Aiming to Connect with Society Based on Reliability

Nippon Steel & Sumitomo Metal (NSSMC) is a corporation whose business activities exert a large influence on the environment. This is borne out by the fact that we consume approximately 5% of the total energy used throughout Japan. For this reason, as a corporation we have determined the Basic Environmental Policy, and we are fulfilling our commitment to contribute to the creation of an environmental-preservation oriented society with lower environmental impact under the principle of “Ecological Management.”

First, to address the problem of global warming, the NSMMC Group achieved its CO₂ emission reduction target in the voluntary action plan by FY2012. Now, with the aim of achieving the action plans for a low carbon society by the target date of FY2020, we are promoting initiatives with a strong sense of mission and sense of ownership so that we can effectively fulfill our responsibility to society.

In addition, we keenly sense the fact that environmental risk management, which includes the control of accidents and trouble, is indispensable to NSSMC’s business survival. Accordingly, we are implementing detailed environmental impact reduction measures, based on actual conditions at each operating base, including not only compliance with laws and regulations but also conformity to local government ordinances and standards. At the same time, we are ceaselessly continuing measures aimed at enhancing environmental preservation through the use of both equipment and services.

Through three “ecos” of eco process, eco products® and eco solutions and the development of innovative technologies, NSSMC will continue to be actively involved in various environmental issues from the local community level to the global scale. These areas encompass measures to address global warming and the maintenance and improvement of good living environments as well as the promotion of reduction and recycling of waste and the maintenance and improvement of biological diversity.

As this Sustainability Report introduces NSSMC’s various initiatives related to the environment, including details of the topics mentioned above, please take a look at it.

The NSMMC Group advocates the following as the first point of its Management Principles: “We continue to emphasize the importance of integrity and reliability in our actions.” I myself, while being responsible for environmental matters until I was appointed as President, have conducted business operations while remaining strongly aware that environmental initiatives, including not only measures to address global warming but also the reinforcement of environmental risk management and the promotion of resource recycling, are a vital commitment in terms of connecting the Company with society based on reliability.

By developing bilateral communication with all stakeholders, i.e., local communities, customers, shareholders, investors, researchers, and environmental NGOs, we intend to continue to further enhance the quality of our ecological management.

We are ready to learn from your candid opinions regarding our environmental and other activities.

Kosei Shindo
Representative Director and President
NSSMC’s Commitment to the Three Ecos and Innovative Technological Development

Nippon Steel & Sumitomo Metal Corporation (NSSMC) manufactures high-grade steel products at the world’s highest levels of energy efficiency. Being manufactured by Eco Processes, our Eco Products® contribute to saving of energy and resources and are provided to our users worldwide. By using our steelmaking infrastructure, we are developing Eco Solutions, which include recycling of waste plastic and tires, and harmonious activities with nature. Those three ecos are based on innovative technological development, to which we are firmly dedicated. NSSMC, with its advanced technologies, is committed to contributing to realization of a sustainable society.

Three ecos

ECO PROCESS
The way we manufacture is “eco-friendly”
NSSMC manufactures steel products with world-leading resources and energy efficiency and is aiming to develop eco-friendly steelmaking processes by further improving efficiency.

ECO PRODUCTS
What we produce is “eco-friendly”
We produce and offer eco-friendly “products” using our world-leading technological capabilities, thus conserving resources and energy and thereby contributing towards building a sustainable society.

ECO SOLUTION
Sharing our “eco-solutions”
We contribute to the reduction of CO2 emissions and other environmental burdens on a global scale by diffusing our Group’s world-class environmental and energy-saving technologies in Japan and overseas.

DEVELOPMENT OF INNOVATIVE TECHNOLOGIES
Based on the objective of offering to society technologies and products that contribute to the saving of resources and energy and the reduction in environmental burden, we are developing innovative advanced technologies from a medium- to long-term perspective.

R&D group of approximately 800 researchers
Total number of patents held
Approximately 23,000 patents issued in around 70 countries

Contributing to solving environmental and energy issues through steelmaking

Energy-saving technologies in steelmaking processes
Economical use of energy

Consumption of energy
Down 11.1%
(Average of FY2008 and FY2009 vs. FY1990)

Next-generation coke manufacturing technology
Solve the problem of limited reserves of high-grade coal used in steelmaking

SuperDyma®, the product with due consideration of an overall product lifecycle
Enhanced corrosion resistance

Realizing longer product life
About 4 times longer
(vs. conventional products)

Strong points of steel from a total life cycle perspective
The greatest strong point is unlimited recycling

Recycling of steel
95%
(Case of automotive steel materials in Japan)

Contribution to creation of a recycling-oriented society
Waste plastic recycling

NSSMC’s contribution of waste plastic recycling
About 30%
(Ratio of the amount recycled by NSSMC of waste plastic collected in Japan)

Technical cooperation and technology transfer promoted on a worldwide scale
Japanese steel industry’s international cooperation on environmental preservation and energy conservation

Potential reduction of CO2 emissions by the world steel industry
About 400 million tons of CO2
(In case Japan’s technologies were adopted by the world steel industry)
Energy-preservation technologies used in steelmaking processes

Effective and economic use of energy

Nippon Steel & Sumitomo Metal Corporation (NSSMC) collects and effectively uses gas, which is generated in large volumes as by-products of steelmaking processes, and heat energy and pressure energy. The gas recovered is used as source of fuel for making steel materials and, together with heat energy and pressure energy, for power generation. NSSMC self-generates most of the electric power it needs, and the remaining power is supplied to general households and industries through electric power companies. We will enhance our world-class technologies and continue to make effective use of limited natural resources and energy.

