Environment: Panasonic Environment Vision 2050

Panasonic Environment Vision 2050

While the global attention being paid to the social issues surrounding the environment and energy is intensifying, the focus on the Sustainable Development Goals (SDGs) set by the United Nations and the Paris Agreement—through which a number of countries allied together to work towards global warming prevention—indicates the seriousness of these issues worldwide.

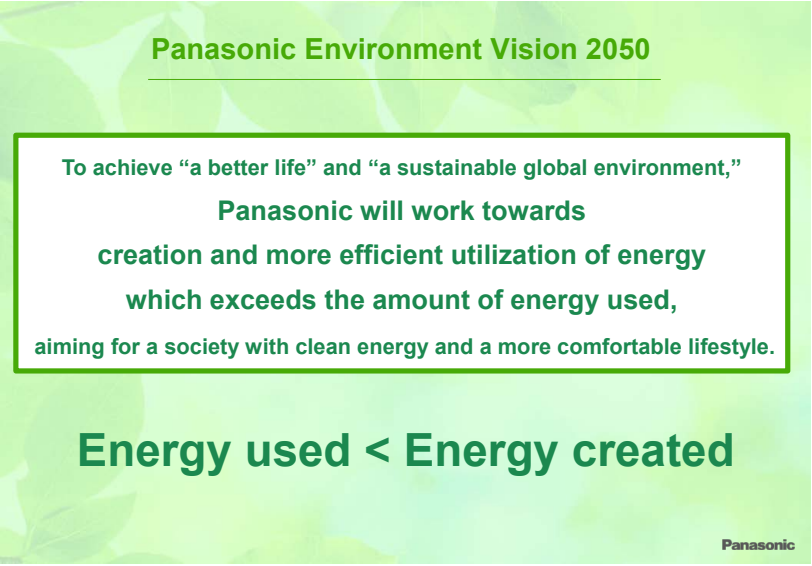
Also, in the World Economic Forum held in January 2018, where political and economic leaders from across the world gathered, the issues concerning the environment and energy, such as climate change and natural disasters, occupied the major part of the list of the most significant risks. Based upon the results of these discussions, the world leaders initiated actions that could lead to fundamental solutions.

Aware that society's expectations of the role of corporations in resolving these global social issues is rising, Panasonic formulated the Panasonic Environment Vision 2050 in 2017 to determine our own initiatives in responding to the expectations and requests from our stakeholders.

The Environment Vision 2050 means to work towards creation and more efficient utilization of energy which exceeds the amount of energy used, aiming for a society with clean energy and a more comfortable lifestyle.

Currently, relative to the amount of energy used (energy used in our operation, and energy used by products in consumer use), the amount of energy created (clean energy that is created and/or made available by products and services by Panasonic, such as photovoltaic power generation systems, storage batteries, and energy solutions) is merely one-tenth. From now on, for the energy used, we will develop technologies for improving energy-saving performances of products and innovate manufacturing processes to reduce the amount of energy consumption. For the energy created, we will expand energy-creation and storage businesses as well as contribute to new social systems such as a hydrogen society to increase the use of clean energy.

Through these efforts, Panasonic will endeavor to make the "energy created" exceed the "energy used" toward the year 2050.



Activities for Achieving the Environment Vision 2050

In order to realize the Environment Vision 2050, we promote two major activities.

One of the initiatives to realize the Environment Vision 2050 is “creating a safe and secure society with clean energy.” To be specific, we will work to provide eco-conscious and smart living spaces as well as contribute to eco-conscious and smart travel and transport.

Another initiative is “promoting businesses aiming for a sustainable society.” We will work to promote effective utilization of resources as well as promote the creation of factories with zero CO_2 emissions.

1. Panasonic will Create a Safe and Secure Society with Clean Energy

The eco-conscious and smart living spaces that Panasonic strives to provide means living spaces that create electricity and/or hydrogen using clean energy and then storing/transporting the created energy. Such living spaces offer a safe and secure life with clean energy enabled through appropriate energy management for energy-saving equipment and buildings with high insulation performances. Here, living spaces refer to not only homes of individuals but also working or learning spaces, and spaces for living or leisure. It refers to all spaces relating to people’s lives.

In order to realize this, Panasonic will work on development of environmental technologies from the four viewpoints of energy creation, energy saving, energy storage, and energy management.

As for energy creation, in particular, we will develop a next-generation solar cell technology and fuel cell technologies that use hydrogen derived from clean energy as energy source. At the same time, for energy storage, we will work on technologies relating to storing and/or supplying hydrogen, and storage batteries. These will expand the possibilities of utilizing clean energy anywhere in the society.

We will also work on developing environmental technologies to realize eco-conscious and smart travel and transport. With further development in technology of storage battery systems for eco-cars such as electric vehicles, we will contribute to promoting the shift from fossil fuels to clean energy. Additionally, for a safe mobility society, we will work on further development of support systems for autonomous driving and utilize our IoT technology etc. to realize next-generation logistics/transport solutions that help arteries in the society flow more smoothly.

In June 2018, we started a demonstration experiment concerning pure hydrogen fuel cells in the “Yume Solar Kan Yamanashi” in Komekurayama, Kofu City, Yamanashi Prefecture. In this experiment, hydrogen is produced by the electrolysis of water with clean electricity generated from photovoltaic cells, which is then used to run three 5kW pure hydrogen fuel cell batteries. The aim of this experiment is to verify reliability and efficient operational control under variable power demands. Through this demonstration experiment, we aim to improve the pure hydrogen fuel cell functions, contributing to the creation of a society where people can live safely with clean energy.

Pure hydrogen fuel cell batteries

2. Panasonic will Promote Businesses Aiming for a Sustainable Society

As efforts to promote effective utilization of resources, Panasonic will aim for sustainable use of resources through the reuse of parts and materials and product recycling.

To create factories with zero CO_2 emissions, we are switching the lighting to LED, and plan to complete this transition by the end of fiscal 2019[*1]. We will also expand the utilization of advanced energy-management systems such as FEMS[*2] and smart manufacturing. In addition, we will complete the adoption of photovoltaic power generation systems in all our business sites by the end of fiscal 2021[*1] as an initiative to increase energy creation.

As a prior example of our efforts for creating a zero CO_2 factory, Panasonic do Brazil (PANABRAS) has started using 100% renewable energy-guaranteed electricity.
Specifically, in 2016, all three factories under PANABRAS (Extrema, San Jose, and Manaus) shifted to power companies that can supply 100% renewable energy-guaranteed electricity. Through this, the factories have become the first factories in Panasonic to achieve manufacturing with 100% renewable energy-guaranteed electricity. Taking this effort by PANABRAS as a prior example toward realizing a zero CO_2 factory under the Environment Vision, we will sequentially expand the use of renewable energy.

Extrema factory in PANABRAS

*1 Installable sites

*2 Factory Energy Management System

Environment: Policy

Contributing to society has been the management philosophy for Panasonic ever since its founding, and we have been taking measures against pollution since the 1970s. We announced the Environmental Statement in June 5, 1991, clarifying our approaches to address global environmental issues as a public entity of society. Since then we have been carrying out initiatives including matters on global warming prevention and resources recycling corporate-wide, aiming to attain a sustainable, safe, and secure society.

After the completion of the Green Plan 2010 which was established in 2001, the Green Plan 2018 was established in 2010 to clarify our targets for fiscal 2019 (from April 1, 2018 to March 31, 2019) as well as an action plan for all employees in order to achieve the targets. The Green Plan 2018 will continue our initiatives in five areas: CO_2 reduction, resources recycling, water, chemical substances, and biodiversity.

In 2013, the Panasonic Group introduced a new brand slogan, “A Better Life, A Better World,” aiming to realize a better life for all its customers, and is promoting environmental initiatives as an important element in achieving that goal. Based on this, the Green Plan 2018 was revised in 2013, followed by the newly-established Environmental Action Guideline. Furthermore, in response to rising demand by the society for CO_2 reductions following the 21st session of the Conference of the Parties (COP21) of the United Nations Conference on Climate Change, and to the need to make changes to our business structure, including growth in the automotive and B2B businesses, the Plan was revised again in 2016.

Additionally, we formulated the Environment Vision 2050 in 2017 to achieve “a better life” and “a sustainable global environment,” aiming for a society with clean energy and a more comfortable lifestyle. Under the Vision, through the development of products, technologies, and solutions relating to energy creation, storage, saving, and management, Panasonic will work towards creation and more efficient utilization of energy which exceeds the amount of energy used.

Environmental Policy

Environmental Statement

Fully aware that humankind has a special responsibility to respect and preserve the delicate balance of nature, we at Panasonic acknowledge our obligation to maintain and nurture the ecology of this planet. Accordingly, we pledge ourselves to the prudent, sustainable use of the earth's resources and the protection of the natural environment while we strive to fulfill our corporate mission of contributing to enhanced prosperity for all.

Environmental Action Guideline

Toward achieving a sustainable society, we will strive to develop our business through the creation of environmental value. For this purpose, we will address environmental challenges through our business activities and will expand our environmental initiatives based on collaboration with stakeholders.

(1) Initiatives to address environmental challenges
- We will reduce CO_2 emissions through production activities and products/services.
- We will work to efficiently use resources by pursuing Recycling-oriented Manufacturing.
- We will conserve water resources through efficient use of water and prevention of contamination.
- We will reduce the impact of chemical substances on human health and the environment.
- We will consider and conserve biodiversity.

(2) Initiatives based on collaboration with stakeholders
- We will provide products and services that create environmental value for customers with our technical strengths.
- We will expand our environmental contributions with our partner companies.
- We will deepen communications with local communities and work as a team to address environmental challenges.

Environmental Action Plan

We strive to grow and develop our business through the creation of environmental value for customers with our technical strengths while each and every employee follows the Environmental Policy to address environmental challenges. Therefore, collaboration with stakeholders including our partners is essential. We will continue to sincerely work on environmental sustainability management through further collaboration with stakeholders.

Environmental Action Plan "Green Plan 2018"

The Green Plan 2018 is focused on maximizing the size of our contribution in reducing CO_2 emissions through products and services (see pages 36-37), which is an indicator that represents our efforts for CO_2 reduction, as well as on steady and continual reduction in CO_2 emissions from our factories to contribute to making net CO_2 emissions from the entire community peak and decline thereafter at an earlier timing.

Panasonic has introduced its own indicator called "the size of contribution in reducing CO_2 emissions" to strengthen CO_2 reduction efforts through products and services. The size of contribution in reducing CO_2 emissions had been disclosed from the fiscal 2011 results to represent the volume of our direct contribution to CO_2 emissions reduction by cutting down power consumption during product use through energy-saving designs for our key consumer products. Now, we are also engaged in business development in the areas of housing, automotive, and B2B. Accordingly, more of our products are being integrated into finished goods and services of other companies, contributing to their energy-saving performances. For this reason, we have defined the CO_2 emissions reduction effect in these business areas as "the size of indirect contribution to reduction," and disclosed the figures from the fiscal 2015 results. In addition, the revised Green Plan 2018 clearly stated the target amount of CO_2 reduction to clarify our contribution in these areas.

Furthermore, we define our products and services that accelerate the transition to a sustainable society, such as energy-saving performances, as Strategic Green Products (GPs). Of these, we call the products that deliver the industry's top class

environmental performance “Super GPs,” and are actively working for business expansion and wider use.

In production activities, exhaustive energy-saving measures have been implemented in all factories worldwide, pushing for further CO_2 emissions reduction in our production activities. As for resources recycling, we promote higher recycled resource utilization ratio and factory waste recycling rate, as well as create more resources recycling-oriented products to materialize recycling-oriented manufacturing.

In addition, the revised Green Plan 2018 has set new targets such as 100% completion of water risk assessments for our factories. It also clearly states zero violation of laws and regulations related to environmental pollution by factories, and products.

In the area of eco-conscious products and businesses, we have expanded the scope of our activities to products, services, and solutions in our B2B business, while applying our strengths in home appliances. The concrete numerical targets established in line with the revisions to the Green Plan 2018 are aimed at creating environmental value for our customers. Panasonic will deepen the collaboration with various partners across the supply chain and accelerate environmental initiatives to extend better impacts on the society.

We will steadily execute this Environmental Action Plan towards achieving our fiscal 2019 targets.

Environmental Action Plan “Green Plan 2018”

Priority issues	Targets for 2018
(1)Initiatives to address environmental challenges	
CO_2 Reduction	• Maximize the size of contribution in reducing CO_2 emissions through products and services[*1] (Size of contribution in reducing CO_2 emissions through products and services: 55million tons)
	• Reduce CO_2 emissions per basic unit in factories (Basic unit: -5% or more compared with 2013)
	• Expand the use of renewable energy (In-house renewable energy adoption: 10,000 MWh or more)
	• Reduce CO_2 emissions per basic unit in logistics (Basic unit of weight[*2]: -5% or more compared to 2013 [in Japan])
	• Increase the Business of Energy Conservation Support Service for the Entire Factory
Resources Recycling	• Reduce total resources used and increase recycled resources used (Recycled resin consumption: 45,000 tons or more (2014-2018 total))
	• Achieve “zero waste emission” from production activities at sites both in and outside Japan (Factory waste recycling rate[*3]: 99% or more)
	• Expand the creation of Resources Recycling-oriented Products
Water	• Increase products to save water and contribute to water recycling
	• Reduce water consumption in production activities and increase the use of recycled water
	• Water risk assessment of factories: Complete 100%
Chemical Substances	• Develop alternative technologies for environmentally hazardous substances
	• Discontinue the use of substitutable environmentally hazardous substances in products
	• Minimize the release of environmentally hazardous substances from factories
Biodiversity	• Increase products contributing to biodiversity conservation
	• Use green areas in business divisions to contribute to biodiversity conservation
	• Promote green procurement for wood toward sustainable utilization of forest resources
Compliance	• Compliance with laws and regulations (Factories and products); Zero violations

(2) Initiatives based on collaboration with stakeholders	
Customers	• Offering products, services, and solutions that improve people's lifestyles, reduce burden on the environment, and help to make our society more sustainable

Improvement of energy-saving performance of major consumer electronics products*4	Energy-saving performance improvement: 35% (compared to 2005)
Dissemination of household fuel cells	Total power generation: 440,000 MWh (2010-2018)
Dissemination of LED lighting (Residential and non-residential buildings)	LED lighting sales ratio: 75%
Dissemination of photovoltaic power generation systems	Total power generation: 5.0 million MWh (2012-2018)
Air quality improvement in living environment (air purification)	Amount of air with improved quality: equivalent to 14 million rooms (2015-2018)
Dissemination of Net Zero Energy Houses (ZEH)	ZEH*5 ratio to all detached houses: 22%
Development of smart cities	Start construction/sales: 3 sites (870 lots) (2015-2018)
Increasing automotive battery supply	Battery supply meeting the demand: 200% (compared to 2014)
Dissemination of eco-conscious B2B equipment*6	Expansion of sales in Strategic GPs: 120% (compared to 2015)

	• Promote 'eco' marketing firmly rooted in each region and country
Supply Chain	• Increase environmental contributions through the promotion of Green Procurement with suppliers (Establish environmental management systems and address five major environmental challenges)
	• Promote the ECO-VC (Value Creation) Activity aimed at simultaneously achieving environmental contributions and cost reductions
Local Communities	• Participate in presenting proposals for environmental policies by the government, aimed at the creation of a sustainable society
	• Implement initiatives contributing to local communities and educate children who will be the major players in the next generation (Promote Panasonic Eco Relay for Sustainable Earth) (Provide environmental education to 3 million children or more around the world by 2018)

Note: 2005, 2010, 2012, 2013, 2014, 2015 and 2018 here refer to fiscal 2006 (April 1, 2005 - March 31, 2006), fiscal 2011(April 1, 2010 - March 31, 2011), fiscal 2013 (April 1, 2012 - March 31, 2013), fiscal 2014 (April 1, 2013 - March 31, 2014), fiscal 2015 (April 1, 2014 - March 31, 2015), fiscal 2016 (April 1, 2015 - March 31, 2016), and fiscal 2019 (April 1, 2018 - March 31, 2019), respectively.

*1 The size of contribution in reducing CO_2 emissions is defined as the amount achieved by deducting the actual emissions from the amount that would have been emitted without the improvements by the energy-saving performance of our products and productivity from fiscal 2006, and this amount is combined with the emission reduction resulting from power generation by energy-creating products. This total of size of direct contribution through our key consumer products, and indirect contribution through our main housing, automotive, and B2B businesses. (see pages 36-37)

*2 CO_2 emissions per basic unit in logistics = CO_2 emissions in logistics/Transportation weight

*3 Factory waste recycling rate = Amount of resources recycled/ (Amount of resources recycled + Amount of landfill)

*4 Air conditioners, refrigerators, TVs, washing machines, etc.

*5 A ZEH is a house designed to produce net-zero or nearly zero consumption of primary energy per year by improving the energy-saving performance of the housing structure and equipment and utilizing energy efficient means such as renewable energy. The Japanese government aims to make ZEH as the standard for new houses by 2020. Including Nearly ZEH (A house that reduces its primary energy consumption per year by 75% to less than 100% by utilizing energy efficient means such as renewable energy).

*6 Audio-visual solutions and mobility solutions equipment (such as laptop PCs) etc.

Our performance in fiscal 2018 compared with the numerical targets in the Green Plan 2018 is shown below.

Numerical Targets and Performance Levels under Green Plan 2018

Priority issues	Numerical targets	Results in 2017	Pages
(1) Initiatives to address environmental challenges			
CO_2 Reduction	Size of contribution in reducing CO_2 emissions through products and services: 55million tons	60.97 million tons	p.37
	Reduction in CO_2 emissions per basic unit in factories: -5% or more compared with 2013	14%	p.42
	In-house renewable energy adoption: 10,000 MWh or more	21,000MWh	p.44
	Reduction in CO_2 emissions per basic unit in logistics: -5% or more compared to 2013 (in Japan)	4.6%	p.46
Resources Recycling	Recycled resin consumption: 45,000 tons or more (2014-2018 total)	64,900 tons	p.49
	Factory waste recycling rate: 99% or more	99.1%	p.53
Water	Water risk assessment of factories: Complete 100%	100%	p.59
Compliance	Compliance with laws and regulations (Factories and products); Zero violations	5 violations	p.24
(2) Initiatives based on collaboration with stakeholders			
Customers	Energy-saving performance improvement of products: 35% (compared to 2005)	44%	p.38
	Total power generation of household fuel cells: 440,000 MWh (2010-2018)	382,000 MWh	p.39
	LED lighting sales ratio: 75%	77%	p.38
	Total power generation of photovoltaic power generation systems: 5.0 million MWh (2012-2018)	4.51 million MWh	p.39
	Amount of air with improved quality: equivalent to 14 million rooms (2015-2018)	10.90 million rooms	p.33
	ZEH ratio to all detached houses: 22%	28%	p.40
	Start construction/sales of smart cities:3 sites (870 lots) (2015-2018)[*7]	3 sites (531 lots)	p.40
	Automotive battery supply meeting the demand: 200% (compared to 2014)	178%	p.39
	Sales expansion of eco-conscious B2B equipment (Strategic GPs): 120% (compared to 2015)	120%	p.32
Local Communities	Provide environmental education to 3 million children or more around the world	2.885 million children[*8]	website[*9]

*7 Smart cities constructed and sold by Panasonic Homes Co., Ltd.

*8 Cumulative total from 2009 to 2017. Results for 2017 alone is 85,500.

*9 Contribution to Local Communities and Education for the Next Generation
http://www.panasonic.com/global/corporate/sustainability/eco/community.html

Note: 2005, 2009, 2010, 2012, 2013, 2014, 2015, 2016, 2017 and 2018 here refer to fiscal 2006 (April 1, 2005 - March 31, 2006), fiscal 2010 (April 1, 2009 - March 31, 2010), fiscal 2011 (April 1, 2010 - March 31, 2011), fiscal 2013 (April 1, 2012 - March 31, 2013), fiscal 2014 (April 1, 2013 - March 31, 2014), fiscal 2015 (April 1, 2014 - March 31, 2015), fiscal 2016 (April 1, 2015 - March 31, 2016), fiscal 2017 (April 1, 2016 - March 31, 2017), fiscal 2018 (April 1, 2017 - March 31, 2018), and fiscal 2019 (April 1, 2018 - March 31, 2019), respectively.

Environment: Environmental Governance

Promoting Corporate-wide Environmental Sustainability Management Centering on PDCA

Striving for the creation of a sustainable society, we are following our initiative under the executive officer in charge of environmental affairs (Yoshiyuki Miyabe Senior Managing Executive Officer as of August 2018) and working to fulfill our corporate social responsibility through eco-conscious business activities as well as to resolve environmental issues such as climate change, resources, water, etc.

Panasonic Group formulates its annual environmental management policy in accordance with the Group management policy, the Environment Vision 2050, Environmental Action Guideline, and the environmental action plan, “Green Plan 2018.” The annual environmental policy is shared across the entire organization through the Operation Policy Meeting led by the executive officer in charge of environmental affairs, who has the authority delegated from the president. Companies, business divisions, and Regional Headquarters outside Japan establish their own environmental policies and targets based on this Group policy, and plan and promote their activities accordingly.

The progress and results of activities for the key environmental targets we pledged achieving to society under the Green Plan 2018, as well as Environment Vision 2050 are examined in the Group Strategy Meeting. This meeting is attended by the presidents of Panasonic Corporation and the four Companies as well as other members of senior management, for reviews of policy directions, issues, and, particularly important measures to be adopted.

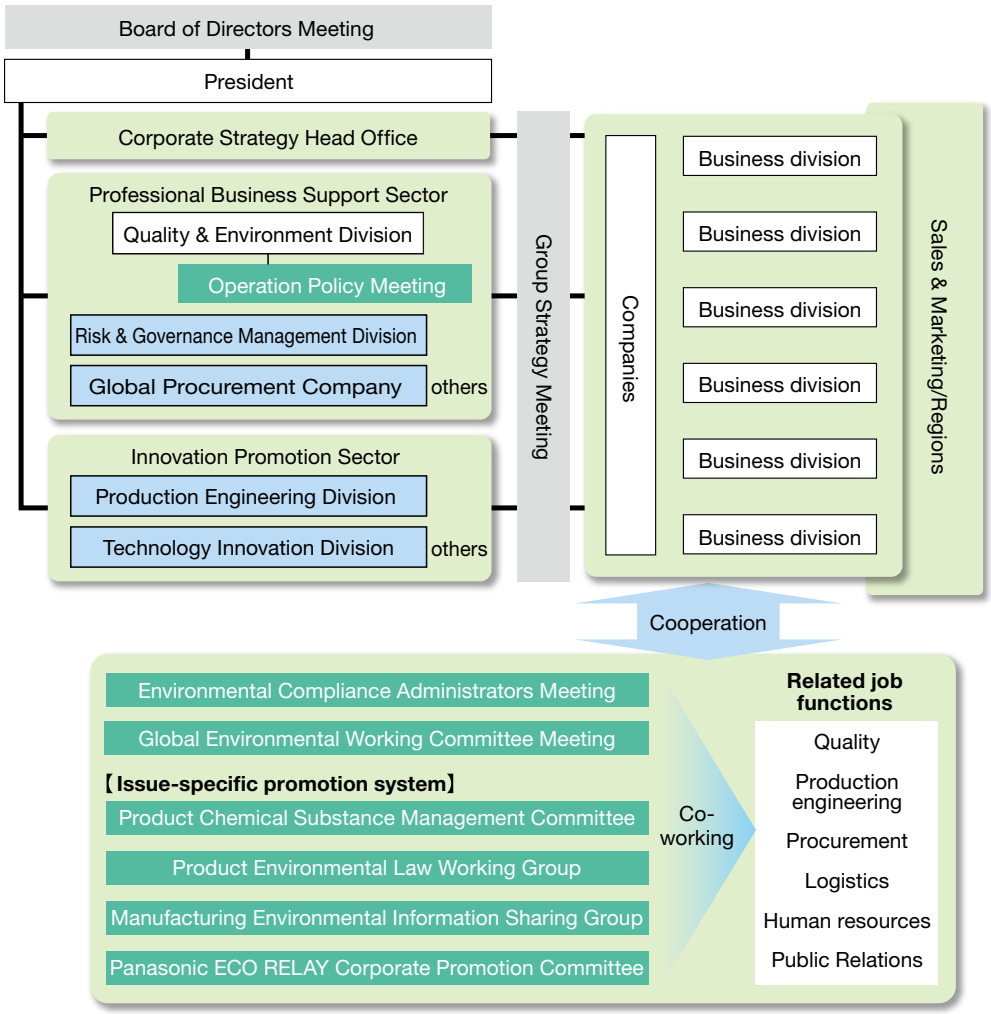
In fiscal 2017, the Environmental Compliance Administrators Meeting (held twice a year) attended by the executive officer in charge of environmental affairs and environmental compliance administrators at the four Companies was newly established to accelerate decision-making for corporate-wide action in the area of the environment. In addition, as has been the way until now, successful practices, challenges in implementation, and approaches to mid-term to long-term targets at Companies and various regions are shared and discussed at the Global Environmental Working Committee Meeting, held twice a year, which consists of environmental compliance administrators and environmental operation administrators at Companies and Regional Headquarters, seeking to enhance the level of corporate-wide environmental sustainability management through the PDCA management cycle.

In principle, results of activities relevant to environmental targets are gathered and assessed on a monthly basis as environmental performance data, to identify the achievements, and additional measures are taken as needed. Feedback of annual performance data is given internally and disclosed externally after review, onsite audits, and independent assurance by a third-party. Moreover, reviews and feedback from stakeholders are utilized in subsequent measures to ensure further continuous improvement.

Promotion System for Environmental Sustainability Management

To implement key measures across the entire company, theme-specific committees and working groups are formed to set a promotional structure that enables coordinated action across Companies, related job functions, and Regional Headquarters outside Japan. Specific examples include the Product Chemical Substance Management Committee which deliberates and ensures the implementation of chemical substance management guidelines, and the Product Environmental Law Working Group which engages in information sharing regarding product-related legislation and reviews the actions to be taken.

Promotion System of Environmental Sustainability Management in Fiscal 2019



Environment: Environmental Management Systems

Environmental Sustainability Management Founded on Environmental Management Systems (EMS)

As the foundation of environmental sustainability management, Panasonic established EMS in all of our manufacturing sites across the world in fiscal 1999, and has continued to have the sites ISO14001 certified since then.

In order to further reinforce environmental sustainability management globally, we have established EMS in all our sites including non-manufacturing sites across the world, and these sites have certified ISO14001 in principle. In October 2011, we published the Environmental Management System Establishment Guidelines that summarize EMS concepts for different business forms such as manufacturing, sales and services, and head office administration, aiming to build EMS in accordance with the Basic Rules for Environmental Affairs on a global scale. Based on the Guidelines, Group-wide action is underway to achieve the goals set out in the Green Plan 2018.

The revisions to ISO 14001 in 2015 called for consolidation of environmental and business activities as well as for actions from a wider perspective. In response to the revision, activities are underway to gain deeper understanding, including in-house seminars on the transition held at each Company and business division, training sessions for internal auditors, information-sharing with divisions that have already made the transition, and materials exclusively prepared for top management aimed at promoting awareness. We will work to complete compliance with the new standards during the transition period until September 2018.


