Chapter 2 - Manufacturing

Pursuing high-efficiency manufacturing that simultaneously reduces environmental impacts and costs.

Basic strategies

Toshiba Group is pursuing high-efficiency manufacturing that minimizes resource inputs in production processes in Japan and abroad, eliminates unnecessary tasks in manufacturing processes, and reduces to minimum emissions into the atmosphere and waters, thus simultaneously reducing environmental impacts and costs.

We aim to contribute to resolving climate change and other environmental issues by promoting the following two initiatives: “improvement of plant efficiency,” which refers to efforts to grasp energy consumption appropriately in order to ensure effective improvement of equipment operation and introduce high-efficiency equipment, and “process innovation,” which aims to achieve sustainable manufacturing in collaboration with all involved divisions.

In terms of mitigation of climate change, Toshiba Group is actively taking energy-saving measures on a company-wide scale to reduce emissions of greenhouse gases, including CO2 and perfluorocarbons (PFCs). In terms of efficient use of resources, we will continue our efforts to reduce the total volume of waste generated through 3R activities as well as strive to use water resources efficiently by reusing and recycling. As for management of chemicals, we make efforts to reduce environmental impacts mainly through the introduction of alternative substances and process improvements.

We appreciate your opinions and comments about this report. Questionnaire for Environmental Report 2019

Toshiba Group Environmental Report 2019

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<table>
<thead>
<tr>
<th>Major Results for FY2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mitigation of Climate Change</td>
</tr>
<tr>
<td>- Total GHG emissions: 1.24 million t-CO₂</td>
</tr>
<tr>
<td>Efficient Use of Resources</td>
</tr>
<tr>
<td>- Waste volume: 40,000 tons</td>
</tr>
<tr>
<td>- Amount of water received per unit production (Compared to FY2013 level): 92%</td>
</tr>
<tr>
<td>Management of Chemicals</td>
</tr>
<tr>
<td>- Total amount of chemicals discharged per unit production (Compared to FY2013 level): 76%</td>
</tr>
</tbody>
</table>
■ High-efficiency manufacturing

Pursuing high-efficiency manufacturing that minimizes inputs and outputs while simultaneously reducing environmental impacts and costs

Future goals

- Sustainable manufacturing
  - Motivation
  - Easy-to-understand Visualization of energy use
  - Process innovation

INPUT

- Energy (electricity + heat), materials + consumables, chemicals, and industrial water

OUTPUT

- Greenhouse gases, waste, chemical substances, and wastewater

Past

Present

Future goals

- Sustainable manufacturing
  - Motivation
  - Easy-to-understand Visualization of energy use
  - Process innovation

INPUT

- Energy (electricity + heat), materials + consumables, chemicals, and industrial water

OUTPUT

- Greenhouse gases, waste, chemical substances, and wastewater

Plant efficiency improvements × Process innovation

Mitigation of Climate Change

- Reducing energy consumption and the volume of greenhouse gases used
- Introduction of energy-saving processes and equipment
- Shift to low-carbon energy and gases with low greenhouse effects

Efficient Use of Resources

- Reducing the total waste volume
- Reuse of waste
- Collection and recycling of end-of-life products
- Reduction in the volume of water received

Management of Chemicals

- Pre-use risk assessments for hazardous substances
- Reducing the volume of chemicals used and introducing alternatives
- Appropriate management of substances used

Environmental impacts of business operations

- Streamlining of energy and material procurement
- Resource recycling, reuse

Energy, resources

Business operations

- Waste, end-of-life products
- Promoting the three Rs (Reduce, Reuse, and Recycle)

Products

Users

Atmosphere

- (Chemicals and GHGs such as CO₂)
- VOC

Hydrosphere

- (Chemical substances)

Emissions reduction

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Mitigation of Climate Change

Reducing total GHG emissions

Toshiba Group proactively installed systems to collect and/or remove sulfur and to insulate heavy electric machinery, and perfluorocarbons (PFCs), which are used to produce semiconductors. By means of this effort in FY2010, the Group succeeded in reducing the total amount of GHG emissions by nearly 40% compared to the FY1990 level, and in subsequent years GHG emissions continued to decrease as the Group steadily took measures to improve its production processes. To reduce energy-derived CO2 emissions resulting from use of electricity, we continuously make efforts to proactively adopt energy-saving measures at our production sites, including those overseas, to improve production efficiency, as well as to introduce renewable energy.