Flow chart of energy generated from steelmaking processes

Coke Dry Quenching (CDQ) facilities

The hot coke is quenched and cooled down not with water but with inert gas, which primarily consists of nitrogen gas and CO₂. Waste heat is recovered for power generation, while dust generation is almost fully curbed. See p. 25

Gas holders

A gas holder is a storage container used for gas by-product that is to be used as fuel. Gas by-product is stored at night and is used as fuel for power generation during the daytime when power demand is high. Through this, we accommodate to fluctuation in the level of demand for power and reduce use of petroleum in power plants.

Kalina cycle power generation

The Kalina cycle captures waste heat from hot water of about 100 °C, which has condensed from converter gas, and turns it into power. NSSMC is the first in the world to be successful in this mode of practical use, at the Kashima Works in 1999. In the past, low-temperature waste heat was difficult to capture but can now be collected for power generation.

Top Pressure Recovery Turbine (TRT)

This equipment drives a turbine using blast furnace gas generated in large volumes in a blast furnace to generate electric power. Pressure energy is effectively used, while greenhouse gases such as CO₂ are not generated and involve no use of fuel. In the case of the Kashima Works, the TRT generates nearly 10% of power consumed at the site.

Cooperative thermal power plants

Through joint investment with local electric power companies, NSSMC has constructed power plants and generate electric power by using gas by-product generated within a steelworks, thermal coal, and petroleum as the fuel source. Power is supplied to general households and industries through the local electric power company.

Major energy collection facilities

Major power generation facilities

NSSMC internally generates 84% of the electricity it uses. NSSMC supplies 43% of internally-generated electricity in the local community.
SuperDyma®, the steel sheet that is considerate of the overall lifecycle

**Corrosion Resistance Has Lengthened the Product Life by Four Times**

SuperDyma® has enhanced corrosion resistance by four times by the composite effect of adding aluminum, magnesium, and silicon to the conventional galvanized (zinc coating) steel sheet. It has thus extended the product life. Less energy is consumed during the manufacturing process, consumption of steel materials is reduced, and product durability is enhanced—advantages that have led to increasing adoption of SuperDyma® as exterior construction material, contributing to longer life of buildings.

SuperDyma®

**High corrosion resistance enables four times longer product life**

SuperDyma® steel sheet lasts four times longer than the conventional hot-dip Zn-coated sheets.

**High corrosion resistance enables reduced use of resources and energy**

- The amount of coating materials needed can be about 25% that of hot-dip Zn-coated sheets for a given duration of life.
- Due to elimination of post-coating and post-painting on cut-end surfaces, consumption of coating and painting materials and energy for fabrication is reduced.
- The conventional hot-dip Zn-coated sheets require a heavy sheet thickness to prevent distortion during post-coating. SuperDyma® products, with no need of post-coating, can be thinner and lighter, which also means a lower cost of fabrication.

**High corrosion resistance justifies wide diffusion as a construction material**

SuperDyma® is used in various applications, including construction, electric appliances, automotive parts, and solar panel installation mounts, as it has the advantage of longer life and lower cost.

**Can be recycled after the end of its product life**

SuperDyma® can be recycled and reused as steel material, after the product made of SuperDyma® is no longer used at the end of its service life.

**What we produce is “eco-friendly”**

Even after the service life of products such as automobiles ends, steel materials are recovered as scrap and recycled as new steel products. The greatest strong point of steel materials is the fact that unlimited recycling is possible. When recovered scrap is used again as steel material, it is possible to proportionately reduce the amount of natural resources that are newly consumed and the CO₂ generated at the time of iron ore reduction. In other words, scrap has “environmental value.”

The World Steel Association is focusing on this point and has established a method to evaluate environmental impact that factors in scrap recycling after product disposal. For example, this is a method where the environmental value possessed by scrap that is recovered at the time of the disposal of automobiles is deducted and reallocated if scrap is reused. If this method is used, the effect of the improvement to the environment caused by scrap recovery can also be appropriately evaluated and it is possible to fairly evaluate the entire steel process for making products from both natural resources and scrap.

In addition, there is a limit on the amount of scrap that is generated when steel products whose service lives have ended become a source of supply, and it is impossible to provide for all the supply of steel, for which demand is expanding worldwide.

The lighter an automobile is, the better its fuel economy is and the more it is possible to reduce CO₂ emissions when driving. Accordingly, the application of lightweight materials aimed at improving fuel economy is likely to continue to accelerate. However, at the stage of manufacturing lightweight materials, a large amount of energy is consumed, and it is not possible to recycle materials after automobiles are disposed of. CO₂ emissions can conversely end up increasing over the entire life cycle. It is therefore important to consider environmental impact over the entire life cycle, including the manufacture and recycling of materials, and not just based on a cross section of products.

**Strong points of steel from a total life cycle perspective**

The greatest strong point is unlimited recycling.