Training session for internal auditors

Obtainment of ISO 14001 Certification (as of end of March 2018)

Region	Number of certifications obtained*1		Total
	Manufacturing	Non-manufacturing	
Japan	14	14	28
North America & Latin America	16	0	16
Europe & CIS	12	2	14
Southeast Asia, & Oceania	41	9	50
China & Northeast Asia	52	0	52
India, South Asia, Middle East & Africa	6	3	9
Total	141	28	169

*1 Including multi-site certifications. Depending on the consolidation and closure of sites and promotion of multi-site certifications, the number of certifications obtained varies each year.

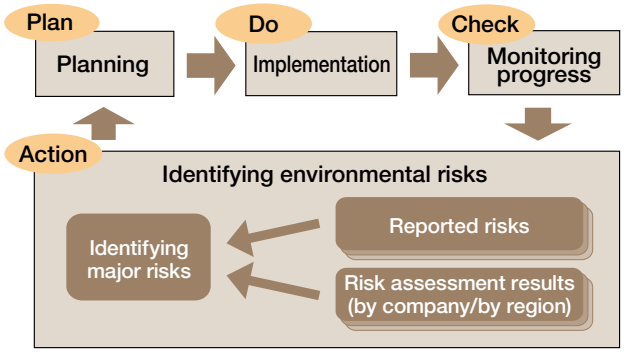
▶Obtaining of ISO 14001 Certification
http://www.panasonic.com/jp/corporate/sustainability/pdf/eco_isolist2017.pdf

Environment: Environmental Risk Management

Group-wide Systems to Manage Environmental Risks

As a tool to continuously reduce environmental risks, Panasonic has established an Environmental Risk Management System specific to each Company. In accordance with the basic risk management policy for all Companies (see page 8), we promote (1) identification of environmental risks and group-wide risk management each year, and (2) ensuring quick responses to reported environmental risks.

Classification of Environmental Risks and Countermeasure Implementation



To identify environmental risks and implement the management system, environmental risks are identified for each Company and for each region in the world each year. From these risks, environmental risks on a group-wide level are selected. The risks that show a high level of frequency or seriously impact business management are designated as major risks and prioritized in planning and executing risk-reducing measures. These measures are implemented for each major risk, and progress is monitored and followed up on a quarterly basis in the PDCA cycle.

When an environmental risk is found, the relevant Company, related job functions, and Regional Headquarters collaborate to promptly implement emergency measures and recurrence prevention measures adapted to the risk level. Also, the management flow in case of risk discovery is standardized to prevent the occurrence of secondary risks as a result of confusion.

Environmental Compliance Management at Factories

Panasonic manages its environmental systems in full compliance with laws and regulations. We regularly measure emissions of gas, wastewater, noise, odor, etc., and introduce preventative measures for cases that may lead to serious violations.

Furthermore, key human resources are developed for information sharing among the Companies/Business Divisions, environment-related job functions, and Regional Headquarters, to ensure exhaustive compliance with legislation related to factory environment management in respective countries where Panasonic manufacturing sites are located. Specifically, activities to share information as well as specialized training are conducted for factory management officers in charge of the management of chemical substances, waste, wastewater, and exhaust gas, either by country or by region in Japan, Europe, China, and Southeast Asia. Field surveys on laws and regulations using checklists were conducted on a global scale to confirm comprehensive implementation of environmental compliance, and we also conducted verification of the effectiveness of various measures.

However, in fiscal 2018, we discovered five violations of environment-related legislation across the world. These cases were promptly reported to the respective authorities along with implementation of countermeasures against the causes of such violations and we have already corrected the issues in order to meet the standard requirements. We continue our efforts for thorough legal compliance and the prevention of any recurrence.

Case of Violations of Laws and Ordinances (e.g. excess of the standard legal level) in Fiscal 2018

Region	Environmental pollution					Other	Total
	Air	Water quality	Noise	Odor	Waste	Permission / Approval	
Global (including Japan)	2	1	0	0	1	1	5
(Japan)	(1)	(0)	(0)	(0)	(0)	(0)	(1)

Compliance with Environmental Regulations Relating to Products

Panasonic manages compliance with regulations relating to its products through a quality management system. Compliance with regulations is ensured with our Products Assessment System, a mechanism which incorporates environmental performance targets such as customer demands for environmental performance, the energy efficiency labeling program, and third-party certification systems, as well as evaluation of compliance with regulations on chemical substance management, energy efficiency, 3R, and recycling, to (1) establish general targets at the product planning stage, (2) define concrete targets at the design planning stage and confirm compliance at the design stage, (3) conduct interim assessment at the design completion stage, and (4) conduct final assessment at the mass production decision-making stage. Additionally, acceptance inspections are being conducted on a regular basis for purchased components to ensure compliance with the RoHS Regulations which regulates the content of six hazardous substances (see page 61 “Chemical Substances Management”).

In fiscal 2018, no violations concerning chemical substance management were discovered. We continue our efforts for thorough legal compliance.

Measures Against Soil and Groundwater Contamination

In the latter half of the 1980s, soil and groundwater contamination due to chlorinated organic solvents was detected at some Panasonic sites. In response, we have conducted anti-contamination activities across the company. Specifically in 1991 we created the Manual for Preventing Contamination of Soil and Groundwater and began conducting necessary surveys and measures. In 1995 we discontinued the use of chlorinated organic solvents, and in 1999 created Guidelines on the Prevention of Environmental Pollution to ensure there would be no recurrence of similar problems at our sites. In fiscal 2003 we began enhancing our surveys and measures to comply with relevant laws and regulations, including the Soil Contamination Countermeasures Act, which was enforced in Japan in 2003, and in fiscal 2004 started implementing measures to place all our bases across the globe under management supervision with regard to soil and groundwater.

Specifically, we conduct onsite inspections and interviews at the bases, in addition to surveying their use of VOCs and heavy metals. Furthermore, we implement surface soil surveys within the premises. For the sites where contamination was detected beyond the regulatory pollution standards, we conduct detailed borehole surveys to identify the boundaries of the contaminated areas and take remedial measures.

As a result of these efforts, we were able to place all our bases under management supervision in 2008. Furthermore, in fiscal 2011, the management supervision scheme was purpose-specifically reorganized and reinforced to establish a new management supervision scheme. With the highest priority given to preventing dispersion of pollution beyond our premises, this new scheme is implemented across all operating sites to further improve the level of measures against contamination. In fiscal 2017, we reviewed the new management supervision guidelines in response to the amended Soil Contamination Countermeasures Act in Japan.

Soil and Groundwater Risk Management Policy

Conditions subject to management supervision	Procedure
Pollution dispersion prevention beyond Panasonic premises	1. Conduct historical surveys 2. Determine and install monitoring wells at the premises' borders 3. Analyze groundwater at the borders 4. Check possibility of pollution from external sources 5. Report to management department 6. Determine the external pollution dispersion prevention methods 7. Install the external pollution dispersion prevention methods 8. Install assessment wells 9. Begin assessments (monitoring)
Thorough pollution source elimination	10. Conduct brief status check 11-1. Horizontal direction detailed analysis 11-2. Vertical direction detailed analysis 12. Determine the magnitude of pollution 13. Discuss the areas and methods of purification 14. Conduct purification and install pollution dispersion prevention measures 15. Monitor pollution source (groundwater) after purification 16. Report purification completion to management department

Soil and Groundwater Pollution Surveys and Remedial Measures for Fiscal 2018

Region	Number of sites that completed remedial measures	Number of sites currently taking remedial measures
Global (including Japan)	0	39
Japan	(0)	(33)

Initiatives for PCB Pollution

Our initiatives for PCB pollution are introduced on the following website.

http://www.panasonic.com/global/corporate/sustainability/eco/governance/risk.html

Environment: Environmental Information Systems

Integrated Management of Corporate Environmental Information

In order to implement the PDCA cycle for environmental sustainability management, it is essential to collect a significant amount of environmental performance data on energy, waste, chemical substances, and water, etc. at each business site in a prompt and accurate manner.

Panasonic has built and introduced an environmental performance system, the Eco System (Factory), to globally collect and manage environmental data from all of our business sites. With this system, monthly CO_2 emissions are managed in particular, allowing checking the progress of initiatives and identifying issues. The system plays an important role in achieving the reduction of CO_2 emissions by sharing the information and taking measures.

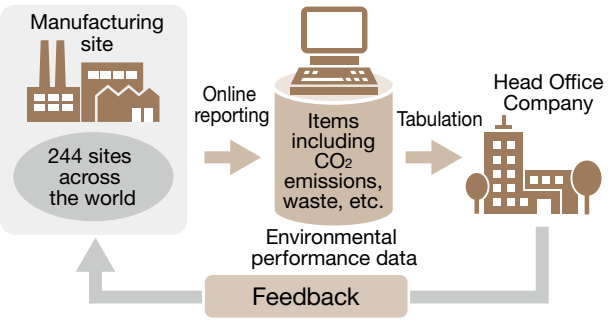
The Eco System (Factory) is also functioning as a scheme for sharing information on the status of compliance among sites across the world. In the event of complaints from local community residents or when a specific value exceeds ordinance-regulated levels, the person in charge at the business site enters such data, which is instantaneously e-mailed to relevant persons at the Company and the Head Office. This enables swift information-sharing and appropriate action.

As for products, legislation relating to chemical substances in products is becoming more stringent, and communication and disclosure of information in the supply chain are mandatory under the REACH Regulations.

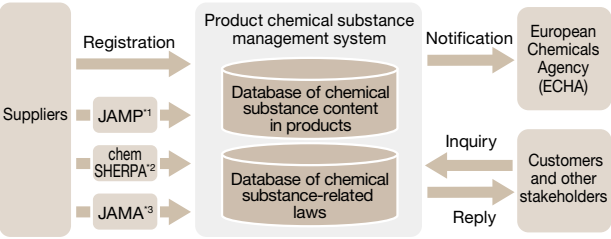
Panasonic has developed its own product chemical substance management system based on industry-standard information handling method in order to respond to a wide range of regulations and requirements. In January 2017, we renewed the system to adopt the chemSHERPA, the new format for information handling of chemical substances in products developed by the Ministry of Economy, Trade and Industry. With the expansion of our business, we also adopted JAMA/IMOS, the standard material data system for automotive industry, in order to respond to increasingly complicated and expanding product regulations.

Also, we aim to cut down CO_2 emissions during product use by improving the energy-saving performance of our products. For this reason, the Eco System (Product) is used to globally assess the size of contribution in reducing CO_2 emissions by linking product performance data such as annual power consumption for each product category with other data such as sales volume and CO_2 emission factors in each region.

Mechanism of the Eco System (Factory)

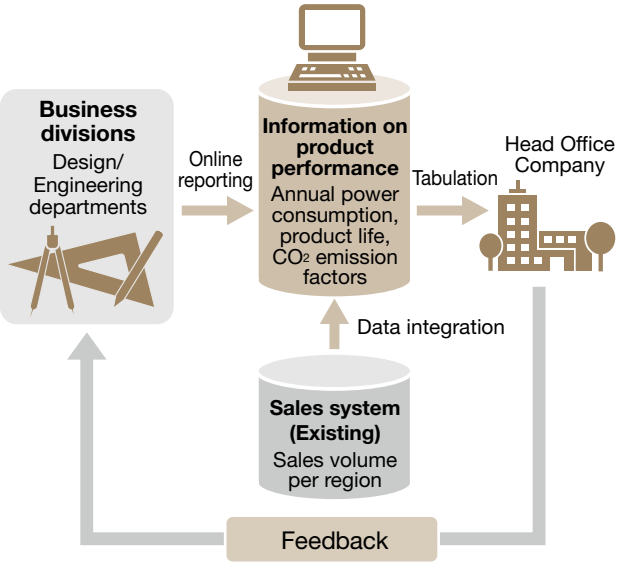


Mechanism of the Product chemical substance management system



*1 Flow of information handling recommended by the Joint Article Management Promotion Consortium.
*2 New format for information handling of chemical substances in products developed by the Ministry of Economy, Trade and Industry
*3 Standard survey format for the automotive industry

Mechanism of the Eco System (Product)



Environment: Overview of Environmental Impact and Environmental Accounting

Overview of Environmental Impact from Business Operation

In order to mainly manufacture and market electrical and electronic products, Panasonic consumes petroleum and electricity as energy sources and resources as raw materials of parts and components. As a result, we emit CO_2 and wastes into the environment. This diagram maps the environmental impact from our business operation from a procurement stage to recycling activities. Also, GHG throughout the entire supply chain is classified into Scope 1, Scope 2, and Scope 3 and assessed according to the GHG Protocol, the international calculation standard.

Overview of Environmental Impact from Business Operation

INPUT	Suppliers	OUTPUT
Energy: 43 thousand TJ Electricity: 3.66 billion kWh Town gas: 0.13 billion m³ LPG: 12 thousand tons Heavy oil: 9 thousand kl Kerosene: 2 thousand kl Renewable energy: 21 thousand MWh*1 Resources Recycled resin: 14.3 thousand tons Recycled iron: 108 thousand tons Water: 25.84 million m³ Chemical substances: 282,508 tons*2	Production	CO_2: 2.28 million tons*3 GHGs other than CO_2 from energy use (CO_2-equivalent): 0.13 million tons Total wastes including revenue-generating waste: 372 thousand tons Landfill: 3.1 thousand tons Water discharged: 20.47 million m³ Release and transfer of chemical substances: 4,757 tons*4
Energy: 7.369 million GJ*5 Biodiesel fuel: 20 kl*6	Logistics	CO_2: 0.944 million tons
Electricity: 121.1 billion kWh	Product use	CO_2: 64.49 million tons
Collected products: 145 thousand tons*6*7 CRT TVs: 8 thousand tons Plasma/LCD TVs: 6 thousand tons Air conditioners: 28 thousand tons Refrigerators/freezers: 57 thousand tons Washing machines/ clothes dryers: 46 thousand tons PCs: 9 tons	Recycling	Recycled products: 106 thousand tons*6*7 Metals: 79 thousand tons Glass: 3 thousand tons Other: 24 thousand tons Generated waste: 39 thousand tons*6

Production: 244 manufacturing sites

Logistics: Logistics stage of procurement, production, marketing and waste by partner companies and Panasonic.

Product use: Lifetime power consumption (a) of major products*8 with large amounts of energy use and CO_2 emissions (b) associated therewith.

a = Annual power consumption of a model sold*9 x Sales quantity x product life*10

b = Annual power consumption of a model sold*9 x Sales quantity x product life*10 x CO_2 emission factor*11

Recycling: Recycling of products means to use by oneself or to make into a state available for sale or free of charge the components and materials of a separated product.

*1 Figures from photovoltaic, wind, and biomass sources. Heat pumps not included.

*2 Target substances include all substances in the Panasonic Group Chemical Substances Management Rank Guidelines (For Factories).

*3 The factors related to fuels are based on the Guidelines for Calculation of Greenhouse Gas Emissions (version 4.3.1) published by the Japanese Ministry of the Environment. The CO_2 emission factor for electricity purchased in Japan (kg-CO_2/kWh) is fixed at 0.410. The factors above are also used for electricity purchased from power producers and suppliers (PPS). The GHG Protocol factors for each country are used for electricity purchased outside Japan.

*4 Release amount: Includes emissions to air, public water areas, and soil.
Transfer amount: Includes transfer as waste and discharge into the sewage system. Recycling that is free of charge or recycling where Panasonic pays a fee for treatment under the Waste Management and Public Cleaning Law is included in "Transfer." (Different from the transferred amount reported under the PRTR Law.)

*5 Intra-region outside Japan not included.

*6 Figures for Japan.

*7 Air conditioners, TVs, refrigerators/freezers, washing machines/clothes dryers, and PCs.

*8 Household air conditioners, commercial air conditioners, fluorescent lamps, LED lamps, household refrigerators, commercial refrigerators, LCD TVs, washing/drying machines, fully-automatic washing machines, clothes dryers, dish washer and dryers, IH cooking heaters, EcoCute, bathroom ventilator-dryers, humidifiers, dehumidifiers, air purifiers, extractor fans, vending machines, electronic rice cookers, microwave ovens, warm-water washing toilets, clothing irons, hair dryers, under-rug heaters, vacuum cleaners, electric thermal pots, extractor hoods, telephones, security cameras, projectors, production modulars etc.

*9 For each product category, the model that was sold in the largest quantity in the region was selected.

*10 Number of years during which spare parts for the product are available (defined by Panasonic).

*11 Regional CO_2 emission factors (kg-CO_2/kWh) used: 0.410 (Japan); 0.487 (Europe); 0.579 (NorthAmerica); 0.740 (China & Northeast Asia); 0.927 (India & South Asia); 0.527 (Southeast Asia & Oceania); 0.332 (Latin America); and 0.599 (Middle East & Africa).

GHGs from the Whole Supply Chain (by Scope)

Category		Emissions(10,000 tons)	
		FY2017	FY2018
Scope 1 *12		44	46
Scope 2 *13		197	195
Scope 3 *14	1. Purchased goods and services	1,291	1,294
	2. Capital goods	89	112
	3. Fuel- and energy-related activities	13	13
	4. Upstream transportation and distribution	81.7	94.4
	5. Waste generated in operations	1.8	1.8
	6. Business travel	2.3*15	2.6*15
	7. Employee commuting	3.6*15	3.6*15
	8. Upstream leased assets	1.0*15	0.8*15
	9. Downstream transportation and distribution	2.2*15	2.1*15
	10. Processing of sold products	–	–
	11. Use of sold products	6,350	6,449
	12. End-of-life treatment of sold products	122	127
	13. Downstream leased assets	–	–
	14. Franchises	–	–
	15. Investments	–	–

*12 Direct emissions from facilities owned and controlled by Panasonic (e.g. emissions from use of town gas or heavy fuel oil).

*13 Emissions from production of energy consumed at facilities owned and controlled by Panasonic.

*14 Other indirect emissions, excluding Scope 1 and Scope 2.

*15 Figures for Japan.

Environmental Accounting

Panasonic globally collects data on its environmental conservation costs and economic benefits obtained through its environmental activities in relation to generated/controlled environmental impact. This data is internally utilized as basic information for our continuing environmental sustainability management.

Environmental Accounting for Fiscal 2018

Environmental conservation in factories	
Investments*16	3,990 million yen
Expenses*16,*17	112 million yen
Economic benefit	2,084 million yen

*16 Includes all investments relating to environmental conservation. The difference or appropriate portions (divided proportionally) are not calculated.

*17 Expenses include a cost of capital investment depreciation. For example, if latest energy-saving facilities were installed, the value includes depreciation for the first year but not for the second year and later.

Environmental Conservation Benefits for Fiscal 2018 (in physical terms)

Categories	Emission reduction	Reference indicator: environmental impact	
		Fiscal 2017	Fiscal 2018
CO_2 emissions from production activities	0.02 million tons	2.30 million tons	2.28 million tons
Human Environmental Impact	4 thousand counts	526 thousand counts	522 thousand counts
Landfill of waste	0.0 thousand tons	3.1 thousand tons	3.1 thousand tons
Water consumption	1.48 million m^3	27.32 million m^3	25.84 million m^3

Fiscal 2018 data on the reduced amount of electricity and effect of reduced electricity costs through our energy-saving products are as shown in the chart below.

Economic Effects for Customers for Fiscal 2018

Electricity cost reduction from product usage (global)	
Reduced amount of electricity*18	84.8 billion kWh
Reduced electricity costs*19	1,727 billion yen

*18 Calculated under the same conditions as when determining the size of contribution in reducing CO_2 emissions through energy-saving products (see page 36).

*19 Electricity costs were set for each region based on IEA Statistics.

We are also engaged in R&D of new products that create environmental value. The R&D expenses related to environmental management were approx. 9.5 billion yen in fiscal 2018.

Environment: Eco-conscious Products and Factories

Initiatives for Eco-conscious Products (Green Products)

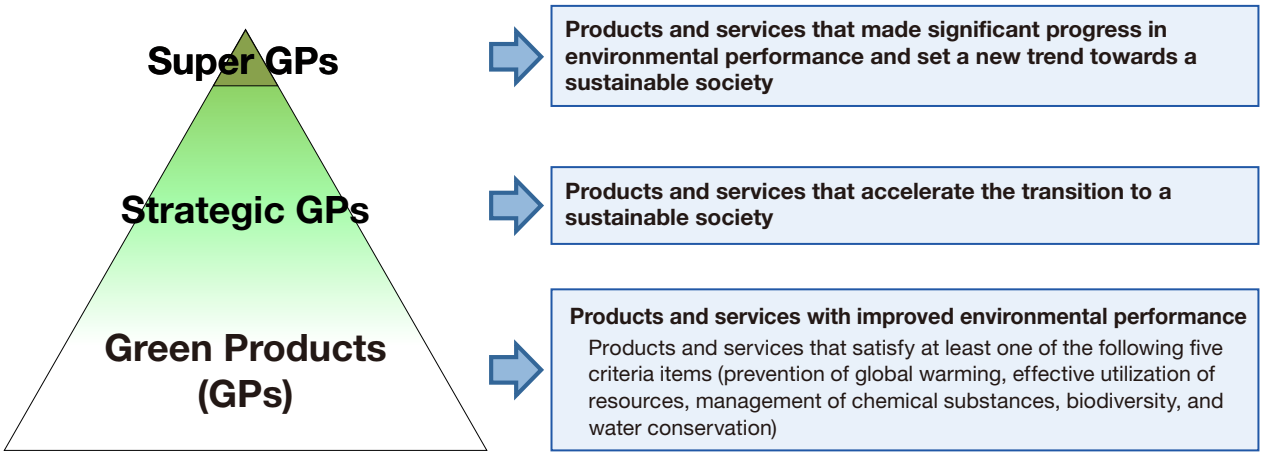
Panasonic uses a product assessment system that evaluates the environmental impacts of our products and services starting at the planning and design stages. Based on our criteria, we accredit our products and services that achieved high environmental performance as Green Products (GPs).

In the GP accreditation criteria, we assess the performance of our products in terms of prevention of global warming, effective utilization of resources, and management of chemical substances by comparing not only among our own products but also with competitors' products. In fiscal 2012, we took steps to further enhance our accreditation criteria by adding biodiversity and water conservation to existing items. This has in turn enabled the creation of a wider range of GPs.

Starting in fiscal 2014, the existing Superior GPs[*1] have been enhanced to designate products and services that accelerate the transition to a sustainable society as Strategic GPs. Of these products, products that particularly create new trends are certified as Super GPs.

*1 Products and services that showed superior environmental performance to products in the same category in the industry.

Green Product Structure



Definition of Strategic GPs

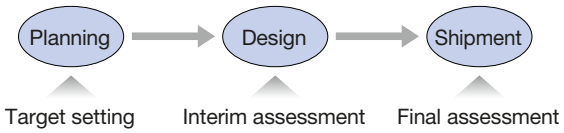
Products and services that accelerate the transition to a sustainable society:

(1) Products and services that reduce environmental impact with top-level environmental performance in the industry
(Energy-/Resources-/Water-saving products, etc.)

(2) Products and services whose promotion and dissemination lead to reducing environmental impact
(Recyclable or energy-creating products, energy-storing products, energy management systems, Smart Houses and Smart Cities, smart meters, products/services that support next-generation vehicles and environmental performances of stores, LED lighting, etc.)

(3) Products and services that reduce environmental impact on a specific region, or support measures to address environmental impact
(Air filtration devices, water filters, environmental engineering service, etc.)

Products Assessment System



Product Environmental Assessment		
Items for assessment		Assessment criteria
(1) Products	Prevention of global warming	CO_2 emissions and energy saving
	Effective utilization of resources	Resource saving, light weight/downsizing, number of reused parts, durability, amount of recycled resources used, structure to recovery/recycling, etc.
	Water and biodiversity conservation	Water saving, consideration for biodiversity
	Comparison with competitors' products	
(2) Production process (of relevant products)	Prevention of global warming	CO_2 emissions and energy saving
	Effective utilization of resources	Resource saving, mass of packaging materials to be wasted, amount of resources used, amount of waste from factories, etc.
(3) Packaging	Effective utilization of resources	Resource saving, light weight/downsizing, amount of foamed plastic used, amount of recycled resources used, etc.
(4) Instruction manual	Effective utilization of resources	Resource saving, light weight/downsizing, amount of recycled resources used
(1) (2) (3) (4)	Management of chemical substances	Panasonic's Chemical Substances Management Rank Guidelines (for products and factories)
LCA*2		Global warming
Information management		Green procurement, information provision across the supply chain, etc.

Laws/regulations and criteria, guidelines, and environmental action plan of Panasonic

*2 Life Cycle Assessment: Method of quantitatively assessing the environmental impact of products at each life cycle stage.

Expanding the Scope of Strategic GPs

Panasonic has been devoting much of its energies into the creation of No. 1 eco-conscious products (Superior GPs) until fiscal 2013. In the course of business reorganizations such as expansion of B2B businesses, Panasonic has decided not only to pursue environmental performance of consumer products but also to work on further expansion of products and services that lead to the mitigation of environmental impact. Starting in fiscal 2014, the concept of Strategic GPs has been introduced for the creation of such products and services. In addition to alleviating impact on the global environment with top-level environmental performance, we aim to accelerate the drive to shift to a sustainable society through a variety of business operations, including those that are expected to reduce impacts through wider dissemination and those directly cutting impact in specified regions.

The sales ratio of Strategic GPs in fiscal 2018 accounted for approx. 21% of the total sales. Additionally, in our Green Plan 2018, we have set the fiscal 2019 target as 120% of expansion of sales in eco-conscious B2B Strategic GPs (compared with fiscal 2016). The result of fiscal 2018 was 120% compared to fiscal 2016. Panasonic will work to further push up the ratio of Strategic GPs in the future.

The following three were named Super GPs for fiscal 2018: FA servo “MINAS A6” family; Data archiver “freeze-ray”; and Air quality improvement products with PM2.5 purification function.

FA Servo “MINAS A6” Family:

Optimized magnetic circuit and the adoption of unique motor structure to increase heat dissipation shortened the length of the body by 30% and lightened the weight by 20% compared with the conventional one, realizing reduction in size and weight at the industry’s highest level. In addition, Panasonic’s own control software algorithm technology and the application of a high-performance CPU drastically enhanced the responsiveness of a servo motor, which contributes to increase the production of machine and equipment that require high-speed positioning. Further, the industry-first wireless servo amplifier enabled remote adjustment.

FA Servo Motor and Servo Amplifier with wireless dongle

Data Archiver “freeze-ray”:

The “freeze-ray” data archiving system was developed in order to meet customers’ needs for long-term storage of large data in response to the development and application of IoT and AI technologies. Newly developed optical discs with triple in capacity compared with conventional discs and sophisticated robotics technology realized high-reliable and large data storage capacity of 1.9 PB at a maximum. There is no need for air conditioning costs of data storage, making it possible to consume less electricity. In addition, this optical discs made from long-lasting materials with environmental stress resistance enable to drastically reduce constant migration, contributing to saving resources.

https://panasonic.net/cns/archiver/

Data Archiver “freeze-ray”

Air quality improvement products with PM2.5 purification function:

This range of products improves indoor air quality by purifying outdoor air through filters with high dust collecting capacity during airing. In order to mitigate the effects of worsening PM2.5 in China, Panasonic developed ventilation products with a top-class purifying capacity with PM2.5 removal rate of 98%. The PM2.5 sensor in the products measures a condition of air release, air supply, and air circulation. Amid growing attention to air quality in response to an environmental policy in China, the sensor enables customers to easily see indoor and outdoor air environment by showing the condition on the liquid-crystal display. Additionally, the products are designed for low noise not to disturb a living environment.

http://pesesgd.panasonic.cn/products/ (Chinese)

Wall-mounted energy recovery ventilator (ERV) unit

Improving Air Quality in Living Environments

Air pollution caused by PM2.5 etc. is now a major social issue not only in developed countries such as Japan but also in emerging countries including China and India. With this background, Panasonic has set offering products, services, and solutions that improve people’s lifestyles, reduce burden on the environment, and help make our society more sustainable as the fiscal 2019 target in its Green Plan 2018. One specific element of the Plan is to improve the air quality of living environments (air purification), with a target figure equivalent to 14 million rooms with improved air quality over fiscal 2016 to 2019. The cumulative total for over fiscal 2016 to 2018 is equivalent to 10.90 million rooms.