Results of FY2018

Toshiba Group is working to reduce GHG emissions other than energy-derived CO2 emissions mainly by installing PFC removal equipment and due to this effort emissions have remained almost constant since FY2010. Meanwhile, energy-derived CO2 emissions were affected by deterioration in the CO2 emission coefficient for electricity due to the effects of the Great East Japan Earthquake, but the Group reduced energy consumption compared to the FY2010 level by taking proactive conservation measures, including making capital investments.

Future initiatives

The CO2 emission coefficient for electricity will continue trending higher in the future, but Toshiba Group will continue to make steady efforts to reduce total GHG emissions by investing proactively in high-efficiency equipment. The Group goal is to reduce total GHG emissions to 1.66 million t-CO2 or less by FY2020.

Total GHG emissions

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Amount emitted (million t-CO2)</th>
<th>FY2013 target</th>
<th>FY2017</th>
<th>FY2018</th>
<th>FY2019</th>
<th>FY2020 (target)</th>
<th>FY2020 (goal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY2017</td>
<td>1.27</td>
<td>1.54</td>
<td>1.24</td>
<td>1.61</td>
<td>1.66</td>
<td>1.66</td>
<td></td>
</tr>
<tr>
<td>FY2018</td>
<td>1.18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.06</td>
<td></td>
</tr>
<tr>
<td>FY2020</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The power receiving coefficient (in Japan: 5.31t-CO2/10,000kWh) is used as the CO2 emission coefficient for electricity in calculation of CO2 emissions. Overseas electricity is based on the GHG Protocol data.

Breakdown of total GHG emissions (FY2018)

Energy-derived CO2 emissions and those per unit activity

Results of FY2018

In FY2018, energy-derived CO2 emissions amounted to 1.06 million t-CO2. As a result of initiatives to reduce power consumption mainly through energy-saving investments and production adjustments, Toshiba Group was able to reduce energy-related CO2 emissions per unit activity to 95.0% of the FY2013 level, exceeding the initial target by 1.0 percentage points.

Future initiatives

In order to meet growing market demand, Toshiba Group plans to introduce more facilities. Therefore, energy-derived CO2 emissions are likely to increase in the near future. The Group will continue its efforts to reduce CO2 emissions per unit activity by 8% compared to the FY2013 level in FY2020 by adopting a variety of energy-saving measures, including investing in energy-saving facilities.

Breakdown of energy-derived CO2 emissions (FY2018)
Our Fuchu Complex was certified as a Top-Level Facility by the Tokyo Metropolitan Government for outstanding global warming countermeasure efforts. The certification reflects the recognition of its long history with the completion of the building in 1940, a large-scale facility in the manufacturing industry with solar power generation and high efficiency production facilities, control of peak power and power usage by using the power monitoring system, “Demand EYE,” participated by all employees, and so on.

In addition to these efforts, Fuchu Complex has been working on other various global warming countermeasures toward the achievement of “Zero Emission Tokyo” promoted by the Tokyo Metropolitan Government, which includes: weeding by goats and sheep; promotion of demonstration experiments at a hydrogen utilization facility; and the zero emission building (ZEB) concept for buildings and offices under Fuchu Complex Next Plan*.

Looking forward, Fuchu Complex will continue to aim at reducing environmental impacts and improving production efficiency through highly environmentally conscious facility management as Toshiba Group’s leading production site.