The supply of steel that society requires is founded on an integrated system where iron ore, which is a natural resource, is seen as the principal source of supply and scrap recycling is also incorporated.

System for evaluation of CO₂ emissions over entire life cycle

Emphasis that considers entire life cycle

**Expect to curb social costs in ASEAN and reduce environmental impact**

NS BlueScope has decided to commence production of SuperDyma® in Thailand in 2015. This is the first time that SuperDyma® will be produced outside Japan. SuperDyma® is a product that was developed by Nippon Steel & Sumitomo Metal and has been widely used in construction materials to home appliances due to its outstanding corrosion resistance. It acquired a Japanese Industrial Standard (JIS) in 2012 and its applications are expected to expand further.

We are convinced that SuperDyma® will curb social costs in ASEAN countries and also contribute to a reduction in environmental impact. We will strive to expand the use of this wonderful ecological product in ASEAN.

**VOICE**

Somkiat Pintatham
President, NS BlueScope (Thailand) Ltd.
Contribute to a recycle-oriented society by use of the steelmaking technology

Waste Plastic Recycling

Since 1997, Nippon Steel & Sumitomo Metal Corporation (NSSMC) has been doing a research on waste plastic recycling with a focus on the thermal decomposition process (in coke ovens). Since the fall of 2000 when we installed our first waste plastic treatment equipment, at our Nagoya Works and Kimitu Works, four other steelworks have installed the equipment and we have established a nationwide system to collect waste plastic. At present, NSSMC recycles about 30% of waste plastic which is collected by municipalities across Japan.

Waste plastic recycling process, using coke ovens for steelmaking

**Feature (3) Eco Solution**

**Households**
- Use plastic products
- Collect and store plastic products
- Compress and package plastic
- Plastic bags, plastic wrap Bottles, tubes Trays, packages, cups
- Sort, and discard unusable materials

**Municipalities**
- Collect and store plastic products
- Collect and sort plastic products collected from households

**NSSMC**
- Collect and sort plastic products
- Secondary crushed plastic, after being sorted and removed of non-plastic materials
- Agglomerated plastic solidified and formed with heat generated by friction

**Oil**
- 40%
- Light oil
- Tar
- Used as plastic and other chemical raw materials in a chemical plant

**Coke**
- 20%
- After being cooled, the coke is put in a blast furnace and is used as an iron ore reducing material

**Coke oven gas**
- 40%
- The coke oven gas is used as energy at a thermal power plant within a steelworks.

**Contribute to a recycle-oriented society by use of the steelmaking technology**

Japan faces the very difficult issue of having to resolve environmental and energy problems while realizing industrial competitiveness and economic development. One of the keys to resolving this issue is making the maximum effective use of existing resources, including multiple uses for various applications. In this regard, I think that recycling waste plastic by using a coke oven is an ideal technology. The decharisation process is not required and initial investment is substantially restrained due to the use of existing coke ovens. Waste plastic can be revived by changing its form to coke, heat, electricity and chemical products, for example. Steelworks certainly emit large quantities of CO₂. However, that’s why they are also a treasure house of ideas to solve environmental problems. We should be able to learn a great deal from steelworks in terms of solving environmental, energy and economic problems.

Yaichi Aoshima
Professor
Institute of Innovation Research
Hitotsubashi University
Nippon Steel & Sumitomo Metal Corporation (NSSMC) is committed to reduction of the environmental burden created by production activities and manufacturing processes. We make continuous efforts in all processes to not waste limited resources and energy.

NSSMC uses iron ore mined overseas, coal as an iron ore reductant, and scrap generated by society as its main raw materials for steel production. By-product gases, such as coke oven gas generated by dry distillation of coal in the coke manufacturing process and blast furnace gas generated from blast furnaces, are fully utilized as fuel for steel heating furnaces or energy sources for power generation plants on the premises of steelworks.

Electricity generation by recovering waste heat helps raise the heat efficiency of the whole steelworks to around 70%. In addition, more than 90% of water for cooling or washing products and production facilities is recycled and reused. When one ton of iron is produced, the amount of by-products generated exceeds 600 kg, but the steel slag, dust, and sludge are reused in-house as raw materials, or are used by society or other corporations as raw materials for cement, construction materials, and so forth. These efforts have resulted in the achievement of a very high recycling rate of approximately 99%.

We are also engaged in the recycling of various types of by-products generated by society or other industries by utilizing our steelmaking processes that are carried out at high temperature and high pressure. In recent years, we have been actively recycling waste plastics, waste tires, and other waste materials.
Global Warming Countermeasures

Nippon Steel & Sumitomo Metal Corporation (NSSMC) promotes energy conservation and CO2 emissions reduction throughout the entire supply chain: manufacturing, transportation, and final use of products. We also actively work at innovative technology development and transfer of established technology to our overseas operations, helping them to contribute to CO2 reduction over the medium- and long-term.

Activities for reducing CO2 and conserving energy during production processes
From the time of the first oil crisis until around 1990, NSSMC intensively promoted continuous processes, exhaust heat recovery, and other measures, all to enable significant energy conservation. The Japan Iron and Steel Federation (JISF) members including the former Nippon Steel and the former Sumitomo Metals adopted voluntary action plans with a goal of 10% reduction in energy consumption (CO2 emissions reduction of 9%) for FY1988 through FY2012 relative to the FY1990 level, and made efforts to achieve this goal. As a result, both NSSMC and the JISF have succeeded in achieving the goal.

