Activities for Global Warming Countermeasures in Plants and Offices

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The first commitment period (2008 to 2012) of the Kyoto Protocol that sets a reduction goal for greenhouse gas emissions in developed countries has expired, and so negotiations are being carried out to establish a new international framework after fiscal 2013. In Japan since the Great East Japan Earthquake, although energy and environmental policies including the nuclear problem are under review, Japanese industries have voluntarily set a reduction goal to be achieved by 2020 and are continuing with activities to reach that goal. As the Fujitsu Group's activities in plants and offices for global warming countermeasures, this paper describes the plans for and results of greenhouse gas (GHG) emission reductions and the ongoing measures, mainly including those in relation to facility equipment. In addition, it covers case examples of activities to develop energy-saving technologies in production processes and to promote the introduction of renewable energy.

1. Introduction

The Kyoto Protocol, which sets a reduction goal for greenhouse gas (GHG) emissions in developed countries (participating and ratifying countries), has reached the end of its first commitment period which ran from 2008 to 2012. For the subsequent second commitment period, some concern has been raised about its effectiveness because the percentage of countries obligated to reduce GHG emissions out of the GHG emissions of the entire world has further decreased. Accordingly, there are ongoing discussions and negotiations on a new framework that is fairer and more effective and involves major emitting countries and developing countries not covered by the Kyoto Protocol.

Assuming the construction of a new framework, Japan set a target of achieving "a 25% reduction from the 1990 level" by 2020 and chose not to participate in the second commitment period (as of 2010). However, the subsequent Great East Japan Earthquake and reduced rates of operation of nuclear power stations obliged Japan to revise its medium- to long-term energy policy and global warming countermeasures and the 25% reduction target was replaced by "a 3.8% reduction from the fiscal 2005 level" (as of November 2013).[1)]

Meanwhile, as a voluntary activity, industrial circles formulated the "Keidanren's Commitment to a Low Carbon Society" in December 2009 and have been promoting the setting and announcement of reduction targets to be met through domestic corporate activities by 2020 for the respective industrial sectors.[2)]

This paper describes the trends in domestic regulations relating to global warming countermeasures and use of energy and the activities for preventing global warming carried out in the plants and offices of the Fujitsu Group in these situations.

2. Trends in domestic regulations

While the medium- and long-term policy and targets are under review in Japan, the country's active attitude toward measures against global warming is unchanged. In recent years, the following cases of legislation and tax reforms have taken place.

1) Tax to prevent global warming

Since October 2012, taxation has been implemented in the form of adding an increase on top of the existing petroleum and coal tax by a tax rate corresponding to the environmental load (amount of CO_2 emissions) of each fossil fuel. The tax rates are scheduled to go up in stages in the future.

2) Feed-in tariff scheme for renewable energy

Starting in July 2012, power companies have been obligated to purchase surplus power generated from renewable energy (by facilities that meet the requirements established by the government) at fixed prices. This scheme specifies that the costs of purchase shall be transferred to electricity users in the form of a nationwide equal surcharge in addition to electricity charges.

Since the rates of operation of nuclear power stations decreased, thermal power generation has increased fuel usage and the impact of the weaker yen has caused fuel price hikes, which together have resulted in successive increases of electricity rates by power companies. These taxation and surcharge burdens along with raised electricity rates require enterprises to strengthen their energy-saving measures from the perspective of cost reduction as well.

3) Revision of Act on the Rational Use of Energy

It has been determined that, in addition to the conventional energy-saving measures (efficient use and reduction of energy), measures should be established concerning shifting of power use from peak hours so as to equalize power demand after the Great East Japan Earthquake (the corresponding Act was promulgated in May 2013, enforced in April 2014).

4) Low-Carbon Society Action Plan of the electric and electronic industries

The electric and electronic industries agree with and participate in the Keidanren's Commitment and have formulated an action plan. For the year 2020, they have set a target of improving energy efficiency in their production processes by an annual average of 1% and started activities for that purpose in fiscal 2013.[3)] The Fujitsu Group also participates in this plan in the sectors concerned.

3. Fujitsu Group Environmental Action Plan

The Fujitsu Group has formulated the Fujitsu Group Environmental Action Plan as a set of specific targets for implementing its environmental policy. It was launched in 1993 as Stage I and activities for the prevention of global warming have been continuously carried out.

