Contribution to Global Warming Prevention

by IT Solutions

JEITA

Contribution to Global Warming Prevention by IT

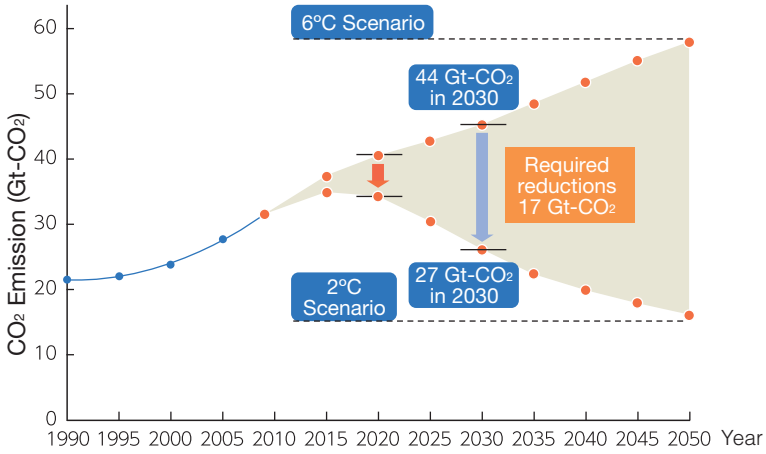
1 Situation Surrounding Global Warming Prevention

Awareness of global warming issue

IPCC*1 stated in its Fifth Assessment Report that warming of the climate system is unequivocal and that it is extremely likely that anthropogenic greenhouse gas (GHG) emissions are the dominant cause of observed warming since the mid-20th century.

It is also reported that, in order to keep the temperature rise less than 2°C over the 21st century relative to pre-industrial levels, GHG emissions should be reduced by 40 to 70 percent compared to 2010 by 2050, falling to almost zero or below in 2100.

Mid-to long-term CO_2 emissions forecasts and reduction scenarios

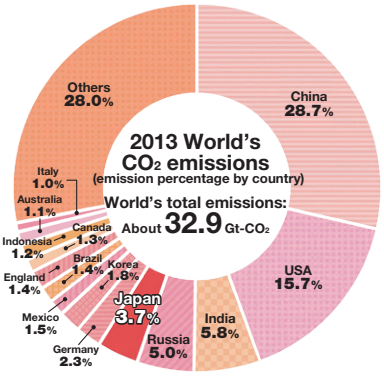


Source: JEITA data based on IEA*2 Energy Technology Perspectives 2015 "Scenarios & Strategies to 2050"

"Paris Agreement" participation by all counties

In December 2015, the "Paris Agreement," a new international framework for GHG emissions reduction towards post-2020, was adopted in the 21st Conference of the Parties of the United Nations Framework Convention on Climate Change (COP21) in Paris, and entered into force in November 2016.

Under the "Paris Agreement," all the major GHG emitting countries agree to make efforts on global warming prevention, aiming to hold the increase in the global average temperature to well below 2°C above pre-industrial levels (2°C goal) as the universal long-term goal, and substantially eliminating GHG emissions in the second half of this century. In the future, all the participating countries, including developed countries, emerging countries, and developing countries, are required to make efforts on global warming prevention on the basis of this agreement.



Source: EDMC/2016 Energy and Economy Statistical Abstract (translated by JEITA)

Major countries' goal given in their Intended Nationally Determined Contribution (INDC)

Countries	Key Points
China	・To lower CO_2 emissions per unit of GDP by 60% to 65% from the 2005 level by 2030. ・To achieve the peaking of CO_2 emissions around 2030.
USA	・To achieve an economy-wide target of reducing its GHG emissions by 26%-28%. below its 2005 level in 2025 and to make best efforts to reduce its emissions by 28%.
EU (28 countries)	・To achieve an at least 40% domestic reduction in GHG emissions by 2030 compared to 1990.
India	・To reduce the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level (emission gases are not specified). ・To achieve about 40 percent cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030 with the help of transfer of technology and low cost international finance.
Russia	・CO_2 emissions reduction of 25% to 30% relative to 1990 in 2030 might be a long-term indicator.
Japan	・To achieve the level of a GHG emissions reduction of 26.0% by FY 2030 compared to FY 2013 (25.4% reduction compared to FY 2005).
Brazil	・To reduce GHG emissions by 37% below 2005 levels in 2025 (To reduce GHG emissions by 43% below 2005 levels in 2030 as Subsequent indicative contribution).