As the energy management activities of NSSMC and other members of the JISF had been highly evaluated, the JISF acquired ISO50001 (Energy management system) certification as the first in the world as an industrial organization. This acquisition is a clear demonstration of transparency, reliability, and the validity of the JISF’s voluntary action plans and its subsequent version of the action plan for a low-carbon society, in light of requirements of international standards.

From FY2013 on, NSSMC will continue energy conservation efforts to achieve the FY2020 goal of JISF’s action plans for a low-carbon society (CO2 reduction of 5 million tons from expected CO2 emissions under certain production assumptions, through the maximum use of cutting-edge technologies).

Energy conservation and CO2 emissions reduction
The most effective measure against global warming is energy conservation, and therefore, NSSMC is striving to improve energy efficiency by using energy generated in steelmaking processes, including power generation through use of by-product gas, exhaust heat recovery, or by using waste plastics and discarded tires. As a result of these efforts, the NSSMC and affiliated electric furnace companies consumed 1,126 PJ energy in FY2013 and emitted 97.6 million tons of CO2.

5 Affiliated electric furnace and other companies: Osaka Steel Co., Ltd., Kobe Steel, Ltd., Nippon Steel & Sumitomo Stainless Steel Corporation, Nippon Steel & Sumitomo Metal Corporation, and Nippon Steel & Sumi Engineering Co., Ltd., Meiko Cooperative Thermal Power Companies (Kumamoto, Tochigi, and Shizuoka), and three thermal centers (Lapiao and Shido in Japan and Nakasi in Thailand).

A provisionary value based on the assumption that the CO2 level in a unit of purchased electricity in FY2013 is the same as in FY2012.

Japan Iron and Steel Federation’s action plans for a low carbon society
In the voluntary action plans, the Japanese steel industry promotes three eco: energy conservation in own manufacturing process (eco process); CO2 reduction related to final products containing high-performance steel materials (eco products); and CO2 reduction on a global scale by transferring and promoting energy-saving technologies (eco solutions). From a medium- and long-term perspective on CO2 reduction, the industry also is promoting development of innovative steelmaking processes (“COURSE 50”). From FY2013 onward, we will continue to promote 4-pronged anti-warming measures consisting of the three eco and COURSE 50, under action plans for a low carbon society.

CO2 reduction efforts in transportation of products
NSSMC transports approximately 13.4 billion ton-kilometers of steel products and semi-finished products per year. Historically, we have made joint efforts for logistics efficiency with the logistics companies within the NSSMC Group, such as the improvement of transportation efficiency and fuel economy.

Efforts to improve the transportation efficiency include shortening ship’s time at berth for loading and unloading by improving cargo handling efficiency or using larger vessels (changing from 700 ton to 1,500 ton vessels) in domestic transportation, in addition to maintaining and improving high modal shift rate.

To improve fuel economy, in land transportation for example, we have promoted fuel-efficient driving (i.e., use of digital tachometers) and introduced efficient energy tires and lightweight vehicles. In marine transport, fuel economy improvement measures have also been implemented and the range of application.

In addition to efficiency in transportation, we have achieved some progress in reduction of packaging materials by creating and expanding adoption of shipping systems for sheet products that do not require packing.

Going forward, with the aim of transporting large quantities of steel products in one shipment, we are also working on adopting a new optimal ship and land vehicle distribution system by use of the ship and land vehicle scheduling know-how accumulated over many years. We will thus further improve transportation efficiency.

We will further strive to significantly reduce CO2 emissions through realization of synergy effects of the merger, in addition to improving logistics efficiency through an optimal production system and transportation efficiency by reviewing the logistics system.

Logistics sector’s ten-kilometer achievements for FY2013

<table>
<thead>
<tr>
<th>Transportation quantity</th>
<th>Percentage of improvement</th>
<th>Improvement (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ship</td>
<td>2,068 (56%)</td>
<td>11,718</td>
</tr>
<tr>
<td>Railway</td>
<td>6 (90%)</td>
<td>41 (100%)</td>
</tr>
<tr>
<td>Truck and trailer</td>
<td>1,647 (64%)</td>
<td>1,662 (13%)</td>
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<tr>
<td>Total</td>
<td>3,721 (100%)</td>
<td>13,421 (100%)</td>
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Side note: modal shift rate is a percentage of cargo volume transported over a distance of 500 km and more by rail or sea (including ferry) (as defined by the Ministry of Land, Infrastructure, Transport and Tourism).

Efforts made in office and at home
In addition to concerted efforts to reduce CO2 emissions in the manufacturing process, NSSMC has implemented a policy of lights-out during lunch breaks, a business-casual dress code during summer, no working days, etc. in offices, as part of the energy-saving activities.

In order to encourage our employees make energy-saving efforts at home and actually reduce emissions, we have promoted eco-Kakeibo (household bookkeeping) on a company-wide scale. Our “eco-Kakeibo” system is used by over 10,000 employees’ families. They keep records of usage of electricity, gas, kerosene, gasoline, etc. and to thereby the actual amount of household CO2 emitted. Doing so contributes to reducing CO2 emission at home by visual representation of data, such as CO2 emissions per family member and comparison with the average of families for each business division.