Examples of air purifiers are introduced in the following website.
http://www.panasonic.com/global/corporate/sustainability/eco/gp_gf.html

Initiatives for Eco-conscious Factories (Green Factories)

Panasonic is working on Green Factories (GF) activities in its efforts to cut down environmental impact caused by manufacturing. Specifically, based on legal compliance, each factory develops a variety of plans for reducing environmental impact in production activities, focusing on CO_2 emissions, total waste generation, water consumption, and chemical substance releases and transfers. Progress control is implemented and improved through total emissions reduction and specific unit management to achieve both environmental impact reduction and business management.

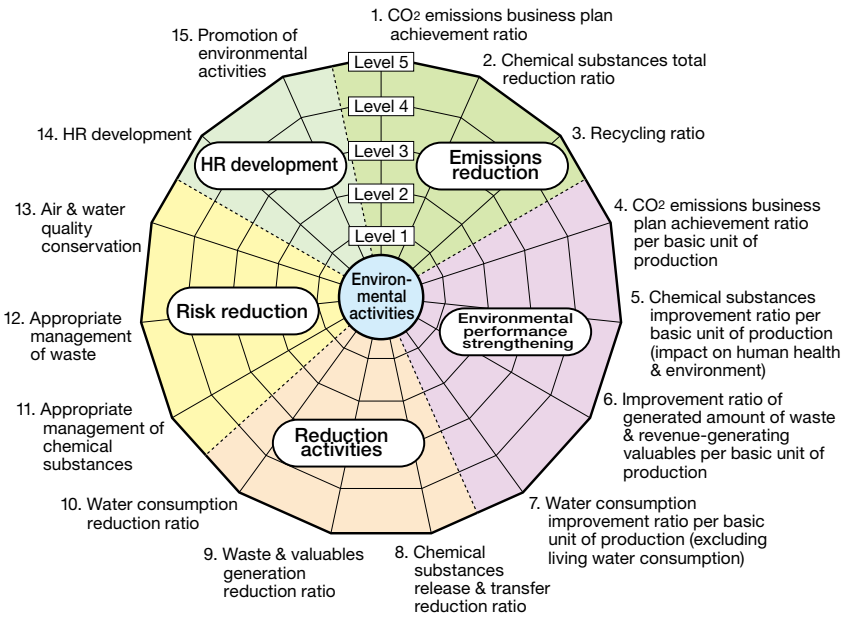
The GF assessment system was introduced in fiscal 2011, aiming for further advancement by visualizing the activity levels at factories. Under the system, the factories evaluate themselves on a one-to-five scale across 19 environmental activity items classified into six basic groups: emissions reduction, environmental performance enhancement, reduction activities, risk reduction, human resource development, and management. Comparing the progress with other sites and implementing relative assessment enables the factory to identify issues and voluntarily review/promote measures for improvement. In fiscal 2014, the system was upgraded to enable the addition of further assessment items to the existing 19, based on the Company's needs. For example, at Companies where additional items have been introduced in the area of compliance with environmental regulations and management methods, assessment questions such as whether voluntary standards on air and water quality of the facilities/air conditioners have been set at a level higher than what is required by law have been included to strengthen risk management at respective factories.

Additionally, information on global activities for environmental impact reduction, legislation, and social trends are shared through the Manufacturing Environmental Information Sharing Group. In Europe, Southeast Asia, China, and Latin America where our factories are located, regional information exchanges and competitions on best practices to reduce environmental impact (presentation of awards for best practices and activities for group-wide expansion) are held as needed. We are promoting GF activities suited to the issues of each region to boost and accelerate efforts and actions.

Furthermore, the best practices regarding CO_2 emissions, waste, chemical substances, water, etc. at respective factories are registered and shared in the Before/After (BA) chart search system accessible on a global scale, to enable utilization in other factories. In fiscal 2018, in order to assess and revise the existing support tools and manuals for energy saving, we have prepared a check sheet for energy-saving potential to visualize and evaluate the efforts for energy saving as well as to find efficient approaches, expanding this activity to our business sites worldwide to reinforce and improve our energy-saving practices. Also, as a new activity to ensure our compliance with local environmental laws in China and Southeast Asia where a lot of our business sites incased, introduced a cross-company mutual audit, through which the Panasonic factories operated in the same area conduct an environmental audit mutually beyond the companies. We are further improving our eco-conscious approach utilizing know-how accumulated across the Group.

Cross-company mutual environmental audit

Indicators for GF Assessment System



Management

16. CO_2 emissions management/activity level
17. Chemical substances management level
18. Waste management level
19. Water management level

Essential items

Continuous acquisition of ISO14001
Compliance with environmental legislation
Promotion of measures against soil and groundwater contamination
Monthly data registration

We are working on optimal management of SOx (sulfuric oxide) and NOx (nitric oxide), the principal causes of air pollution, as well as the indicators of water contaminant concentration BOD (biochemical oxygen demand) and COD (chemical oxygen demand).

SOx/NOx management example: Panasonic Eco Solutions Interior Building Products Co., Ltd. Gunma factory

	FY	Facility name	Average measured	Maximum measured
SOx(Nm^3/h)	2016	Boiler No. 1	0.091	0.110
		Boiler No. 3	0.067	0.067
		Boiler No. 5	0.062	0.062
	2017	Boiler No. 1	0.047	0.073
		Boiler No. 3	0.042	0.042
		Boiler No. 5	0.023	0.023
	2018	Boiler No. 1	0.038	0.054
		Boiler No. 3	0.029	0.029
		Boiler No. 5	0.032	0.032

Boiler No. 1: Legal limit: 23.44, Voluntary limit: 4.00, Measuring frequency: Twice a year
Boiler No. 3: Legal limit: 1.12, Voluntary limit: 0.50, Measuring frequency: Once a year
Boiler No. 5: Legal limit: 0.61, Voluntary limit: 0.50, Measuring frequency: Once a year
The three boilers indicated above are those that resulted in high measured values in the respective fiscal year

	FY	Facility name	Average measured	Maximum measured
NOx(ppm)	2016	Boiler No. 1	295	320
		Boiler No. 3	100	100
		Boiler No. 5	100	100
	2017	Boiler No. 1	270	310
		Boiler No. 3	100	100
		Boiler No. 5	79	79
	2018	Boiler No. 1	210	240
		Boiler No. 3	94	94
		Boiler No. 5	83	83

Boiler No. 1: Legal limit: 350, Voluntary limit: 320, Measuring frequency: Twice a year
Other boilers: Legal limit: 250, Voluntary limit: 180, Measuring frequency: Once a year
The three boilers indicated above are those that resulted in high measured values in the respective fiscal year

BOD/COD management example: Panasonic Ecology Systems Co., Ltd. Head Quarter factory

	FY	Facility name	Average measured	Maximum measured
BOD(mg/l)	2016	Wastewater treatment facility/Integrated wastewater outlet	2.2	4.3
	2017	Wastewater treatment facility/Integrated wastewater outlet	1.7	4.5
	2018	Wastewater treatment facility/Integrated wastewater outlet	2.1	3.0

Legal limit: 25.0, Voluntary limit: 16.0, Measuring frequency: Once a month

	FY	Facility name	Average measured	Maximum measured
COD(mg/l)	2016	Wastewater treatment facility/Integrated wastewater outlet	3.8	7.6
	2017	Wastewater treatment facility/Integrated wastewater outlet	3.5	8.0
	2018	Wastewater treatment facility/Integrated wastewater outlet	4.0	6.7

Legal limit: 25.0, Voluntary limit: 16.0, Measuring frequency: Once a month

Environment: CO_2 Reduction

Approaches to CO_2 Reduction

The Paris Agreement that went into effect in November 2016 sets out a target to limit global temperature increases to less than 2°C above pre-industrial levels and a more ambitious target to keep global temperature increases to less than 1.5°C above pre-industrial levels, as well as sets the goal for CO_2 and other greenhouse gas emission levels for the second half of this century to be virtually zero. To achieve these targets, it is essential to cut CO_2 emissions to the greatest extent possible, and companies are required to make further contributions to reducing CO_2 emissions.

In association with the announcement of the Environment Vision 2050 (see page 13) focusing on energy, we have set the reduction targets for CO_2 emissions to be achieved by 2030 and 2050 : reducing CO_2 emissions from our business activities by 30% by 2030 compared to that of fiscal 2014, achieving zero emission by 2050, and reducing CO_2 emissions from our product use by 30% by 2030 compared to that of fiscal 2014, in line with the goal set by the Paris Agreement. The targets have been approved as Science Based Targets (SBT[*1]) by the SBT initiative in October 2017. We are currently working towards CO_2 emissions reduction from our business activities and product use in order to achieve these targets.

*1 SBT is science-based reduction targets for greenhouse gas emissions set to achieve the goal which keeps global temperature increase below 2°C compared to pre-industrial temperatures.

Size of Contribution in Reducing CO_2 Emissions through products and services

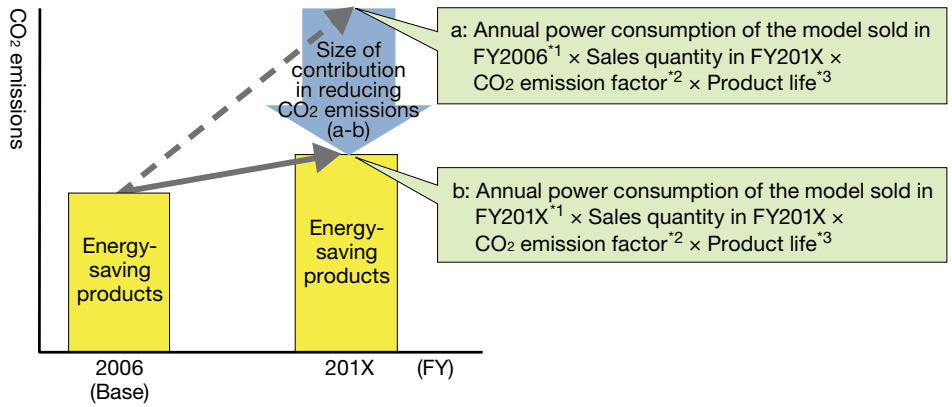
Panasonic has introduced a unique indicator “size of contribution in reducing CO_2 emissions” to accelerate emissions reduction, targeting our products (for energy saving and energy creation). The size of contribution in reducing CO_2 emissions is defined as the amount achieved by deducting the actual emissions from the amount that would have been emitted without the improvements by the energy-saving performance of our products from fiscal 2006, and this amount is combined with the emission reduction resulting from power generation by energy-creating products. In other words, it reflects the continuous efforts being made to reduce CO_2 emissions.

Panasonic will continue to maximize the size of contribution in reducing CO_2 emissions.

Size of Direct Contribution in Reducing CO_2 Emissions through Energy-saving Products

We will improve the energy-saving performance of our products to reduce the energy consumed in using the products. The more energy-saving products are introduced and promoted, the size of contribution in reducing CO_2 emissions will further increase.

Size of Direct Contribution in Reducing CO_2 Emissions through Energy-saving Products



*1 For each product category, the model that was sold in the largest quantity in the region was selected.

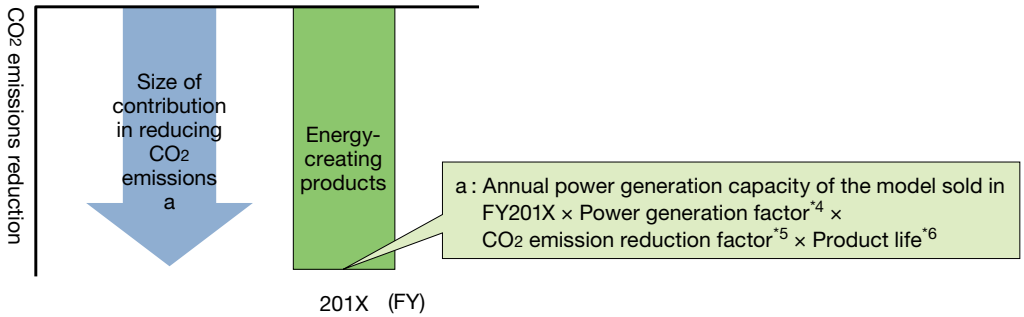
*2 Regional CO_2 emission factors (kg-CO_2/kWh) used: 0.410 (Japan); 0.487 (Europe); 0.579 (North America); 0.740 (China & Northeast Asia); 0.927 (India & South Asia); 0.527 (Southeast Asia & Oceania); 0.332 (Latin America); and 0.599 (Middle East & Africa).

*3 Number of years during which spare parts for the product are available (defined by Panasonic).

Size of Direct Contribution in Reducing CO_2 Emissions through Energy-creating Products

By using electricity generated by solar power generation and such, we can reduce CO_2 emissions from thermal power plants. Panasonic will further foster its energy creation business to increase the size of contribution in reducing CO_2 emissions.

Size of Contribution in Reducing CO_2 Emissions through Energy-creating Products



*4 For photovoltaic power generation: 1,204 kWh/kW (after fiscal 2015), 1,193 kWh/kW (fiscal 2014 and prior). Considering sunshine conditions, system loss, and other variables.

*5 For photovoltaic power generation: 0.360kg-CO_2/kWh (Source: Voluntary Rules on Indication (2010) by the Japan Photovoltaic Energy Association).

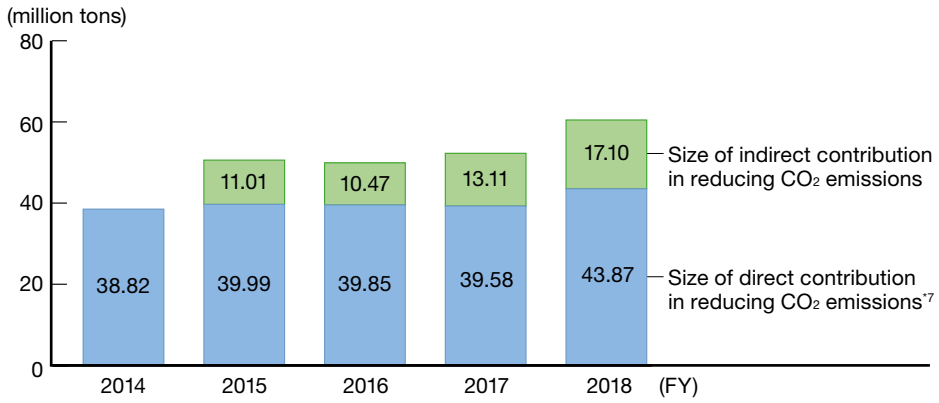
*6 For photovoltaic power generation: 20 years.

Size of Indirect Contribution in Reducing CO_2 Emissions

Effects of reducing CO_2 emissions in domains of housing, automotive, and B2B businesses which we are focusing on are shown as the size of indirect contribution to reducing CO_2 emissions to distinguish it from the size of direct contribution in reducing CO_2 emissions from Panasonic-brand products. The size of indirect contribution in reducing CO_2 emissions represents the CO_2 emissions reduction effects from other companies' products, in which our components contribute to reducing CO_2 emissions. Specifically, the data represents "air conditioning load reduction effects from improved insulation performance in Panasonic housing," "energy-saving effects from products by other companies equipped with Panasonic energy-saving compressors, motors, and vacuum insulation materials" and "improved fuel economy effects from electric vehicles equipped with Panasonic automotive batteries." From the results for fiscal 2017, CO_2 reduction effects as a result of energy saving such as less travelling made possible through the use of our HD Visual Communication Systems, and from the results for fiscal 2018, the energy-saving effects from using our HEMS and BEMS are also calculated and disclosed.

Our size contribution in reducing CO_2 emissions through products and services amounted to 60.97 million tons in fiscal 2018. Of this, direct contributions amounted to 43.87 million tons, and indirect contributions to 17.10 million tons.

Size of Contribution in Reducing CO_2 Emissions through Products and Services



*7 Total amount of contribution in reducing CO_2 through energy-saving products and energy-creating products.

Environment: CO_2 Reduction through Energy-saving/ creating/storing Products

Energy-saving Products

The size of direct contribution in reducing CO_2 emissions through our energy-saving products in fiscal 2018 was 38.65 million tons due to steady sales of home appliances in overseas, especially air conditioners in China. In the breakdown of the size of contribution in reducing CO_2 emissions by global product category, 84% was from air conditioners, lighting equipment, TVs, and refrigerators. By region, Japan, Southeast Asia & Oceania, China & Northeast Asia made up approx. 79%. CO_2 emissions from the use of our major products[*1] in fiscal 2018 is estimated to be approx. 64.49 million tons. We will continue to further reduce the CO_2 emissions from the use of major products by making energy-saving products even more widely available.

Also, improvement in energy efficiency of major consumer electronics by 35% compared to the fiscal 2006 level is our numerical target for fiscal 2019 under our Green Plan 2018. The results for fiscal 2018 marked 44% due to an increase in sales of high energy-saving performance models. The Green Plan 2018 also includes a numerical target for fiscal 2019 to achieve a 75% sales ratio for LED lighting (residential and non-residential buildings), and the fiscal 2018 results marked 77%.

*1 Lifetime CO_2 emissions from major products[*2] with large amounts of energy use.
Lifetime CO_2 emissions = Annual power consumption of a model sold[*3] x Sales quantity x Product life[*4] x CO_2 emission factor[*5]

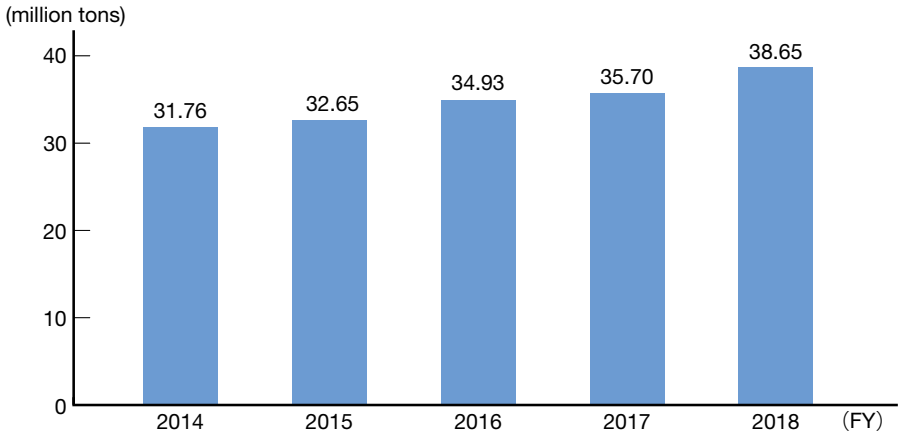
*2 Household air conditioners, commercial air conditioners, fluorescent lamps, LED lamps, household refrigerators, commercial refrigerators, LCD TVs, washing/drying machines, fully-automatic washing machines, clothes dryers, dish washer and dryers, IH cooking heaters, EcoCute, bathroom ventilator-driers, humidifiers, dehumidifiers, air purifiers, extractor fans, vending machines, electronic rice cookers, microwave ovens, warm-water washing toilets, clothing irons, hair dryers, under-rug heaters, vacuum cleaners, electric thermal pots, extractor hoods, telephones, security cameras, projectors, production modulars etc.

*3 For each product category, the model that was sold in the largest quantity in the region was selected.

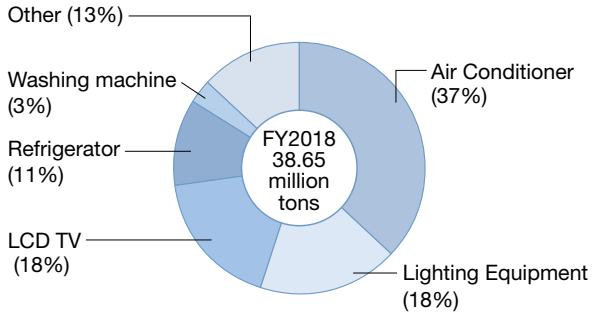
*4 Number of years during which spare parts for the product are available (defined by Panasonic).

*5 Regional CO_2 emission factors (kg-CO_2/kWh) used: 0.410 (Japan); 0.487 (Europe); 0.579 (North America); 0.740 (China & Northeast Asia); 0.927 (India & South Asia); 0.527 (Southeast Asia & Oceania); 0.332 (Latin America); and 0.599 (Middle East & Africa).

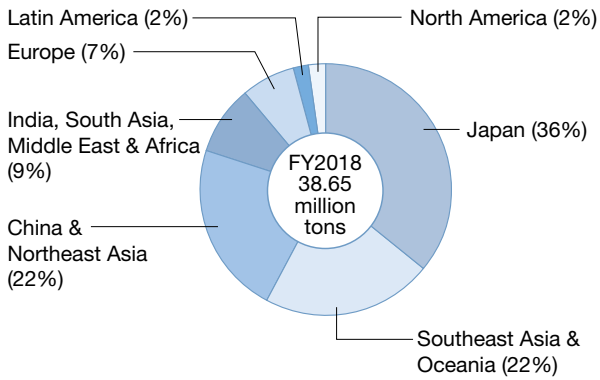
Size of Contribution in Reducing CO_2 Emissions through Energy-saving Products



Size of Contribution in Reducing CO_2 Emissions through Energy-saving Products (by product)



Size of Contribution in Reducing CO_2 Emissions through Energy-saving Products (by region)



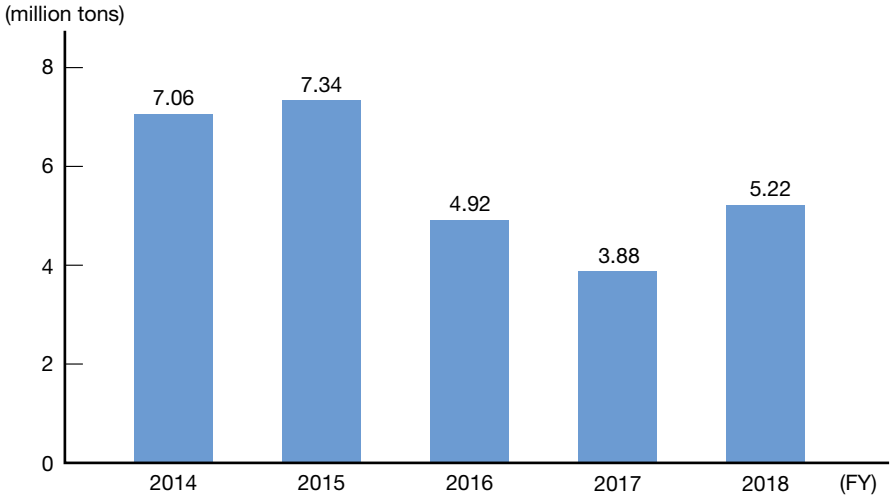
Energy-creating Products

We actively develop our energy creation business to maximize the size of contribution in reducing CO_2 emissions. By delivering photovoltaic power generation systems and household fuel cell cogeneration systems as means to create necessary electricity with few CO_2 emissions, we reduce CO_2 emissions in society.

The size of direct contribution in reducing CO_2 emissions through energy-creating products in fiscal 2018 was 5.22 million tons due to the expansion of global demand for photovoltaic power generation solar panels. By region, Japan accounts for approx. 45%.

Other fiscal 2019 targets under the Green Plan 2018 include achieving 440,000 MWh of total power generation from dissemination of household fuel cells (fiscal 2011 to fiscal 2019), and 5 million MWh of total power generation from dissemination of photovoltaic power generation systems (fiscal 2013 to fiscal 2019). The results of total power generation up to fiscal 2018 were 382,000 MWh from household fuel cells and 4.51 million MWh from photovoltaic power generation systems.

Size of Contribution in Reducing CO_2 Emissions through Energy-creating Products



Initiatives for Energy-storing Products

Energy-storing products such as lithium-ion batteries can be used in various situations for electric power storage and contribute to CO_2 reduction through installation in offices, homes, etc. In addition, our automotive lithium-ion batteries are one of the key devices that help promote the popularization of eco-conscious cars. Panasonic is actively engaged in the development of energy-storing products.

Under our Green Plan 2018, we have set the target as 200% for battery supply demand for increase in automotive battery supply (compared to the fiscal 2015 level). The results up to fiscal 2018 were 178%.

Examples of Energy-saving/creating/storing products are also introduced on the following website.
http://www.panasonic.com/global/corporate/sustainability/eco/co2/product.html

Environment: Global Warming Mitigation and Adaptation

Global Warming Mitigation

While people seek for affluent lifestyles, the acceleration of global warming caused by the increase in CO_2 emissions from people's daily lives and corporate activities is becoming a concern. Panasonic promotes measures to mitigate the progress of climate change and to minimize the impact by reducing the greenhouse gases emitted from its products and services as well as production activities.

As measures to mitigate the impact of our products and services, we offer energy-management products and solutions that link and control a range of energy-saving/creating/storing products.

In promoting our Net-Zero Energy House (ZEH), we set a numerical target in Green Plan 2018, which is "achieving the ZEH ratio of 22% in all detached house". The achievement in fiscal 2018 was 28%.

In addition to these energy management solutions in the housing area, the Panasonic Group is also promoting Smart Town projects in Fujisawa City and Yokohama City in Kanagawa Prefecture. Under Green Plan 2018, we are aiming to start construction/sales at three locations (870 lots) from fiscal 2016 through fiscal 2019. The results up to fiscal 2018 were three locations (531 lots).

More details on reducing CO_2 emissions at our factories can be found on pages 46-47. For details on reducing CO_2 emissions in logistics, see pages 42-45.

Examples of solutions for global warming mitigation are also introduced on the following website.
http://www.panasonic.com/global/corporate/sustainability/eco/co2/solution.html

Global Warming Adaptation

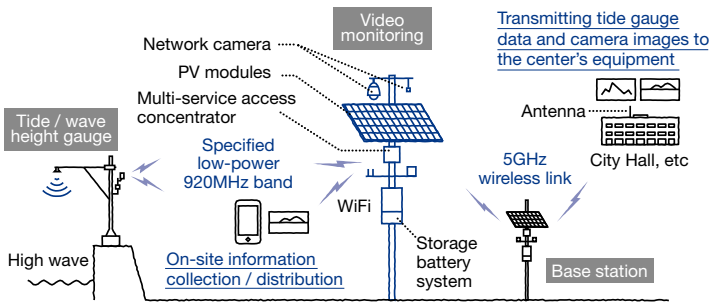
Panasonic is also making efforts for adaptation to address unavoidable impacts on the global environment that cannot be addressed by mitigation measures. Such adaptation is based on the matters indicated by the Intergovernmental Panel on Climate Change (IPCC) etc., focusing on the impact of climate change on the ecosystem, society, and the economy. Further, we understand that it is important for the measures to take account of regional characteristics, as impacts of climate change vary according to the region.

