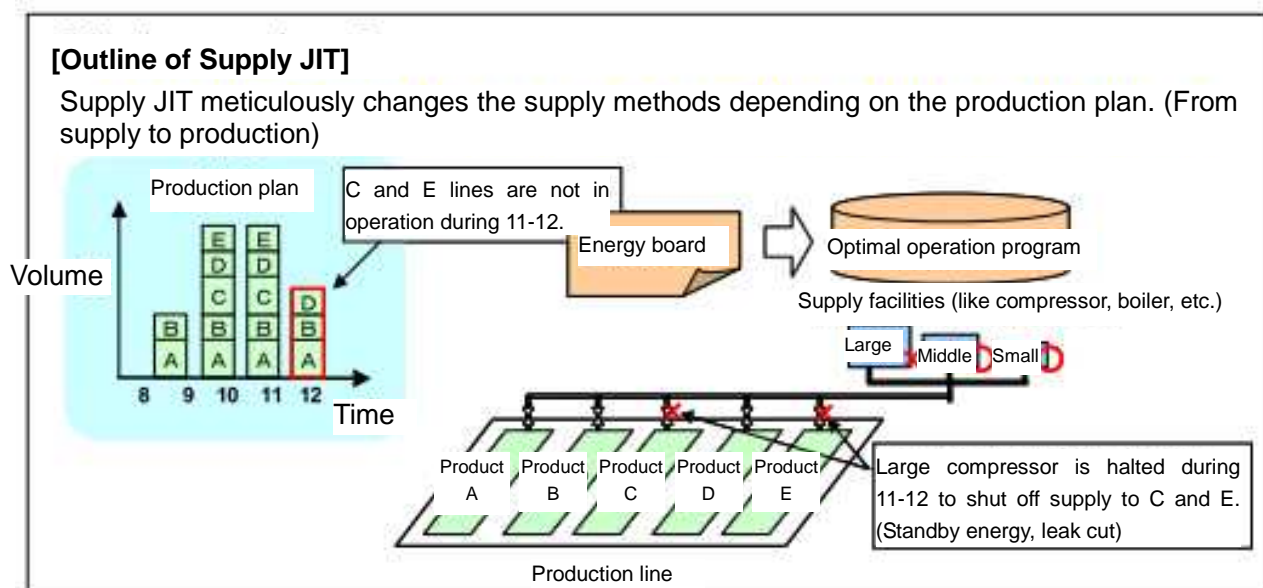
The production side is promoting activities to materialize JIT by making the fixed energy being variable, through scrutinizing operation conditions including idle transport, warm air operation and thermal hold for each production facility, eliminating wastes, and finally introducing the mechanism that automatically cuts off power during non-operation.

- Warm-up and cool-down based on the time schedule
- Idle stop and power down for line, facility, unit, and machinery
- Steamless, individual separate compressor, airless, etc.

### <Supply JIT>

In order to optimally provide in conjunction with the production volume, the supply side gets the production information and promotes the activities to realize the supply JIT that controls the operation of energy supply facilities. For example, by grasping beforehand the production information [Necessary information, time, volume, place] as an energy board, it is possible to perform idle stop that eliminates standby energy of driving facility and to do the best mix operation that realizes the optimal combination drive. Also, by cutting off energy supply to the non-operating areas, it is possible to eliminate supply losses like leak or dead energy.

Traditionally, energy was taken for granted as an infrastructure. However, the principle of supply JIT positions it as something that should be prepared only when it is necessary, like parts. Thus, we are thoroughly eliminating waste through the supply JIT.



#### (d) Exhaustive improvement: PEF (Perfect Energy Factory) activity

Though each of 20 manufacturing departments of our company is engaged in energy-saving activities on its own, there are many cases that can be shared by many departments. By establishing the mechanism by which a certain case can be shared by the entire company, we managed to promote the entire-company [Exhaustive activity] as the CO<sub>2</sub> reduction enhancement measure.

#### Energy-saving processes and facilities that can be developed through the entire company

- Processes where air is used: Driving source like air cylinder, air-blow like water wipe-off after cleansing and powder blow for cutting
- Motors, fans: oil-pressured pump motor, vacuum pump, cleansing pump, dust collector, exhaust fan, etc.
- Heater: thermal treatment, fusion furnace, drying furnace, molder, etc.
- Facility equipment: air-con, lighting, air pressure machine, boiler, etc.