Changes in energy consumption

<table>
<thead>
<tr>
<th>1990 vs. average in 2008–2012</th>
<th>Achieved target of 10% reduction</th>
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</thead>
<tbody>
<tr>
<td>Energy consumption per ton of crude steel (high scale)</td>
<td>Energy consumption per ton of crude steel (low scale)</td>
</tr>
<tr>
<td>PJ (t–AE/t)</td>
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Energy-derived CO2 emissions

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Japan Iron and Steel Federation’s Action Plans for a Low Carbon Society

<table>
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<tr>
<th>Eco process</th>
<th>Eco products</th>
<th>Eco solution</th>
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</table>
| Achieved improving energy efficiency in the steelmaking processes, including blast furnaces and reduction in output (the most efficient in the world). CO2 reduction of 9% (from the amount of CO2 emissions expected under certain production assumptions) | By providing high-performance steel materials, the NSSMC and its affiliated electric furnace companies, including our members, work to maintain a clean and carbon-free society, i.e., towards the realization of the following objectives: | By transferring to and promoting development of innovative steelmaking processes such as COURSE 50, and improving logistics efficiency with the logistics companies within the NSSMC Group, such as the improvement of transportation efficiency and fuel economy.

We will thus further improve transportation efficiency. We will further strive to significantly reduce CO2 emissions through realization of synergy effects of the merger, in addition to

Development of innovative steelmaking process “COURSE 50”

The level of CO2 emissions is reduced by approximately 30% in the steelmaking processes through iron ore reduction with hydrogen and aqueous reduction of CO2 from blast furnace gas. The project is a cooperative rescue project for the blast furnace industry by around 2050, and is expected to help in achieving CO2 emission reduction of 5 million tons by 2050.

The project is a cooperative rescue project for the blast furnace industry by around 2050, and is expected to help in achieving CO2 emission reduction of 5 million tons by 2050.

The data for “All industries (except basic industrial substances, i.e. iron & steel, oil, coal)” was obtained from “Transport material of different industries based on different transportation” issued by the Ministry of Land, Infrastructure, Transport and Tourism.

Transportation quantity base defined by the Ministry of Land, Infrastructure, Transport and Tourism (FY2013)

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Modal shift
A modal shift indicates the domestic freight transport shift from truck carrier to coastal shipping from coastal shipping to rail carrier, and more by rail or sea (including ferry).

Japan’s all industries

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<tr>
<th>Ship</th>
<th>Railway</th>
<th>Truck and trailer</th>
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</thead>
<tbody>
<tr>
<td>Ships, railway 95.0 %</td>
<td>Ships, railway 65.0 %</td>
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</table>
NSSMC is promoting management of environmental risk with the aim of continually enhancing preservation of the environment in various regions, with due consideration of environmental risks, which differ by each steelworks and factory, and with due consideration to compliance with Japan’s Air Pollution Control Act and other regulations. We also are engaged in reducing environmental risk throughout the Group.

Activities for reducing environmental risks

Atmospheric risk management

In order to reduce emissions of sulfur oxides (SOx) and nitrogen oxides (NOx), NSSMC is taking measures such as using low-sulfur fuel, and installing effective equipment, including equipment that reduces SOx and NOx emissions, low NOx generating burners, and exhaust gas treatment units. To curb emissions of soot and dust, we try to choose equipment based on air pollution risk analysis through scientific simulation. We also conduct constant monitoring and regular patrols to ensure that no abnormal emissions are released outside.

Water quality risk management

NSSMC does approximately 6 billion m$^3$ of freshwater a year at all of our steelworks and factories combined. Approximately 90% of this is re-circulated or reused. We try not to waste precious water resources, and to limit wastewater discharge to a minimum. To achieve this, we make daily efforts to maintain and improve the performance of wastewater treatment equipment, and the inspection and control of wastewater quality.

In consideration of the importance of preventing water pollution, we have installed devices such as detectors, control valves, and emergency water storage pits. We also strive to check, repair, and maintain equipment in order to prevent water pollution, and to train our personnel in methods of checking of operations and controlling work procedures.

Soil risk management

We are taking appropriate measures in compliance with the Soil Contamination Countermeasures Act, guidelines issued by the Ministry of the Environment, local government ordinances, and so on. We report to the local government when performing landfill modification work such as excavation which is required to be reported. We conduct pollution surveys when needed.

Chemical substances discharge control

Comprehensive control of discharge

NSSMC appropriately manages and tries to improve the production, handling, and discharge or disposal of chemical substances in accordance with the PRTR Act$^1$, Chemical Substance Control Law$^2$, Volatile Organic Compounds (VOC) voluntary management, and other laws concerning the management of chemical substances as well as following the requirements of relevant management procedures. NSSMC also took the lead to promote use of alternatives to steelmaking and materials that can contain hazardous materials, such as asbestos and polyvinylidene fluoride (PVDF). We have been replacing or disposing of possibly risky parts and materials, according to handling standards which ensure safety.