Coastal tsunami monitoring system in Higashi Matsushima City in Miyagi Prefecture

Our measures are currently implemented from the viewpoints of the following two aspects:

(1) Efforts to reduce the impact of climate change through our products, services, and solutions; and
(2) Efforts to reduce the impact on our corporate activities

Specific examples of (1) include the coastal monitoring system and the Green Air-Conditioner. Panasonic has developed the coastal monitoring system that sources power independently. This system continuously operates wireless network cameras and wireless transmission devices by photovoltaic power generation modules and storage batteries. It would contribute to preparing for high tides that are expected to increase due to climate change.



Coastal Tsunami Monitoring System Configuration

Development of Green Air-Conditioners is underway in cooperation with other companies in time for the 2020 Olympic and Paralympic Games in Tokyo. Dry-type mist made by mixing fine particles of water and air to minimize the sense of wetness as well as air curtains that will create dome-shaped cool spaces under shades are designed to provide relief from the summer heat in open spaces. These systems are expected to reduce heat stroke and other adverse effects on everyday life caused by global warming.

▶ Coastal tsunami monitoring system in Higashi Matsushima City in Miyagi Prefecture (An example of a coastal monitoring system) (Japanese)
http://www2.panasonic.biz/es/solution/works/higashimatsushima.html

▶ Demonstration experiment of Green Air-Conditioner at a bus stop to be a cool spot (Japanese)
https://news.panasonic.com/jp/press/data/2017/07/jn170721-1/jn170721-1.html

Demonstration experiment of Green Air-Conditioner at Shimbashi Station in Tokyo from August to September 2016.

As for (2), the importance lies in first identifying the issues to be addressed by assessing the impact of climate change on Panasonic. One such issue is the effect of water shortages on our production activities. We are currently working on assessing water-related risks, and we plan to examine necessary measures based on the assessment results. For more details, see the chapter on Water Resource Conservation (pages 59-60).

Environment: Global Warming Prevention at Factories

Reducing CO_2 Emissions through Production Activities

Panasonic has been working to reduce CO_2 emissions in factories with the aim to contribute to climate change mitigation and reinforce our environmental management, such as by improving production efficiency in factories and reducing energy costs.

Since fiscal 2011, we have been using our unique indicator, the size of contribution in reducing CO_2 emissions, to improve our energy management capabilities and reduce the CO_2 emissions per basic unit, working to maximize the size of contribution in reducing CO_2 emissions in production activities. In revising Green Plan 2018, our Environmental Action Plan, we changed the indicator for CO_2 reductions in our production activities to "CO_2 basic unit," with the target for fiscal 2019 to exceed the fiscal 2014 level by at least 5% (more than 1% annual reduction on average).

In addition to individual efforts implemented in each factory, energy-saving and CO_2 emission reduction measures including horizontal introduction of good examples across the company, specialist training, and CO_2 ITAKONA initiatives[*1] are promoted. We are also promoting the introduction of photovoltaic power generation to achieve our fiscal 2019 target of "at least 10,000 MWh of in-house renewable energy adoption." Our investment in CO_2 emissions reduction in fiscal 2018 was 3.5 billion yen[*2].

As a result, the CO_2 basic unit in fiscal 2018 reduced by 14% compared to fiscal 2014. Not only the basic unit but also the total amount of energy consumption is reducing steadily.

Furthermore, we are shifting the lighting to LED at our factories, offices, showrooms, and other buildings. We plan to complete this transition on a global scale by the end of fiscal 2019[*3].

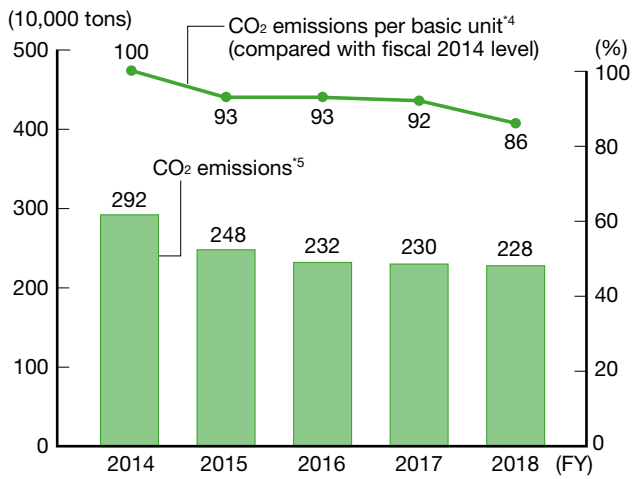
Panasonic is a member of Keidanren's Commitment to a Low Carbon Society, a voluntary action program for global warming prevention across the entire electric and electronic industry, with the targets set aiming at 2030. Specifically, we are steadily implementing energy-saving measures in factories and offices in order to achieve the goals set by the industry in Japan, aiming improvement in energy consumption rate in factories and large offices at an annual rate of 1% on average towards 2030.

*1 ITAKONA is a term unique to Panasonic which refers to a process by which we review stages prior to production to study raw materials to ensure waste is minimized and quality is maintained. We apply a similar review process for our CO_2 emissions reduction efforts and call these our CO_2 ITAKONA initiatives. The activity is aimed at discovering energy conservation measures from a new viewpoint through continuous display of energy consumption levels (energy consumption per basic unit), and analyzing the factors that influence the variables in each basic unit.

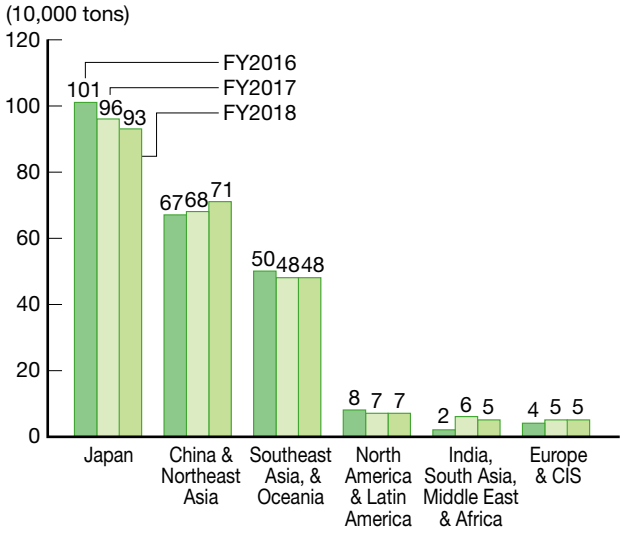
*2 Includes all investments concerning CO_2 emissions reduction. Differences or appropriate portions are not calculated.

*3 Installable sites

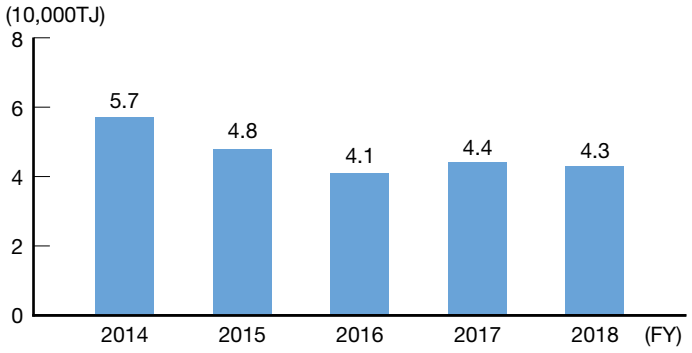
CO_2 Emission in Production Activities and CO_2 Emission Per Basic Unit



CO_2 Emission in Production Activities (by region)



Energy Consumption in Production Activities



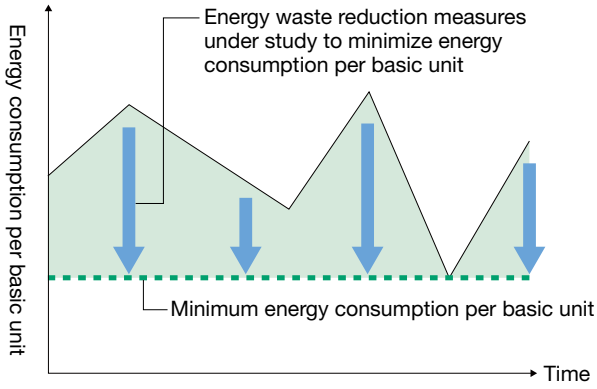
*4 Calculated using the weighted average of improvement rates compared to the fiscal 2014 in CO_2 emissions per basic unit, which is calculated by dividing CO_2 emissions by the volume of activity closely related to CO_2 emissions, including production amounts and volumes, etc. of each factory. Basic unit of fiscal 2014 was converted into an index as 100.

*5 The factors related to fuels are based on the Guidelines for Calculation of Greenhouse Gas Emissions (version 4.3.1) published by the Japanese Ministry of the Environment. The CO_2 emission factor (kg-CO_2/kWh) for electricity purchased in Japan in each fiscal year is fixed at 0.410 to accurately reflect efforts for CO_2 emissions reduction. If the factors set for each fiscal year are used instead (0.570 for fiscal 2014, 0.554 for fiscal 2015, 0.587 for fiscal 2016, 0.512 for fiscal 2017 and 2018), total CO_2 emissions will be 3.19 million tons for fiscal 2014, 2.77 million tons for fiscal 2015, 2.68 million tons for fiscal 2016, 2.50 million tons for fiscal 2017, and 2.47 million tons for fiscal 2018. The factors above are also used for electricity purchased from power producers and suppliers (PPS). The GHG Protocol factors for each country are used for electricity purchased outside Japan.

Promoting CO_2 Reduction Activities in our Factories

To ensure the reduction of CO_2 emissions at our factories, it is important to track the energy consumption of each factory and the effects of specific emissions reduction measures to visualize reduction effects. To date, we have introduced more than 40,000 measurement systems and Factory Energy Management System (FEMS) at all of our global manufacturing sites. This CO_2 reduction was based upon promotion of the METAGEJI (Meter and Gauge)[*6] initiative, which visualizes and analyzes energy consumption.

Concept of the CO_2 ITAKONA Initiative



Based on this scheme, the CO_2 ITAKONA initiative has been implemented since fiscal 2011. The activity is aimed at discovering energy conservation measures from a new viewpoint through continuous display of energy consumption per basic unit of production, and analyzing the factors that influence the variables in each basic unit.

In order to accelerate action under the CO_2 ITAKONA initiative, we developed the SE-Navi software that displays energy and production data simultaneously and analyze energy consumption per basic unit. The “energy-saving navigation function” of this software quantitatively extracts energy loss per device as well as loss per factor, based on the automatic energy loss analysis results through CO_2 ITAKONA analysis. With this function, energy-saving efforts prioritizing processes with large energy loss have been made easier.

Conventionally, energy consumption and other data had been analyzed manually by specialists in order to develop energy conservation measures. This function automatically analyzes data and enables users to consider energy conservation measures based on the energy-saving measure database. Not only did this contribute to a reduction in working time but also to the identification of energy-saving measures without the assistance of specialists.

An example of factory energy conservation support service is introduced on the following website.

http://www.panasonic.com/global/corporate/sustainability/eco/co2/service.html

*6 METAGEJI is a term unique to Panasonic which refers to visualizing energy consumption and implementing measurable reduction initiatives by introducing measurement instruments, such as meters and gauges.

To continuously study mechanisms for CO_2 reduction, the Factory CO_2 Reduction Working Group was set up in fiscal 2017 as a corporate-wide program and has continued its activities in fiscal 2018. One of the working group's activities is the exhaustive use of measuring instruments and FEMS previously introduced to bring greater results of CO_2 reduction. The working group introduces and promotes advanced CO_2 emissions reduction technologies and measures as model trials in order to accumulate knowledge and results for taking further CO_2 reduction measures. In model plants, measurement of physical data of main processes such as temperature, humidity, and differential pressure, was added to enable multifaceted data analysis and to bring further depth to our energy saving efforts in major manufacturing process, as well as pressure difference and other aspects. In fiscal 2017, Uji factory of Automotive & Industrial Systems Company in Kyoto, analyzed differences in temperature, humidity, and differential pressure between the outside and inside of manufacturing processes using the existing FEMS, leading to change the air supply system from intake of external air to inner air circulation. As a result of this improvement, they successfully reduced the annual CO_2 emissions by 80 tons. In order to enhance the mechanism and efficiency of this system, the factory focused on improving the processes that require fine temperature and humidity control to ensure product quality in fiscal 2018. They gained the prospect of reducing CO_2 emissions while retaining quality by building a new algorithm into the FEMS to control the dew point and electricity consumption. Activities to assess the effects of these energy -saving measures and expand its application will take place from fiscal 2019 onwards.

Factory CO_2 Reduction Working Group

Utilization of Renewable Energy

In order to reduce CO_2 emissions, Panasonic actively and globally promotes the adoption of renewable energy suitable to the characteristics of the region, such as photovoltaic power generation. The large scale installation of a photovoltaic power generation system took place in China in fiscal 2018. In February 2017, Panasonic Appliances (China) Co., Ltd (PAPCN), located in the Panasonic Industrial Park in Suzhou, installed 3.5 MW photovoltaic power generation system, which is one of the largest in scale for a single manufacturing company in our Group. The photovoltaic power generation modules were set up on the rooftop of the two factory buildings and bicycle parking garages. These modules can generate renewable energy that covers approximately 20% of the total annual power demand of PAPCN, and electricity produced by the system is supplied to our other manufacturing companies in the Suzhou Industrial Park.

Panasonic Manufacturing (Beijing) Co., Ltd. (PMFBJ) installed 0.6 MW photovoltaic power generation system in July 2017. This system has been installed through the solution business with the Panasonic HIT™ photovoltaic modules offered by Panasonic Solution Service China Company, which delivers Panasonic product solution business in China. In addition to the production of photovoltaic modules, we offer the solution business utilizing the modules to promote the utilization of renewable energy.

Photovoltaic power generation system in PAPCN

As a result of such efforts, our in-house renewable energy adoption across the entire company*7 reached 21,000 MWh*8 in fiscal 2018, and we have exceeded our target under the Green Plan 2018, our environmental action plan, revised in fiscal 2017, which was to reach 10,000 MWh in the use of in-house renewable energy by fiscal 2019.

Adoption of photovoltaic power generation system is also underway at respective sites on a global scale in addition to those mentioned above, and we aim for completion at all sites considered feasible for adoption by the end of fiscal 2021.

Photovoltaic power generation system in PMFBJ

We will continue our efforts to achieve further reductions in CO_2 emissions.

Examples of the use of renewable energy are introduced on the following website.
http://www.panasonic.com/global/corporate/sustainability/eco/co2/site.html

*7 Includes renewable energy utilization at non-production sites.

*8 Includes photovoltaic, wind, and biomass power but not power from heat pumps.

Approach towards the CO_2 Emissions Trading Scheme in China

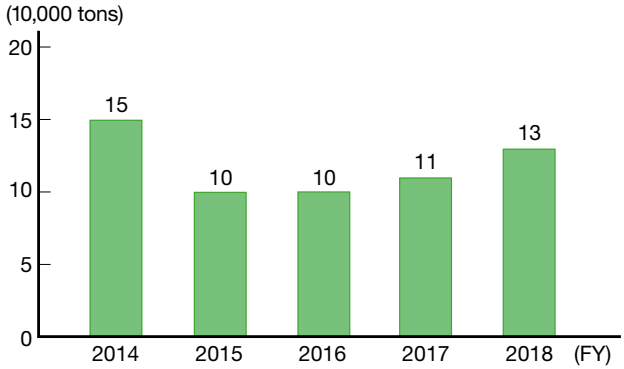
In China, the Emissions Trading Scheme (ETS) for more than 1,700 companies in the power industry has been conducted from December 2017. Although Panasonic is not included in the list of these companies as of April 2018, we have a lot of business sites in China. By taking advantage of our ongoing initiatives for the reduction of CO_2 emissions in manufacturing, we continue to take measures for effects of the ETS on our business and our potential inclusion in the light of risks and opportunities.

Reducing the Emissions of GHGs Other than CO_2 from Energy Use

GHGs other than CO_2 from energy use emitted by Panasonic include hydrofluorocarbons (HFCs) used in air conditioner factories as refrigerants for products and nitrogen trifluoride (NF_3) used as a cleaning gas in LCD factories. To reduce these gases, we implement a variety of measures, such as preventing leakage of refrigerants, recovering waste refrigerants, decomposing at external parties, and installing removal devices.

GHG emissions other than CO_2 from energy use (CO_2-equivalent; hereinafter the same) in fiscal 2018 amounted to 130,000 tons, which was 20,000 tons more than the previous fiscal year.

Emissions (CO_2-equivalent) of GHGs Other than CO_2 from Energy Use in Production Activities

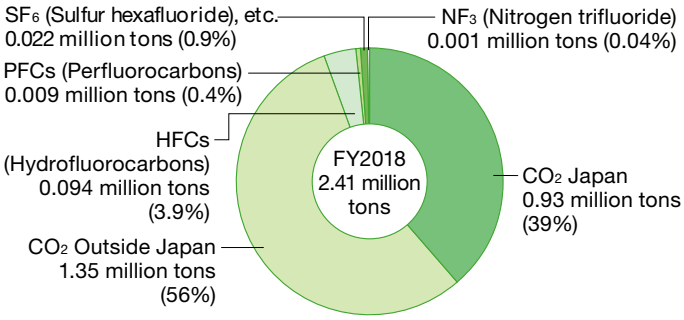


Breakdown of Total GHG Emissions (by gas and by scope)

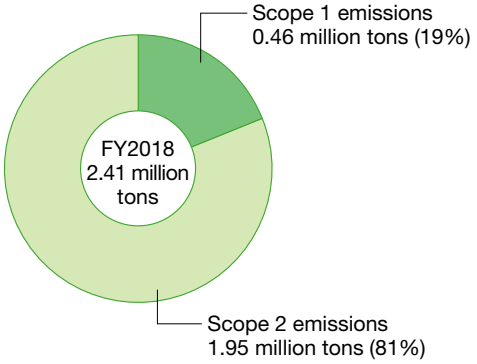
Our GHG emissions, including emissions from energy sources and other sources, reached 2.41 million tons in fiscal 2018, the breakdown being 19% for Scope 1 emissions[*9] and 81% for Scope 2 emissions[*9] (see page 29 for Scope 3 emissions).

*9 GHG emissions defined by the GHG Protocol, an international calculation standard for GHG emissions. Scope 1 emissions refer to all direct GHG emissions from facilities that are owned or controlled by the reporting entity (e.g. emissions from usage of town gas or heavy oil). Scope 2 emissions refer to GHG emissions from manufacturing of the energy that is consumed in facilities owned or controlled by the reporting entity (e.g. emissions from generation of electricity that the reporting entity purchased).

Breakdown of Total GHG Emissions (CO_2-equivalent) in Production Activities (by category)



Breakdown of Total GHG Emissions (CO_2-equivalent) in Production Activities (by scope)



Environment: Green Logistics

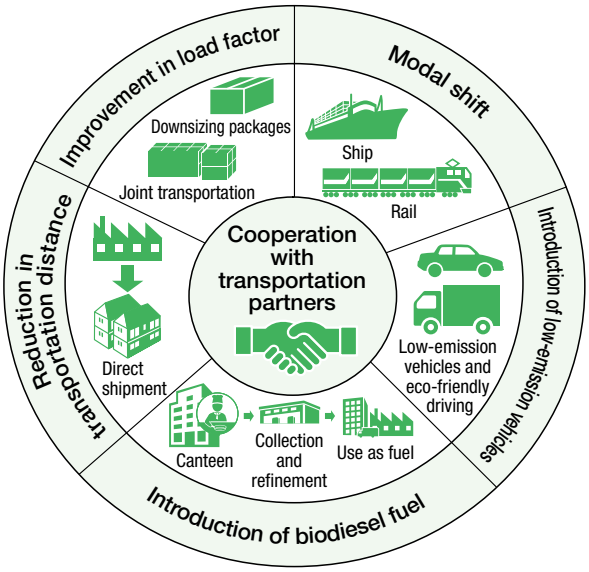
Reducing CO_2 Emissions in Logistics

To contribute to the prevention of global warming as well as to improve transportation efficiency while reducing costs, Panasonic is working to reduce CO_2 emissions in logistics. When we revised Green Plan 2018, our Environmental Action Plan, in 2016, we set the targets of reducing CO_2 emissions per basic unit[*1] by at least 1% year-on-year, and by 5% from the fiscal 2014 level by fiscal 2019, focusing on modal shift, introduction of low-emission vehicles and biodiesel fuel, reduction in transportation distances, and improvement in load factor.

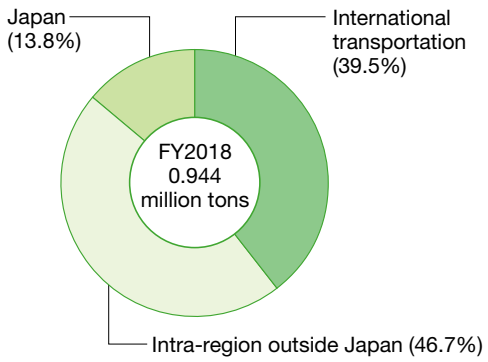
In fiscal 2018, our global CO_2 emissions from logistics activities came to 0.944 million tons across the world, of which international transportation was 0.373 million tons, and domestic transportation within Japan was 0.131 million tons. CO_2 emissions per basic unit of transportation within Japan reduced by 4.6% from the fiscal 2014 level.

*1 CO_2 emissions per transportation weight.

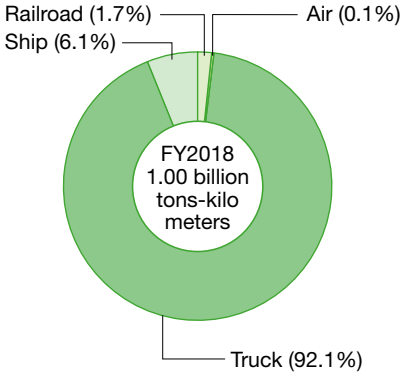
Major Initiatives Taken for Green Logistics



CO_2 Emissions from Logistics



Transportation Amount by Transportation Method (Japan)



Modal Shift*2 Initiative in Collaboration with Logistics Partners

Panasonic promotes a modal shift in transportation from trucks to railroad and ships in order to reduce CO_2 emissions.


Domestic vessel transportation

As a part of this initiative, we have been working together with Suzuyo & Co., Ltd., Suzuyo Cargo Net Co., Ltd. and Nittsu Panasonic Logistics Co., Ltd. towards a new manner of transportation since 2017. Panasonic has conventionally used cargo trucks to transport its washing machines from Fukuroi City in Shizuoka Prefecture to Tosu City in Saga Prefecture. We have managed to switch this means of transportation to domestic shipments twice per week by reducing the shipping volume variation to average out the transportation load. This initiative generates a CO_2 emissions reduction effect equivalent to 81 tons.

*2 Switch from truck and air transport to railroad and sea vessel transport that has less environmental impact.

Use of Biodiesel Fuel (Japan)

Panasonic promotes transforming waste cooking oil collected from its business sites into biodiesel fuel and utilizing it for vehicles used in production, procurement, and marketing activities. Since fiscal 2010, we have been using 100% biodiesel fuel for the joint transportation with the Asahi Shimbun Company in the Tokai and Tokyo Metropolitan areas to enhance further usage of biodiesel fuel. Biodiesel fuel usage in fiscal 2018 was 19,664 liters. We aim to increase the biodiesel fuel usage in vehicles that run only in private premises, such as forklift trucks.

Recycling of Stretching Film Used in Transportation

As an effort to reduce logistics waste, we jointly entered into a full recycling scheme for used stretch film with Nozoe Industry INC. (Nozoe) in fiscal 2015, and are continuing the initiative in fiscal 2017. The stretch film used for our transport was previously discarded, but is now recycled by Nozoe as a material for plastic garbage bags, which we then purchase.

Stretch Film Recycling Scheme with Nozoe

In fiscal 2018, in response to the prohibition of imports of waste plastic by China in the end of 2017, our operation sites which have not collaborated with Nozoe started working with the firm. The beginning of full-scale operation of Nozoe's recycling factory in Saitama Prefecture led to expand our recycling scheme for used stretch film in Kanto region, and a total of 360 tons of stretch film was recycled, which is increased by 198% over the previous year. We plan to increase the purchase of Nozoe's recycled products in fiscal 2019. We continue to make effective use of used stretch film and reduce logistics waste.

Landing Shipments at a Port Close to the Target Sales Area

Aiming for higher efficiency in transporting products, Panasonic is expanding its our efforts to land imported products at a port close to the target sales area in Japan. Conventionally, landing of products was centralized to a port near the West Japan Global Logistics Center (GLC) in Amagasaki City in Hyogo Prefecture, stored at the West Japan GLC, and then transported to respective locations as required. Landing the products at ports closer to the target sales areas can reduce the distance required for land transport within Japan, thereby contributing to reducing not only CO_2 emissions but also inbound and outbound deliveries between sites as well as distribution costs. This effort has reduced CO_2 emissions by 926 tons per year in fiscal 2018.

We will further refine projection of sales demand in various regions and optimize stock amounts held in those areas, and expand landing products at ports near target sales areas.

Recycling-oriented Manufacturing

With swift economic growth advancing worldwide and bringing heightened attention to concerns over resources, the sourcing of new resources and materials not only significantly impact the environment, but mineral resource depletion and material pricing run-up have also become issues.

To address these concerns, and as a responsibility of a manufacturer that uses a large volume of resources, Panasonic has been propelling Recycling-oriented Manufacturing under the theme of recycling resources since 2010, placing it as an important issue along with CO_2 emissions reduction. Under the Green Plan 2018, which was revised in 2016, increase in the usage amount of recycled resin and higher factory waste recycling rates continue to be promoted, and realization of recycling-oriented manufacturing is being further implemented through efforts such as expanding the creation of recycling-oriented products. Recycled resin, in particular, is being promoted with a target figure to ensure increase in usage.

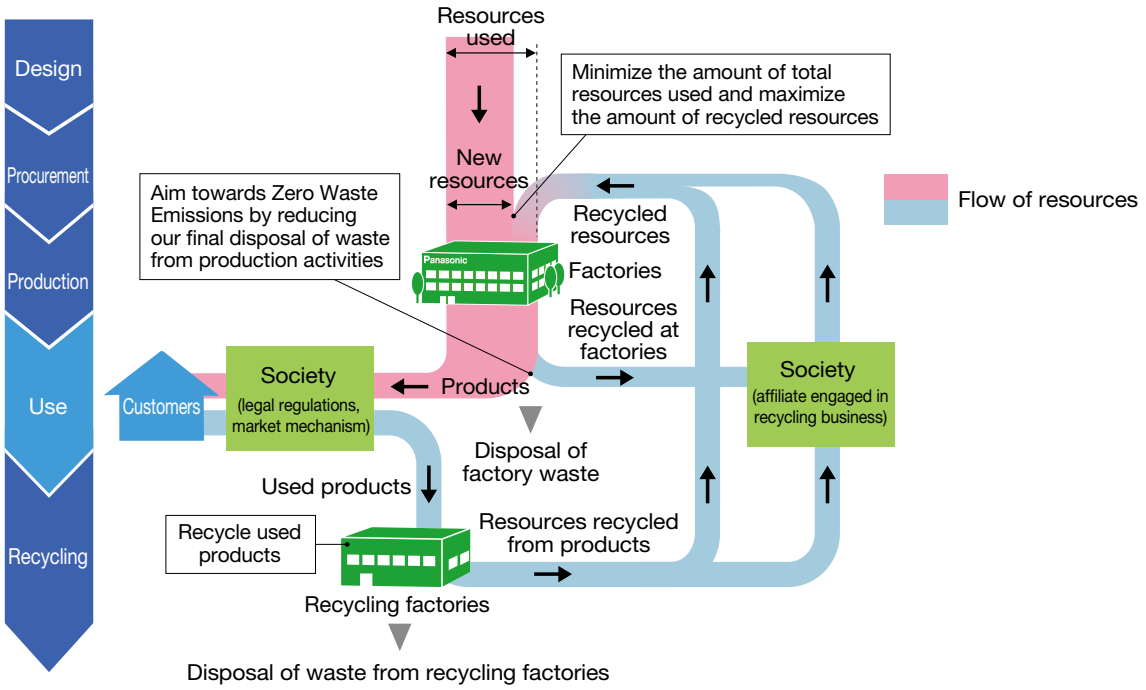
Recycling-oriented Manufacturing has three aspects under this concept, which are to minimize the amount of total resources used and maximize the amount of recycled resources, aim towards Zero Waste Emissions by reducing our landfill disposal of waste from production activities, and recycle used products.

