

# Leading-Edge Green ICT Research and Development

We are concerned with reducing environmental burdens at the policy and proposal stages in our leading-edge research and development and we are continuously creating technologies that contribute to saving electricity and using next-generation sources of energy.

## Basic Approach

### Promote the Development of Products and Services that are Optimized to Benefit Lower Environmental Burdens

To achieve the goal of reducing CO<sub>2</sub> emissions by about 30 million tons a year in Japan by 2020, as proposed in Green Policy 2020, our medium-term environmental vision, we need to develop revolutionary leading-edge technologies that have even greater environmental burden-lowering effects than at present.

Fujitsu Laboratories Ltd., which handles the Fujitsu Group's leading-edge green ICT R&D, has introduced the slogan "Strengthen leading-edge green ICT R&D and contribute even more to Fujitsu Group business" and is pushing forward with R&D on technologies that can benefit lower environmental burdens. Based on the concept of Green R&D, we are establishing and implementing policies from an environmental standpoint in all development work, from materials and devices through facilities, to systems and solutions.

## Efforts in FY 2010

### Quantitatively Evaluating CO<sub>2</sub> Emissions Reduction Benefits from the R&D Stage

To accelerate our environmentally oriented R&D, in April 2010 we started efforts to evaluate quantitatively the benefits in reduced CO<sub>2</sub> emissions (i.e., the environmental contribution) to be expected from the products and services that would include leading-edge technology while we were still in the R&D phase of developing that technology. These efforts are implemented across all units in the laboratories, and since researchers can evaluate the technologies they are responsible for (see figure), we can clarify the main advantages of the technologies from an environmental standpoint. Furthermore, by adding "the environment" to the axes of performance/functionality/quality and cost, R&D on leading-edge technologies that is balanced across all three of these axes becomes possible.

The Fujitsu Group Environmental Protection Program (Stage VI) sets up "Strengthening leading-edge green ICT R&D" as a priority and divides this into two areas with specific targets: the area of

next-generation data centers and networks and the area of solutions.

The target for the next-generation data center and network area is developing technologies that can double the overall efficiency of ICT equipment by the end of FY 2012. The target for the solutions area, also by the end of FY 2012, is to increase by at least 35% the development ratio for technologies that improve the effective reduction of environmental burdens.

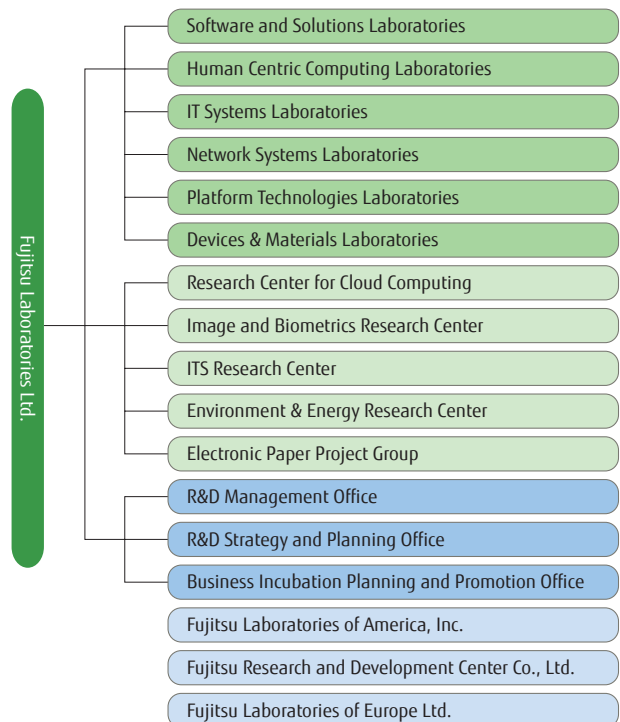
In FY 2010, we did not just clear the target of developing technologies that can increase ICT equipment efficiency by of 1.2 times, we improved it to 1.3 times. Then again, in the solutions area, we were able to achieve a development ratio of 58% for technologies that improve the effective reduction of environmental burdens rather than the minimum 25% of the fiscal year target. Based on these results, we revised the solutions area development ratio target to at least 70% by the end of FY 2012.

Fujitsu Laboratories Inc. will, while further increasing the environmental contribution of our leading-edge technologies, aim to expand the applications areas to complete systems including those in which the individual technologies work together.



Press Release:  
<http://www.fujitsu.com/global/news/pr/archives/month/2010/20100329-02.html>

## Organization of Fujitsu Laboratories Ltd. (As of March 2011)



### Basic Approach to Research and Development

- Promoting the development of revolutionary leading-edge technologies with green ICT as a priority area.
  - Rendering visible the low-carbon benefits across the whole value chain
  - Low-carbon technologies for ubiquitous equipment
  - Energy-saving technologies for data centers and networks
  - Environmental solution technologies
- Exhibiting synergy between total technology development and open innovation
  - Consolidation of elemental technologies from materials and devices to solutions
  - Global technology coordination

### R&D Example 1 Optical Switch that Cuts Power Consumption by Half

In November 2010, Fujitsu succeeded in developing technology that reduces the power consumed by optical switches to one-half of previous levels.