* Fuchu Complex’s medium-term strategy plan

**Visualization of electric power (Demand EYE)**

**Unique weeding measures**

Goat, Sheep, Sunlight robot

**Utilization and demonstration of renewable energy**

- Photovoltaic power generation (Self-consumption)
- Hydrogen utilization facility (Demonstration facility)
- Wind power generation (Self-consumption)

**Planned facility upgrade toward growth strategy**

Increasing efficiency and reducing loss based on a forecast for increasing energy demand

**ZEB concept for buildings and offices under Fuchu Complex Next Plan**

As the first step of demonstration, the interrelation between the office environment and productivity is being evaluated (since October 2019)

**Participation in “Zero Emission Tokyo”**

Participation in the world’s first urban cap-and-trade program covering office buildings promoted by the Tokyo Metropolitan Government

In regard to reduced CO₂ emissions as an effect of being certified as a top-level facility, we donated 50,000 tons of CO₂ credits to the Tokyo Metropolitan Government.
Efficient Use of Resources

Promoting recycling

In FY2018, Toshiba Group recycled 94,000 tons of resources. 94% of the total volume of waste generated was reused effectively as various resources. The recycled resources consisted mainly of scrap metal, waste paper, and wood chips, and 93.9% of them were used effectively for material recycling (recycled into materials for products), and the remaining 6.1% for thermal recycling (heat recovery). In the future, Toshiba Group will continue to increase the total volume of resources recycled and at the same time will strive for higher quality recycling chiefly by increasing the percentage of resources recycled into materials.

Reducing Waste Volumes

Toshiba Group is working to reduce waste generation by minimizing the volume of waste generated per unit production, which indicates business process efficiency improvement, as well as by reducing the total volume of waste to a level below the Earth's environmental capacity.

Results of FY2018

The volume of waste (excluding that of objects with value) totaled 40,000 tons, which is 8,000 tons lower than the initial target. The total volume of waste generated per unit production was 91% compared to that of FY2013, achieving the initial target.

Future initiatives

We will work to reduce the amount of generated waste and increase sales of objects with value from waste, with the goal of reducing waste volume by 52,000 tons and improving the total volume of waste generated per unit production for FY2020 by 4% compared to the FY2013 level.

Waste volume and total volume of waste generated

<table>
<thead>
<tr>
<th></th>
<th>FY2013 (Benchmark year) result</th>
<th>FY2017 result</th>
<th>FY2018 target</th>
<th>FY2018 result</th>
<th>FY2019 target</th>
<th>FY2020 Final fiscal year goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste volume</td>
<td>108,000 tons</td>
<td>96,000 tons</td>
<td>48,000 tons</td>
<td>40,000 tons</td>
<td>51,000 tons</td>
<td>52,000 tons</td>
</tr>
<tr>
<td>Total waste volume</td>
<td>100%</td>
<td>84%</td>
<td>98%</td>
<td>91%</td>
<td>97%</td>
<td>96%</td>
</tr>
</tbody>
</table>

Breakdown of the volume recycled (FY2018)

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount recycled</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure Systems</td>
<td>30.6%</td>
<td></td>
</tr>
<tr>
<td>&amp; Solutions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retail &amp; Printing</td>
<td>10.6%</td>
<td></td>
</tr>
<tr>
<td>Solutions</td>
<td>10.6%</td>
<td></td>
</tr>
<tr>
<td>Storage &amp; Electronic</td>
<td>40.0%</td>
<td></td>
</tr>
<tr>
<td>Devices Solutions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>9.1%</td>
<td></td>
</tr>
<tr>
<td>Waste volumes</td>
<td>40,000 t</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>9.1%</td>
<td></td>
</tr>
<tr>
<td>Industrial ICT</td>
<td>1.9%</td>
<td></td>
</tr>
<tr>
<td>Solutions</td>
<td>1.9%</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>4.6%</td>
<td></td>
</tr>
<tr>
<td>Energy Systems &amp; Solutions</td>
<td>34.1%</td>
<td></td>
</tr>
<tr>
<td>Storage &amp; Electronic</td>
<td>30.4%</td>
<td></td>
</tr>
<tr>
<td>Devices Solutions</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Breakdown of the waste volume (FY2018)