We have been working on the weight reduction and downsizing of products to minimize the total resources used, and are continuing to increase resource collection through introduction of new recycling technologies and systems to expand the usage of recycled resources.

Furthermore, by reducing the amount of factory waste and thoroughly recycling resources from waste, we are working to eliminate the amount of waste treated in landfills to as close to zero.

In addition to utilizing the resources that were previously wasted across the entire production process, we have established a process where resources are recovered from used products, recycled into products, and further delivered to customers, to realize sustainable business activities throughout the product life cycle.

Goal of Recycling-oriented Manufacturing



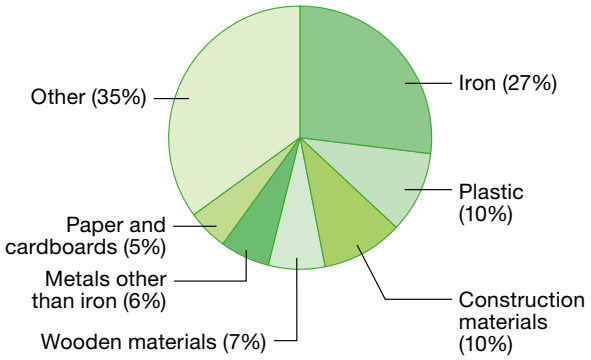
We use many kinds of resources, including iron (27% of total resources used) and plastic (10% of total resources used), due to our wide range of products and businesses, from home appliances, components such as semiconductors and batteries, to housing. In Recycling-oriented Manufacturing, it is important to promote the reduction of total resources used, and at the same time develop a recycling process according to the specific characteristics of each resource for expansion of our usage of recycled resources.

Furthermore, we clarify recycled resource utilization issues by identifying the volume of each type of resource used across the Panasonic Group. For example, in the case of recycled resin, we used approx. 14,300 tons of recycled resin in our products in fiscal 2018 by identifying the characteristics required in the materials to be used, securing a stable supply, researching how to recycle it in production, and developing new recycling technologies. Total usage of recycled resin since fiscal 2015 has reached approx. 64,900 tons. Although we have achieved the target under the Green Plan 2018, we will continue to work on further reducing total resources used and maximizing utilization of recycled resources, to maintain and improve our recycled resource utilization ratio.

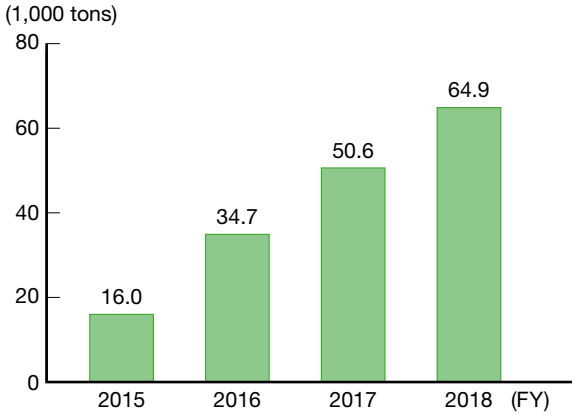
In addition, as for the recycling rate of waste at factories, we had traditionally set different targets for Japan and countries outside Japan according to the relevant local infrastructures. However, with the awareness of the importance of zero waste emission activities, we have set a globally standardized target since fiscal 2011 and are taking steps to improve the standard level of waste recycling across the entire Group. The factory waste recycling rate[*1] was 99.1% for fiscal 2018 against the target of 99% or more in fiscal 2019. (see page 53)

*1 Factory waste recycling rate = Amount of resources recycled/(Amount of resources recycled + Amount of landfill)

Breakdown of Total Resources Used in Fiscal 2018 (by category)



Results of Recycled Resin Usage (Cumulative total from fiscal 2015)



Environment: Reduction in Resources Use and Use of Recycled Resources

Reduction in Resources Used

To minimize the use of resources for production, we continuously look to reduce the weight of our products. Through the Product Environmental Assessment (see page 32), Panasonic has been promoting resource saving from the product planning and design stage, such as using less resources, making our products lighter and smaller, and using less components. We also implement various measures from the standpoint of resource recycling throughout the product life cycle, such as component reuse, longer durability, use of recycled resources, easier battery removal, and labels necessary for collection/recycling.

Examples of weight reduction and recyclable product design are also introduced in the following website.
http://www.panasonic.com/global/corporate/sustainability/eco/resource/reduce.html

Products Using Recycled Resources

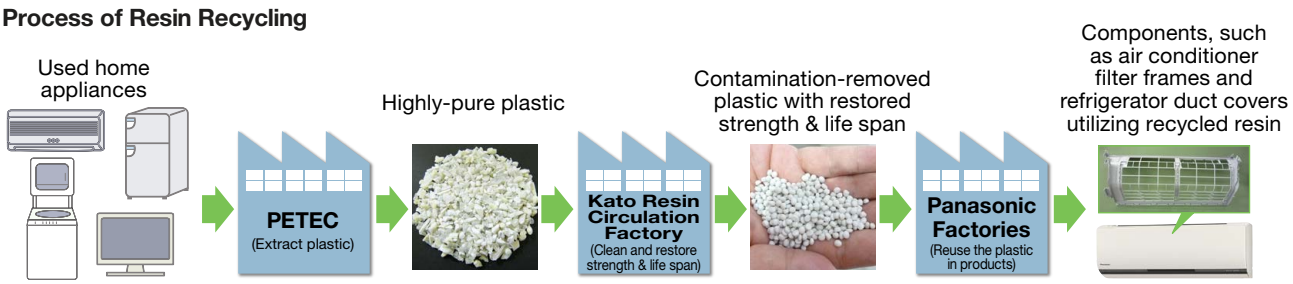
Under the concept of "product-to-product", we are enhancing our initiatives of utilizing resources recovered from used products. As for resin, we promote the reuse of resin recovered from our used home appliances (refrigerators, air conditioners, washing machines, and TVs) for our products. We also started recycling scrap iron recovered from used home appliances in our products in 2013.

▶ Our approaches to Resources Recycling
http://www.panasonic.com/global/corporate/sustainability/eco/resource_sp.html

Enhanced Use of Recycled Resin in Home Appliances

To efficiently utilize resin recovered from collected waste home appliances in addition to metals such as iron, copper, and aluminum, our recycling factory, Panasonic Eco Technology Center Co., Ltd. (PETEC), and Kato Plastic Recycling Factory of the Appliances Company work together for resin recycling.

Process of Resin Recycling



Using technologies such as our original near-infrared identification technology, PETEC is capable of sorting shredder residue of waste home appliances into three major types of resins with different purposes and properties—polypropylene (PP), acrylonitrile butadiene styrene (ABS), and polystyrene (PS)—at a material purity of over 99%.

Near-infrared sorting machine that can sort three types of resin simultaneously

The recycled single resins sorted and recovered at PETEC are then transferred to the adjacent Kato Plastic Recycling Factory to be further purified and processed to recover their chemical properties. Kato Plastic Recycling Factory is a manufacturing and development site that demonstrates promotion of use of recycled resin at our Appliances Company, a home appliance manufacturer and seller. The factory plays an important role in enhancing recycled resin utilization by developing recycling technologies, such as a more efficient method for improving the purity of recycled resins. Recycled resin is generally weaker in strength and has a shorter life than new resin. This is why its chemical properties have to be recovered to the level of new resin to make them usable as materials and components in new products. The properties required by our customers vary depending on the resin. We have established techniques that make full use of the properties optimal to each resin such as PP, ABS, and PS, which include adding antioxidants or mixing recycled and new resins.

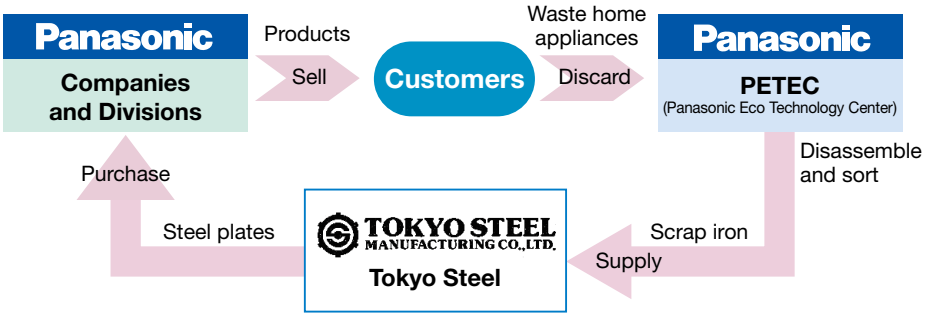
In fiscal 2018, development of high-performance materials was focused, including the recycling of flame retardant PS from the back covers of TV sets and flame retardant PP from nonwoven fabric. A recycling method was also developed for PPGF (PP containing short glass fibers) from drum-type washing machines that had not been recycled in the past into talc-filled PP with high rigidity.

Recycled resin quality-assured by Kato Plastic Recycling Factory are being used in our manufacturing factories, and depending on the resin type, reborn as internal parts of air conditioners, IH cooking heaters and refrigerators.

Building a Recycling Scheme for Scrap Iron

Jointly with Tokyo Steel Co., Ltd., we started a recycling scheme for scrap iron in July 2013. In this scheme, we recover the scrap iron from used home appliances and Tokyo Steel makes it into steel sheets. We then purchase the sheets back as a material for our products. Supplying scrap iron for recycling and repurchasing the recycled iron is the first scheme of its kind in the Japanese electrical manufacturing industry.

Self-recycling Scheme for Electric Steel Plates



Specifically, scrap iron from home appliances collected and treated at PETEC is supplied to Tokyo Steel's Okayama Plant, where the scrap iron is processed into electric steel plates.[*1] Panasonic procures the recycled steel plates and utilizes them in products. Discussions with Tokyo Steel commenced in 2010, and we have worked together since then to improve the quality of recycled iron to a level sufficient for production use, as well as developing the technology to improve the applicability of the recycled iron. From this we identified the optimum application of the electric steel plates, and refined its specific features (e.g. shape, strength, and weldability) to meet application-specific requirements. Use of thin electric steel plates in our products was first made possible in 2011. Through this close collaboration, we materialized this recycling scheme in 2013, a scheme where a home appliance recycling company that we own supplies scrap iron to be used to make electric steel plates.

The amount of scrap iron we initially supplied to Tokyo Steel was about 50 tons per month. In fiscal 2018, it reached over 2,600 tons, and the recycled steel is being used in our products, including washing machines and ceiling materials for housing.

Self-recycling Scheme Process

PETEC	Tokyo Steel	Panasonic
 Supply high quality scrap iron recovered from home appliances	 Add supplied scrap iron to the electric steel plate manufacturing process  Completed electric steel plates	  Processing electric steel plates (Photos: Lightweight ceiling materials by Panasonic Homes)

The increase in electric steel plate usage leads to an increase in the usage of scrap iron, which is one of the most important resources in Japan. In addition, producing steel plates from scrap iron emits much less CO_2 compared with producing steel plates from scratch. This scheme also stabilizes the procurement price, because the price of scrap iron supplied from PETEC and the price of electric steel plates procured from Tokyo Steel are determined by the scrap iron fluctuation rate agreed between the two companies. We will further expand this recycling scheme for more efficient resource utilization, CO_2 emissions reduction, and stabilization of procurement prices.

*1 Steel produced from scrap iron melted and refined in an electric arc furnace.

Environment: Factory Waste Management – Zero Waste Emissions

Improving Factory Waste Recycling Rate

From the viewpoint of effective usage of resources, we believe that generation of waste and revenue-generating waste at factories must be minimized, even if such waste could be sold as valuable commodities. Based on this belief, we identify the amount of generated waste (including both revenue-generating waste and factory generated waste) and classify it into: (1) recyclable waste (including those that can be sold and those which can be transferred free of charge or by paying a fee), (2) waste that can be reduced by incineration or dehydration, and (3) landfill (waste with no option other than being sent to landfills).

We reduce the emission of waste by boosting yield in our production process and increasing the recycling rate of our waste materials. Accordingly, we strive globally toward achieving our Zero Waste Emissions from Factories*1 goal by reducing the amount of landfill to nearly zero. We have reinforced such efforts particularly in China and other Asian countries, where many of our factories are located. We will continue our initiatives to achieve the factory waste recycling rate target of 99% by fiscal 2019.

As a means to reduce the generation of waste, we are fostering resource-saving product design. In our production activities, we are engaging in resource loss reduction, employing our own unique material flow analysis methods. We consider materials that do not become products and excessive use of consumables as resource losses, and make the material flow and lost values for each process visible in order to resolve the issues with close collaboration with the design, manufacturing, and other relevant business divisions. In the future, we will promote further reductions in resource losses through the Resource Loss Navigation, our original system developed to automatically display information to help reduce resource losses.

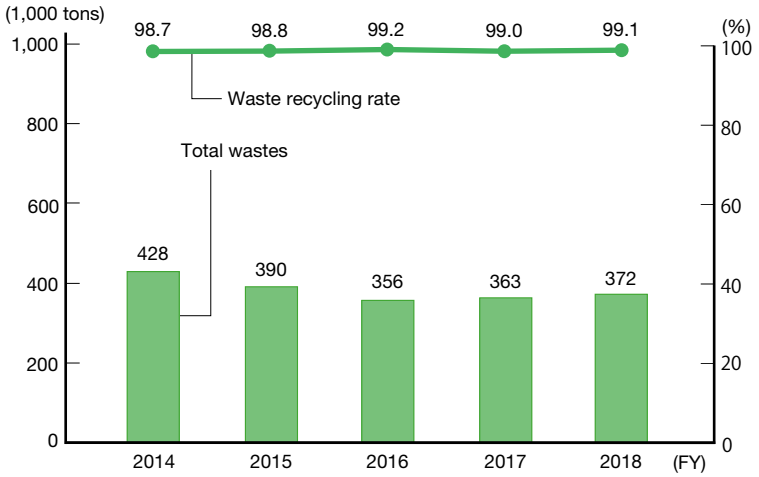
As measures to reduce the amount of landfill of waste and revenue-generating waste, we constrain the amount of waste materials that are particularly difficult to recycle, such as thermosetting resin. We are also strictly adhering to waste sorting practices in production processes to further expand the reuse of resources.

Because waste recycling rates in our overseas factories lag behind those in Japan, we have worked to improve the average level of recycling activities by sharing information within and between regions outside Japan. Specifically, in addition to accelerating the information sharing on waste recycling issues between our local factories and group companies in Japan, we also promote the sharing of excellent examples and know-how among our factories across regions by utilizing BA Charts*2 prepared by each region, following our long-standing approach toward CO_2 reduction activities.

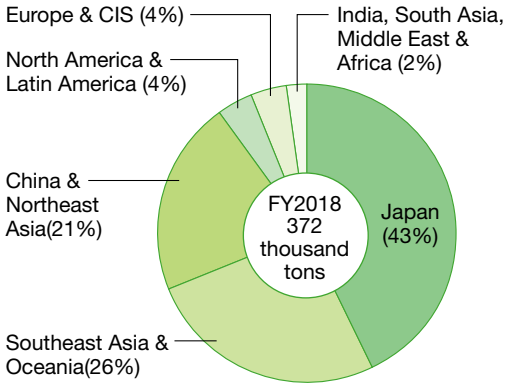
*1 Definition by Panasonic: Recycling rate of 99% or higher. Recycling rate = Amount of resources recycled/(amount of resources recycled + amount of landfill).

*2 A chart-format summary of comparisons between “before and after” implementation of waste reduction and recycling measures.

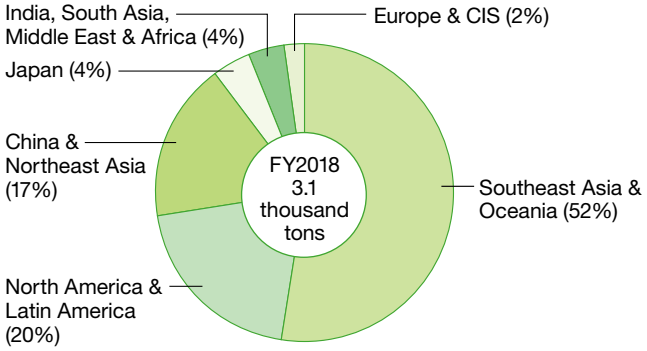
Amount and Recycling Rate of Total Wastes Including Revenue-generating Waste



Breakdown of Total Wastes Including Revenue-generating Waste (by region)



Breakdown of Landfill (by region)



Breakdown of Total Wastes Including Revenue-generating Waste for Fiscal 2018 (by category)

(1,000 tons)

Items	Total wastes	Recycled	Landfill
Metal scrap	154	153	0.4
Paper scrap	39	39	0.09
Plastics	44	41	0.5
Acids	32	21	0.1
Sludge	15	10	0.8
Wood	27	26	0.004
Glass/ceramics	6	6	0.05
Oil	19	18	0.08
Alkalis	19	16	0.005
Other *3	17	15	1.0
Total	372	345	3.1

*3 Combustion residue, fiber scraps, animal residue, rubber scraps, debris, ash particles, items treated for disposal, slag, infectious waste, polychlorinated biphenyls (PCBs), waste asbestos.

An example of factory waste reduction is also introduced in the following website.
http://www.panasonic.com/global/corporate/sustainability/eco/resource/zero.html

Environment: Product Recycling

Global Initiatives for Used Product Recycling

For the purpose of efficient use of natural resources and the prevention of environmental pollution, many countries around the world have been enacting recycling laws and developing their recycling systems. Examples include: the Law for Recycling of Specified Kinds of Home Appliances (Home Appliance Recycling Law) and the Act on the Promotion of Effective Utilization of Resources in Japan, the WEEE Directive in the European Union, and recycling laws in many states in the United States. In China as well, a similar recycling law has taken effect. In addition to complying with the Basel Convention which controls the transfer of hazardous waste to non-OECD countries as well as with related laws in respective countries, we strive to establish the most efficient recycling system in each country that is in line with its local recycling infrastructure, including the utilization of third parties.

Product recycling results in fiscal 2018 are as shown below. Because the collected products are becoming more compact and lighter due to the less volume of collection and recycling of CRT TVs and more flat screen TVs, and because the volume of collection and recycling has decreased due to reforms of business areas in various countries, the weight of collected products is on a flat or downward trend.

FY2018 Results

Japan	Processed approx. 145,260 tons of four kinds of used home appliances
Europe	Collected approx. 28,000 tons of used electronic products
USA	Collected approx. 583 tons of used electronic products

Product Recycling Initiatives in Japan

In response to the Home Appliance Recycling Law of 2001, which covers four specified kinds of home appliances, we established Ecology Net Co., Ltd. jointly with Toshiba Corporation to operate and manage a geographically dispersed recycling network through the effective use of existing recycling facilities nationwide. This recycling management company operates comprehensive recycling-related services on behalf of the “Group A” manufacturers (19 companies including Panasonic), and supervises 340 designated collection sites (shared by “Group A” and “Group B”) and 28 recycling facilities. Our recycling factories, Panasonic Eco Technology Center Co., Ltd. (PETEC), Panasonic Eco Technology Kanto Co., Ltd. (PETECK), and Chubu Eco Technology Co., Ltd. (CETEC)[*1] conduct unique research to improve our processes for further efficient recycling of the four kinds of used home appliances[*2] and for the recovery and supply of many resources. In fiscal 2018, we processed approx. 145,260 tons of the four specified used home appliances.

Compact crushing and sorting system for heat exchanger of air conditioner in PETECK

Amendment of the Home Appliance Recycling Law was considered in 2014 in order to make recycling fees clearer and lower, as well as to increase recycling rates.[*3] This resulted in the revision of the statutory recycling rate[*4] in April 2015.

Panasonic recycling factories are working to further enhance resource recycling by improving the productivity and recycling rates through efforts of applying different recycling methods appropriate to the characteristics and materials of respective products.

PETECK has developed and put into practical use a space-saving, low-cost compact crushing and sorting system, aiming to efficiently sort air conditioner heat exchangers into single materials. The system can crush heat exchangers in indoor and outdoor air conditioner units simultaneously as they are, and removes grease with centrifugal force generated by high-speed rotating blades on the crushing machine. Aluminum, copper, and iron are sorted by gravity and blower. Copper can be recovered at a high purity of 99%.

In addition, PETEC has introduced crushing and sorting lines for copper pipes and mixed metals. In these lines, copper pipes cut and recovered from the air conditioner line, as well as mixed metals (mixture of copper and aluminum) obtained after removing iron and plastic from crushed refrigerators, are re-crushed and re-sorted to increase the resource values of copper and aluminum.

*1 PETECK and CETEC are joint ventures between Mitsubishi Materials Corporation and Panasonic.
*2 Air conditioners, TVs, refrigerators/freezers, and washing machines/clothes dryers.
*3 Recycling rate = Valuable resource weight/Total weight of used home appliances.
*4 The amended statutory recycling rates are at least: 80% for air conditioners, 55% for CRT TVs, 74% for LCD and plasma TVs, 70% for refrigerators and freezers, and 82% for washing machines and clothes dryers.

▶ Overview of Recycling of Specified Home Appliances (Japan)
http://www.panasonic.com/global/corporate/sustainability/eco/resource/recovery/recycling.html
▶ Panasonic Eco Technology Center Co., Ltd. (PETEC)
https://panasonic.net/eco/petec/
▶ PC Recycling
http://www.panasonic.com/global/corporate/sustainability/eco/resource/recovery/pc.html

Recycling Efforts in the Europe / CIS Region

In 2017, we collected approx. 28,000 tons[*5] of used products covered by the WEEE Directive across Europe.

Article 15 of Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE) requires producers of electrical and electronic equipment (EEE) to provide information free of charge about preparation for re-use and treatment for each type of EEE placed on the market.

To fulfil the WEEE Article 15 requirements for providing specific recycling related information to recycling organizations in a much more efficient and beneficial way than in the past, producers and producer responsibility organizations have teamed up to create “Information for Recyclers – I4R”, a unique one-stop source platform aimed at providing a whole range of information and guidance on how to handle WEEE: http://www.i4r-platform.eu. This new platform will allow recyclers to access information about the presence and location of materials and components that need separate treatment. Panasonic was very active in providing information for I4R.

The Russian Waste Law has been amended several times. The most recent amendment came into force in December 2017. It sets environmental collection targets and fee rates for WEEE, packaging, and batteries for 2018 until 2020. Producers and importers must manage waste from their product and packaging waste either through self-compliance or a collective organization, or pay an environmental fee. 14 members (including Panasonic) are registered as members of the collective organization EPR E-WASTE RECYCLING. Panasonic is working on further developing appropriate regulations through the industry association RATEK.

*5 Calculated by multiplying the weight of collected products per collection system by Panasonic market share in terms of weight per collection system.

Promoting Recycling Activities in North America

Panasonic continues its leadership role in establishing and operating a recycling system for waste batteries and consumer electronic products in North America. Following the startup of a state recycling law in Minnesota in July 2007, we established the Electronic Manufacturers Recycling Management Company, LLC (MRM), jointly with Toshiba Corporation and Sharp Corporation in September of the same year, and began recycling TVs, PCs, and other electronic equipment.

With collaborative ties to several recycling companies, MRM operates collection programs on behalf of 43 companies across 20 states and the District of Columbia. MRM has collected approximately 395,144 tons since its inception in 2007. With the changes in Panasonic’s business strategies in the US in 2016, our remaining collection obligations are de-minimis, MRM will continue operating its collection programs on behalf of the manufacturers it serves.

As for waste batteries, we established Call2Recycle in 1994 jointly with other battery manufacturers, and now provide recycling programs for rechargeable batteries throughout the US and Canada. Call2Recycle provides collection programs and a robust retail collection network for over 300 companies, and collected approx. 6,300 tons of primary and rechargeable batteries in the U.S. and Canada, across more than 10,000 public and 13,000 private collection sites.

Recycling end-of-life products in Canada started in 2004 with the Alberta Government Extended Producer Responsibility (EPR) Regulation. Since then a total of ten provinces and two territories have legislated WEEE, each with their own unique parameters and requirements. In an effort to harmonize these programs, Panasonic Canada takes an active role in the governance of the Electronic Product Recycling Association, a not-for-profit management organization which was established with the mandate to standardize operations and bring about economies of scale on a national basis through 3,200 collection sites. They are now responsible for managing all the provincial programs with the exception of Alberta and

the two territories, as these three programs are under the direct jurisdictions of their governments and not industry. The currently active provincial EPR programs have proven to be very effective in diverting e-waste as reflected in last year's totals, where 132,417 tons were collected and resulted in an average of 3.58 kg per capita in Canada.

As the number of heavy CRT televisions entering the e-waste stream is on the decrease and the trend of light weighting of our products continues, it is anticipated that future collection weights will also decrease.

In 2017, New Brunswick was the last province to launch the end-of-life recycling program leaving the territories of the Yukon, with a delayed program, and Nunavut working to legislate e-waste.

Initiatives in China

In China, through the Executive Committee of Foreign Investment Companies (ECFIC) and other organizations, we are engaged in activities to clarify the products covered by the Second Catalog (published in February 2015) of the Regulation for the Administration of the Recycling and Treatment of Waste Electrical and Electronic Products, which was published in May 2012 and enforced in July of the same year. In addition, we actively gather information and submit comments on setting unit-based rates for the covered products, toward early disclosure of information by Chinese governmental organizations such as the Ministry of Environmental Protection and the Ministry of Finance.

We are also carrying out an assessment of the development of the Plan on Promoting Extended Producer Responsibility promulgated by the government in January 2017 and reviewing our response.

International Collaboration in Southeast Asia and Oceania

Vietnam

Since the introduction of recycling law in Vietnam in July 2016, producers and importers are required to establish a take back scheme for their products sold in Vietnam. Panasonic Sales Vietnam has since set up 7 collection points in Hanoi, Ho Chi Minh, Haiphong, Thanhhoa, Nghean, Danang, and Cantho. In 2017, 4 tons of e-waste were collected and sent to licensed recyclers for proper treatment.

Australia

The National Television and Computer Recycling Scheme was established in Australia in 2011.

Panasonic Australia is a member of the MRI PSO, a co-regulatory arrangement approved by the Australian government to fulfill our obligation under the national scheme. Below are the recycling-related data for televisions and computers from 2012-2018:

Period	Collection Volume
July 2013 – June 2014	1,052 tons
July 2014 – June 2015	1,166 tons
July 2015 – June 2016	1,108 tons
July 2016 – June 2017	1,027 tons
July 2017 – June 2018	1,221 tons

Panasonic Australia is also a member of the Battery Industry Working Group (BIWG). In 2017, BIWG together with the Queensland Government and other stakeholders, conducted two successful pilot collection and recycling programs for handheld batteries.