An optical switch is a unit that can switch the optical signal path without conversion in a communication network. Previously, progress had been made in developing next-generation networks with low power consumption using optical switches, since the power consumption of converting from optical to electrical signals is high.

In the structure used in this switch, instead of the earlier fine-patterned silicon, Fujitsu used, for the first time, fine-patterned silicon-germanium and achieved a reduction in power consumption to half that of earlier switches.

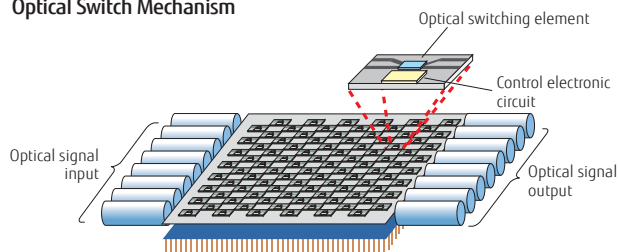
With the volume of data transmitted over networks increasing every year, power consumption in network equipment is increasing in step and there is concern that this could become a serious energy issue in the future. Next-generation large-capacity network communications applications such as cloud computing and ultrahigh-definition video distribution can be supported by using this technology to reduce power

consumption. Note that since this optical switch uses commonly available silicon fabrication technology, its price can be reduced through mass production.

Fujitsu will continue to strive to achieve large-scale optical switches that can implement next-generation networks.

**WEB** Press Release: <http://www.fujitsu.com/global/news/pr/archives/month/2010/20101109-02.html>

#### Optical Switch Mechanism



### R&D Example 2 Hybrid Energy Harvesting Device for Generating Electricity from Heat and Light Developed

In December 2010, Fujitsu developed a power generating device with a new hybrid structure that can extract power from both heat and light.

Previously, to use both heat and light as energy sources for generating electricity it was necessary to provide two separate devices: a thermoelectric element for generating electricity from heat and a photovoltaic cell for generating electricity from light. There was also the problem that combining multiple elements increased device costs.

For this newly developed hybrid energy harvesting device, Fujitsu developed a new organic material that can generate electricity from both heat and light and created a device that can generate electricity from both thermal and optical environments. Previously, there had been cases where in one of these environments it would have been impossible to harvest adequate energy. This new hybrid device, however, makes it possible to provide a larger amount of energy by selecting the more favorable environment and switching to that mode of generation. Furthermore, since the material used is relatively inexpensive, manufacturing costs can be held to a minimum. Since neither power from a generating station nor batteries are used, it is not necessary to use electrical wiring or change batteries.

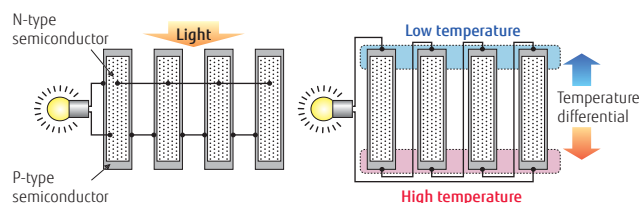
We hope that this technology can be used in the energy harvesting area, in which energy is collected from the surrounding environment

in the form of light, vibration, heat, or radio waves and converted to electricity. Although energy harvesting is seen as a next-generation energy source, since a given mode of energy, say light or vibration, is not always present, there is demand for the ability to switch appropriately to an energy source that does exist in the surrounding area and generate electricity efficiently.

We are aiming for practical application of this device around 2015 as one that can respond to next-generation needs and are working to increase performance and develop mass-production technologies.

**WEB** Press Release: <http://www.fujitsu.com/global/news/pr/archives/month/2010/20101209-01.html>

#### Hybrid Generating Device



### R&D Example 3 Developing a Wide-Area Traffic Simulator that Can Provide a Virtual Driving Experience

Smooth traffic flow is a critical issue for preventing traffic jams and accidents and reducing the associated CO<sub>2</sub> emissions. Given this background, to achieve future traffic patterns in which traffic jams can be avoided, in December 2010 we developed a wide-area traffic simulator that also allows drivers to experience the simulation.

At the same time as reproducing, in real time, the behavior of tens of thousands of vehicles on roads covering a wide area, this simulator also generates visual images for drivers and allows one of those vehicles to be driven virtually.

As an example of traffic policies that make use of this technology, we simulated a service that notifies drivers of the recommended speed that will allow them to pass through traffic signals without accelerating or decelerating. As a result of evaluation, we learned that the ease of driving and the CO<sub>2</sub> reduction effect change with the way drivers are notified and with the timing of such notifications. In addition to allowing the *a priori* evaluation of a variety of measures for smooth traffic flow, it also allows benefits and problems to be evaluated from the actual viewpoint of drivers. This will make it possible to implement appropriate measures that match the road conditions.

In addition to moving forward with practical implementation of this service, we will work to expand the simulation to an even wider area, expand the service, and aim at applying this system to verification of traffic policies over a wide area.

**WEB** Press Release: <http://www.fujitsu.com/global/news/pr/archives/month/2010/20101206-01.html>



Driving experience simulator