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&amp; Solutions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retail &amp; Printing</td>
<td>6.0%</td>
<td></td>
</tr>
<tr>
<td>Solutions</td>
<td>5.1%</td>
<td></td>
</tr>
<tr>
<td>Storage &amp; Electronic</td>
<td>16.9%</td>
<td></td>
</tr>
<tr>
<td>Devices Solutions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>0.3%</td>
<td></td>
</tr>
<tr>
<td>Americas</td>
<td>5.1%</td>
<td></td>
</tr>
<tr>
<td>Europe</td>
<td>0.3%</td>
<td></td>
</tr>
<tr>
<td>Asia</td>
<td>6.0%</td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>16.9%</td>
<td></td>
</tr>
<tr>
<td>Waste volumes</td>
<td>40,000</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>9.1%</td>
<td></td>
</tr>
<tr>
<td>Industrial ICT</td>
<td>1.9%</td>
<td></td>
</tr>
<tr>
<td>Solutions</td>
<td>1.9%</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>4.6%</td>
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</tr>
<tr>
<td>Energy Systems &amp; Solutions</td>
<td>34.1%</td>
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<tr>
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<tr>
<td>Devices Solutions</td>
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<tr>
<td>Others</td>
<td>0.3%</td>
<td></td>
</tr>
<tr>
<td>Americas</td>
<td>5.1%</td>
<td></td>
</tr>
<tr>
<td>Europe</td>
<td>0.3%</td>
<td></td>
</tr>
<tr>
<td>Asia</td>
<td>6.0%</td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>16.9%</td>
<td></td>
</tr>
<tr>
<td>Waste volumes</td>
<td>40,000</td>
<td></td>
</tr>
</tbody>
</table>
Reducing abrasive used with abrasive concentration sensing

Toshiba Electronic Devices & Storage Corporation
Himeji Operations-Semiconductor

Himeji Operations-Semiconductor manufactures discrete semiconductor. Discrete semiconductor is packaged with a mold resin to protect semiconductor chips. However, burrs* form on the mold resin during manufacturing and abrasive is applied to remove burrs. Since the abrasive is used by dissolving it in water, its concentration must be managed. Before making the improvement, the worker regularly stopped the abrasive projection machine, let the abrasive precipitate, and then added abrasive according to the amount of precipitation. In this improvement, we have installed a fiber sensor which indicates the abrasive concentration in real time, allowing us to optimize the interval and amount to add abrasive. Through this optimization, we have been able to reduce the amount of abrasive used by 600 kg in a year.

* Unnecessary projection

Waste management in overseas production site

Toshiba Information Equipment (Philippines), Inc.

- Recycling rare metal from waste
  Some waste from defective products that are produced in the process for manufacturing HDD contain rare metal. We sell them to companies which have treatment facilities outside Philippines, let them extract the rare metal, and in this way recycle resources. By establishing this process, the amount of product waste recycled by Toshiba Information Equipment (Philippines) in FY2018 was 207 tons.

- Reducing landfill waste by utilizing waste heat treatment facility
  Previously, some of our waste was disposed of as landfill. By using a heat treatment facility that has recently been put into service, the amount of waste disposed as landfill by the entire Toshiba Information Equipment (Philippines) has been substantially reduced from 0.17% in FY2016 to 0.025% in FY2017 and further to 0.019% in FY2018.
Efficient Use of Resources

Reducing the Amount of Water Received

In response to a global increase in concerns regarding water problems, Toshiba Group is promoting sustainable water resource management. Each of our production sites has incorporated reducing the amount of water received into its annual plan in order to develop specific strategies and conduct follow-up surveys on an ongoing basis. We are promoting wide-ranging initiatives including recycling the wastewater generated in sites and introducing systems for using rainwater.