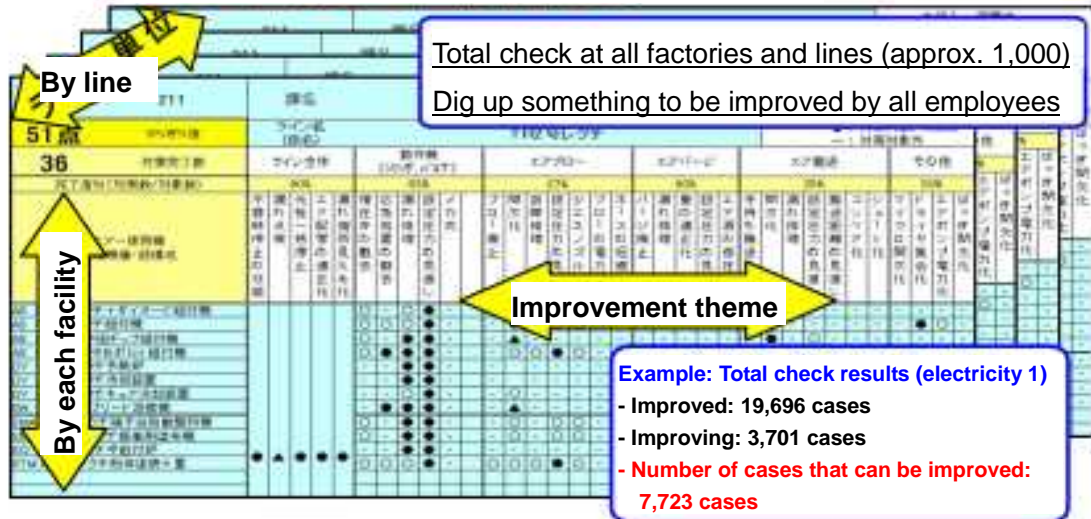
#### Mechanism of development through the entire company

Each department checked whether a certain case could be applied to facilities in use and conducted exhaustively the [PEF Total Check List] to visualize the energy-saving improvement status at all production facilities. We crafted two types of checklists for

electricity and air to promote energy-saving enhancement for air.

**PEF Total Checklist**

**Example: Energy-saving total checklist for air**

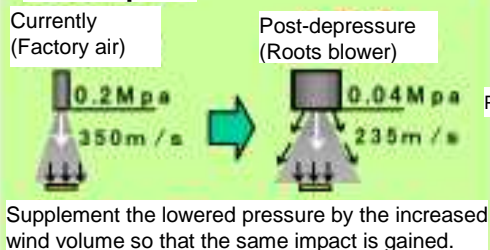


**PEF development example**

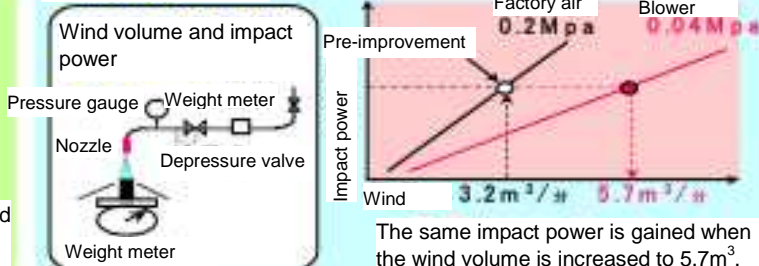
One of the development examples of PEF that brought about a major effect is [introducing air blower]. This case found that even when the compressed air (0.5 Mpa) used to wipe off water drips from fabricated parts is loosened to the lower pressure (0.05 Mpa), almost the same air blowing effect is achieved. Thus, energy saving of some 80 percent has been gained by switching from compressed air to lower pressure air. This case brought us [Award of Minister of Economy, Trade and Industry] as the nation's excellent energy-saving example for FY2004. It was adopted as a standards of judgment in the FY2006 Energy-Saving Law.

### <Blowing by low-pressure air>

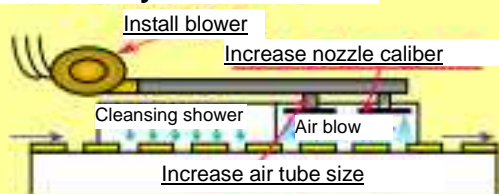
#### < Principle >



#### < Experiment >



#### < Validation by real machine >



Air blow quality: The site says "Effect of wiping off water drips is same or better than pre-improvement."