NSSMC’s progress in dissemination of electronic manifests

NSSMC is promoting use of an electronic manifest to enhance management of environmental risks, which differ by each steelworks and factory, and with due consideration to compliance with Japan’s Air Pollution Control Act and other regulations. We also are engaged in reducing environmental risk throughout the Group.

NSSMC’s final disposal amounts

NSSMC recycles 100% of plastic containers and packaging and all discarded tires by using them in the steelmaking processes. (See p. 14)

NSSMC’s progress in dissemination of electronic manifests

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NSSMC’s progress in dissemination of electronic manifests
NSSMC’s eco-friendly products help reduce environmental burden

Our Group’s products, that have advanced or highly specialized functions, technological capabilities, and reliability, are used in diverse areas including energy, transport and construction equipment, and household products. They typically help our customers become more efficient while making their products lighter or lengthening product life. That translates into the saving of resources and energy, and into a reduction in carbon emissions at the point of use at our customers, contributing to lessening the environmental burden.

Pure titanium sheet for aircraft and titanium alloy rods for aircraft engines
The use of high strength, low-density titanium contributes to the reduction of the weight of aircraft, thereby achieving higher energy efficiency. Nippon Steel & Sumitomo Metal Corporation’s (NSSMC) supplies titanium alloy rods used in aircraft engine blades and pure titanium sheet used in pylons that connect wings and engines.

Steel slag-based fertilizer
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Prepainted VIEWKOTE® steel sheet
The prepainted VIEWKOTE® steel sheets are aesthetically appealing and highly corrosion-resistant and are used for washing machines, refrigerator, and other electric appliances. Reduction of CO2 emissions has been achieved by eliminating some coating processes, enabling thinner coating, and adopting a special low-temperature drying coating.

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Welded light gauge steel H sections
Welded light gauge steel H sections, manufactured from a hot-rolled steel strip by welding, are light in weight and thus save more resources by enabling thinner plate thickness compared to hot-rolled H sections, for use in steel-structure buildings and plants. The welded H sections are used as steel frames in applications such as prefabricated housing and wooden houses and highly valued for their more accurate cross-sectional dimensions and high durability.

ABREX® Series abrasion-resistant steel plate
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High-tensile-strength steel materials
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Steel tire cord
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Steel materials for offshore wind power generation
The NSSMC Group is participating in the world’s first offshore wind power generation project that uses a floating wind farm. We are providing high-tensile light-weighted materials with high-performance weldability for chains. Supply of this material contributes to reduced CO2 emissions in construction and railway transportation.

Railway rails
NSSMC’s railway rails are widely used in Japan and overseas. By developing various technologies, such as for control of the amount of carbon in order to enhance the durability of the surface of the steel, the life of the rails has been extended by 20-40%, less frequent need to replace the rails means limiting CO2 emissions has been achieved by eliminating some coating processes, enabling thinner coating, and adopting a special low-temperature drying coating.

Wheels (wheels and axles) for high-speed railways
NSSMC manufactures almost all wheels and axles for the Shinkansen and other high-speed railways in Japan. While pursuing weight reduction and thus contributing to energy conservation in railway transport, we have also developed technology to dampen the noise of meshing of a gear unit or hissing sound of brake disks.

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With the understanding that the transfer of Japan’s advanced energy-saving technologies overseas can be one of the most effective ways to globally reduce CO2 emissions, Nippon Steel & Sumitomo Metal Corporation (NSSMC) is participating in many energy-saving and environmental initiatives in Japan and overseas. For example, we work with the World Steel Association, the Global Superior Energy Performance Partnership (GSEP), and directly with countries such as China and India.

Japanese steel industry’s international cooperation on environmental preservation and energy conservation

Japan’s steel industry, including NSSMC, plays a leading role in the Global Sectoral Approach, a worldwide initiative to preserve the environment and conserve energy based on technologies accumulated in the steelworking industry.

Since 2005, China and Japan have held “Japan-China Steel Industry Advanced Technology Exchange Meetings for Environmental Preservation and Energy-saving” to exchange industry-based technology between Japanese and Chinese specialists. NSSMC has been participating in this activity from the first meetings.

The Japanese government is currently proposing a new approach called a “bilateral offset credit scheme” as a means to contribute to CO2 reduction overseas. This is a system, under a bilateral agreement with a developing country, to smoothly and flexibly evaluate and recognize contributions of low carbon technologies to emissions reduction and distribute the merits among the parties concerned (governments of Japan and a partner country, and companies concerned). As part of these activities, the Japanese government and Japan’s steel industry, with Indian steel industry participants, initiated a “Public and private collaborative meeting between the Japanese and Indian iron and steel industries” in FY2011 and began drawing up a List of Energy-Saving Technologies which is suitable for the current situation of the Indian steel industry. In FY2013, NSSMC participated in analyzing the status of energy saving of the Bhilai Steel Works of the Steel Authority of India Limited (SAIL), based on the List of Energy-Saving Technologies in December 2013 and played a central role in revising the list at a conference held in Tokyo in February 2014. We also began similar initiatives with the Southeast Asian steel industries in FY2013.

Regarding multinational efforts, a steel section Working Group (WG) of the GSEP (with Japan as the chair) was launched in FY2011. In March 2012, the first conference was held in Tokyo. The new partnership aims at regional collaboration with more countries including the EU in promoting energy-saving and environmental technologies. In FY2013, a steel section WG workshop was held in Tokyo with participation by Japan, the U.S.A., China, India, and South Korea. Energy management issues were discussed and NSSMC made a presentation on the Japanese steel industry’s initiatives on climate changes.