At present, we are implementing the Environmental Action Plan, Stage VII, which runs from fiscal 2013 to fiscal 2015, in which we have set the following targets in our plants and offices in view of the social trends described up to now and future business forecasts.

1) Reduction of GHG emissions

Reduce GHG emissions in our offices by 20% as compared with fiscal 1990.

2) Improvement of energy efficiency

Improve energy consumption per unit in our offices by over 1% each year.

3) Expansion of usage of renewable energy

Increase generation capacity and procurement of renewable energy.

The following presents examples of activities carried out for achieving these targets.

4. Facility and infrastructure equipment measures

Figure 1 shows the changes in the GHG emissions from plants and offices of the Fujitsu Group. The 2012 result shows CO_2 emissions of approximately 910 000 tons caused by energy consumption and gases other than CO_2 of approximately 104 000 tons, indicating that CO_2 accounts for about 90% of the total emissions. Applications that use large amounts of energy (electricity, fuel oil and gas) include air-conditioning and heat source equipment and taking measures for such equipment can have a significant effect. At present, the following are named as priority measures for practicing energy conservation, and they have produced good results.

1) Optimization of air-conditioning and heat source capacity suited for the current size of the business (load)
2) Systematic upgrading to high-efficiency devices
3) Changeover to power and fuel that cause less CO_2 emissions

4.1 Energy conservation by eliminating waste in air conditioning of data centers

Fujitsu's Kawasaki Research & Manufacturing Facilities operates a data center for internal shared service systems. In fiscal 2012, we performed a thermal fluid simulation with the ultimate aim of reducing electricity consumed for air conditioning. This simulation was designed to determine whether shutting down air-conditioning equipment would lead to the

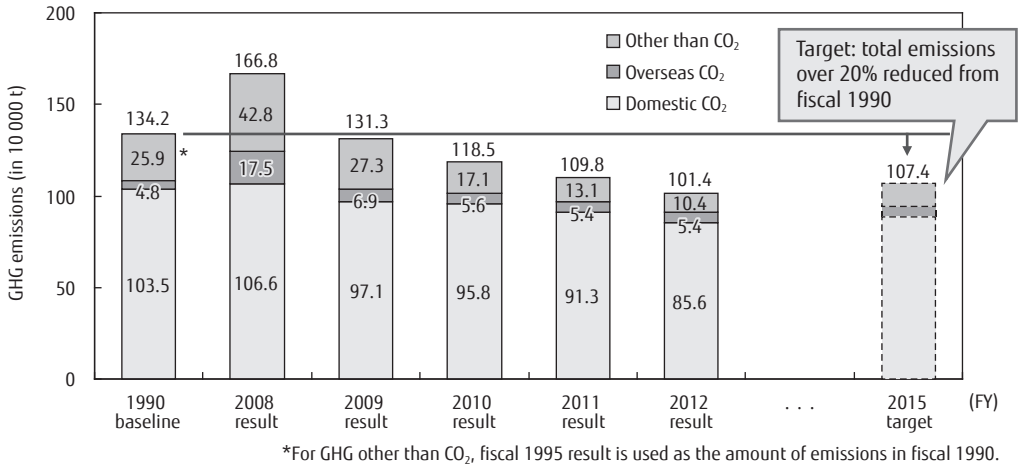


Figure 1
Changes in GHG emissions and reduction target.

development of hot spots or an extreme temperature distribution. The most important characteristic of this simulation is that it can provide accurate data for an entire data center, which it would be impractical to test while in operation. Through the simulation performed, it was determined that eight of the internal data center air conditioners could be turned off. Based on these results, we turned off air conditioners, took temperature readings and confirmed that temperatures remained within tolerances. We expect that using fewer air conditioners will cut annual costs by 2.47 million yen and reduce annual CO_2 emissions by 83.8 tons.

4.2 Energy conservation by upgrading deteriorated facilities

Completed in August 1986, our Oita Systems Laboratory had been in use for around 25 years and its facilities had deteriorated from age. In fiscal 2012, we renovated the existing facilities. With regard to lighting, in particular, we introduced high-efficiency apparatus such as high-frequency (Hf) fluorescent lamps and installed a lighting control system that makes it possible to adjust the amount of light used, and these were intended to address deterioration and reduce power. Once installation work was completed in August 2012, we began to realize benefits, including a reduction of 9423 kWh in monthly electricity consumption, annualized CO_2 emissions lowered by 46 tons and annualized running cost savings of 1.79 million yen as compared with before the installation (based on average results through February 2013). Renovation work also included an upgrade of the air-conditioning system, which was completed in May 2013. This investment is expected to cut electricity consumption by 34%.