Energy cost	
Factory air	: 1,840 1,000 yen/year
Blower (6.5kw)	: 390 1,000 yen/year
Cost reduction	1,450 1,000 yen/year

Method established  
Effect validated

— 80% Energy saving

### PEF development results (FY2004-FY2008)

<Year>	<Number of improvements>	<CO <sub>2</sub> reduction effect>	<Investment recovery (average)>
FY2004	764	27,115 t-CO <sub>2</sub>	1.1 ← Entire company development
FY2005	826	37,506 t-CO <sub>2</sub>	1.4
FY2006	964	32,886 t-CO <sub>2</sub>	1.9 ← Each department's own activity
FY2007	1,341	36,793 t-CO <sub>2</sub>	1.8
FY2008	1,333	31,290 t-CO <sub>2</sub>	1.5 ← Strengthened activity

### (e) Exhaustive co-generation

Since there are many device departments and precision fabrication departments in our company, there are many processes that require air conditioning and many processes, and many cleansing process that need hot water, thus, each factory uses lots of steam throughout the year.

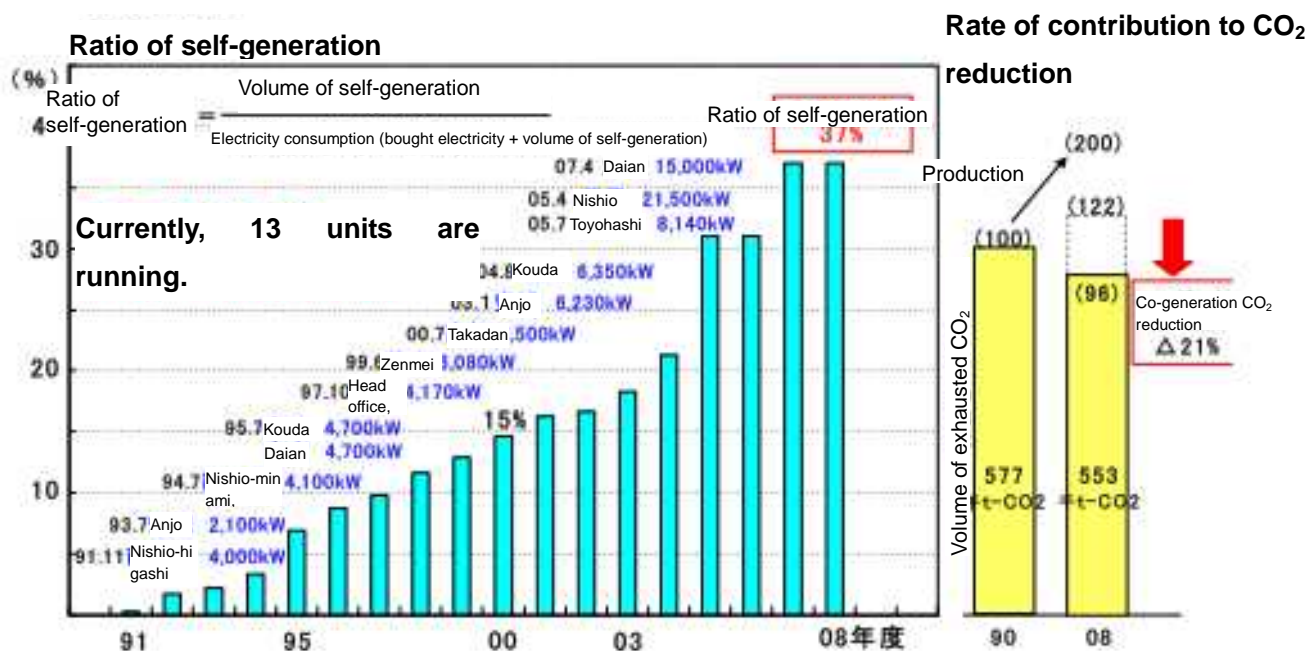
Since the early 1990s, the company has been promoting the introduction of highly efficient co-generation as the important energy-saving measure. Since the first equipment (4000 kW gas turbine co-generation) was introduced in 1991, city gas (13A) has been used as a fuel of [energy selection with little CO<sub>2</sub>].