Other Southeast Asia countries

Regulators in Malaysia, Thailand, and Singapore are also gearing towards the global trend of mandating responsible end-of-life product recycling. Discussions with regulators and industry bodies are in progress. Such examples include Malaysia Department of Environment-Japan International Cooperation Agency (JICA) e-waste management mechanism development project and Thailand local industry association.

Through such engagements between the government and industry bodies, Panasonic hopes to contribute to the formulation of sustainable e-waste management policy in each country.

Recycling Efforts in India

In India, the new e-waste recycling law has been implemented by the Ministry of Environment, Forests and Climate Change (MoEFCC) from the 1st of October 2017, with Extended Producer Responsibility (EPR) targets based on end-of-life (EoL) defined in the e-waste (Management) rules 2016. To fulfill the compliance, we will collect and recycle waste home appliances through the “I Recycle” program already established by Panasonic India (PI).

Panasonic has also been taking part in the Consumer Electronics and Appliances Manufacturers Association (CEAMA), which promotes an analysis of current recycling activities in India as well as a long-term plan for waste problem solutions.

We are having various dialogues with the Indian government, jointly with CEAMA, about the EPR target and EoL definition for recycling management.

We are also actively engaged in different active associations including the Federation of Indian Chambers of Commerce and Industry (FICCI) and Confederation of Indian Industry (CII) to establish an even more efficient and robust recycling system and to submit industry comments to the Indian government for a better governance system.

Recycling Initiatives in Latin America

In response to a growing trend in stricter environmental laws in Latin American countries, discussions on the establishment of recycling laws and actual enforcement are being conducted.

In Brazil, jointly with industry groups and retailers, we are discussing the establishment of local recycling systems with the government, as well as actively participating in collection campaigns in major cities.

In Peru, under the recycling law that came into force in 2016, we joined a nonprofit organization Asociación Peruana de Actores para la Gestión de Residuos (ASPAGER) as a leading member, and started a used-product recovery program through discussions with the government.

In Costa Rica, we commenced collecting used products through Unidad de Cumplimiento para la Gestión Integral de Residuos Electrónicos (ASEGIRE), a compliance organization for integrated management of waste electronics. A similar program is also in progress in Mexico under the government-approved recycling and management plan. In Colombia, leading manufacturers including Panasonic formed a recycling management organization in cooperation with governmental organizations and industry groups to address the issue of ozone depletion. As part of its activities, the organization has been collecting refrigerators from 2014 and other consumer electronics products such as washing machines and microwave ovens from 2016.

In Chile, the legislation process has also been accelerated and preparations for setting up a collection program are underway through continuous discussions with the government. In Argentina, we are participating in the Latin American Battery Association (ALPIBA) and engaging in continuous discussions with the government for effective legislation on the regulation of dry cell batteries.

Environment: Water Resource Conservation

Approaches to Water Resource Conservation

It is said that available fresh water is only about 0.01% of the Earth's total water resources. In addition, the World Economic Forum, host of the Davos meetings, has stated in its annual report on global risks that the water crisis continues to be one of the top risks with global impact, in view of the increase in water consumption to be caused by future economic growth and population increases.

With water shortages becoming an increasingly grave social problem, Panasonic is working to conserve water resources both in its products and production activities, in order to fulfill its social responsibility and to reduce management risks. Our Environmental Policy (page 17) stipulates that we make efforts to conserve water resources by using water efficiently and preventing pollution. In Green Plan 2018, our Environmental Action Plan toward fiscal 2019, we aim to expand the range of products that contribute to saving and recycling water. At the same time, we will work on reducing the volume of water we consume and using more recycled water in our production processes, in order to conserve water resources throughout our business activities. In risk management, we are aiming to complete our water risk assessments for all our production sites by fiscal 2019.

Concrete action that we have taken for this includes an evaluation of the scale of water risks in all regions where our production sites are located, in order to identify and mitigate the impact of our production activities on our use of water.

In the evaluation, we employ evaluation tools such as the mapping tool Aqueduct by the World Resources Institute (WRI) and the Water Risk Filter by the World Wide Fund for Nature (WWF), which can not only assess the physical risks of water shortages but also examine the risks in water-related regulations as well as reputation risks in each region. We are also making use of public databases available from respective national governments. Furthermore, in areas with higher water risks, we are working to collect information through public local information as well as through interviews with relevant organizations, etc. By conducting detailed analyses and close examination of such local information and production site data including water use volume, we will specifically identify the impacts on our production activities. We have steadily continued such water risk assessment towards fiscal 2019, and as a result, we completed the water risk assessment in all of our production sites a year ahead of our target. At present, no water risks which could affect our business operation have been reported. We will work to conserve water resources and reduce business risks in regions where water risks are determined to be high, by focusing on promotions to reduce water consumption and expand water recycling.

To promote such activities, we have established an Environmental Sustainability Management System (page 21) for these activities including water management, under the executive officer in charge of environmental affairs (Yoshiyuki Miyabe, Senior Managing Executive Officer as of August 2018), and are aiming to raise the environmental management level by implementing the PDCA cycle.

In addition, we have established an Environmental Risk Management System to continuously reduce risks, and (1) identify environmental risks and promote company-wide risk management every fiscal year and (2) promptly respond to occurrence of environmental risks (see page 24). We will continue to manage our environmental risks through these activities.

We are also a member of the Water Project, a public-private collaborative project aimed at boosting awareness, organized under the initiative of Japan's Ministry of the Environment in 2014. Its objective is to maintain a sound water cycle and promote its recovery, and presents water-related activities by business corporations as well as communicates information on the importance of water as its activities. We will work in cooperation with the Japanese government and other companies to conserve water resources.

Water Resource Conservation through Products

By thoroughly analyzing the use of water through our products, we have developed functionalities that allow a considerable amount of water conservation by utilizing water at a maximum level through improvement of water flow control and cyclic use. In fiscal 2012, we enhanced one of the criteria, water conservation, in our Green Product accreditation criteria (see page 31), and are speeding up the development of industry-leading products that contribute to water saving.

▶ Example of water-saving products are introduced in the following website.
http://www.panasonic.com/global/corporate/sustainability/eco/water.html

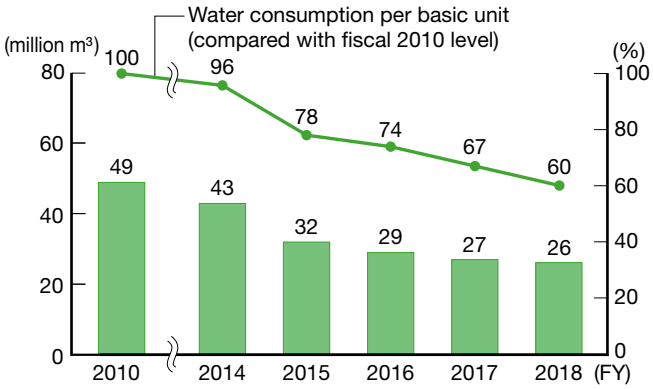
Initiatives for Water Resource Conservation through Production Activities

By collecting and reusing wastewater from our manufacturing processes and air conditioning systems, we reduce the amount of water use and wastewater effluent. This reduces the impact of the intake and effluent of water in production activities on water resources. With many regions around the world threatened by water shortages, we focus on certain regions to address our use of water in our activities.

Water used at factories in fiscal 2018 resulted in 25.84 million m³, reduced by 5.4% compared to fiscal 2017. The water used at our factories per basic unit of production[*1] improved year-on-year through impacts of structural reform, promotion of reuse, etc.

Our use of recycled water[*2] in fiscal 2018 amounted to 5.77 million m³, accounting for 22.3% of our total water consumption. Discharged water in fiscal 2016, 2017, and 2018 resulted in 22.46 million m³, 21.84 million m³, and 20.47 million m³, respectively.

Water Consumption in Production Activities and Water Consumption Per Basic Unit



Note: Then-SANYO Electric and Panasonic Liquid Crystal Display not included in fiscal 2010.

*1 Water used at factories per basic unit of production = Water used at factories / Production volume.

*2 The calculation excludes the water circulating for a single purpose (e.g. water in a cooling tower).

FY2018 Breakdown of Water Consumption (by region)

(10,000 m³)

Region	Consumed	Municipal water/ industrial water	Groundwater	Rivers/lakes	Discharged	Sewer systems	Waterways
Japan	1,578	499	1,080	0	1,354	195	1,159
China & Northeast Asia	495	492	3	0	328	241	87
South East Asia, & Oceania	426	374	48	4	317	174	143
North America & Latin America	34	23	11	0	19	19	0
Europe & CIS	22	11	11	0	18	8	10
India, South Asia, Middle East & Africa	29	4	25	0	11	11	1
Total	2,584	1,401	1,179	4	2,047	648	1,399

In the Automotive & Industrial Systems Company under the Panasonic Group, water used at factories in fiscal 2017 resulted in 15.05 million m³, against a target of 15.38 million m³.

Panasonic Industrial Devices (Qingdao) Co., Ltd. is located in Qingdao, China, where water shortage is a concern. In the factory, water is used to treat hydrochloric gas produced during manufacturing processes of electrostatic capacitance-type touch panels. Corresponding to an increase in the usage of water due to production expansion, they introduced a system in which alkaline drainage water generated during processes except that of manufacturing can be utilized to neutralize acid drainage water efficiently, resulting in a decrease in the usage of water in the whole factory by 7.4%. Panasonic continue our efforts to conserve water resources.

Panasonic Industrial Devices (Qingdao) Co., Ltd.

Environment: Chemical Substance Management

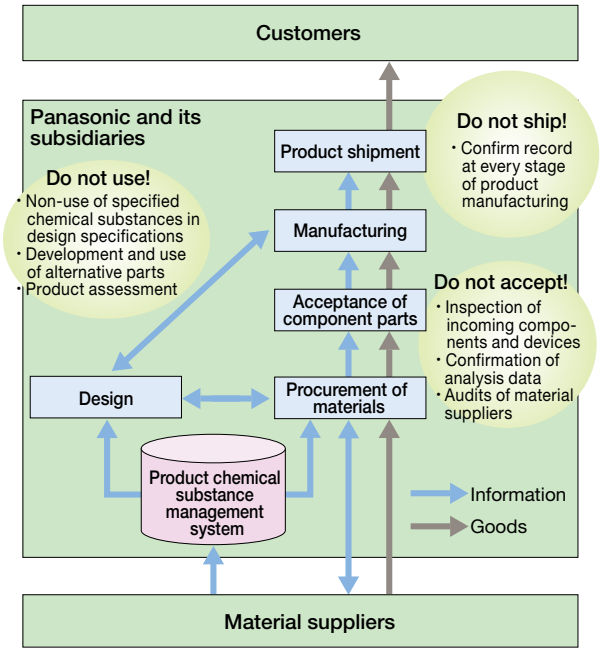
Initiatives to Reduce the Environmental Impact of Chemical Substances

In order to prevent content of hazardous substances prohibited under the EU RoHS Directive*1, published in 2002 and recast in 2011, and the like to Panasonic products, it is important not only to be aware during the product design stage but also to be aware that certain substances are not contained in purchased components.

To ensure compliance with the Directive, Panasonic has been promoting the "Do not accept! Do not use! Do not ship!" campaign throughout the various production stages from designing to shipment inspection in business sites across the world since October 2005. Specifically, we employ a range of mechanisms using screening devices to search for and exclude specific chemical substances.

We also conduct environmental audits on suppliers of parts and materials with high risk of content of specified hazardous chemical substances to support them in building a sound chemical substance management system.

Specified chemical substance management system

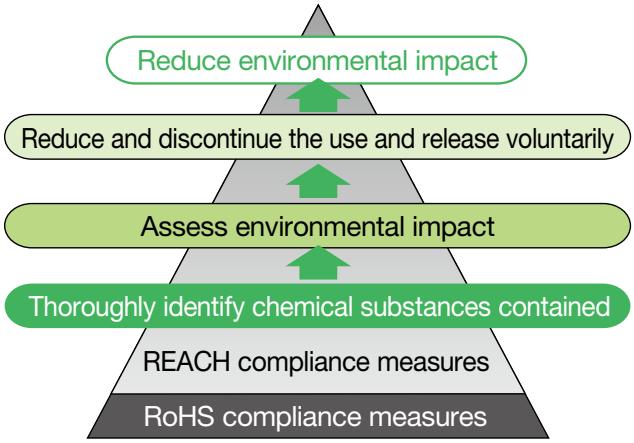


Meanwhile, as represented by the enforcement of the REACH regulation*2 in the European Union, the world is moving toward the goals agreed at the World Summit on Sustainable Development (WSSD) held in 2002, which is to produce and use all chemical substances in a manner that minimizes their impact on human health and the environment by 2020. In support of the precautionary approach proposed in the Rio Declaration made at the Earth Summit in 1992, we have been manufacturing products in line with our basic policy of reducing the use of chemical substances that might adversely affect human health and the environment throughout their lifecycles. As specific initiatives, we aim to reduce the environmental impact of our products by (1) identifying hazardous substances contained in our products, (2) evaluating these substances on their environmental impact, and (3) voluntarily reducing or discontinuing their use in case of any environmental risks.

*1 Directive on the Restriction of the use of certain Hazardous Substances in electrical equipment

*2 Regulations on the registration, evaluation, authorization, and restriction of chemical substances.

Process to Reduce the Environmental Impact of Chemical Substances



To promote our initiatives clearly, we set forth our Chemical Substances Management Rank Guidelines, which prohibit or specify certain substances for management in terms of our products and factory activities. Companies in the Panasonic Group are requested to follow the Guidelines, and suppliers are also requested for support as necessary. In fiscal 2013, we added Level 3 to the Chemical Substances Management Rank Guidelines (For Products) to review the timing for the prohibition of further substances that may adversely affect humans and the environment, in addition to the current and forthcoming prohibitions.

Chemical Substances Management Rank Guidelines (For Products) and relevant documents, which prohibit or specify certain substances for management, can be downloaded from the website shown below (Green Procurement).

▶ Green Procurement (Download of Chemical Substances Management Rank Guidelines (For Products))

http://www.panasonic.com/global/corporate/management/procurement/green.html

Chemical Substances Management Rank Guidelines (For Products)

Rank		Definition
Prohibit	Level 1	(1) A substance contained in products that is prohibited by existing laws and regulations; or a substance where the upper limit of concentration is specified. (2) A substance that will be prohibited in products by laws and regulations or where the upper limit of concentration will be specified within one year of the revision of these Guidelines.
	Level 2	(1) Substances other than those specified as the Level 1 Prohibited Substances that will be prohibited in products after a certain period by a treaty, law, or regulation. (2) Substances that are prohibited in products by the Panasonic Group prior to the effective period specified by a treaty, law, or regulation. (3) Substances whose use is voluntarily restricted by the Panasonic Group.
	Level 3	Any substance other than those specified as a Level 1 or Level 2 Prohibited Substance that is reviewed for prohibition by legislation etc., and the clarification of substitution-related issues as well as the timing for prohibition is reviewed by the Panasonic Group in light of future legislation trends.
Manage		Substances whose consumption needs to be monitored and for which consideration needs to be given to human health, safety and hygiene, adequate treatment, etc. The intentional use of these substances is not restricted, but their use and contained concentration must be monitored.

Note: Covered legislation and chemical substances include: Class I Specified Chemical Substances under the Act on the Evaluation of Chemical Substances and Regulation of Their Manufacture, etc.; substances whose manufacture etc. is prohibited by Article 55 of the Industrial Safety and Health Act; EU RoHS Directive; and Annex XVII of the EU REACH Regulation. For more details, see the chapter on Specified Managed Substances in the Chemical Substances Management Rank Guidelines (For Products).

Chemical Substances Management Rank Guidelines (For Factories)

Rank	Definition
Prohibit	Use of the following substances should be immediately discontinued: Carcinogens for humans Ozone depleting substances Substances whose use is prohibited by Panasonic Chemical substances designated as Class I Specified Chemical Substances by the Japanese Act on the Evaluation of Chemical Substances and Regulation of Their Manufacture, etc. Substances whose manufacture is prohibited by the Japanese Industrial Safety and Health Act Substances whose manufacture and use are prohibited by international treaties
Reduce	Substances whose use, release and transfer should be identified and reduced. Substances other than prohibited substances that might pose risks to human health and the environment.

Note: Covered legislation include: PRTR Act (chemical substances), environmental criteria under the Basic Environment Act; the Industrial Safety and Health Act; and the Stockholm Convention. For more details, see the contents on The Aim of Establishing the Chemical Substances Management Rank Guidelines (For Factories) in the Chemical Substances Management Rank Guidelines (For Factories).

History of Our Initiatives to Reduce the Environmental Impact of Chemical Substances

	1990	1995	2000	2005	2010	2015
Social trends	1989: The Montreal Protocol entered into force	1992: Earth Summit in Rio de Janeiro—Agenda 21 1996: Discontinuance of the use of specified chlorofluorocarbons by industrialized countries	2002: WSSD in Johannesburg	2006: The RoHS Directive entered into force	2007: The REACH Regulation entered into force	
Panasonic						
All products		1992: Discontinued use of PVC resin in packaging materials	March 2003: Discontinued use of lead in solders globally*3	October 2005: Discontinued use of six RoHS substances globally*3	March 2009: Discontinued use of PVC in internal wiring of new products to be sold in Japan*3 March 2011: Discontinued use of PVC in internal wiring of new products globally*3	July 2018 (planned): Use of four types of phthalates specified by the RoHS Directive to be discontinued in new products globally
Individual products	1991: Released mercury-free manganese dry cells	1992: Released mercury-free alkali dry cells 1995: Discontinued use of CFC refrigerant in refrigerators globally	2002: Discontinued use of HCFC refrigerant in air conditioners (Japan)	2004: Refrigerators in Japan market became fluorocarbon-free (Japan) 2006: Released lead-free plasma display panels	2010: Released fluorocarbon-free freezers using CO_2 refrigerant and compatible display cases	2013: Released air conditioners using new refrigerant R32 with low Global Warmer Potential (GWP) (Japan)
Chemical substances used at factories		1996: Discontinued use of chlorinated organic solvents 1997: Began identification work for PRTR	1999: Launched the "33/50" reduction activity*4	2004 (Japan): Achieved Voluntary Action Plan Reduced use by 75% Reduced release and transfer amount by 62% compared to fiscal 1999 level	2010 (Global): Achieved Voluntary Action Plan Reduced release and transfer amount of key-reduction target substances by 46% compared to fiscal 2006 level	

*3 Excluding applications where the quality such as safety cannot be ensured, or applications where the material is designated by laws and regulations.

*4 A reduction activity that promotes cutbacks in the use, release, and transfer of chemical substances by 33% in three years and by 50% in six years, compared to the fiscal 1999 level.

Management of Chemical Substances in Products

To minimize the environmental impact of chemical substances contained in products, we endeavor to identify chemical substances used in the components and materials of our products. In addition, for substances that are prohibited in products in major developed countries due to legislation such as the European RoHS Directive, we specify prohibited substances to globally ensure that they are not used or contained in our products, except in certain cases where substitution of the substances is infeasible. We will also conduct environmental impact assessments for managed substances contained in our products, take steps to reduce the use of substances where the impact on human health and the environment cannot be ignored, and plan to eventually prohibit the use.

Identifying Chemical Substances in Products

To contribute to the achievement of the global goals set at the WSSD, it is important for us to disclose and communicate information on the chemical substances used in our products across the supply chain, for which we must promote cross-industrial initiatives to establish and disseminate an effective system. We are a member of the Joint Article Management Promotion consortium (JAMP) together with about 440 major companies from various industries, such as chemical, component, and equipment manufacturers. We are proactively formulating, utilizing, and disseminating chemical substance management standards and systems through this organization. Since fiscal 2005, we have been using a product chemical substance management system to gather data concerning the chemical substances contained in the components and materials for our products from our suppliers. In July 2009 we asked our suppliers to submit the data in a common format by JAMP, and approx. 10,000 suppliers are currently using this format.

Meanwhile, in Japan alone, burden on companies grew, as a number of hazardous substance inspections were carried out throughout the supply chain using formats unique to each company that were not standardized such as the JAMP format for information handling. The Ministry of Economy, Trade and Industry recognized this issue and presented a new scheme, "chemSHERPA," for sharing and exchanging information about chemicals contained in components and products throughout the supply chain. Because chemSHERPA follows the standardized JAMP format to handle information, Panasonic has joined the scheme and adopted the use as the information-gathering format in its system. We plan to replace the current JAMP mechanism with chemSHERPA by June 2018 when the JAMP support and maintenance period will discontinue (excluding communication of information on automotive equipment for the automobile sector for which the industry's standard information sharing system is already established).

In addition, with the supply chain expanding to a global scale, it is particularly important for overseas suppliers to deepen their understanding on the handling of hazardous chemical substances. We have carried out education programs for persons in charge of chemical substance management and suppliers in more than 100 our business sites in nine countries including China and other Asian countries, and completed the conversion of the existing system into chemSHERPA by June 2018, when the JAMP format becomes fully obsolete.

▶ JAMP http://www.jamp-info.com/english

▶ Chemicals in Products (Ministry of Economy, Trade and Industry) http://www.meti.go.jp/policy/chemical_management/english/cip-e_index.html

▶ ChemSHERPA https://chemsherpa.net/chemSHERPA/english/

Companies that procure electronic components may need to have a full understanding of the substances contained in the components at the point of selection or usage in order to adhere to the EU RoHS Directive and REACH regulation. Particularly, as the REACH Substances of Very High Concern (SVHC) List is updated every six months, those companies expect their suppliers to provide the latest substance data to demonstrate compliance with the list.

Also, as a company supplying electronic components to other companies, we have published a table of RoHS and REACH compliance status on our website since November 2012 so that our clients can obtain relevant chemical substance information from us quickly and efficiently. The table covers our RoHS Directive compliance information and the substances designated in the RoHS / REACH Confirmation Report for all our major generic electronic components.

▶ RoHS / REACH Confirmation Report for major generic electronic components
http://industrial.panasonic.com/ww/downloads/rohs-reach

For products covered by the Act on the Promotion of Effective Utilization of Resources, the Panasonic Group does not manufacture, import, or sell products that contain certain chemical substances beyond specified standards, other than in exempted parts. For more details, see Information on the Content of Certain Chemical Substances in Covered Products below.

▶ Information on the Content of Certain Chemical Substances (Japanese)
http://www.panasonic.com/jp/corporate/sustainability/eco/chemical/jmoss.html

In June 2015, the Act on Preventing Environmental Pollution of Mercury was established to implement measures agreed in the Minamata Convention on Mercury. The act requires manufacturers of products containing mercury to provide information such as labelling so that such products are appropriately sorted and discharged when being disposed of. We have established a new webpage, Information Based on the Act on the Preventing Environmental Pollution of Mercury, in May 2017 to communicate information concerning the mercury used in our products to customers.

▶ Act on Preventing Environmental Pollution of Mercury
https://members.wto.org/crnattachments/2015/TBT/JPN/15_2560_00_e.pdf#search=%27Act+on+Preventing+Environmental+Pollution+of+Mercury%27

▶ Information Based on the Act on Preventing Environmental Pollution of Mercury (Japanese)
http://www.panasonic.com/jp/corporate/sustainability/eco/chemical/jmoss/mercury.html

Assessing the Impact of Chemical Substances

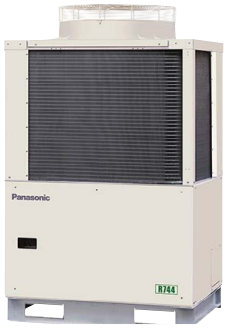
Scientifically identifying the impact on human health and the environment of products containing chemical substances is vital to the development of products with low environmental impact. We are engaging in activities designed to assess the levels to which customers are exposed to substances of very high concern (SVHC), as well as safety at the time of product use.

To date, we have undertaken assessments on the impact of ceramic fibers used in certain models of commercial microwave ovens. As part of our efforts to comply with the EU REACH regulation which requires preparing information for the safe use of products containing a certain amount of SVHC, we have created and disclosed a safety assessment document. The exposure was considered to be nominal with little concern for any impact on human health. Furthermore, usage of ceramic fibers in our products was discontinued in December 2010.

▶ Management of Chemical Substances in Products
http://www.panasonic.com/global/corporate/sustainability/pdf/RCF_Professional_microwave_oven.pdf

Reduction in Usage and Emissions of Chemical Substances

Fluorocarbons used as a heat insulator and a refrigerant for freezers and air conditioners can damage the ozone layer and cause global warming. We developed the technology to utilize CO_2, which has much smaller impact than fluorocarbons, as a refrigerant and have been supplying a home boiler using CO_2 refrigerant since 2001. Although the CO_2 refrigerant is suitable for heating purposes, it was difficult to apply to refrigerators and freezers, especially in large professional equipment due to insufficient cooling efficiency and size problems. However, with support from the New Energy and Industrial Technology Development Organization (NEDO), we developed a refrigeration system using CO_2 refrigerant, and started supplying these fluorocarbon-free freezers and refrigerator display cases to supermarkets and convenience stores in Japan from 2010. By the end of March 2017, we delivered roughly 5,800 units to approx. 2,200 stores.



OCU-CR2001MVF, a fluorocarbon-free freezer using CO_2 refrigerant

FPW-EV085, a display case compatible with a fluorocarbon-free freezer

Making the best use of our expertise in the Japanese market, in May 2017 we also started sales of fluorocarbon-free CO_2 freezers designed for small stores and prefabricated refrigerator/freezers for the European market, where F-gas regulations and other environmental regulations are in place. We released the product in Norway, Denmark, Sweden, and Belgium, aiming to sell more than 300 units in the first year. We plan to expand the market to other countries, including Germany and Holland. We also commenced the trial release in the Asian market, to expand its sales in China, Taiwan, Malaysia, and Indonesia.

In addition, as measures against ozone depletion caused by HCFCs, a refrigerant called R410 that does not deplete the ozone layer was used in compact air conditioners, but this substance has a very high Global Warming Potential (GWP). Panasonic then developed a model that uses a new refrigerant R32, which has a lower GWP and introduced it to the market in 2013. Furthermore, PT. Panasonic Manufacturing Indonesia, which owns the factory for manufacturing compact air conditioners in Indonesia, redesigned its production facility that used an ozone-depleting HCFC refrigerant R22 to one using R32 in fiscal 2015, and commenced supplying new R32-based air conditioners. Panasonic contributed to the Indonesian government's initiative to eliminate the use of HCFCs.

Mercury lamps are currently widely used as the light source for projectors, because they provide high luminosity easily. However, mercury can have a serious impact on human health and the environment if not treated properly, and the short life of the lamps causes high consumption of resources as well as high environmental impact. For these reasons, Panasonic is developing products that adopt laser light sources. The PT-RZ31K Series are projectors for professional use that provide high luminosity by employing a high-output semiconductor laser light source module and a heat-resistant phosphor wheel. In addition, the casing material does not use halogenated flame retardant, making the projector an eco-conscious product that contributes to reducing the use of hazardous substances.

PT-RZ31K Series, a laser projector for professional use

Reducing the Use of PVC Resin

Polyvinyl chloride (PVC) is a material of concerns to the generation of hazardous substances from inappropriate disposal, as well as the harmful effects of certain additive agents (phthalates) used to render PVC more pliable. In light of the significant potential for inappropriate disposal of the PVC resin used in the internal wiring of products, due mainly to difficulties associated with the sorting of this resin from used products, we have switched our new products launched from April 2011 to non-PVC.