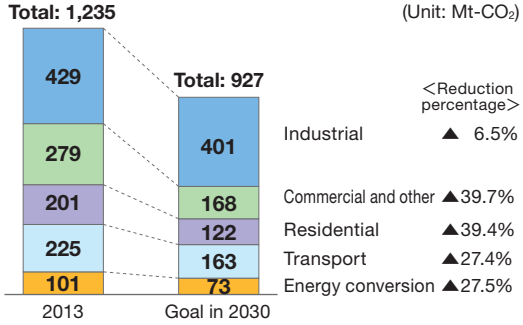
Source: JEITA data based on a document of the Ministry of Economy, Trade and Industry

Domestic measures aiming for the achievement of the mid-term goal in Japan

In May 2016, following the "Paris Agreement," the Japanese cabinet approved the "Plan for Global Warming Countermeasures," which sets forth the guidelines for domestic countermeasures against global warming. This Plan sets the emissions reduction goal for individual sectors (industrial, commercial and other, residential, transport, and energy conversion) for the year 2030 to achieve the medium-term goal of reduction of GHG emissions in FY2030 by 26% relative to FY2013. In particular, the reduction goal for energy-originated CO_2 emissions for the residential sector and for the commercial and other sector is as high as about 40%.

Achieving the emissions reduction goal for individual sectors requires cross-sectoral measures throughout the entire society.

The guide for energy-originated CO_2 emissions by sector



Source: JEITA data based on the "Plan for Global Warming Countermeasures" of the Ministry of the Environment

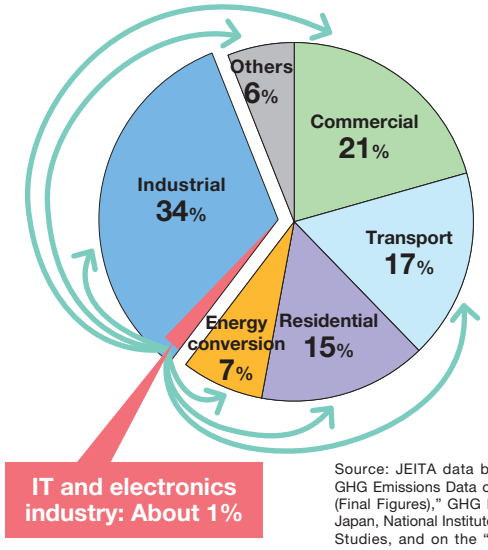
*1 IPCC: Intergovernmental Panel on Climate Change
*2 IEA: International Energy Agency

2 IT Contribution to Energy Saving in Society

Wide range contribution by IT and electronics industry

The IT and electronics industry continuously promotes energy saving investments and measures, and energy-efficient manufacturing.
Moreover, the industry has steadily promoted the improvement of energy saving performance of various IT and electronics equipment, which is widely spread in society, thereby contributing to CO_2 emissions reduction when such equipment is used.
Furthermore, IT solutions contribute to CO_2 emissions reduction in other sectors by encouraging efficient use of energy throughout society.

Sectoral percentage of CO_2 emissions in Japan (FY2014) and the contribution of the IT and electronics industry to each sector

