Sectoral Approach
in the Steel Industry

The Japan Iron and Steel Federation


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Sectoral Approach in the Steel Industry

Outline of Steel Working Group of the Global Superior Energy Performance Partnership

January 2013

The Japan Iron and Steel Federation

Executive Summary With global crude steel production expected to continue expanding into the medium-to-long term thanks to the growth in China, India and other countries. Since the steel industry consumes a great deal of energy, the transfer of Japan's world-leading technology in energy conservation and environmental protection will be indispensable to the formation of a sustainable society from a global perspective.

The Japanese steel industry continues to press ahead with a cooperative, sectoral approach towards the greater diffusion of energy-saving and environmentally friendly technologies. Especially, GSEP (Global Superior Energy Performance Partnership) Steel WG (working group) conforming to its technology-based, bottom-up approach based on PPP (Public and Private Partnership) is playing a core role in this initiative.

In this document, we would like to provide an introduction covering a step-by-step explanation of the cooperative, sectoral approach that the steel industry is adopting, the significance of the PPP, the story of the transition from the APP (the Asia-Pacific Partnership on Clean Development and Climate) to the GSEP Steel WG, and an outline of the GSEP Steel WG itself.

Introduction

Japan's industrial sector continues to implement and strengthen measures towards energy conservation, by constantly exploiting and introducing cutting-edge technology to the maximum extent possible, to raise what is already the world's highest degree of energy efficiency yet further. And it continues to make a positive contribution to the energy conservation and environmental protection initiatives of society at large by supplying outstandingly high-quality products. Furthermore, the energy conservation and environmental protection measures undertaken worldwide thank to the transfer and diffusion of Japanese technology can be said to be indispensable to the development of a sustainable society by balance between the economy and the environment on a global scale.

Against this background, Japan's steel industry, along with the cement and electric power generation industries have outpaced other industrial sectors in creating structures for international cooperation. Every year since 2005, 'Japan- China Steel Industries Conference on Exchange of Advanced Technologies on Environmental preservation and Energy saving' for specialists in the field has been held. And the APP Steel Task Force started in 2006. The task force comprises seven nations (Japan, Australia, China, India, South Korea, the USA and Canada) and its activities include the sharing of information about energy conservation technologies and diagnostic surveys of steel production mills in China, India and other countries. Furthermore – both leveraging the success of the APP Steel Task Force and broadening its scope to encompass the worldwide steel industry – the decision was taken by the World Steel Association (worldsteel) in October 2007 to adopt 'A Global Steel Sectoral Approach'.

Nowadays too, thanks to the GSEP (the Global Superior Energy Performance Partnership which is the successor organization to the APP Steel Task Force) Steel WG (working group) and Japan-India bilateral initiatives and other cooperative undertakings, the aim remains to foster the transfer of effective energy-saving and environmental conservation technologies.

What sort of structure is preferable for international coordination efforts contributing to the transfer of energy-saving and environmental conservation technologies?

In this document, we shall provide a step-by-step explanation, based on the guidelines etc. adopted at the inaugural round of the GSEP Steel WG, of the cooperative, sectoral approach adopted by the Japanese steel industry as well as an outline of the GSEP Steel WG that forms the nucleus of our current and future activities.

We shall be extremely grateful if you take this opportunity to become more familiar with the ideals and activities of the Japanese steel manufacturing industry as it strives, to meet the challenges of spreading its energy conservation and environmental protection technologies through its technology-based, bottom-up model.

1. Global crude steel production and production processes and the energy conservation and environmental protection technologies required for the formation of a sustainable society

1.1. Global crude steel production

The volume of world crude steel production was around 700-800 million tons in the 90s but rose sharply from 2000 onwards in response to rapid growth in China. The global economic crisis sparked by the Lehman Shock of autumn 2008 brought a temporary decline but, from the second half of 2009 onwards, growth was stimulated by the economies of the emerging nations and had reached nearly 1.5 billion tons by 2011 (Fig. 1).

From a longer-term perspective, the growth in India and other nations is expected to result in this figure exceeding 2 billion tons in 2050 (Fig. 2).