Furthermore, after 2005, as the CO<sub>2</sub> reduction enhancement measure, Nishio Plant introduced 20 MW in 2005 and Dian Plant 15 MW in 2007 thanks to the investment subsidy from the NEDO energy rationalization supporter assistance project. So far, we introduced 13

units in all, completing development to the entire company.

- Introduction results: 13 units, 94,999 kW (Generated power in FY2008, 512,000 MWh (37% of the total electricity consumption) )
- CO<sub>2</sub> reduction effect (results in FY2008): 153,000 t-CO<sub>2</sub> reduction

### Co-generation development results



### (f) Natural energy development utilizing our own technology

As part of CO<sub>2</sub> reduction measures raised in Eco-vision, our company is promoting introduction of natural energies. In introducing natural energies, we use our own technologies. For example, we use our own alternator to introduce micro waterpower that utilizes the waterfall difference when the water used in the factory is discharged and to introduce micro windpower utilizing cleansed exhaust from a factory. Also, we are contributing to enlightening local people by receiving 60 groups of visitors between 2003 and 2008.

**Combination of new energies and Denso's own latest technology**

Introduced year	Outline of new energy facility			PR points
	(Type)	(Plant)	(Scale)	
2002	Micro waterpower	Nishio	4 kW	Factory wasted water (unused energy) + own product (SC alternator)
2004	Micro waterpower	Koda	4 kW x 2	
	Micro windpower	Zemmei	4 kW x 2	Own product (SC alternator)
2005	Micro windpower	Anjo	2 kW	Factory exhaust + natural wind + own product
2006	Micro windpower	Toyohashi	0.5 kW	Battery station in disaster
	Micro windpower	Daian	0.5 kW	Eco-symbol (bio-trail power)
	Micro windpower	Akubi	3 kW	All original like wind mill/generation control
2008	Micro windpower	Ikeda	0.5 kW	Battery station in disaster (improved start)



Koda micro waterpower



Zemmei micro windpower

Contribution to Earth environment by Denso's latest technology

**(g) Energy-saving physical training in winter (Emergency measure)**

We expected the intensity to worsen due to the drastic slowdown of the auto industry in late 2008. As the activity of the entire company, we conducted [Strategic winter physical training] until January-March 2008 to strengthen the manufacturing performance. Also, we took this opportunity as a chance to further enhance energy-saving activities and launched six critical items, like [Day of no energy use], as emergency measures. We got everyone to fully know and do those measures, including the monthly progress confirmation by CGO and Manufacturing Director and achieved great success.



**Themes and effects of energy-saving strategic winter physical training**

No.	Theme	Contents	Target	Effect
1	Day of no energy use	Reduce the fixed energy by halting energy use on holidays	10 million yen/day	10.6 million yen/day (Feb.-Mar. average)
2	Thorough check-ups to eradicate air leak	Root out air leak by using a flow meter	90 million yen/year	(90 million yen/year) (For entire plant)
3	Exhaustive PEF audit	Exhaustive promotion by energy-saving audit of PEF 115 items	Depending on audit	107 million yen/year
4	Energy-saving optimal control of air-con for production	Energy-saving control of room temperature based on temperature and humidity of external air	25 million yen/year	44 million yen/year (30 places)
5	Lower pressure to send steam	Reduction in boiler fuel cost by lowering pressure to send steam	40 million yen/year	Impossible to lower 1 <sup>st</sup> side (Studying lowering pressure on 2 <sup>nd</sup> side: unit heater)
6	Energy-saving patrol on offices and experiment areas	Enlightenment and improvement of energy saving (weekday, night and holiday)	Depending on audit	8.8 million yen/year

Total effect

1 Energy halt: 110 million yen (Jan.-Mar.)  
2-6 total: 248 million yen/year

**(h) Program CDM (Gains overseas CO<sub>2</sub> emission credits by own technology)**

As the worldwide global warming prevention measures in accordance with the Kyoto Protocol, Denso is engaged in the promotion of CDM utilizing company's own energy-saving technologies and know-how. The CDM project (reduction volume: 170 t-CO<sub>2</sub>/year) intended for a Malaysian production company (DNMY) was approved by the CDM council of the United Nations in November 2007, after it had been approved by both Japanese and Malaysian governments. This is the first time for Japan not only as a car-related manufacturer, but as the specific technology program of the demand side (transfer of energy-saving technology and know-how). Also, the CDM project (reduction volume: 850 t-CO<sub>2</sub>/year) intended for a Mexican production company (DNMX) was approved by the CDM council of the United Nations via the same approval process.