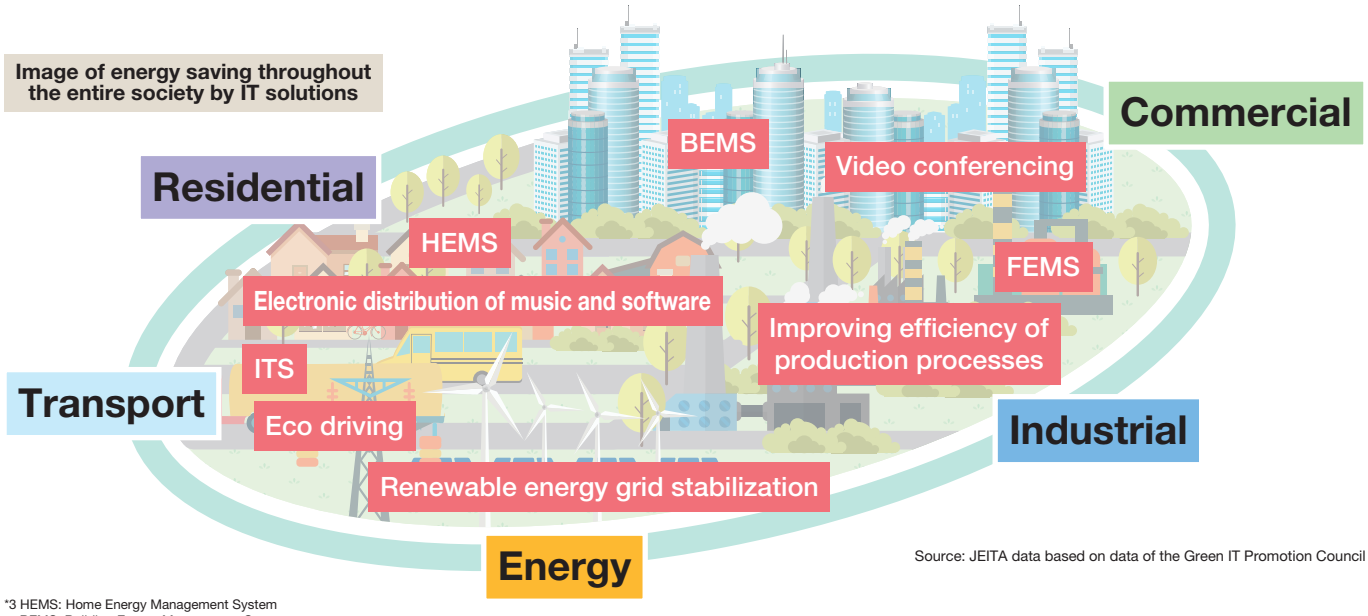


Source: JEITA data based on the "The GHG Emissions Data of Japan in FY2014 (Final Figures)," GHG Inventory Office of Japan, National Institute for Environmental Studies, and on the "Commitment to a Low-Carbon Society Fiscal 2015 Follow-up Results Summary (Performance in fiscal 2014)," Japan Business Federation

Energy-saving effects by IT solutions

The utilization of IT solutions will help to eliminate waste or irregularity in our living and to produce energy reduction effects. For example, the utilization of the intelligent transportation system (ITS), which controls traffic on the entire road network, will help to save more energy in a wide area of the transport sector. The spread of video conference systems and electronic distribution of music also helps to reduce movement of people and waste of resource consumption, producing an effect of suppressing energy consumption. Energy management systems, such as HEMS, BEMS and FEMS*3, which monitor the status of energy usage to control energy consumption at an optimum level, also contribute greatly to the reduction of energy consumption.
Furthermore, by means of the development of innovative technologies, such as cyber physical system (CPS) and Internet of Things (IoT), utilization of IT solutions in a wide range of society and a drastic increase in energy reduction effect are expected.
IT solutions have high potential in contributing to CO_2 emissions reduction in various sectors, including the industrial, commercial, residential, transport and energy conversion sectors.

Image of energy saving throughout the entire society by IT solutions



Source: JEITA data based on data of the Green IT Promotion Council

*3 HEMS: Home Energy Management System
BEMS: Building Energy Management System
FEMS: Factory Energy Management System