1.2. Japanese energy conservation and environmental technology necessary to the formation of a sustainable society

Japan's steel industry achieved a rapid expansion in production volumes in response to the fast growth in the country's economy in 1960s. The industry also took steps so as to proactively deal with the challenges raised by the problems of various types of pollution, the suitable treatment of waste water drainage and gas emissions, the effective usage of water resources, and the greening of factory sites etc. which surfaced as a result of this rapid industrial development. In response to the two oil shocks of the 1970s, the introduction of energy-conservation technology was promoted as a national policy priority and the industry made great efforts to proactively develop and install various types of energy-saving technologies (including programs implemented to reduce the environmental burden by the treatment of waste gases and augmented measures to control particulate pollution so as to control the impact of a large increase in energy consumption).

Thanks to these measures, the dissemination rate of the main large-scale energy-conservation technologies such as coke dry quenching (CDQ) and blast furnace top gas pressure recovery power generation equipment (TRT) reached close to 100% which, in turn, resulted in the achievement of the world's highest level of energy efficiency being achieved in Japan. (Fig. 3, 4, 5, 6)

Because the energy conservation and environmental technology that enable the Japanese steel industry to achieve such results can be introduced into steel mills worldwide, it is essential for the formation of a sustainable global society that they contribute to the energy conservation and environmental protection strategies adopted worldwide.