4.3 Energy conservation by switching to inverters for cold and hot water pumps

At Fujitsu's Kyushu R&D Center, we have successfully saved energy by switching to inverters for cold and hot water pumps. At the Center, we use cold and hot water produced by an external supplier to cool and heat the entire building (a system referred to as district heating and cooling) to heat and cool tenant spaces, computer rooms and other areas. However, with increased use of personal computers, tenant heat burdens rose and the supply of hot water for heating in the winter became excessive. Furthermore, computer rooms had to be supplied with cold water for cooling even in winter, but pumping capacity, which was enough for the entire building, greatly exceeded this need. In March 2013, therefore, we installed inverters on the cold and hot water pumps. These inverters can control the rotational speed of the motor freely by adjusting the electrical frequency of the motor's power. The frequency of the cold water pump was changed from 60 Hz to 45 Hz and that of the hot water pump was altered from 60 Hz to 30 Hz, and the rotation speeds of motors and the amount of water supplied by each pump were controlled. This reduced our monthly electricity consumption by 32 176 kWh, cut annual CO_2 emissions by 160 tons and slashed annual running cost by 6.55 million yen.

5. Development of green manufacturing technologies

In production-related plants, CO_2 emissions from air conditioning and heat sources account for 40–50%, which is followed by emissions from equipment for production including assembly and processing, accounting for 30–40%.

For air conditioning and heat sources, the activities described above are producing a reduction effect. Accordingly, one major challenge is to reduce the energy consumed by production equipment, which accounts for a large portion of the entire CO_2 emissions in terms of applications as well, in addition to the activities in the facilities area that have been carried out up to now. In order to reduce the energy consumed in production, we are striving to improve processes and facilities, which can efficiently reduce power consumption, by making the power usage "visual" with the focus on the surface mount technology (SMT), assembly and testing processes.

5.1 Reduction of power consumption by insulating electric heaters

PFU Techno Wise Ltd., a manufacturer of scanners and information kiosk terminals (information terminals often seen in familiar places such as community facilities, public transportation stations and stores) for the Fujitsu Group, develops green manufacturing technologies, including ones that reduce electricity usage, for saving energy. In this plant, CO_2 emissions from production processes including assembly and processing and the equipment account for approximately 40% of the entire emissions. In May 2012, it came up with a way to greatly reduce the amount of electricity used by aging tents, which are used in the manufacturing of information kiosk terminals and evaluate the reliability of products under an elevated temperature. In a conventional aging tent, an electric heater mounted at the top takes in and heats outside air to keep the inside of the tent at 40°C. Air pressure inside the tent, therefore, is higher than outside and warm air leaks from the bottom and sides. For that reason, the heater must produce the amount of warm air leaked, which means that energy efficiency is very bad. To improve on this situation, the electric heater was covered with an insulated box, causing the warm air inside the tent to recirculate through the heater (**Figure 2**). This relieved the difference in air pressure, eliminating the warm air leakage and, because the recirculation of warm air improved the operating efficiency of the heater, the amount of electricity needed to keep the redesigned tent at 40°C was reduced. Measurements show that an improved