NSSMC also participates in the Climate Action Program of the World Steel Association, which uses universal methods to calculate and report on the CO2 emitted by steelworks. We have been selected as a Climate Action member recently. Quite a few customers have shown confirmation that their steelmakers are Climate Action members. Efforts to standardize these calculation methods as ISO have been spearheaded by the Japanese steel industry. This had resulted in international standardization of the procedure as ISO14404 “Calculation method of carbon dioxide emission intensity from iron and steel production” in March 2013. It has enabled steelworks not participating in the World Steel Association to calculate CO2 intensity using universal methods. This marked the first step forward in greatly facilitating the global sectoral approach sought by the steel industry. NSSMC is promoting diffusion of ISO14404 through the initiatives taken by Japan and India, Japan and Southeast Asia, and other relations.

In India, by 2025, thanks to rapid economic growth, steel production is projected to expand to 300 million tons. This will be about three times higher than the present production volume in Japan. This increase means that energy saving is becoming more of a challenge for India. Japan’s steel industry has developed and commercialized many energy-saving technologies since the oil crisis in the 1970’s and has achieved the world’s highest level of energy efficiency. I am involved in the research on technological transfer to emerging markets, and in particular India. Diffusion of those energy-saving technologies and energy management systems in India, if realized, can contribute to a significant CO2 reduction. I believe that the NSSMC Group’s operation of the CDQ in India is a representative case. Consequent to adoption of energy-saving regulations and measures for conservation of water and reduction of air pollution, the Japanese equipment is now being introduced in India, in intense competition with Chinese engineering companies. Further adoption of this type of equipment is anticipated, based on stable operating performance, which is a notable feature of the Japanese equipment.
Creation of Hometown Forests and Creation of Sea Forests

In order to realize a sustainable society, companies have to take effective initiatives to live in harmony with nature. Among eco-solutions that NSSMC’s environmental management provides, “Creation of Hometown Forests” and “Creation of Sea Forests” are two ongoing activities we believe are well representative of our policy initiatives in this regard. Here, we provide an update on both.

Creation of Hometown Forests

Sea desertification, a problem of the sea bed losing ability to support marine life due to a decline in kelp, brown seaweed, and other varieties of seaweed, is happening along about 5,000km of the sea bed in Japan. Iron fulvate, which is said to be one of the causes for sea desertification, NSSMC has developed “Beverly® Series,” iron supply units composed of steel slugs, humus, and soil and steel slag and has been promoting regeneration of seaweeds beds by using these units.

Conserving biodiversity and sequestering CO₂

Wild birds such as bulbuls and eagles gather and animals such as Ezo red fox and deer visit the forests we make and maintain at our steel works sites across Japan. Wild birds and animals inherent to the land return to the forests. Thus, the “Creation of Hometown Forests” helps conserve biodiversity, and sequesters CO₂.

Sumiko Takeuchi
Board Member and Senior Researcher
International Environmental Economic Institute

“I visited NSSMC’s Kimitsu Steel Works, which is said to be the forerunner of factory-led afforestation in Japan, and was impressed with such deep greenery. This was not merely a green space in a factory. This was a factory in a forest. NSSMC’s for-eco-creating projects, which were begun in the early 1970’s, were ahead of the times. But I would like to point out the significance of undertaking the projects together with local residents of the community. I walked around the "Hometown Forest" with Mr. Shigeta, Manager (at that time) of the Safety, Environment & Plant Safety Division. He told me that he had participated in growing saplings in pots when he was an elementary school student. That has reminded me the words by Japanese novelist Wahei Tatematsu, "planting trees in people’s hearts.""

“Creation of Sea Forests”

Recreating a forest similar to a nearby grove of the village shrine in steelworks

We have carried out the “Creation of Hometown Forests” projects at our steelworks and factories in Japan under the guidance of Dr. Akira Miyasaki, director of the Japanese Center for International Studies in Ecology (professor emeritus of Yokohama National University), with the aim of facilitating harmonious coexistence between nature and humans. This project comprises research on the natural vegetation inherent to a certain area in a nearby grove associated with a historical shrine, careful selection of suitable trees, growth of their saplings in pots, and planting them in designated places by local residents and our employees.

This was the first project by a private company in Japan to create a forest that harmonizes with the local scene and is based on an ecological approach. This is one way we try to raise the awareness of our employees regarding the environment. At present, our forests in aggregate have grown to total around 900 hectares (about the size of 190 Yankee Stadiums).

During the Golden Week holidays in May 2014, I visited Khabarovsk, Russia, as I had longed to see firsthand the Amur River and the surrounding forest along the river. It has been found that iron fulvate which was created in the big forest and the wetland along the watershed of the Amur River has a role in generation of phyto-plankton, which supports the bottom of the food chain in Sanriku offshore in northeastern Japan. The area is said to be one of the three major fishing grounds in the world. (Please note that Sanriku was the area hit hardest by the earthquake and tsunami in March 2011.)