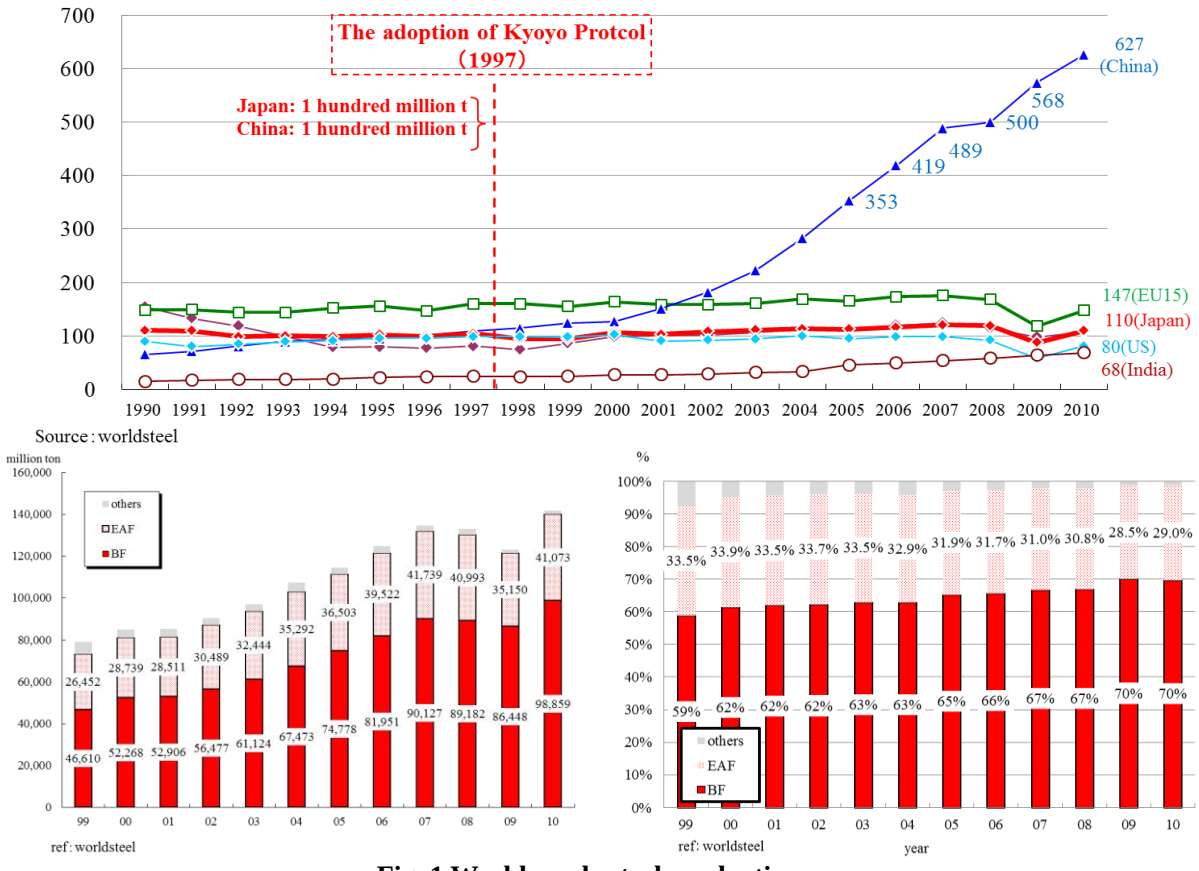


Fig. 1 World crude steel production

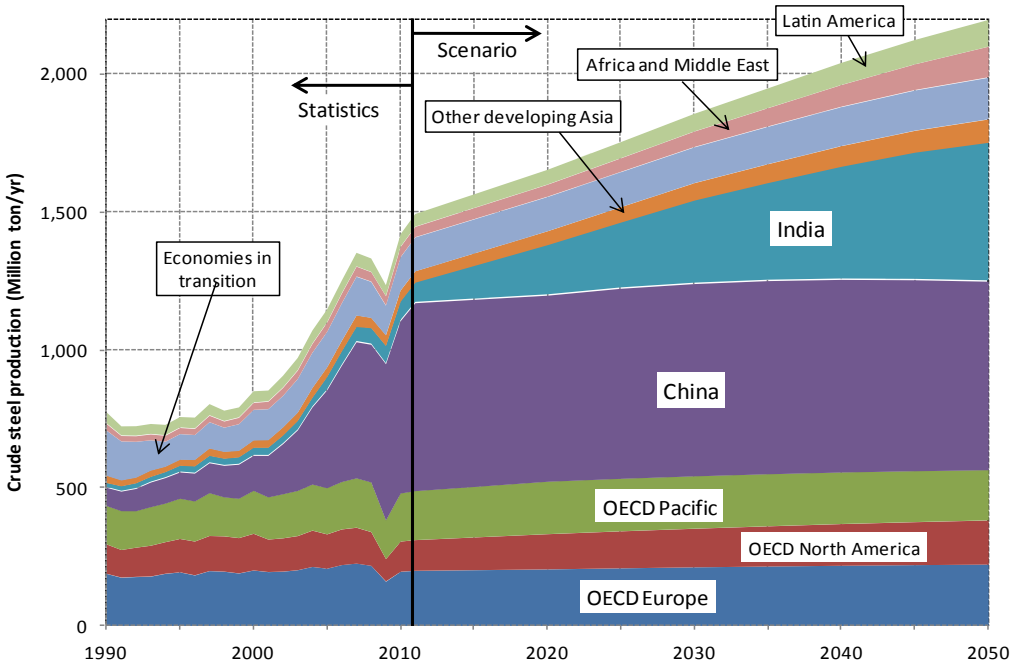
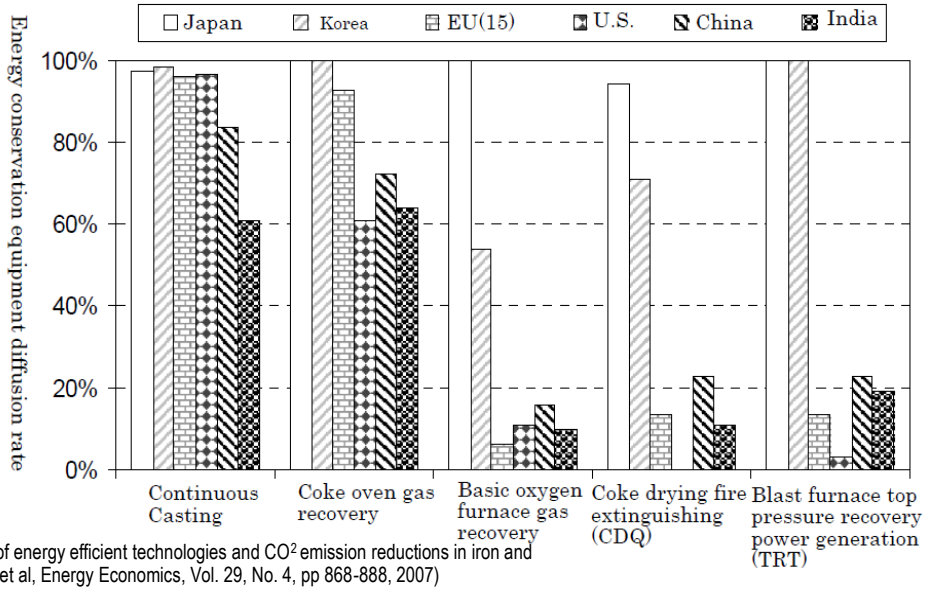
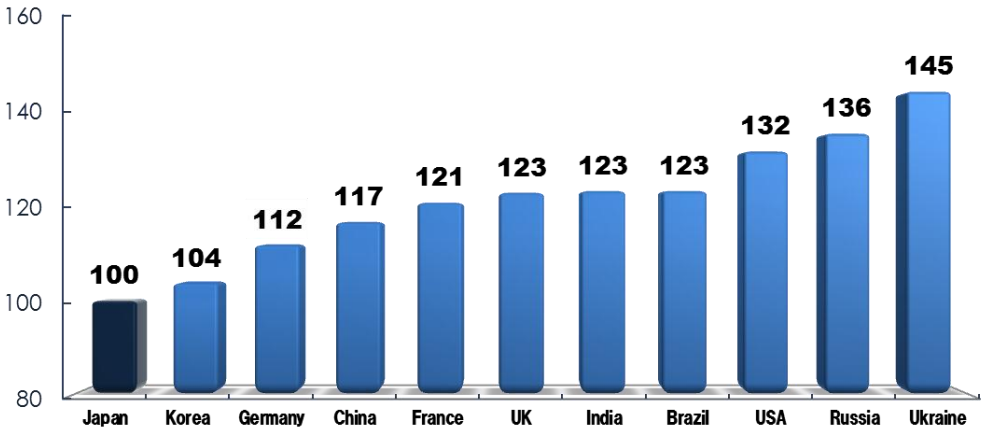