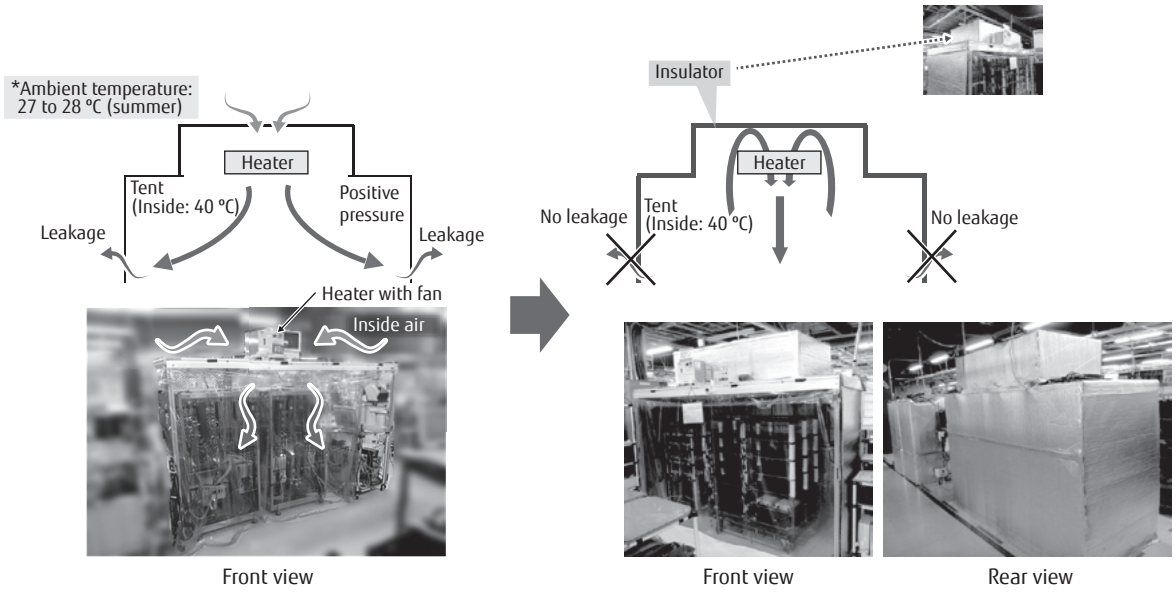


Figure 2
Configuration and appearance of aging tent.

aging tent uses only 0.325 kWh, less than a quarter (more specifically, savings of 76.8%) of the 1.4 kWh used by a conventional model. In February 2013, this initiative was one of 60 energy-saving activities that were recognized with an award for outstanding energy management at the 2012 Ishikawa Energy-Saving promotion convention.[4)]

Moving forward, we will continue with efforts to steadily save energy with changes to air-conditioning facilities, exhaust ducts and other improvements within manufacturing plants.

5.2 Adoption of low-melting-point lead-free solder

Fujitsu IT Products Ltd., which makes server products, had adopted the use of lead-free solder in consideration of the impact of lead on the human body and environment and for products' compliance with the RoHS Directive. The solder, however, had a high melting point of over 200°C, meaning that the heater for the solder furnace had to be kept at a high temperature and large amounts of electricity were consumed. To address this situation, for UNIX servers out of the server products, the lead-free solder was fundamentally changed to a low-melting-point solder composed of tin, bismuth and silver. With this new solder, which has a melting point of only 139°C, the solder furnace can be kept at a lower temperature (**Figure 3** and **Figure 4**). Electricity consumption for the furnace heater has been reduced by 39% (equivalent to reducing annual energy cost by about 740 000 yen and CO_2 emissions by about 14 tons). This low-melting-point lead-free solder is now being planned for use on Intel Architecture (IA) servers and mainframes.

6. Adoption of renewable energy generation equipment

In order to accumulate technologies and know-how related to renewable energy generation equipment and adopt renewable energy smoothly and efficiently, which is a goal set in the Environmental Action Plan, Stage VII, we established the Renewable Energy working group (WG) in August 2012. The WG activities have been implemented 14 times up to now (once a month), in which about 100 feasibility studies for technologies to generate renewable energy (photovoltaic, wind, micro hydraulic and geothermal power generation, etc.) and investigation of environmental conditions of all offices of the Fujitsu Group have been conducted. In addition, we have built a tool that recommends the optimum renewable energy generation equipment in terms of power generation efficiency simply by inputting environmental conditions of an office such as the amount of insolation and wind volume to help operators consider installing such equipment. We also have created new energy adoption guidelines for offices that will adopt renewable energy generation equipment in the future to present a workflow for selecting and adopting new energy generation equipment according to the purpose.

As part of the result of the Environmental Action Plan, **Figure 5** shows photovoltaic power generation facilities that have been adopted up to now in the Fujitsu Group. In addition to the total of 608 kW (rated capacity of the facilities) achieved by fiscal 2011, in fiscal 2012, new power generation facilities with capacities of 20 kW and 27 kW were installed respectively at Fujitsu

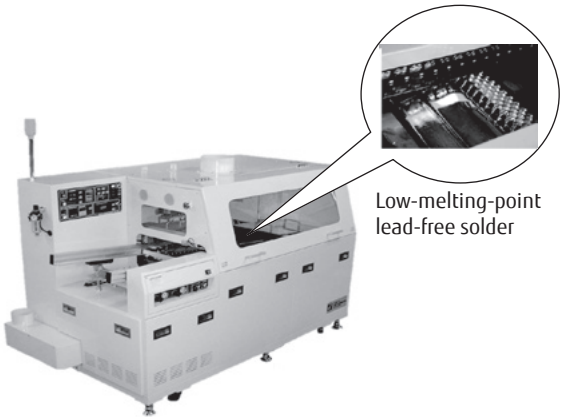


Figure 3
Solder melting furnace.