▶ List of Our PVC-free Products http://www.panasonic.com/jp/corporate/sustainability/pdf/eco_pvclist2016.pdf

Restriction on the Use of Phthalates

Phthalates are often used in PVC products, and the use of four phthalates[*5] will be restricted under the EU RoHS2 from July 22, 2019.

We specified these substances as Level 2 Prohibited Substances in our Chemical Substances Management Rank Guidelines Ver. 10 (for products) issued in June 2016, and delivery of such substances will be prohibited from July 22, 2018. We have specified other phthalates as Level 3 Prohibited Substances, and are promoting substitution.

As for the four phthalates, we are currently working on creating an analysis and assessment system to ensure substitution.

Since phthalates have a migration characteristic (where a substance from another article migrates through contact), materials may be contaminated by migration from production equipment as well as process equipment containing the four phthalates specified as Level 2 Prohibited Substances. Accordingly, we are also discussing management of preventive measures against contamination through contact.

To build an inspection system for purchased components, we revised the acceptance inspection standards and determined to conduct inspections on the supplied components with a high chance of containing phthalates, such as PVCs, elastomers, and glues. We have already assessed and selected a phthalate analyzer to use for these inspections, and commenced installation in our procurement sites. Phthalates contained in our products exported to the Europe used to be as high as 10 tons. This figure was reduced to less than one ton as of March 2018, and we aim at completing phthalate substitution by July 2018.

*5 Bis(2-ethylhexyl) phthalate (DEHP), Butyl benzyl phthalate (BBP), Dibutyl phthalate (DBP), and Diisobutyl phthalate (DIBP).

Management of Chemical Substances at Factories

Panasonic is working to minimize environmental impact by identifying the hazardous substances used in our products, assessing the impact of such use, and voluntarily discontinuing the use or reducing the release of such substances. Since 1999, we have been conducting the 33/50 Reduction Activity to materialize reduction by 33% in three years and by 50% in six years. In Japan, we started promoting cutbacks in the use, release, and transfer of chemical substances at our factories in fiscal 2000. Against the target in our voluntary action plan, a reduction by 50% from the fiscal 1999 level, we achieved a 75% reduction in chemical substance use and a 62% reduction in release and transfer in fiscal 2005. Since then we have been continuing the activity, focusing on substances with particularly large amounts of release and transfer, setting a voluntary action target of reduction by 30% compared to the fiscal 2006 level. As a result, we achieved a 46% reduction in the amounts of release and transfer of specified key reduction-target substances across all factories worldwide in fiscal 2011.

Reflecting international trends in chemical substance management, our reduction measures have focused increasingly on particularly hazardous substances from fiscal 2011. Our Chemical Substances Management Rank Guidelines (for Factories) was established in 1999 as a guideline to help manage the above chemical substance reduction activities. In Version 1, the guidelines specified a list of chemical substances to be managed, mainly focusing on carcinogenic substances. The guidelines were later updated to Version 2 in 2000 to include rules concerning the Japan PRTR Law. Version 3, introduced in 2004, additionally covered a list of substances specified by chemical substances management legislation in Japan. The chemical substances covered by Version 4 and later from 2009 are those specified in legislation on human health and environmental impact in Japan, the U.S., and Europe, as well as those specified under international treaties.

Under our Chemical Substances Management Rank Guidelines (For Factories), we have focused our management on select chemical substances that are hazardous to human health and the environment. Further, we have created a unique indicator, the Human Environment Impact,[*6] which is used globally in all our factories. Conventionally the chemical substances were managed by “quantity,” such as usage amount or emissions/release. However, such quantity-based management has a problem in that some highly hazardous substances do not become subject to reduction or management if the usage amount was small, and therefore would fall out of the scope of impact assessments. In addition, the toxicity criteria varied according to substance types and regional legislation, which made standardized management across the Group difficult. To address this issue, Panasonic worked together with experts from both within and outside the company, reclassified chemical substances based on an overall assessment of their hazardousness, and specified a hazardousness factor for each classification. Specifically, we set a hazard classification to each substance by utilizing carcinogen risk assessments issued by international organizations, together with publically available hazard information and lists of ozone depleting substances. For substances that have multiple hazard information items, the item ranked with the highest hazard risk is used for classification. We utilize this internal indicator as the Human Environmental Impact indicator to promote efforts to ensure reduction of highly hazardous substances with greater environmental impacts, such as carcinogens and ozone depleting substances, according to the risk level. The Panasonic Group Chemical Substances Management Rank Guidelines is also available on the website on our Green Procurement activities to promote collaboration with our suppliers, encouraging them to offer materials that do not contain hazardous substances.

▶ Green Procurement (PDF Download of Chemical Substances Management Rank Guidelines (For Factories))
http://www.panasonic.com/global/corporate/management/procurement/green.html

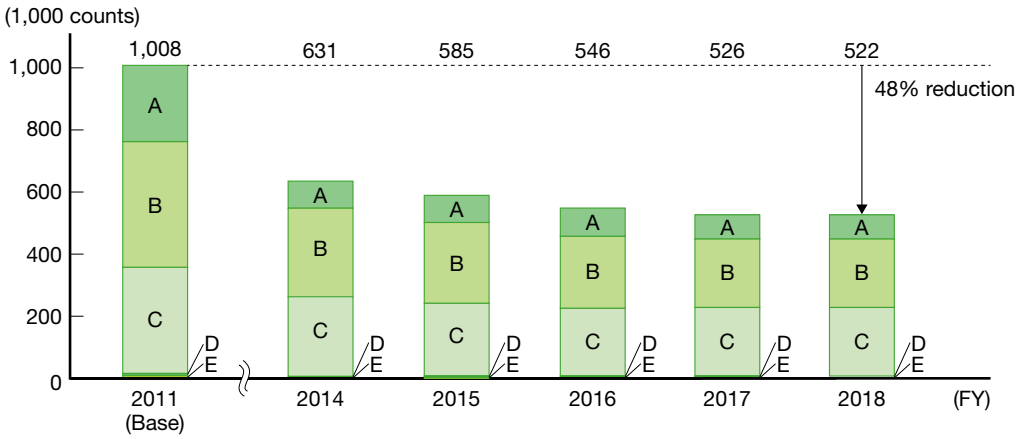
*6 Human Environmental Impact = Hazardousness factor x Release and transfer amount.

Classification of Hazards

Classification	Hazards*7	Hazardousness factor
A	Carcinogenicity/Ozone layer depletion	x 10,000
B	Serious or direct impact	x 1,000
C	Medium impact	x 100
D	Small or indirect impact	x 10
E	Minor impact or not assessed	x 1

*7 In addition to carcinogenicity, hazards to human health include genetic mutation, reproductive toxicity, and acute toxicity. In addition to ozone depleting substances, hazards to/substances with impact on the environment include ecological toxicity, substances that impact global warming, and substances that generate photochemical oxidants.

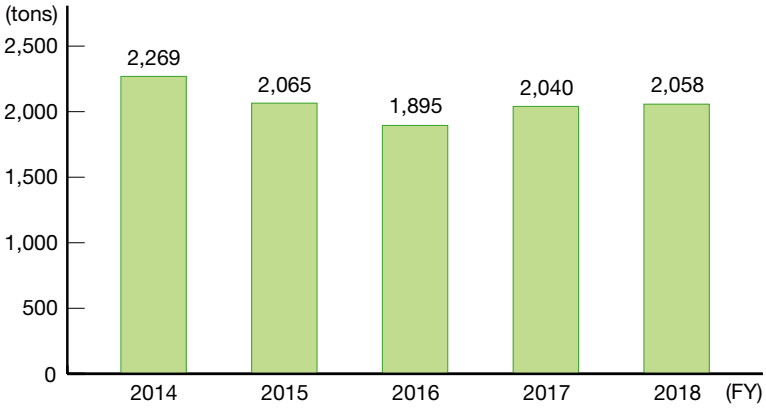
Human Environmental Impact



Note: Overseas sites of former SANYO Electric not included in fiscal 2011.

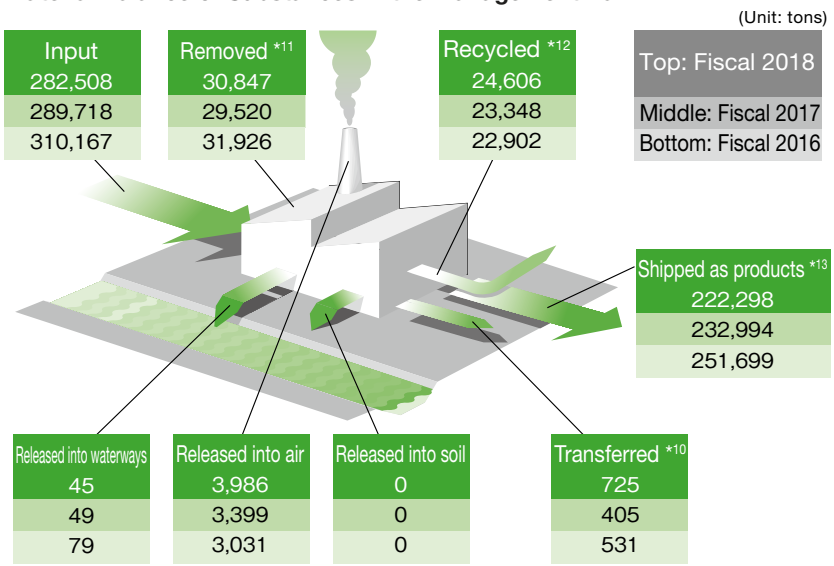
In fiscal 2018, we were able to reduce Human Environmental Impact by 48% compared to fiscal 2011 by substituting highly hazardous substances in paints, improving yields, promoting recycling, introducing substances with low-solvents and hazards, and improving processes, including reviewing the amount of paint or the number of washing cycles, as well as improving the efficiency of removal/deodorization equipment. We will continue our initiatives to minimize the amount of substances with environmental impact released through our production activities.

VOC*8 Emissions



*8 Emissions of Volatile Organic Compounds (VOC) into the air caused by use. The calculation covers 100 major VOC substances that Panasonic selected from those listed in the Air Pollution Control Act.

Material Balance of Substances in the Management Rank*9



*9 Based on the Chemical Substances Management Rank Guidelines (for factories). Includes all the substances specified in the Pollutant Release and Transfer Register Act.

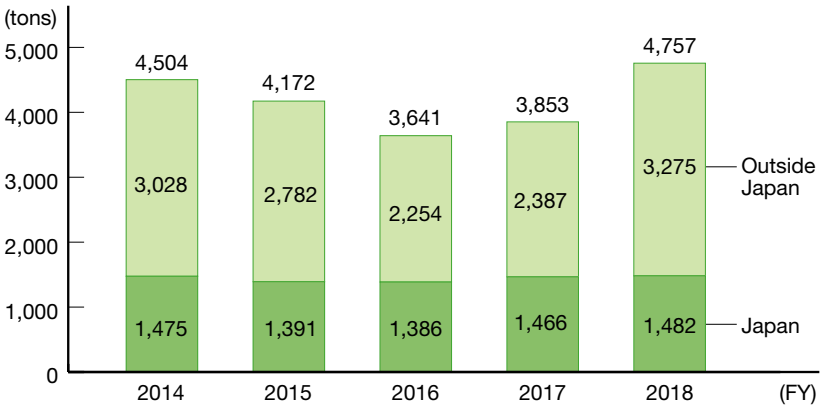
*10 Includes substances transferred as waste, as well as those discharged into the sewage system. Recycled amount which is free of charge or accompanies treatment cost under the Waste Management Law is included in "Recycled." (Different from the transferred amount reported under the PRTR Law.)

*11 The amount of substances converted into other substances through neutralization, decomposition, or other chemical treatment.

*12 The amount of substances recycled with revenue, as well as those recycled free of charge or with any payment.

*13 The amount of substances that have been changed to other substances as a result of chemical reactions, and/or those that are contained in or accompanied with products and shipped out of factories.

Release/Transfer of Substances Requiring Management



Environment: Biodiversity Conservation

Approaches to Biodiversity

Business management and human life in our society is founded on the ecosystem services—a multitude of nature's blessings provided by our natural capital, including soil, air, water, and animals and plants. It is important to preserve biodiversity to sustain the benefits derived from this natural capital towards the future; however, this biodiversity is experiencing significant damage at an unprecedented speed.

We are committed to properly understanding the impact of our business activities on biodiversity and contributing to conservation. To this end, we are promoting initiatives in cooperation with local governments, environmental conservation NGOs, and specialized agencies. We focus on the three key areas of land use, procurement, and products, in order to promote biodiversity conservation as an initiative incorporated into our businesses. In promoting the key areas, we formulate a biodiversity action plan (BAP), which is the basic concept of Article 6 of the Convention on Biological Diversity, and implement measures, check the achievement progress, and improve the initiatives.

Contribution to the Aichi Biodiversity Targets adopted by the 10th Conference of the Parties (COP 10) and the Sustainable Development Goals (SDGs) set by the United Nations is also expected of private corporations. We are expanding our biodiversity conservation activities by collaborating with external organizations.

Initiatives in Land Use

Green areas in our business sites can potentially contribute to conserving biodiversity in that area. In particular, hardly any natural environments where wild animals can live and breed remain in urban areas. Therefore, even small areas of green in corporate premises can become a precious environment for a variety of living organisms if they retain indigenous vegetation and a watery environment.

Preservation of Biotopes in Collaboration with Governments and Experts

Forming an ecological network that connects greenery in our business sites and neighboring woodlands and parks enables birds and insects such as butterflies and dragonflies to move across the areas for flowers and water, expanding their living space. In addition, protecting rare plants and living creatures in local areas is an activity in collaboration with governments and with help and advice of experts to preserve endangered species designated by the Ministry of the Environment or local government that are deemed to be disappearing from that area. Other examples include the Biotope at the Eco Solutions Company in Kadoma City, Osaka Prefecture that concluded the Osaka Biodiversity Partnership Agreement with the government of Osaka Prefecture, Osaka Prefecture University, and the Research Institute of Environment, Agriculture and Fisheries, as well as Tsunagari no Hiroba at Panasonic Homes Co., Ltd. that was set up with the participation as part of Osaka Prefecture's project to create green wind streets and conclusion of the aforementioned agreement with Osaka Prefecture, Toyonaka City, Osaka Prefecture University, and the Research Institute of Environment, Agriculture and Fisheries.

Examples of activities are introduced in the following website.
http://www.panasonic.com/global/corporate/sustainability/eco/biodiversity.html

Acquisition of External Certification Based on Quantitative Evaluation

The Kusatsu Factory of the Panasonic Appliances Company in Kusatsu City, Shiga Prefecture, obtained a certificate from the Association for Business Innovation in harmony with Nature and Community (ABINC) in March 2018 for its contribution to biodiversity. The ABINC certifies a corporation's manner of organization and management of greenery in their business site as a third party by assessing it based on the ABINC guidelines and the Land Usage Assessment Sheet (a quantitative biodiversity and environmental assessment tool) developed by Japan Business Initiative for Biodiversity (JBIB) and partner companies. In the course of assessment, we received positive remarks concerning how we are building greenery to suit diverse living creatures by appropriately preserving the natural environment, keeping invasive

Entire view of the water front

alien species under control and regularly monitor them to track their status, and the proactive use of greenery in liaison with external organizations and local people, such as the local public bodies and primary school pupils. The monitoring survey conducted since 2011 recognized 838 species of plants and living creatures, and found that our greenery is an important biotope in the urbanizing area, which contributes to the formation of local ecological networks.

Rare striated heron juveniles being reared in the factory premises

The Matsumoto Factory of the Automotive & Industrial Systems Company obtained rank A in the JHEP Certification[*1] in September 2015. The certification is updated annually through assessment and our biodiversity preservation activities in our greeneries are maintained continuously.

*1 A quantitative biodiversity assessment method developed by Ecosystem Conservation Society Japan based on the Japan Habitat Evaluation and Certification Program (HEP) used for environmental assessments.

Efforts in Procurement

In an effort to address biodiversity conservation and sustainability, we consulted extensively with World Wide Fund for Nature (WWF) Japan and formulated Panasonic Group Green Procurement Guidelines for Wood.

Exclusion of illegally logged timber and wood materials (Category 3)

In fiscal 2018, the total procurement of timber and wood materials was measured at approx. 350,000 m^3. By category, this breaks down to 77.3% meeting Category 1 “Priority” procurement standards (a 0.3-point year-on-year decrease), 22.7% in Category 2 “Acceptable” (a 0.3+point year-on-year increase), and 0% in Category 3 “Avoiding” (same as previous year). Ever since the establishment of our Procurement Guidelines, we efforts to achieve zero procurement for Category 3, have been implemented with zero procurement continuing since fiscal 2015. We will continue our efforts and maintain zero procurement for Category 3.

Green Procurement Guidelines for Wood Consulted and Formulated with WWF

In green procurement for wood, we implement the PDCA cycle based on development of the annual plan, and confirm the progress status at the end of the fiscal year as well as review the measures for the subsequent fiscal year.

Fit Floor Natural Wood Type (heat resistant & non-heat resistant) & Fit Floor (heat resistant & non-heat resistant)

We are also engaged in the reduction of the use of natural raw materials, from the perspective of preserving timber resources. Flooring materials (woody flooring material) Fit Floor Natural Wood Type (heat resistant & non-heat resistant) and Fit Floor (heat resistant & non-heat resistant) use “Fit Board,” our unique new material made of 100% recycled wood material (excluding adhesives).

The Act on Promoting the Distribution and Use of Legally Harvested Wood (the Clean Wood Law) came into effect on May 20, 2017. Panasonic provides information concerning the legality of our wooden products based on the Clean Wood Law at the following URL.

▶ Compliance with the Clean Wood Law (Japanese)
http://www2.panasonic.biz/es/sumai/law/cleanwood/

Initiatives in Products

Together with the NGO BirdLife International, we have established a third-party assessment system to provide customers with information about product contributions to biodiversity. Through this system, we have assessed products which are closely linked to biodiversity.

We have also enhanced our Green Product accreditation criteria (see pages 31) by adding biodiversity to the existing items. We define products that contribute to biodiversity conservation as those that use biodiversity-conscious materials in their major components and those that include functions to help biodiversity conservation.

In fiscal 2014, Panasonic Environmental Systems & Engineering Co., Ltd. developed ATPS-BLUEsys, a Ballast Water Management System (BWMS) to reduce disturbance from maritime transportation of the marine ecology of local sea areas. Ballast water is sea water used to retain the balance of a freight vessel at sea when it is not carrying shipment. Because the ship travels across the sea taking sea water from one port and then draining the water into another port, the impact of foreign organisms such as plankton and bacteria on the local ecology, environment, and resources is becoming an increasingly serious problem. ATPS-BLUEsys treats microorganisms in the water with inline electrolysis without using filters, which is the first in Japan. The system can treat the water to a level lower than the standards by the International Maritime Organization (IMO), and successfully acquired the IMO G9 Basic Approval (G9BA). Marketing of this system has been launched in fiscal 2018 as it acquired equivalent designation by System, ATPS-BLUEsys received type approval from the Japanese Ministry of Land, Infrastructure, Transport and Tourism in March 2017.

▶[Press Release] Ballast Water Management System ATPS-BLUEsys
http://news.panasonic.com/global/press/data/2014/01/en140128-2/en140128-2.html

Panasonic has developed Sustainable Smart Towns (SSTs) in Fujisawa City and Yokohama City in Kanagawa Prefecture. We are currently planning to develop another SST in Suita City in Osaka Prefecture. The SST urban design guidelines adopt the idea of biodiversity for greening towns as well as plans for reducing greenhouse gas emissions so as to establish sustainable towns by growing indigenous trees and plants and forming ecological networks that exist with communities.

Biodiversity Conservation Through Collaboration with and Support by NGOs and NPOs

We collaborate with NGOs and NPOs through the Keidanren Committee on Nature Conservation, in an effort to promote biodiversity conservation on a global scale as well as in coordination with the industrial sector.


Tree planting activity at the Bukit Barisan Selatan National Park

The Keidanren Committee on Nature Conservation is an organization consisting of more than 110 Keidanren member enterprises that are actively involved in nature protection and biodiversity conservation. Since its establishment in 1992, it has been engaged in supporting NGO efforts in nature conservation, promoting exchanges between business enterprises and NGOs, promoting awareness of nature protection and biodiversity among businesses, and supporting the efforts in the Tohoku region to recover from the earthquake disaster through the restoration of nature.

Through corporate and private donations to the Keidanren Nature Conservation Fund, including donations from Panasonic, support worth a cumulative total of approx. 3.9 billion yen has been donated as of fiscal 2018 to 1,345 NGO projects in Japan and other countries.

In fiscal 2018, we visited the Bukit Barisan Selatan National Park, Sumatra, Indonesia, where World Wide Fund for Nature (WWF) Japan operates, and Gunung Halimun Salak National Park in Java, where Japan Environmental Education Forum runs a project, to monitor their progress. In addition, we talked directly with local residents about their activities for environmental preservation in these parts and their lives, leading to the re-recognition of the importance of the compatibility between long-lasting nature preservation activities and living an independent. Panasonic has also been involved in marine protection activities[*2] for some 20 years through collaboration with WWF Japan. In March 2018, we introduced MSC- and

ASC-certified[*3] sustainable seafood[*4] in canteens in two business sites including the head office, with the help of WWF Japan and supplier companies. This is the first fine in Japan that a corporation continuously provides sustainable seafood in its canteens.[*5] We plan to increase the serving frequency and the number of canteens offering sustainable seafood, aiming to provide it for all of our canteens across Japan by 2020. By familiarizing of sustainable seafood and MSC- and ASC-certification, we promote a change in our employees' consumer behavior while contributing to SDG 14, "Conserve and sustainably use the oceans, seas and marine resources," and bringing biodiversity preservation into the main stream.

Sustainable seafood menu

MSC certification mark

ASC certification mark

*2 Including supports for the preservation of the tidal flats in Ariake Sea (2001 to 2006) and the Yellow Sea Ecoregion (2007 to 2015).

*3 MSC certification is the Marine Stewardship Council's certification for sustainably managed fisheries. ASC certification is the Aquaculture Stewardship Council's certification for responsible fish farming with the minimum impact on the environment and society. Both certifications are given after strict assessment by an external certification body.

*4 Seafood certified for sustainable production (catching or farming), as well as management and traceability of processing, distribution, and sales.

*5 As MSC- and ASC-certified seafood.

Participation in the Japan Business Initiative for Biodiversity

Panasonic is a member corporation of the Japan Business Initiative for Biodiversity (JBIB), through which we understand the global biodiversity trends and risks, and reflect the insight gained to our business operations.

We also participate in the Biodiversity Working group formed by four electrical and electronic industry associations.[*6] The working group has developed a database of the associations' member companies' biodiversity conservation activities linked with the Aichi Targets. This database, including our activities, was then linked with the Nijumaru Declaration operated under the Aichi Target achievement promotion project[*7] to further disseminate biodiversity activities.

*6 Four industry associations of: The Japan Electrical Manufacturers' Association (JEMA), Japan Electronics and Information Technology Industries Association (JEITA), Communications and Information Network Association of Japan (CIAJ), and Japan Business Machine and Information System Industries Association (JBMIA).

*7 Refers to the Nijumaru (double circle) Project sponsored by the Japan Committee for International Union for Conservation of Nature and Natural Resources (UCIN) to achieve the Aichi Targets.

Revitalization of Satoyama* in Coordination with Citizens Groups

We carry at various activities for environmental preservation through the Panasonic ECO RELAY JAPAN (PERJ) together with our domestic business sites, labor union, and retiree group.

Certification Ceremony

Unitopia Sasayama Satoyama Revitalization led by PERJ is an initiative aiming at cyclical use of Satoyama as it used to be in the 26.4 ha of premises in the Unitopia Sasayama Resort owned by the Panasonic Group Workers Unions Association. This activity was certified as a partner project of the Japan Committee for United Nations Decade on Biodiversity in recognition of our unique initiatives such as utilizing a private company's resort facility as a trial field for biodiversity preservation and environmental education, as well as organizing nature conservation activities and related education programs in collaboration with various stakeholders incliding as local authorities, corporations, universities, NPOs, and local farmers.

* Satoyama is a Japanese traditional living area with rich nature that has been utilized by people, and where multiple organisms exist

▶Panasonic ECO RELAY Japan (Japanese)
http://www.panasonic.com/jp/corporate/sustainability/citizenship/environment/perj.html

▶Unitopia Sasayama Satoyama Revitalization Project (Japanese)
http://unitopia-sasayama.pgu.or.jp/ecorelay/

Environment: Collaboration Across the Supply Chain

Collaboration with Suppliers and Transportation Partners

As a company backed by a number of suppliers, we must consider the environmental impacts of our entire supply chain, and not just of our own operations. Through our coordination efforts with suppliers and transportation partners, who form an integral part of our business operations, we strive to minimize our environmental impact across the entire supply chain, focusing on the reduction of CO_2 emissions, resource recycling, chemical substance management, and biodiversity conservation.

Activities for Green Procurement

Since the publication of the Green Procurement Standards in 1999, we have been promoting the manufacture of eco-conscious products in partnership with our suppliers. Furthermore, in the Green Procurement Standards, we set out the establishment of a group of suppliers who support our Environmental Policy in supplying products and goods in order to materialize the targets in supplier collaboration in our Green Plan 2018. In addition to cooperation in "reducing environmental impact in supplier business operations" and "sharing achievements through collaboration," we are asking our suppliers to "seek the cooperation of upstream business partners" to expand the scope of activities of reducing environmental impact throughout the entire supply chain.

Also, based on the Green Procurement Standards, we have been conducting the Green Procurement Survey, where we monitor the implementation status of our suppliers regarding our requests, to promote environmental impact reduction activities more effectively with our suppliers. In fiscal 2013, we conducted a trial survey targeted at our major global suppliers. We received responses from 415 companies, and were able to confirm the level of activity in areas such as environmental management system development, thorough implementation of chemical substance management, reduction of greenhouse gas emissions, promotion of resource recycling, and biodiversity conservation. From fiscal 2014, we have replaced surveys conducted on a group-wide scale with surveys at a site level as a means of communication with our suppliers.

In China, seminars on our CSR Procurement Policy and Chinese environmental regulations were held in September 2016 for more than 400 suppliers in Guangzhou, Dalian, and Shanghai. By calling for exhaustive implementation of CSR through the supply chain by using the CSR self-assessment checklist as well as sharing China's latest environmental regulations, we are making efforts to grasp the risks and reduce environmental impacts across the supply chain. In fiscal 2018, self inspection using the CSR self-assessment checklists was expanded to other Asian countries besides China to gain a wider understanding of environmental impact from our business activities.

In response to the enhancement of regulations such as EU RoHS Directive, we have been engaging in continual environmental quality assurance audits of our suppliers since 2005 to improve the management level throughout the entire supply chain. In fiscal 2018, we assessed the environmental quality assurance systems of some 1,400 suppliers and have supported their efforts to upgrade their management levels.

▶ Green Procurement Standards
http://www.panasonic.com/global/corporate/management/procurement/green.html

Estimation of Environmental Impacts in Business Activities by Suppliers

In order to assess greenhouse gas (GHG) emissions across the entire supply chain (scope 3[*1]), we made our original calculations based on the Greenhouse Gas Protocol, the international accounting standard for GHG emissions. Since fiscal 2012 we have conducted assessment surveys on four occasions, with the cooperation of 185 suppliers in the areas of raw materials, electrical and electronic components, and processed parts.