Fig. 2 Long-term outlook of world crude steel



Source: Diffusion of energy efficient technologies and CO^2 emission reductions in iron and steel sector (ODA et al, Energy Economics, Vol. 29, No. 4, pp 868-888, 2007)

Fig. 3 Utilization rate of major energy-conserving technologies



Source: RITE

Fig. 4 Comparison of Unit Energy Consumption of Steel (2010)

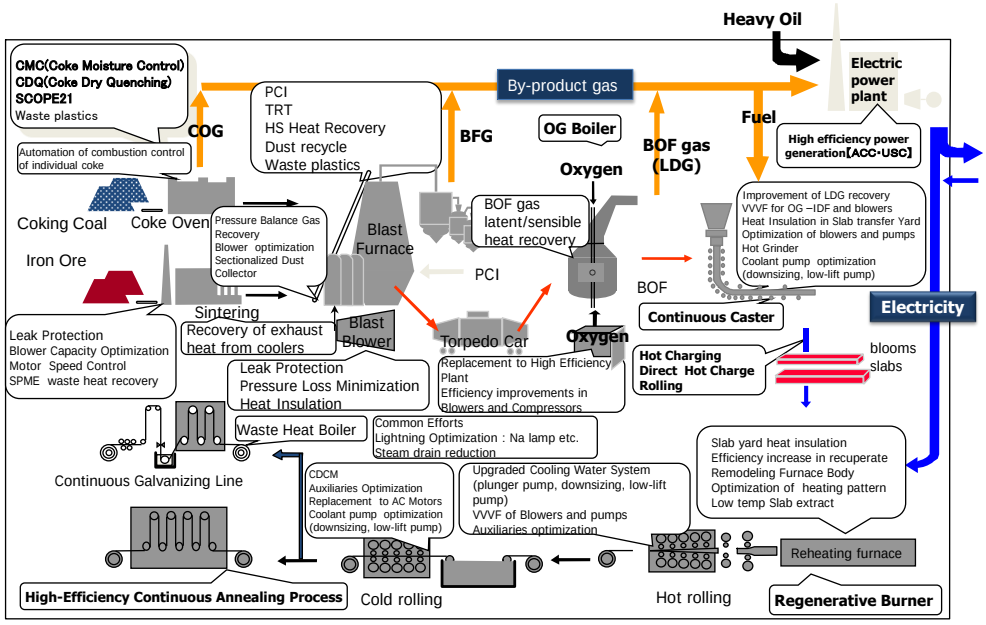


Fig. 5 Environmental Protection & Energy-saving technologies in steel works technologies