3 Sectoral
CO_2 Emissions Reduction Potential by IT Solutions

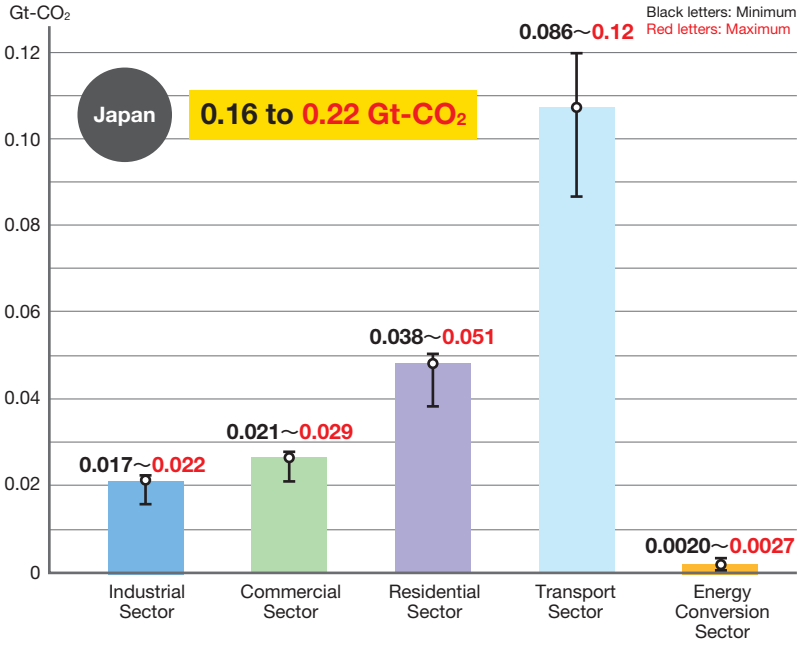
IT solutions will contribute to CO_2 emissions reduction directly and indirectly by bringing a substantial change in work style, lifestyle, manufacturing and resource utilization in various fields in society, and by incorporation of IT technologies into various equipment.

Regarding the emissions reduction effect by IT solutions, a new trial estimate*4 based on the forecast of the amount of contribution estimated by the Green IT Promotion Council in the past gives an overall reduction potential in Japan of about 0.16 to 0.22 Gt-CO_2 per year in 2030. The breakdown of the reduction potential is as follows: about 0.017 to 0.022 Gt-CO_2 per year in the industrial sector, about 0.021 to 0.029 Gt-CO_2 per year in the commercial sector, about 0.038 to 0.051 Gt-CO_2 per year in the residential sector, about 0.086 to 0.12 Gt-CO_2 per year in the transport sector, and about 0.0020 to 0.0027 Gt-CO_2 per year in the energy conversion sector.

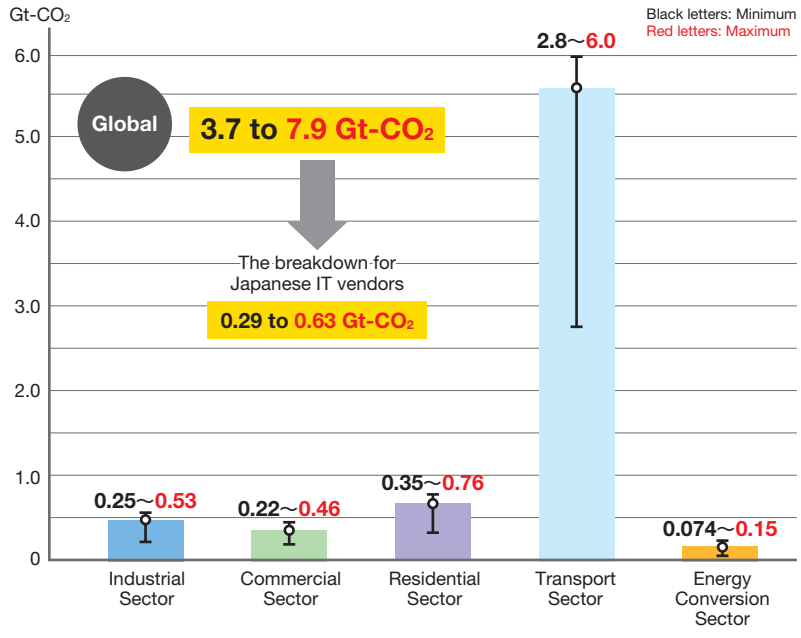
The estimated emissions reduction potential in the world as a whole is about 3.7 to 7.9 Gt-CO_2 per year in 2030. The breakdown of the estimated emissions reduction potential for Japanese IT vendors*5 is about 0.29 to 0.63 Gt-CO_2 per year.

IT solutions will contribute to prevention of global warming in a wide range of fields.