From fiscal 2012, we started estimating our overall GHG emissions in the upstream range by multiplying the volume of materials purchased with the resource-specific GHG emissions per basic unit based on the Input-Output Table published by the Japanese government. The estimation results based on fiscal 2017 data is 12.94 million tons, roughly five times the GHG emissions of our own production activities.

*1 Other indirect emissions, excluding Scope 1 (direct emissions from facilities owned and controlled by Panasonic) and Scope 2 (emissions from production of energy consumed at facilities owned and controlled by Panasonic).

Sharing Achievements through Collaboration

Since fiscal 2010, we have been implementing the ECO-VC*2 Activity with our suppliers. This program is a collaboration between Panasonic and our suppliers, aimed to both reduce environmental impact as well as reinforce product capability and achieve further rationalization for our products and our suppliers. In fiscal 2010, the target for reducing environmental impact was limited to energy saving (CO_2 emission reduction). However, this was extended in fiscal 2011 to Recyclingoriented Manufacturing aiming at saving resources and using recycled materials. The geographical range of our activities has also extended. Initially centered in Japan, actions accelerated to China and other parts of Asia in fiscal 2013, and later extended to a global scale in fiscal 2015.

ECO-VC activities are stored in a database for effective use within the Panasonic Group. Furthermore, exemplary activities are recognized through awards at the ECO VC Presentation of awards/Reception Meeting. These activity presentations are also shown at the meeting venue to be shared with suppliers for use and application in future activities.

The number of activities reported in fiscal 2018 was rather low at 354 compared to previous years, nevertheless the quality remained high as usual. The case selected as the best practice was submitted by ROHM Co., Ltd. In this case, they reduced power consumption in the washing machine power supply system by 67% by adopting a newly-developed power circuit based on their exclusive analog technology and a compact coil, while reducing the standby power consumption by 49% and the component footprint by 70%. Based on the Environment Vision 2050 announced in June 2017 (see page 13), we add the value of energy in addition to Value Engineering to reinforce our partnership with suppliers in the future.

*2 VC: Value Creation

Environmental Achievements Made through Proposals

Items	FY2015	FY2016	FY2017	FY2018
Number of proposals	1,445	933	622	354
CO_2 reductions derived from proposals	512,675 tons	484,532 tons	253,265 tons	58,448 tons
Use of recycled resources derived from proposals	21,323 tons	19,153 tons	18,421 tons	2,671 tons
Reduction in resources used derived from proposals	24,311 tons	21,243 tons	20,224 tons	1,090 tons

Collaboration with Environmental NGOs

Panasonic has more than 50 manufacturing sites in China. With environmental issues in China becoming more serious due to its economic development, we are working to improve the environmental challenges through coordination and continuous communication with environmental NGOs.

In fiscal 2018, we have visited the Institute of Public & Environmental Affairs (IPE), a non-governmental environmental research organization in China, in order to discuss our activities to deal with environmental risks. In the discussion, we reported our deepened understanding on the significance of an environmental audit and environmental laws and regulations in China gained through study sessions for our business sites about the audit, which was held in Guangzhou, Dalian, and Shanghai in June 2017, and also exchanged opinions in relation to an internal environmental audit for our factories. Additionally, we informed them that we post the list of environment-related information of our factories in China and some suppliers of indirect materials on our website. Stricter environmental regulations are expected in China. We work towards the reinforcement of our activities concerning green supply chain so as to further improve our brand value.

▶The list of environment-related information of our factories in China and some suppliers of indirect materials
http://panasonic.cn/csr/green_innovation/annual_infomation

Environment: Human Resource Development

Encouraging All Employees to Become Practitioners of Environmental Activities

We believe that the development of human resources is important in laying the foundations and promoting environmental sustainability management. To put this into action, a training curriculum is in place for each specialty and position. General Programs are organized for all employees to acquire environmental knowledge as well as learn about our environmental policy and activities. Specialized Programs are designed to bring employees' environmental skills to an advanced level.

General Programs are held every year at each business site for employees to acquire a wide range of knowledge, such as energy problems, trends in global society, and environmental activities by Panasonic. Additionally, training catered to the distinctive features of each operation is organized to provide information directly linked to business and operational activities. Other creative initiatives that we continue include environmental sustainability education to new employees and engineering-related employees using exclusive textbooks specific to their respective job experiences and skills to enable them to practice environmental action in their job activities.

In fiscal 2017, twelve courses were held in the Specialized Programs, such as ISO 14001 internal environmental auditor training, environmental legislation, chemical substance management, and factory energy conservation diagnosis, and a total of 139 people took the courses.

The programs are not limited to employees in environment-related job functions, and allow attendance of those in related divisions to expand the scope of practitioners of environmental activities.

Fostering Environmental Awareness and Skills through Global Competitions and On-site Training

The Eco Mind Skills Competition and Energy Conservation Diagnosis Skills Competition are held; as environment-related events in the Panasonic Group Manufacturing Skills Competition held annually for Panasonic employees worldwide, aimed at training employees to acquire advanced skills and become top runners in Panasonic manufacturing. We hope that these events will bring greater environmental awareness and continuous environmental activities among our employees, and thus lead to more active proposals to address and resolve wide-ranging environmental issues and business risks.

Eco Mind Skills Competition

Energy Conservation Diagnosis Skills Competition

The Eco Mind Skills Competition tests the participants' capabilities in overall environmental knowledge and expertise including global environmental issues and environmental sustainability management by Panasonic, as well as environmental improvement skills of proposing and implementing improvement measures that cut down environmental impact. Training materials for the Competition, preparatory study sessions, and mock tests are held at each business site, aiming for promising contenders to win high-ranking places. Additionally, voluntary activities are being organized actively to encourage competitors to acquire and improve their knowledge in the area. In fiscal 2018, 917 people participated in the Competition.

In China, which is one of the major regions where we focus business strategies on, the Eco Mind Skills Competition China has been held since fiscal 2012 at the Manufacturing Technology Learning Center (our in-house center for manufacturing education) in Hangzhou. In fiscal 2016, it was also held in Beijing.

Matters unique to the region, including essential environmental impact reduction at the business site, energy-saving and improvement activities and environmental trends and laws in China, are being included to foster greater employee awareness of the environment.

In the Energy Conservation Diagnosis Skills Competition, 59 employees participated in fiscal 2018 and competed in various fields such as air-conditioning, furnace & heat, etc. The Competition requires competitors to identify energy-saving issues and improvement measures through analysis of the state of facility operations and energy use within a designated

time period. It is an event that requires problem-solving capabilities based on advanced expertise and experience in environmental engineering. We award outstanding performers in the competition, and continue to promote further development of human resources capable of more advanced practices to raise the overall level of the company.

Raising the Level of Human Resources Development Through Environmental Education and Internal Certification System

In May 2017, Panasonic Homes[*1] Co., Ltd. received recognition of its excellence in environmental human resources development at the Environmental Human Resources Development Business Awards 2016, sponsored by the Ministry of the Environment and another organization.

Environmental training via e-learning

The company has been offering environmental education to all its employees via e-learning since fiscal 2008. In fiscal 2014, the company introduced an internal certification system in which employees who demonstrate continuing excellence in performance are recognized as Eco-Men or Eco-Jo (which mean eco-conscious men/women; the names have been registered as trademarks) to promote human resources development in the environment field. Under the HR system of the company, the Eco Kentei (certification test for environmental specialists) is a requirement in a program granting subsidies for acquiring public certification (for labor union members), as well as a promotion requirement for all employees based on job performance standards. Accordingly, the e-learning training covers questions similar to the Eco Kentei.

*1 Its name was PanaHome Corporation as of receiving the award.

Environment: Environmental Communication

Promoting Environmental Communication

Panasonic has been focusing on maintaining close communications with stakeholders. We are actively engaged in environmental communication with our customers, business partners, local communities, governments, investors, employees, NGOs, experts, etc., through a variety of perspectives, including products and services, factories, and cooperation in environmental activities, as well as advertising, exhibitions, and website communication.

Proposals on Environmental Policy

In addition to publicity through Keidanren (Japanese Business Federation) and other industrial organizations, we submit environmental policy proposals not only to the Japanese government but also to governments of other countries through a wide range of opportunities. We joined in policy deliberations on environmental issues that the society is facing today: a future vision for national governments, industry, and people's lives aimed at the creation of a sustainable society, and information sharing and exchange related to international activities. Through this approach we established a deeper understanding of government policy. Based on this, we are engaging in a drive to promote environmental management with an awareness of preventing business risks as well as creating opportunities, through actively presenting proposals from the standpoint of manufacturing, marketing, and technology development.

Communication with Assessment Bodies and Investors

Panasonic has been engaged in constant communication with domestic and international assessment bodies and investors in order to inform them of our contribution to the environment and deepen their understanding of it. Among our contributions, great attentions have been paid especially to our initiatives to reduce the environmental impact of our products across their entire life cycle; to realize a smart society; and our medium and long term environmental vision.

We will continue to engage in such communication.

Engagement with Third Parties

Panasonic actively conducts a number of dialogues with experts from both within and outside Japan, and utilizes their comments in its environmental strategies.

With the Natural Step, in particular, we have built a partnership since 2001. We hold meetings with them to share the most advanced environmental information in Europe and seek their opinions on our environmental strategies and activities to assist us in further improvements.

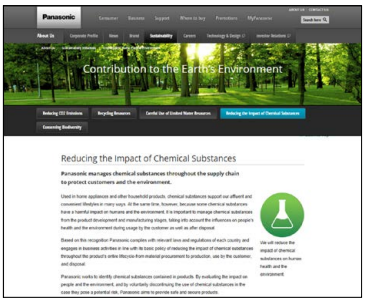
Publishing Environmental Information

Panasonic has been publishing its environmental reports since 1997. In fiscal 2014, we integrated the webpage for our environmental activities with that of for our CSR activities in order to publish comprehensive information in relation to sustainability. From fiscal 2016, among information published on our website, topics of great interest to our stakeholders, such as our environmental policy, approach, and performance data, are also provided in a Sustainability Data Book.

▶ Sustainability Data Book 2018
http://www.panasonic.com/global/corporate/sustainability/downloads.html

In the efforts to foster greater awareness of the five major areas of our Environmental Action Plan "Green Plan 2018" (CO_2 reduction, resource recycling, water, chemical substances, and biodiversity) among general consumers worldwide, we offer an overview of our activities on Panasonic websites in 59 countries and regions (in 35 languages). In the area of chemical substances, for example, activities involving the entire supply chain to control certain chemical substances hazardous to the human health and the environment are presented in an easy-to-understand style.

▶ Example of the Panasonic website for general customers (Australia)
http://www.panasonic.com/au/corporate/sustainability/eco.html



Example of the management of chemical substances

For information on specified chemical substances in products regulated by the Act on the Promotion of the Effective Utilization of Resources, please refer to “Information on the Content of Certain Chemical Substances in Covered Products” below. We do not manufacture, import, or sell products that contain certain chemical substances beyond specified standards, other than in exempted parts.

▶ Information on the Content of Certain Chemical Substances (Japanese)
http://www.panasonic.com/jp/corporate/sustainability/eco/chemical/jmoss.html

In addition, we have established a new webpage, Information Based on the Act on Preventing Environmental Pollution of Mercury, in May 2017 to communicate information concerning the mercury used in our products to customers.

▶ Information Based on the Act on Preventing Environmental Pollution of Mercury (Japanese)
http://www.panasonic.com/jp/corporate/sustainability/eco/chemical/jmoss/mercury.html

Other examples of environmental communication are introduced in the following website.
http://www.panasonic.com/global/corporate/sustainability/eco/communication.html

Environment: History of Environmental Activities

Era	Year	Panasonic Group	World	Japan
~1970s	1967			• Basic Law for Environmental Pollution Control enacted
	1968			• Air Pollution Control Law enacted
	1970	• Pollution Survey Committee established		• Water Pollution Control Law enacted • Waste Disposal and Public Cleansing Law enacted
	1971			• Environment Agency established
	1972	• Environmental Management Office established	• U.N. Conference on Human Environment held in Stockholm (Declaration of Human Environment adopted)	
	1973		• First oil shock occurred	
	1975	• Environmental Management Regulations enacted		
	1979		• Second oil shock occurred	• Energy Conservation Law enacted
1980s	1985		• Vienna Convention for the Protection of the Ozone Layer adopted	
	1987		• Montreal Protocol on Substances that Deplete the Ozone Layer adopted • World Commission on Environment and Development (the Brundtland Commission) advocated the concept of sustainable development	
	1988	• CFC-reduction Committee established		• Ozone Layer Protection Law enacted
	1989	• Environmental Protection Promotion Office established		
1990s	1991	• Matsushita Environmental Charter (Environmental Statement and Code of Conduct) enacted • Matsushita Product Assessment adopted and implemented		• Keidanren Global Environment Charter enacted by Japan Federation of Economic Organizations • Law for Promotion of Effective Utilization of Resources enacted
	1992	• Environmental Policy Committee established	• The Earth Summit held in Rio de Janeiro, Brazil; Agenda21 and Rio Declaration on Environment and Development adopted • United Nations Framework Convention on Climate Change adopted	
	1993	• Matsushita Environmental Voluntary Plan (Year 2000 targets) adopted • Matsushita Group' global environmental internal audits launched		• The Basic Environment Law enacted
	1995	• Acquired Environmental Management System Certification at AV Kadoma Site (first in the Matsushita Group)	• First Conference of Parties to the U.N. Framework Convention on Climate Change (COP1) held in Berlin	• Containers and Packaging Recycling Law enacted
	1996		• ISO 14001 International Standard on Environmental Management Systems launched	
	1997	• Corporate Environmental Affairs Division (CEAD) established • Environmental Conference established (held semi-annually)	• COP3 held in Kyoto and adopted the Kyoto Protocol	• Keidanren Appeal on the Environment announced by Japan Federation of Economic Organization
	1998	• Love the Earth Citizens' Campaign commenced • Recycling Business Promotion Office established • First environmental report (1997) published		• Home Appliance Recycling Law enacted (took effect in 2001) • Law Concerning the Promotion of the Measures to Cope with Global Warming enacted • Energy Conservation Law revised: Top Runner Approach introduced
	1999	• Green Procurement launched • Chemical Substances Management Rank Guidelines established • Acquired ISO14001 Certification in all manufacturing business units		• PRTR (Pollutant Release and Transfer Register) Law enacted
2000s	2000	• Lead-free Solder Project commenced • Held first environmental exhibition for general public in Osaka	• Global Reporting Initiative (GRI) issued The Sustainability Reporting Guidelines	• Basic Law for Establishing the Recycling-based Society enacted • Law for Promotion of Effective Utilization of Resources enacted
	2001	• Environmental Vision and Green Plan 2010 adopted • Held Environmental Forum in Tokyo and Freiburg,Germany • Panasonic Eco Technology Center launched	• Reached final agreement on the actual rules of Kyoto Protocol in COP7 held in Marrakesh	• Reorganized into the Ministry of the Environment • Law Concerning Special Measures against PCBs enacted
	2002	• Panasonic Center Tokyo opened	• Johannesburg Summit (Rio+10) held	• Kyoto Protocol ratified • Vehicle Recycling Law enacted • Law for Countermeasures against Soil Pollution enacted

Era	Year	Panasonic Group	World	Japan
	2003	• Declared 'Coexistence with the Global Environment' as one of the twin business visions • Factor X advocated as an indicator for Creating Value for a New Lifestyle • Completely introduced lead-free soldering globally • Super GP Accreditation System launched • Achieved zero waste emissions in Japanese manufacturing business sites (ongoing program) • Held Environmental Forum in Tokyo	• EU's WEEE Directive was enacted	
	2004	• Environmental Vision and Green Plan 2010 revised • PCB Management Office established • Superior GP Accreditation System launched		• Prohibited manufacturing and use of products containing asbestos in principle
	2005	• Participated in Expo 2005 Aichi, Japan as an official sponsor • Green Plan 2010 revised • Continued with the nationwide Lights-out Campaign • 3R Eco Project launched • Completed the elimination of specified substances (6 substances) in products • Matsushita Group's Green Logistics Policy established • CF Accreditation System introduced • Panasonic Center Osaka opened • Eco & Ud HOUSE opened • Installed the first commercial household fuel cell cogeneration system in the new official residence of the Japanese Prime Minister • Won the first place in Nikkei Environmental Management Survey	• Kyoto Protocol entered into force	• Expo 2005 Aichi, Japan held • National campaign against global warming "Team –6%" launched • Marking for the presence of the specified chemical substances for electrical and electronic equipment (J-Moss) established
	2006	• Environmental specialist position established • ET Manifest introduced into all manufacturing sites of Panasonic in Japan • Realized lead-free plasma display panels and introduced them to the market • Full-fledge introduction of biodiesel fuel in logistics	• Restriction of Hazardous Substances (RoHS) Directive took effect in EU	• Relief Law for Asbestos Victims enacted • Energy Conservation Law revised: new cargo owner obligations, widened product scope of its application, and top runner standard revision
	2007	• Energy conservation activities at our factories in Malaysia approved as CDM project by the U.N. • A new environmental mark 'eco ideas' introduced • Panasonic Center Beijing opened • Environmental Forum in China held • "Declaration of Becoming an Environmentally Contributing Company in China" announced • Panasonic 'eco ideas' Strategy announced	• The Fourth Assessment Report of the Intergovernment Panel on Climate Change (IPCC) released • Registration, Evaluation, Authorisation and Restriction of Chemicals entered into force in EU • Framework for CO_2 reduction agreed at Heiligendamm Summit (G8) • The Bali Road Map for the post Kyoto Protocol agreed at COP13 • Administration on the Control of Pollution Caused by Electronic Information Products (China RoHS) came into effect	• 'Cool Earth 50' announced by Prime Minister Abe • '21st Century Environment Nation Strategy' formulated • 'The Third National Biodiversity Strategy of Japan' formulated • 'Ministerial ordinance partially amending the Enforcement Regulation of the Waste Management and Public Cleansing Law' promulgated • 'Domestic Emissions Trading Scheme Review Committee' established • 'The Second Fundamental Plan for Establishing a Sound Material-Cycle Society' formulated
	2008	• Established the Corporate CO_2 Reduction Promoting Committee • Held environmental exhibitions, 'eco ideas' World • Home Appliances Company announced environmental statement in which named its Kusatsu site as 'eco ideas' Factory • Announced 'eco ideas' Declaration in Europe • Established Environmental Strategy Research Center	• G20 (conference of key countries' environmental and energy ministers) held • Hokkaido Toyako Summit held	• Cool Earth Promotion Program announced by Prime Minister Fukuda • Mislabeling incident of waste paper pulp percentage • Long-term Energy Demand and Supply Outlook announced • Japan's Voluntary Emission Trading Scheme started
	2009	• Opened the 'eco ideas' House to demonstrate a lifestyle with virtually zero CO_2 emissions throughout the entire house • Announced the Asia Pacific 'eco ideas' Declaration • Announced 'eco ideas' factories (in Czech, Malaysia, Thailand, and Singapore) • Sanyo Electric joined the Panasonic Group	• China WEEE law promulgated • New framework for countermeasures against global warming on and after 2013 (post-Kyoto Protocol), the Cophenhagen Accord, was adopted at the COP15 (Copenhagen conference) • Seeking to emerge from the Lehman collapse, countries throughout the world accelerated actions for the Green New Deal	• Energy Conservation Law amended: Covered area expanded from factories to commercial sector facilities • Flat-panel TV and clothes dryer added as covered products under the Home Appliance Recycling Law • 'Eco point' system started
2010s	2010	• Announced "Vision looking to the 100th anniversary of our founding in 2018" • Announced new midterm management plan, "Green Transformation 2012 (GT12)" • Announced 'eco ideas' Declarations (Latin America, Asia Pacific, and Russia) • Established 'eco ideas' Forum 2010 in Ariake, Tokyo • Launched Panasonic ECO RELAY for Sustainable Earth • Kasai Green Energy Park eco-friendly factory completed	• COP10 held in Nagoya—Nagoya agreement made • APEC meeting held in Yokohama • Ruling party lost in US midterm election—changes in anti global warming policy • Cancun agreement made in COP16—Post-Kyoto framework still to be discussed	• Draft legislation of Basic Law of Global Warming Countermeasures submitted but remained in deliberation • Obligatory greenhouse gas emissions reduction started as a part of Tokyo Emissions Trading Scheme • Waste Management and Public Cleansing Law amended: self treatment regulations tightened • Act on the Evaluation of Chemical Substances and Regulation of Their Manufacture, etc. (CSCL) and Law concerning Pollutant Release and Transfer Register (PRTR) amended
	2011	• Announced North America & Taiwan 'eco ideas' Declarations • Announced establishment of Panasonic Dadi Dowa Summit Recycling Hangzhou Co., Ltd. • Announced the Fujisawa Sustainable Smart Town Project • Established Corporate Electricity Saving Division that bridges functions across the organization	• Rare earth prices soared • Revised RoHS directives enforced in EU • COP17 (Durban Climate Conference): Agreement made on long-term future of the scheme, and the second commitment period for the Kyoto Protocol (Japan announced non-commitment)	• Home appliance eco-point incentive program finished • The Great East Japan Earthquake • Revised Air Pollution Control Act and Water Pollution Control Act enforced • Act on Special Measures Concerning Procurement of Renewable Electric Energy by Operators of Electric Utilities enacted (Feed-in tariff system to be enforced July 2012)

Era	Year	Panasonic Group	World	Japan
	2012	• Business reorganization due to full acquisition of Panasonic Electric Works and SANYO Electric • Commenced sales of Resources Recycling-oriented Product series • Terminated production of household incandescent light bulbs • Establishment of Environmental Management Group, Environment & Quality Center, Global Manufacturing Division • Communication of 'eco ideas' Declaration (Vietnam)	• United Nations Conference on Sustainable Development (Rio +20) • "Doha Climate Gateway" adopted at COP 18 Doha 2012, to lay down a future legal framework in which all nations can participate by 2020 and onwards • Revised WEEE Directive implemented in Europe	• The Recycle Resource Project, national campaign by Ministry of the Environment, commenced • 2012 Japan Tax Reform Bill enacted (Environment tax came into force in October 2012) • Feed-in tariff for recyclable energy put into effect
	2013	• Announced new midterm management plan Cross-Value Innovation 2015 • Announced new brand slogan "A Better Life, A Better World" • PETEC's home appliance recycling reached a cumulative total of 10 million units • Announced 'eco ideas' factory (Philippines)	• Phase I of the Kyoto Protocol ends. Japan's target expected to be achieved in combination with forest CO_2 absorption and application of the Kyoto Protocol mechanisms. • GRI announced G4, the next guidelines for CSR reports • Minamata Convention on Mercury to internationally regulate import and export of mercury adopted at UN conference • IPCC Fifth Assessment Report (Working Group 1) announced the possibility of human activity being the principal cause of global warming observed since the mid-20th century is "extremely high." Global average surface temperature is expected to rise as high as 4.8°C • COP 19 Warsaw reaffirmed participation of all nations in the future framework of the Convention for 2020 and later. Nations were asked to submit emission pledges well in advance of 2015.	• Home Appliance Recycling Law for small household appliances enforced • Basic Plan for Establishing a Recycling-Based Society implemented • Keidanren's "Action Plan Towards Low-Carbon Society" started (until FY 2021) • Amended Law Concerning the Rational Use of Energy and Amended Law Concerning the Promotion of the Measures to Cope with Global Warming established. Amended Act on the Rational Use and Management of Fluorocarbons promulgated (June) • Voluntary Action Plan by the electric and electronics industry terminated. Achieved improvement by 48% in CO_2 emissions per basic unit in average actual production output for fiscal 2009–2013 (compared with fiscal 1991 level) to the target of 35% • Japan announced in November its fiscal 2021 reduction target of 3.8% over fiscal 2006 and registered this with UNFCCC Office (but with a possible review of the tentative target, which does not include possible resumption of nuclear power plant operations)
	2014	• Panasonic DADI DOWA Summit Recycling Hangzhou Co., Ltd., started operation • Opening of Fujisawa Sustainable Smart Town • Announced Eco Declaration (Southeast Asia & Pacific) • Communication of housing & town development at the International Greentech & Eco Products Exhibition & Conference (IGEM) (Malaysia)	• Targets for product environmental regulations in Europe begin to shift from energy saving to resource efficiency and environmental impact • EU Parliament reelection results in the appointment of Mr. Jean-Claude Juncker as President of the European Commission. Review of the circular economy package was decided. • IPCC 5th Assessment Report analyzed that the current multiple ways to achieve control of global temperature rise to less than 2°C cannot be materialized unless the target becomes nearly zero by the end of the century. Attention to "adaptation" is growing. • COP12 Convention on Biodiversity, PyeongChang concluded the interim assessment of the Aichi Biodiversity Targets as "progress has been made but remains inadequate" • COP 20 (Peru) reached agreement on the policy of developing reduction targets based on common rules for publication of "a new legal framework beyond 2020 applicable to all Parties"	• The amended Energy Conservation Act was enforced, incorporating action on power conservation during peak periods into existing qualitative reduction targets • Phase II of the Commitment to a Low Carbon Society, a voluntary program promoted by Keidanren as measures against global warming, was newly established in response to government request, setting the target year to 2030 • Toyota Motor launched fuel-cell vehicle MIRAI into the commercial market
	2015	• Won Zayed Future Energy Prize 2015 • Wonder Japan Solutions (Tokyo) held for the first time • Announced the introduction of indirect contributions through housing, automotive, and B2B solutions in the size of contribution in reducing CO_2 emissions • Announced the Tsunashima Sustainable Smart Town development project, together with Yokohama City and Nomura Real Estate Development Company	• Paris Agreement on the international legal framework for global warming control from 2020 and later was adopted at COP21 (Paris) • 2030 Agenda for Sustainable Development was adopted at the UN Summit, focusing chiefly on sustainable development goals (SDGs)	• Draft proposal to cut greenhouse gases by 26% over 2013 levels as its 2030 greenhouse gas reduction target announced by the Japanese government • COOL CHOICE, a new nationwide movement for greenhouse gas reduction, started
	2016	• Establishment of Environmental Management Department, Quality & Environment Division • Announced R&D 10-Year Vision • Revised Green Plan 2018 • Announced participation in Future Living Berlin, the first Smart City project in Germany • Announced collaboration with Tesla Motors for solar batteries.	• G7 Toyama Environment Ministers' Meeting held; ministers representing the G7 nations and the EU discussed policies on seven themes including resource efficiency and 3R, biodiversity, climate change, and related measures • UK decided to leave the EU (Brexit) in a national referendum • GRI announced "GRI Standard," the new guidelines for CSR reports • COP 22 held in Marrakesh, Morocco. Agreement reached on establishing a rulebook to make the Paris Agreement effective by 2018 • Donald Trump won the US presidential election • COP 13, the 13th meeting of the Conference of the Parties on Biological Diversity, held in Cancun, Mexico	• The 2016 Kumamoto Earthquake • The Plan for Global Warming Countermeasures was decided by the Cabinet. Direction of Japan's global warming countermeasures to achieve the Intended Nationally Determined Contributions under COP 21 was clarified. Long-term goal of reducing greenhouse gas emissions by 80% by 2050 was set. • Act on Promotion of Global Warming Countermeasures was amended; focuses on promoting the enhancement of Cool Choice, the reinforcement of international cooperation, and regional global warming countermeasures
	2017	• Announcement of Panasonic Environment Vision 2050 • Opening of Tsunashima Sustainable Smart Town	• France, UK, and China announced the prohibition of sales of gas and diesel cars and the conversion to EVs in the future	• Revision of the Charter of Corporate Behavior delivering on the SDGs through the realization of Keidanren Society 5.0