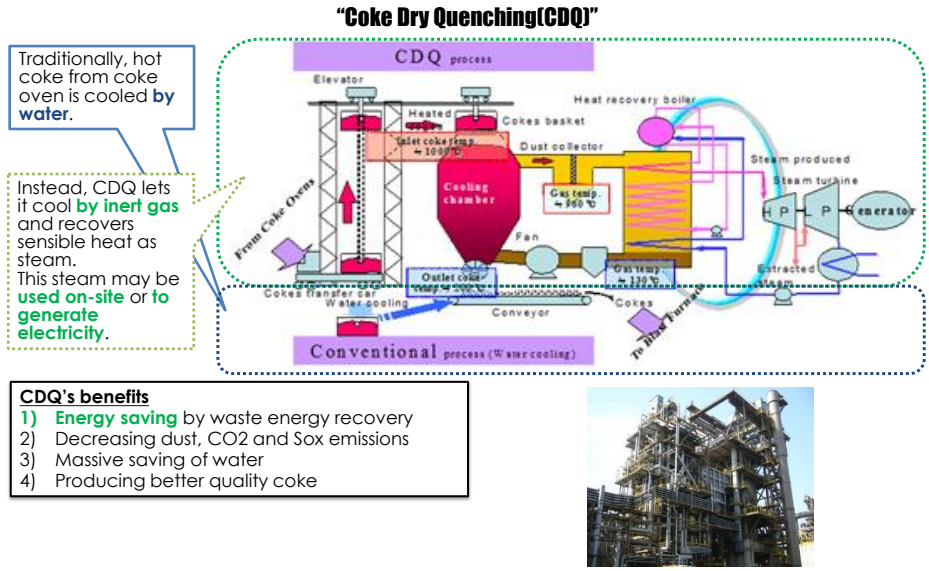


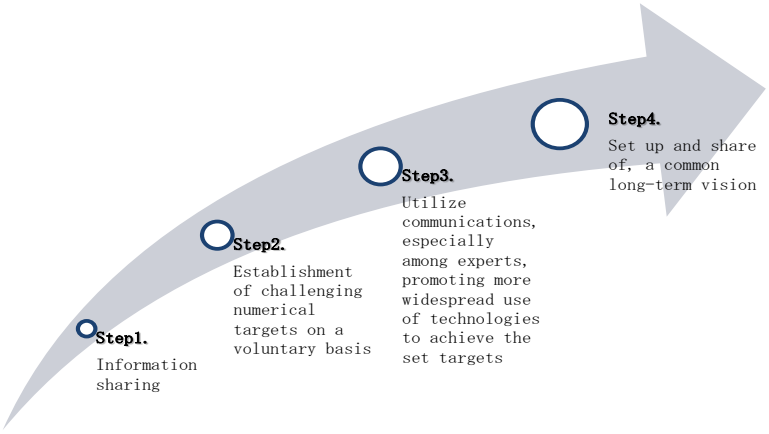
Fig. 6 The example of energy conservation technology in steel works

2. Steps taken towards the cooperative, sectoral approach adopted by the steel industry and the significance of the public-private joint initiative

2.1. The cooperative, sectoral approach

To date, Japan's steel industry, in aiming at the creation of a new international framework to really promote the transfer of energy conservation and environmental protection technologies, has taken a bottom-up based, cooperative, structural approach towards the promotion of concrete, achievable projects resulting from a series of technical discussions with specialists and experts in the field in forums such as the 'Japan-China Steel Industry Advanced Technology Exchange Meetings for Environmental Protection and Energy Conservation', the 'Asia Pacific Partnership for Clean Development and Climate' (APP) and various initiatives undertaken by the World Steel Association (worldsteel).

Specifically, we have followed the 4 Steps outlined below. (Fig. 7)



Source: T Okazaki et. al., Accelerating the Transfer and Diffusion of Energy Saving Technologies. Steel Sector Experience - Lessons learned

Fig. 7 Cooperative sectoral approach of Steel Industry

Step 1. Information Sharing

When transferring energy conservation and environmental protection technologies, the following can be cited as examples of the sort of information that should be shared.

1. Sharing lists of energy conservation and environmental protection technologies

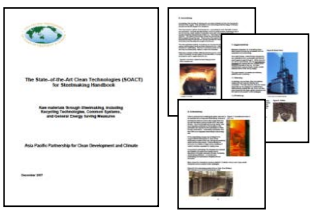
By sharing the technical information/data compiled into lists, it is possible to grasp what sort of energy conservation and environmental protection measures can successfully be deployed in what kind of processes in steel mills.