Japan's CO_2 emissions reduction potential in 2030 by IT solutions*6



World's CO_2 emissions reduction potential in 2030 by IT solutions*7



Examples of IT solutions contributing to the reduction

Category		IT Solutions
Industrial	Factory	FEMS
	Production process	Improving the efficiency of lighting, air conditioning, motors, generators, production processes
Commercial	Building	BEMS
	Indoors	Electronic tag/physical distribution system, paperless office, introduction of IT into business, telework, video conferencing, telemedicine/electronic health records, electronic bidding/electronic applications
Residential	Building	HEMS
	Indoors	Electronic money, electronic publishing/electronic application, electronic distribution of music and software, on-line shopping
Transport	Infrastructure	Adoption of LED traffic light
	Activity	ITS, improvement of automobile fuel efficiency, improvement of the efficiency of transport means, eco driving
Energy conversion	Renewable energy	Grid stabilization

Source: Data prepared jointly by the FUJITSU RESEARCH INSTITUTE and JEITA based on the "Survey and Estimation Committee Summary Report (FY2008-FY2012)," Green IT Promotion Council

*4 FUJITSU RESEARCH INSTITUTE and JEITA jointly estimated the effect. By assuming the year 2005 as the base year (estimation of emissions reduction effect of target IT solutions after the years 2005), the amount of reduction from BAU in the year 2030 was calculated.
The reduction potential in each sector of industrial, commercial, residential and transport was calculated based on the forecast of the amount of Green IT contribution in 2020 given in the Survey and Estimation Committee Summary Report (FY2008-FY2012).
The reduction potential in the energy conversion sector was calculated by multiplying the emission factor and the IT contribution ratio from the difference between the target of introducing renewable energy in the year 2030 (Plan for Global Warming Countermeasures in Japan, and EIA data for the entire world) and the actual results in the year 2005.

*5 The share of Japanese IT vendors was assumed to be 8% based on the "Outlook of global production in the electronics and information industry (December 2015)" of JEITA.

*6 The minimum and maximum reduction potential in Japan were calculated by assuming that the minimum and maximum CO_2 emission factors of electric power grid are 0.3 kg-CO_2/kWh and 0.4 kg-CO_2/kWh, respectively, with the median of 0.37 kg-CO_2/kWh, which is given as the target for the year 2030 in the "Electric Power Industry's Commitment to a Low-Carbon Society (July 2015)" of the Electric Power Council for a Low Carbon Society (ELCS).

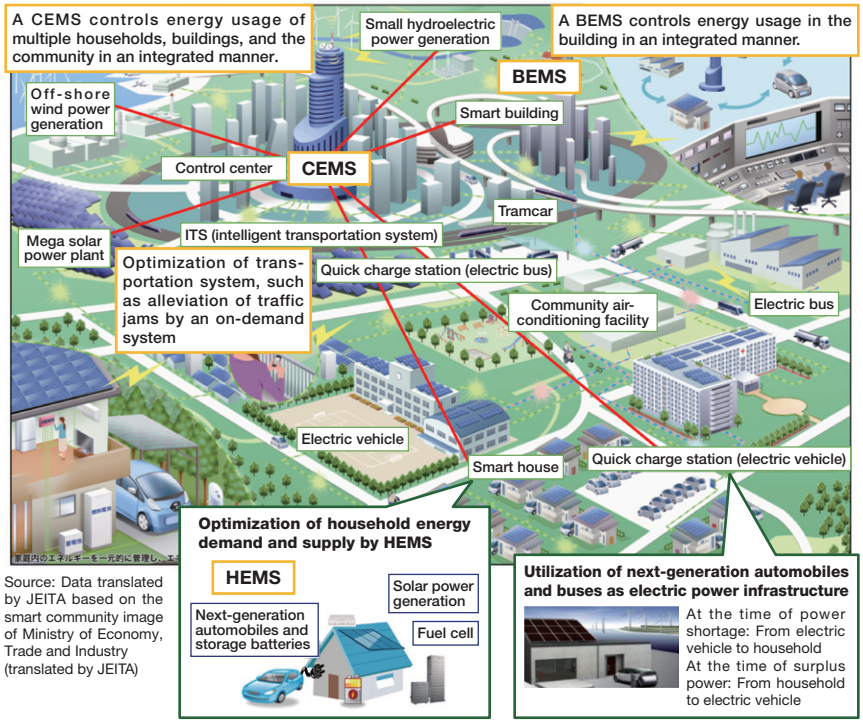
*7 The minimum and maximum reduction potential in the world were calculated by assuming that the minimum and maximum CO_2 emission factors of electric power grid are 0.275 kg-CO_2/kWh and 0.55 kg-CO_2/kWh, respectively, with the median of 0.538 kg-CO_2/kWh, which is the world average of over all types of power generation (the actual value in the year 2013 is from the IEA CO_2 emissions from fuel combustion).