These activities are centered on the energy-saving technology of compressed air. To

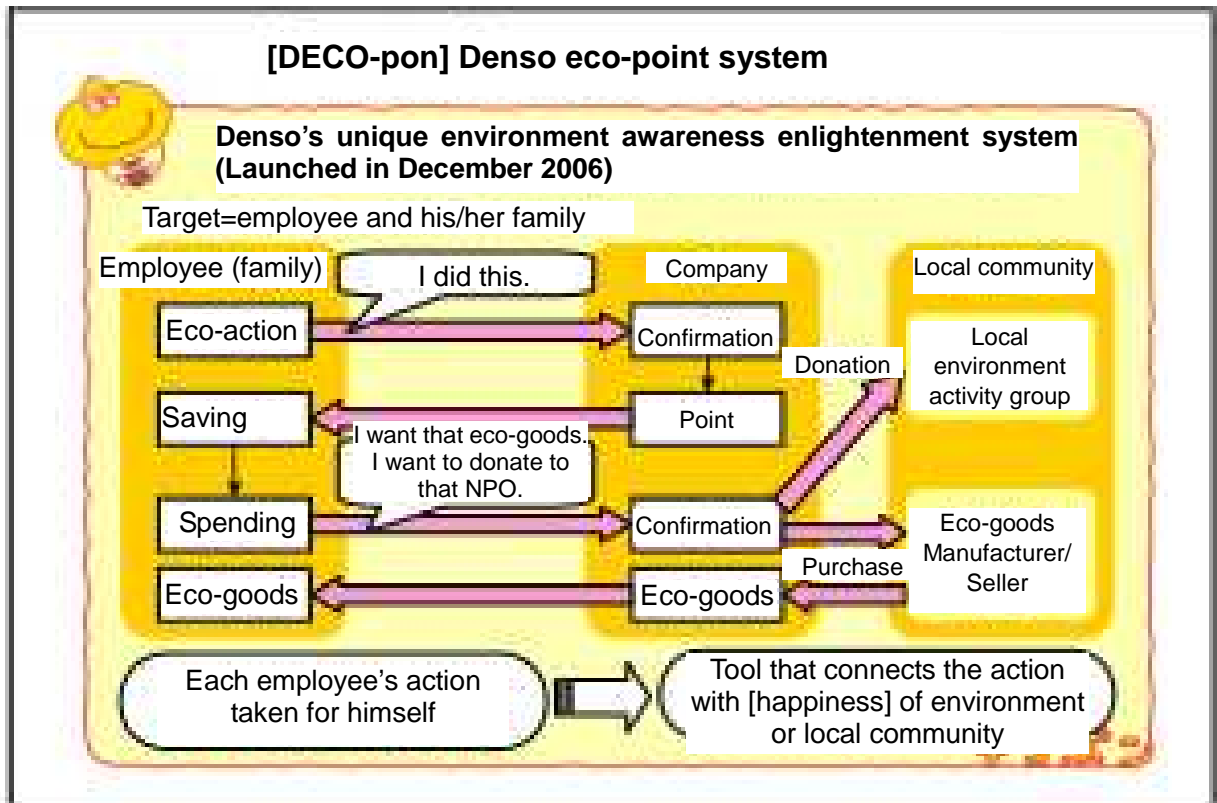
transfer the technology with a level that can be filed for the patent and the know-how nurtured in Japan, we dispatched instructors to those countries to provide the necessary education and training for more than two weeks. Thus, we are engaged in the unprecedented activities including human resource education for energy saving.

**(i) Energy-saving support activity for affiliated companies**

We conducted the PEF audit as energy-saving support for affiliated companies. After auditing how the facility equipment, like production facilities and air-conditioning equipment, are used at two factories, we extracted the 10% energy-saving proposal (26 items). For some of the extracted cases, we took improvement measures after receiving the investment subsidy from [NEDO Rationalization Support Project] in FY2008.

**(j) DECO-pon (Denso eco-point system)**

The DECO-pon system was launched in December 2006 from our company's unique environment awareness enlightenment system. This system includes eco-life check, environment diary, environment event, volunteer work, and eco-commute. The system is supposed to be attended by employees (currently about 8000 employees).