Moreover, regardless of the efficiency of the steel mills in which they are introduced, because the effectiveness of each individual technology is constant, it becomes possible to comprehend in quantitative terms the operational results and energy efficiencies achieved in the case of each individual installation project.

As part of its flagship project, the APP Steel Task Force has compiled a comprehensive collection of the very best energy conservation and environmental protection technologies utilized in the steel industry under the title of the 'SOACT Handbook' and has made it available to everyone by publishing it on its website.

SOACT Handbook:

(http://asiapacificpartnership.org/english/soact2nd.aspx)



2. Sharing barrier analyses of reduction potential surveys and technological dissemination

By investigating the diffusion rates of technologies, it is possible to grasp their reduction potential. Furthermore, the sharing of barrier analyses of technology diffusion is important in the transfer of energy conservation and environmental protection technologies.

Thanks to the APP Steel Task Force and its calculations of the reduction potential (as a theoretical value) particularly in the case of the diffusion of effective energy conservation technologies, it has become possible for the first time for steel specialists to achieve real, quantifiable results for themselves. (Table 1)

Moreover the barrier analyses conducted by APP members on the basis of the expertise of steel specialists were shared.

3. Sharing the settings and results of calculation analyses for the performance indices of steel mills

By establishing the methodologies for calculating the energy performance indicator of the steel mill (by sharing common calculation formulae, boundaries, emissions sources and factors) it is possible to understand in objective terms the energy performance of the steel mill in question.

The APP Steel Task Force has compiled a database of the energy performance indicators of steel mills.

On the basis of this method for determining the input and expenditure of energy, worldsteel has compiled a User Guide to its 'CO2 Emissions Data Collection', constructed a global database of steel mills and has commissioned a follow-up project which is being conducted by steel specialist from nations all over the world.

This technique has been carried forward through Japanese leadership towards recognition under the ISO 14404 international standard. ISO 14404 is a 'Calculation method of carbon dioxide emissions intensity from Iron and Steel production' but by using the standard's scope, emissions sources and boundaries together with its emissions factors of worldsteel values, an annex designation has been granted which is identified as an 'energy performance indicator of the steel mill' (ISO 14404 Annex A). This certainly means that the definition of the calculation formulae, boundaries, emissions sources and various factors etc. for the energy performance indices established by the APP Steel Task Force are now much more minutely and accurately defined. (Fig. 8)

Step 2. Establishment of challenging numerical targets on a voluntary basis (no-legally binding)

The second step requires that challenging, achievable, independent (not legally binding) targets be set on the basis of the technologies. In order that this outcome be properly achieved, it is desirable that these should be evaluated, tested and, if necessary, revise by specialists in the field. The object of this, however, is absolutely not that member nations or business persons be restricted or bound in any way whatsoever.

Step 3. Utilize communications, especially among experts, promoting more widespread use of technologies to achieve the set targets

The third step covers technology dissemination activities undertaken for the sake of meeting these targets.

As part of this process, the APP Steel Task Force has conducted diagnostic investigations concerning energy conservation and environmental protection in China and India and carried out detailed analysis of its findings. (Table 2)

Step 4. Set up and share of, a common long-term vision

The fourth step is concerned with sharing programs for the development of a long-term vision and innovative new technologies. A radical CO2 reduction technology development program called 'CO2 Breakthrough Programme' was started by worldsteel in 2003 and Japan has also participated in the development of an innovative steel production process (COURSE 50).

2.2. The significance of PPP

It is important that energy conservation be promoted not just for the sake of its economic benefits such as lowering energy costs but also from the perspective of establishing and improving (national) energy security in a broad sense. Moreover, projects boosting the production of highly profitable steel products are likely to be prioritized in the investment decisions of private steel manufacturing companies and so, it is essential for governments to take suitable policy measures to promote energy conservation projects such as the gradual phasing in of regulations and closely targeted investment incentives etc. Furthermore, it is necessary that regional environments be taken into consideration in the suitable treatment of waste water drainage and exhaust gases so that the long-term development of the steel industry as one of our key industries, but one which also imposes a heavy burden on the environment, can be fostered. From this perspective it is clear that the participation not just of the private sector but also of government is critically important.