4 Smart Community
CO_2 Emissions Reduction Potential by IT Solutions

A smart community is a next-generation social system, in which energy is effectively used by linking households, buildings and transportation systems through IT networks. In a smart community, it is indispensable to utilize IT solutions consisting of energy management systems such as HEMS, BEMS and FEMS for optimum operation of smart meters, renewable energy and EV*8, CEMS*9 for integrated management of the above EMSs and transportation systems such as ITS.

Smart community CO_2 emissions reduction potential in the year 2030 by IT solutions*10 is estimated to be about 0.02 to 0.11 Gt-CO_2 per year in Japan, and about 0.12 to 0.71 Gt-CO_2 per year in five other countries (USA, China, England, Brazil, and India).*11 The breakdown of the estimated emissions reduction potential for Japanese IT vendors*12 is about 0.010 to 0.057 Gt-CO_2 per year.

Image of smart community



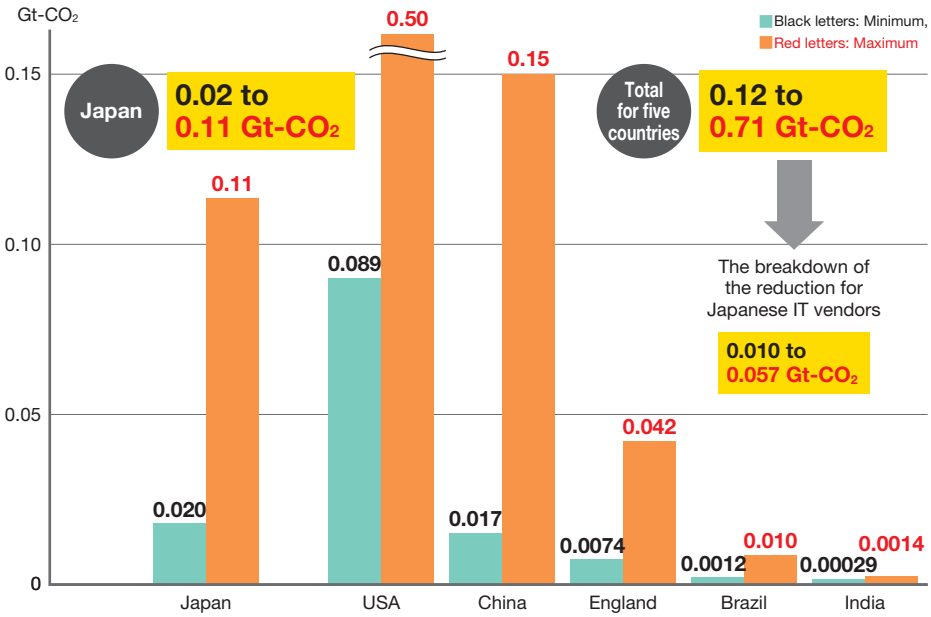
Source: Data translated by JEITA based on the smart community image of Ministry of Economy, Trade and Industry (translated by JEITA)

Major components of smart community in this survey

Classification		Major IT Solutions, Devices, etc.
Management system in the supply side	Grid and power distribution management (grid management and control)	DMS (Distribution Management System)
Management system in the demand side	Integrated management	CEMS
	Facility management	HEMS, BEMS, FEMS
	Transportation management	ITS (and other systems, which utilize transportation information), V2H/V2G technology
Telecommunications		Smart meter
Energy		Renewable energy, thermal energy
Transportation		EV

Source: Data prepared jointly by the FUJITSU RESEARCH INSTITUTE and JEITA based on case examples of smart community-related projects and the conception of the government and organizations