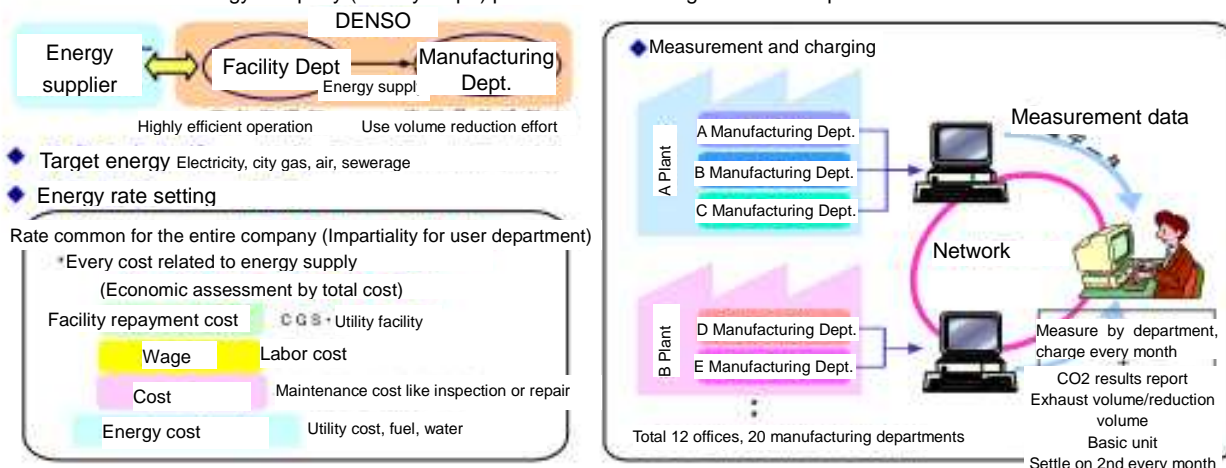


**(k) Energy cost direct link system**

This is the system in which each department measures the internal secondary energy and the department director bears the cost as his own every month in conjunction with cost management. The system was introduced for electricity and city gas in 1991 and then, air and sewerage were added in 1997. The improvement activity became more active than before the system was introduced. In particular, the number of improvements for air doubled thanks to this system and the intensity decreased 50 percent.

**Measure to raise energy-saving awareness by having a user bear the energy cost**  
 Energy-saving activities and cost reduction by the Manufacturing Dept. are directly linked  
 ↓  
 Energy-saving activities in the department became more active

The virtual energy company (Facility Dept.) promotes cost management and improvement activities.



**(l) Energy-saving performance/evaluation and visualization of enthusiasm**

**(m) CO<sub>2</sub> as business index**

The company established the internal award system in 1993 to help energize energy-saving activities of each manufacturing department (20 in all) in the business group. The evaluation items widely include not only the CO<sub>2</sub> target achievement status (emissions, intensity), but also internal and external contributory activities, such as participation in energy-saving results announcement and energy-saving support for the group and vendors. These results are linked with application for energy management excellent factory of the Ministry of Economy, Trade and Industry, raising energy-saving awareness of department directors. The same thing goes for energy-saving cases. They are linked with raising energy-saving awareness of employees. Also, like sales, profit and quality, the CO<sub>2</sub> target achievement status is incorporated in the company business management index and positioned as the company's critical issue.

**6. Involvement of CGO**

As the CO<sub>2</sub> target achievement enhancement measure for 2008, CGO himself proposed **[Establishment of CO<sub>2</sub> Special Project Room]**. CGO himself as a leader is strengthening energy-saving activities.

CGO plays the lead on the CO<sub>2</sub> target achievement status and issues at major meetings

like management meeting and manufacturing directors communication meeting.

**[Internally]**

- Once/quarter: The target achievement status (CO<sub>2</sub> emissions volume and its intensity) of the company and business groups is discussed at the management meeting.
- Twice/year: At the production environment planning meeting, CGO (CO<sub>2</sub> as the special project leader and as the production environment small committee chairman) plays the lead on the policy, targets, planning, target achievement status and issues.
- Once/month: The CO<sub>2</sub> target achievement status of the Manufacturing Dept. is reported at the Manufacturing Dept. directors meeting.



CGO makes comments on the global CO<sub>2</sub> reduction activities in the CSR report.

**[Group]**

- Twice/year: As the domestic group environment meeting chairman, CGO plays the lead on the group's CO<sub>2</sub> long-term and yearly policy, target and planning, target achievement status and issues.