**Results of FY2018**

The total amount of water received in FY2018 was 19.0 million m³ and the amount of water received per unit production was 92% of the total for FY2013, exceeding the initial target by 6 percentage points.

**Future initiatives**

We will promote recycling wastewater and using rainwater and aim to improve the amount of water received per unit production by 4% of the FY2013 level in FY2020.

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### Case

Reducing industrial water and chemicals through optimization of water purification system operating method

In the semiconductor manufacturing process, a large amount of pure water*1 is used for cleaning and efforts for reducing the amount of water used are important. By applying this measure, we optimized the amount of water fed from pure-water production systems according to the flow rate used in the manufacturing process as well as optimized the operating method for pure-water production systems by reducing the frequency for recycling*2 water purification filters while maintaining water purification capacity, resulting in a reduction of industrial water by 7,500 m³ per year, chemicals by 4 tons per year, and energy by 12.8 t-CO₂ per year.

*1 Water from which ions among other contaminants in the water have been removed by ion exchange, etc.

*2 Cleaning a water purification filter (ion exchange resin) to make it reusable. Captured contaminant ions are emitted by chemicals so that the original functionality is restored.

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### Table: Amount of water received per unit production

<table>
<thead>
<tr>
<th>FY2013 (Benchmark result)</th>
<th>FY2017 result</th>
<th>FY2018 target</th>
<th>FY2018 result</th>
<th>FY2019 target</th>
<th>FY2020 (Practical year) goal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amount of water received</strong></td>
<td>20.4 million m³</td>
<td>19.4 million m³</td>
<td>—</td>
<td>19.0 million m³</td>
<td>—</td>
</tr>
<tr>
<td><strong>Per unit production</strong></td>
<td>100%</td>
<td>92%</td>
<td>98%</td>
<td>92%</td>
<td>97%</td>
</tr>
</tbody>
</table>

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### Table: Breakdown of the amount of water received (FY2018)

<table>
<thead>
<tr>
<th>Region</th>
<th>Amount of water received (FY2018)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asia</td>
<td>19.0 million m³</td>
</tr>
<tr>
<td>Europe</td>
<td>19.0 million m³</td>
</tr>
<tr>
<td>Japan</td>
<td>19.0 million m³</td>
</tr>
<tr>
<td>Americas</td>
<td>19.0 million m³</td>
</tr>
<tr>
<td>Others</td>
<td>19.0 million m³</td>
</tr>
</tbody>
</table>

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### Chart: Changing the amount of water fed

The system suspension frequency was reduced by optimizing the flow rate of the follow-up unit for water supply according to the flow rate used.

**Reduction in water and energy needed when restarting the system**

- **Industrial water**: Reduction by 7,200 m³ per year
- **Energy**: Reduction by 1.9 t-CO₂ per year

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### Chart: Changing the fixed amount of water purified*

The frequency for recycling water purification filters was reduced by optimizing the fixed amount of water purified according to the water purification capacity of the follow-up unit.

**Reduction in the chemicals, energy, and water needed for recycling**

- **Industrial water**: Reductions by 300 m³ per year
- **Chemicals**: Reduction by 4 tons per year
- **Energy**: Reductions by 10.9 t-CO₂ per year

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The diagram is an image.

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Management of Chemicals

Managing Chemical Substances by Ranking

Toshiba Group classifies standards for the handling of chemical substances into the three categories of prohibition, reduction, and control, and manages chemical substances according to the regulations for each category. The relationship between substance ranking and management classifications, which shows the concept underlying this initiative, is indicated in the figure below. Approximately 2,000 types of chemical substances are classified into three ranks (hazard level A, B, and C) based on the regulatory levels set by environmental legislation, data on carcinogenic chemicals, and other factors. The classifications of prohibition, reduction, and control are determined by judging risks for each chemical substance using the ranking of the substance equivalent to hazard levels and emissions equivalent to exposure to the substance.