Smart community CO_2 emissions reduction potential in 2030 by IT Solutions



*8 EV: Electric vehicle
*9 CEMS: Community Energy Management System
*10 FUJITSU RESEARCH INSTITUTE and JEITA jointly estimated the effect. By assuming the year 2013 as the base year (estimation of emissions reduction effect of smart communities after the year 2013), the amount of reduction from BAU in the year 2030 was calculated. With the assumption that smart communities would reduce CO_2 emissions from urban areas, the following formula was used to estimate the reduction potential for the fields of "energy," "transportation," and "telecommunications:"

Reduction potential = (Urban population in the target country) × (CO_2 emission per capita) × (CO_2 reduction rate by smart community) × (coverage rate of smart community) × (IT contribution ratio)

CO_2 reduction rate was set by referring to representative smart community examples (four typical domestic verification projects) in which CO_2 emissions reduction effect was verified.
Coverage rate of smart community was set by considering the coverage rate of key solutions.
IT contribution ratio was set by considering the cost percentage relevant to IT solutions. In addition, the maximum and minimum reduction potentials were estimated for the case in which both the coverage rate of smart community and the IT contribution ratio are maximum, and for the case in which both the coverage rate of smart community and the IT contribution ratio are minimum, respectively.

Reference: Four typical domestic verification projects
(1) Yokohama Smart City Project (YSCP)
(2) Toyota City Low-Carbon Project (Smart Melit)
(3) Keihanna Eco City Next-generation Energy and Social Systems Demonstration Project
(4) Kitakyushu Smart Community Creation Project

*11 Target countries are selected from those countries that currently promote smart community projects. In addition, regarding India, this estimate of reduction potential is small, but the development of smart cities is actually declared as a policy of the Indian government and relevant projects have already started. Therefore, it is thought that a larger reduction potential can be expected in India.
*12 The share of Japanese IT vendors was assumed to be 8% based on the "Outlook of global production in the electronics and information industry (December 2015)" of JEITA.

5 GHG Emissions Reduction Potential in Agricultural and Livestock Industries by IT Solutions

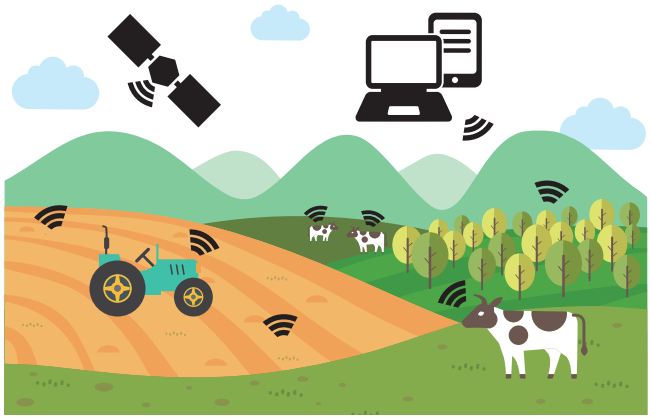
Agricultural and livestock industries emit GHG of as much as about 12 Gt-CO_2 in the entire world.*13 In these industries, while the reinforcement of production volume is needed because of future population growth, impact to global warming is worried about and realization of sustainable agricultural and livestock industries is required.

Recently in these industries under such circumstances, efforts are under way aiming for energy saving, improvement of work efficiency and optimum fertilization through the utilization of IT solutions such as autonomous running tractors and production management systems.

A published report*14 gives an estimate of about 2 Gt-CO_2 as the GHG emissions reduction potential in the agricultural and livestock industries in the year 2030 by IT solutions. A trial estimate*15 of the reduction potential with reference to the report gives about 0.74 Gt-CO_2 per year in developed countries and about 1.26 Gt-CO_2 per year in developing countries.