The forest in the watershed of the Amur River is five times the size of the overall Japan. The river in Khabarovsk is as wide as 20km and flows 800km into the Okhotsk Sea. I took a round trip of the river in a sightseeing vessel and saw that the color of the river was unbelievably the color of iron fulvate. I had a chance to lecture at the Pacific National University, the largest university in the Russian Far East. Many students showed interest in my lecture and participated in a planting festival the next day. Plants cannot grow without iron. The sea is suffering from anaemia. How can we supply iron into the sea? I believe that we need to keep on our research.

Shigeatsu Hatakeyama
Head of Metro-sea-unit-re-inhibits, an incorporated NPO

VOICE

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"Creation of Sea Forests" Implemented in 35 spots in Japan to improve sea desertification

Sea desertification, a problem of the sea bed losing ability to support life due to a decline in kelp, brown seaweed, and other varieties of seaweed, is happening along about 5,000km of the sea shore in various parts of Japan. To offset a part of the decline in the supply of iron from nature, which is said to be one of the causes for sea desertification, NSSMC has developed “Beverly® Series,” iron supply units composed of steel slugs, humus, and soil and steel slag and has been promoting regeneration of seaweed beds by using these units.
Innovative Technical Development

Research & development for global warming prevention

With the aim of preventing global warming, Nippon Steel & Sumitomo Metal Corporation (NSSMC) is taking on a challenge in the form of the “CO2 Ultimate Reduction in Steelmaking Process by Innovative Technology Project,” in addition to making efforts to reduce CO2 by further improving its world’s highest energy efficiency.

The COURSE 50 Project (Technological Development and Innovative Steelmaking Process)

Since 2010, four blast furnace steelmakers including us, and Nippon Steel & Sumikin Engineering, have been working on the “CO2 Ultimate Reduction in Steelmaking Process by Innovative Technology for Coal Earth 50 (COURSE 50) Project” which is aimed at developing dramatically new CO2 reduction technology. Its goal is to reduce CO2 emissions in the steelmaking process by 30% through technology that reduces iron ore using hydrogen-amplified coke oven gas to curb CO2 emissions from blast furnaces as well as technology that uses hitherto-unused exhaust heat to separate and recover CO2 from blast furnace gas.

Regarding iron ore hydrogen reduction technology, by FY2012, we comprehended hydrogen reduction characteristics at a laboratory bench level and conducted property elucidation and performance qualification tests of the hydrogen reduction process at a test blast furnace in Sweden as well as verification tests of hydrogen amplification of coke oven gas at Kitusum Works. With regard to CO2 separation and recovery technologies, verification tests of CO2 separation and recovery from blast furnace gas were conducted at Kitusum Works, while low-temperature exhaust heat recovery verification tests were conducted at Kashima Works, among others. These tests played a substantial part in obtaining desired research results of Phase 1. In Phase 2 (FY2012 to FY2017), which began in FY2013 as a project sponsored by NEDO (New Energy and Industrial Technology Development Organization) in preparation for commercialization in 2030, we are verifying technologies to reduce CO2 emissions from a blast furnace in a comprehensive manner. We are leading R&D efforts mainly in the research on a test blast furnace which aims for establishing reaction control technologies that maximize effects of hydrogen reduction, as well as in the second verification tests that target advanced hydrogen amplification of the coke oven gas. (The test blast furnace is being constructed by incorporating individual element technologies that were acquired during the Phase 1 and is scheduled for main testing in FY2016 at the Kitusum Works.)

Next-generation coke-making technology (“SCOPE21”)

Coke, which is carbonized coal, is indispensable in production of steel materials. As raw materials for coke, high-quality coking coal has long been used. However, for this type of caking coal used in steelmaking there are very low reserves and they are in limited areas of the world, compared to general coal used as fuel. Thus, we are facing a credible threat of a surge in price of the coal.

“SCOPE21” is the next-generation coke-making technology developed as a national project to better address resource problems and open up great potential. For the first time in the world, this technology has enabled the raising of the blending ratio of poor-coking coal up from 20% as in the conventional method to 50%. This is a promising innovative technology that can contribute to the stable supply of energy in the future.

There are three basic processes in the SCOPE21 technology: coal pretreatment, carbonization (destructive distillation of coal by heating), and coke discharging and heat collecting processes.

Next generation coke-making technology “SCOPE21”: Structure and Features

The COURSE50, with the aim of making a drastic reduction of CO2 emissions by Japan’s steel industry, has advanced from a stage of element technology development to a stage of integrated technology development. With regard to the “technology to reduce CO2 emissions from a blast furnace,” one of the major themes, we plan to make the process assessment of a blast furnace that uses hydrogen as alternative to carbon, by using a newly-constructed test blast furnace. The objective is to reduce consumption of carbon, which is a source of CO2 in a blast furnace. The key point of this development is a total verification by incorporating various individual element technologies that have been developed, in the test furnace. Regarding another theme, “technology to reduce CO2 emissions from a blast furnace gas,” we have realized the world’s top-level specific heat energy consumption in development of CO2 separation and recovery by a chemical absorption technique. The first commercial model for manufacturing carbon dioxide gas is scheduled to start operation at the Muroran Works in October 2014. With the chemical absorption technique, we will work on pursuing higher efficiency in the process and realizing the technology to recover heat energy needed for the process from the unused heat output.