■ Substance ranking and management classifications

\[
\text{Risk} = \text{Hazard} \times \text{Exposure}
\]

- **Substance Rank**
  - **Rank A**: Substances whose manufacture and use are prohibited by laws or regulations
  - **Rank B**: Substances whose usage standards are specified or whose usage must be reported by laws or regulations, or whose carcinogenic class is I.a or I.a /I.a
  - **Rank C**: Substances noted in laws or regulations, or whose carcinogenic class is I.a or I.a /I.a, but subject to relatively few restrictions

**Prohibited substances**
- 88 types of substances, including:
  - Asbestos
  - Polychlorinated biphenyl (PCB)
  - CFCs and halons
  - Carbon tetrachloride
  - 1,1,1-Trichloroethane
  - Tetrafluoroethylene
  - Trichloroethylene
  - Benzene
  - Dichlorobenzene
  - Dichloromethane

**Managed substances**
- By emissions amount:
  - Control of the amount of emissions
  - Control of the amount of use
  - Control of whether the substance is used or not

**Substances targeted for reduction**
- 551 substances, including chemical substances designated as Type I under the PRTR Law* as well as volatile organic compounds (VOCs) and other substances:
  - Sulfuric acid
  - Hydrogen chloride
  - Cyclohexane
  - Butyl acetate
  - Isopropyl alcohol
  - Propylene glycol
  - Monomethyl ether
  - Hydrogen fluoride and its water-soluble salts, etc.

* Law Concerning Pollutant Release and Transfer Register (PRTR Law)

Reducing Emissions of Chemical Substances

Toshiba Group strives to reduce the consumption of chemical substances by designating substances that have large direct impacts on the environment as those targeted for reduction. By business segment, Storage & Electronic Devices Solutions and Infrastructure Systems & Solutions account for more than 80% of the total emissions of such substances, and by region, approximately 80% of such emissions originate from Japan.

**Results of FY2018**

In FY2018, Toshiba Group took measures for solvents used in cleaning and resin processing, which ranked high among such emissions, and promoted initiatives such as using alternative substances and improving manufacturing processes in order to reduce the use of raw materials as well as reducing the amount of VOC evaporation by enhancing chemical management. As a result, the Group reduced emissions of substances targeted for reduction by 187 tons (25%) compared to the 2013 level. The amount of chemical substance emissions per unit production was 76% of the FY2013 level and we therefore achieved our target.

**Future initiatives**

In the Sixth Environmental Action Plan, Toshiba Group aims to reduce emissions of chemical substances per unit production in FY2020 to less than the FY2013 level. It plans to use alternative substances and increase material efficiency by improving processes as an incoming countermeasure and to expand usage of emission removal and collection equipment as an outgoing countermeasure.

**Emissions of substances targeted for reduction and those per unit production**

<table>
<thead>
<tr>
<th></th>
<th>FY2013 result</th>
<th>FY2017</th>
<th>FY2018 target</th>
<th>FY2018 result</th>
<th>FY2019 target</th>
<th>FY2020 (Final fiscal year) goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount emitted</td>
<td>725 tons</td>
<td>555</td>
<td>–</td>
<td>558 tons</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Per unit production</td>
<td>100%</td>
<td>76%</td>
<td>98%</td>
<td>76%</td>
<td>97%</td>
<td>96%</td>
</tr>
</tbody>
</table>

**Breakdown of emissions of substances targeted for reduction (FY2018)**

- **Japan**: 79.3%
- **Asia**: 12.6%
- **Europe**: 6.1%
- **Other**: 1.6%
- **Energy Systems & Solutions**: 7.4%
- **Storage & Electronic Devices Solutions**: 44.6%
- **Infrastructure Systems & Solutions**: 40.3%
- **Others**: 1.6%

(By business segment)

(By region)