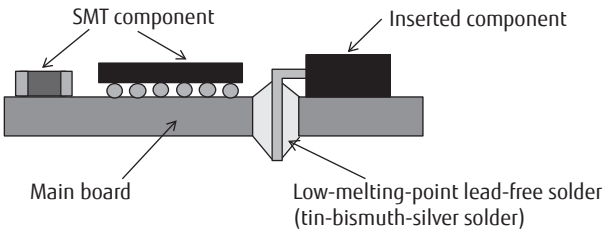
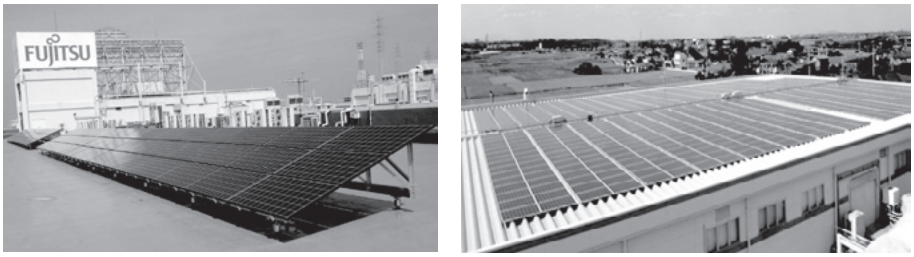


Figure 4
Adoption of low-melting-point lead-free solder.



(a) Fujitsu Oyama Plant (27 kW) (b) Fujitsu Wireless Systems (200 kW)

Figure 6
Photovoltaic power generation equipment (power generation panels).

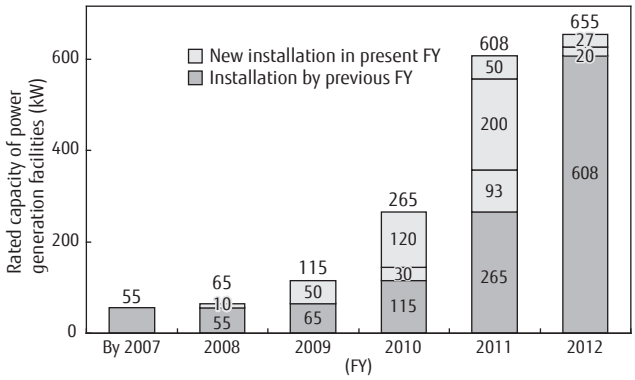


Figure 5
Installation of photovoltaic power generation facilities accumulated total.

Isotec Ltd. and Fujitsu Oyama Plant [**Figure 6 (a)**]. In fiscal 2013, photovoltaic power generation facilities using polycrystalline silicon of 200 kW were adopted in the Kumagaya Plant of Fujitsu Wireless Systems Ltd. to save power for air conditioning and lighting [**Figure 6 (b)**]. In this way, we are steadily expanding the use of renewable energy.

7. Conclusion

This paper has presented trends in domestic regulations relating to global warming prevention and activities for preventing global warming carried out in the Fujitsu Group's plants and offices based on the Environmental Action Plan, Stage VII.

It is recognized that GHG emissions must be halved by 2050 in the entire world. International activities and Japanese policies also show a medium- to long-term future outlook and measures for reducing GHG emissions are expected to further strengthen.

The Fujitsu Group will continue to work on reducing GHG emissions and conserving energy in its business activities, not to mention complying with regulations and industrial targets. At the same time, we intend to see the domestic energy and power supply and demand balance issues not only from the perspective of global warming prevention but as business management and continuity risks. We also intend to enhance creation of energy including renewable energy and storage of energy as a measure for equalizing power usage.

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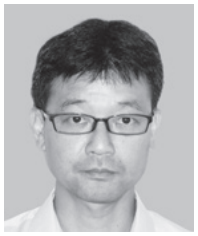

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