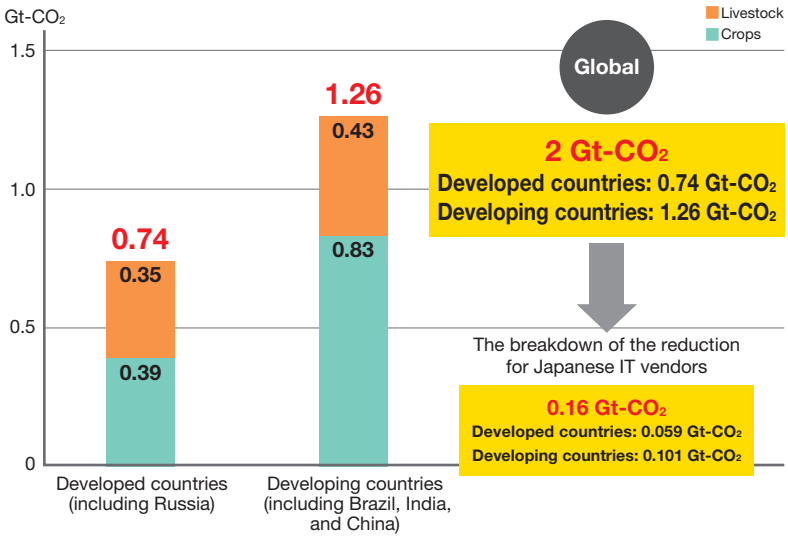
In addition, the breakdown of the estimated world's emissions reduction potential for Japanese IT vendors*16 is about 0.059 Gt-CO_2 per year in developed countries and about 0.101 Gt-CO_2 per year in developing countries.

Image of utilization of IT solutions



Source: JEITA data

World's GHG emissions reduction potential in the agriculture, forestry, and livestock industries in 2030 by to IT solutions



Examples of IT solutions in the agricultural and livestock industries

Means of Reduction	Major Solutions
Reduction of energy consumption	Autonomous running tractor, unmanned helicopter/drone, assist suit
Effective use of chemical fertilizer Effective use of organic fertilizer	Real-time soil sensor, remote sensing/geographic information system (GIS)
Improvement of fermentation in the digestive tract	Individual identification tag, herd management system
Improvement of efficiency of rice farming	Water level sensor
Reduction of food wastes	Growth and harvest forecast, fruits and vegetable automatic sorting machine, production management system

Source: Data prepared jointly by the FUJITSU RESEARCH INSTITUTE and JEITA based on GeSI "SMARTer 2030"

*13 Estimated jointly by FUJITSU RESEARCH INSTITUTE and JEITA based on IPCC "Fifth Assessment Report" and "Climate Change 2014: Mitigation of Climate Change"

*14 The report, "SMARTer 2030," published by the Global e-Sustainability Initiative (GeSI)

*15 Estimated jointly by FUJITSU RESEARCH INSTITUTE and JEITA, with reference to GeSI "SMARTer 2030," by taking into account GDP, gross agricultural production, Internet diffusion rate, etc. of each country, under the classification of countries in which developing countries total 54 (including Russia among BRICs), which are classified as developed countries in the forecast of the Food and Agriculture Organization of the United Nations (FAO), and developing countries total 94, including countries which are classified as developing countries in the FAO forecast, (including Brazil, India, and China among BRICs), and other countries and regions which are not classified as either. By assuming the year 2013 as the base year (estimation of emissions reduction of the agricultural and livestock industries after the year 2013), the amount of reduction from BAU in the year 2030 was calculated.

*16 The share of Japanese IT vendors was assumed to be 8% based on the "Outlook of global production in the electronics and information industry (December 2015)" of JEITA.

Note the following

(1) Regarding the contents of "Section 3: Sectoral CO_2 Emissions Reduction Potential by IT Solutions", "Section 4: Smart Community CO_2 Emissions Reduction Potential by IT Solutions" and "Section 5:GHG Emissions Reduction Potential in Agricultural and Livestock Industries by IT Solutions", JEITA commissioned FUJITSU RESEARCH INSTITUTE to survey the contents and estimated the relevant data.

(2) Please refer to "Report of survey on IT solutions contribution to global warming countermeasures – GHG emissions reduction potential towards 2030 – (JEITA)" for details of the survey.

(3) Note that these data are reduction potential estimated as of the year 2016 and do not guarantee the reduction of such amount of estimated potential, because problems related to calculation indices and impacts of fluctuations in economic environment in the future and others are conceivable.