CGO centrally manages the budget related to the company's energy-saving investment. (Investment target, priority, etc.)

As a manager responsible for R&D of facilities of production processes, CGO aggressively gets involved in the development of energy-saving type facilities and proposes all electricity-driven lines, always raising energy-saving development level high.

Energy-saving enlightenment strategy

CGO energizes employees by making efforts in energy-saving activities and issues instructions internally and externally to draw up energy-saving enlightenment strategy aimed at having employees acknowledged by the society.

CGO aggressively takes part in [Denso Green Project] that is a collaborative activity with local communities as his own environment action.



June 4, 2008 CGO Tsuchiya  
Executive Director (center)  
participates in Denso's Wood In  
Nukada

## 7. Effects

### **CO<sub>2</sub> intensity down 52% compared with 1990 (Fig. 1)**

Since 2000, as a result of energy-saving enhancement, such as energy-saving technology development, exhaustive improvement, and introduction of highly efficient facilities like co-generation toward the achievement of CO<sub>2</sub> reduction target for 2010, the results of 2008 are as follows.

- CO<sub>2</sub> intensity: Down 52% (2010 target: Down 40% from 1990)
- CO<sub>2</sub> emissions volume: Down 4% (2010 target: Down 10% from 1990)

In particular, since 2000, the CO<sub>2</sub> emissions volume has been flat and the intensity has greatly improved thanks to CO<sub>2</sub> reduction enhancement like PEF development and energy-saving technology development though the production grew more than twice.

### **Active energy-saving activities by employees (Big increase in the number of energy-saving improvements About 800 cases/y 2,500 cases/y) (Fig. 2)**

Since Eco-vision was launched in 2000, the number of energy-saving improvements has drastically increased compared with 2000 or earlier thanks to exhaustive implementation of themes common for the entire company in the PEF activity and each department's own active proposals for new improvements.

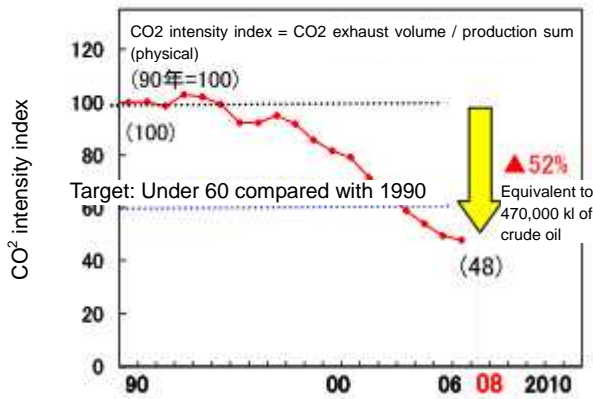


Figure 1. Transition of Intensity Index (FY1990-2008)

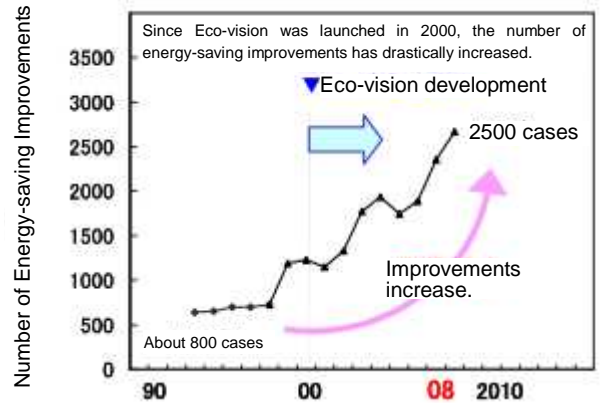


Figure 2. Transition of Energy-Saving Improvements

### External evaluation like energy-saving excellent case

Each department's improvements and energy-saving activities of employee and factory have been highly acclaimed from external organizations. For 9 years between FY2000 and FY2008, the company received 51 awards like Award of Minister of Economy, Trade and Industry.

- |  |   |   |
|--|---|---|
| <ul style="list-style-type: none"> <li>· Award of Minister of Economy, Trade and Industry: 4 times</li> <li>· Award of Director General of Agency for Natural Resources and Energy: 12 times</li> <li>· Award of Chairman of Energy-saving Center/Excellent Award: 12 times</li> <li>· Award of Director General of Bureau of Economy, Trade and Industry: 23 times</li> </ul> | } | Totally awarded 51 times<br>for 9 years (FY2000-2008) |
|--|---|---|