The APP Steel Task Force has, by obtaining the participation of the public sector in addition to that of the private, promoted the dissemination of environmental technology which boasts only limited merit and, by sharing its experience of the introduction

Table 1 Theoretical reduction potential from diffusion survey

Source: APP Steel Task Force

【Based on Data of 2005】

	Reducing Potential (Million t/y)	
	New Analysis (APP 7)	Previous (APP 6)
CO2	129	127
SOx	0.67	0.65
NOx	0.29	0.29

Table 2 Improvement potential based on diagnostic investigations concerning energy conservation and environmental protection in China and India

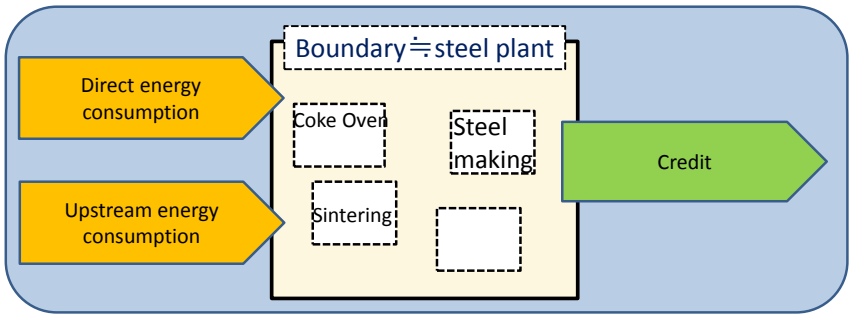
Source: APP Steel Task Force

Steel Plant	Energy Reduction Potential (TJ/Year)	CO_2 Reduction Potential (kt-CO2/Year)	Improvement Ratio of Energy Efficiency (GJ/t)
A	23,558	2,290	4.7(17%)
B	1,995	481	0.6(2%)
C	18,544	2,080	2.4(11%)
D	9,209	1,019	4.4 (13%)
E	2,308	279	1.5 (6%)
F	–	–	–
Total	55,614	6,149	

NOTE)
·Quantitative diagnosis could not be done at Plant F, because the data required for diagnosis was not submitted.

of regulatory and legislative systems in developing, can be regarded as having made a major contribution to building up the capacity of the governmental administration and bureaucracies of countries like China and India. As a result, we believe that public-private initiatives are essential to the future of Japan's steel sector.

The focus from the next chapter onwards is on the GSEP Steel WG.



Energy consumption = Direct energy consumption+ Upstream energy consumption – Credit
Energy intensity = energy consumption / crude steel production

Fig. 8 Calculation method of energy consumption and energy intensity in the steel plant based on ISO 14404 Annex A

3. From the APP Steel Task Force to the GSEP Steel WG

3.1. From APP to GSEP

In the summer of 2010, a communication was sent to the relevant parties concerned with APP in the governments of various nations worldwide to the effect that both the chairman of the APP PIC (Policy Implementation Committee) and the US State Department which was fulfilling the role of secretariat/executive office 'wished to relinquish the APP executive office since (because of political factors) there was some difficulty in guaranteeing the budget related to the APP's executive office expenses'.

Having received this communication and as a result of discussions between the governments of major nations including Japan, the USA, Australia and Canada, there was general agreement that, because the accomplishments of the various APP task forces were extremely highly regarded, their activities should be allowed to continue and so it was determined that whereby at least the Japan-led steel, cement and electric power task forces should be reconfigured as International Partnership for Energy Efficiency Cooperation (IPEEC) task groups and that a framework should be established which it would be possible for non-APP member nations to join. Following on from these developments, it was decided at the first Clean Energy Ministerial (CEM) held in Washington DC in July 2010 that, as part of a Japan-US initiative related to energy conservation, the GSEP should be established under the auspices of the CEM, International Partnership for Energy Efficiency Cooperation (IPEEC).(Fig.9) Between 12 and 13 September 2011, preparatory meetings for the first kick-off sessions of each of the GSEP cement, electric power and steel WG were held with workshops in Washington and the GSEP Steel WG draft guidelines were introduced on this occasion with the work of finalizing the details of the clauses being undertaken principally by Japan and the US. The section below covers the background required to grasp the issues surrounding the confirmation of the points at issue concerning the 'objective' mentioned on the first page of this draft and also the details of the metamorphosis from APP Steel Task Force to GSEP Steel WG. (Fig. 10)

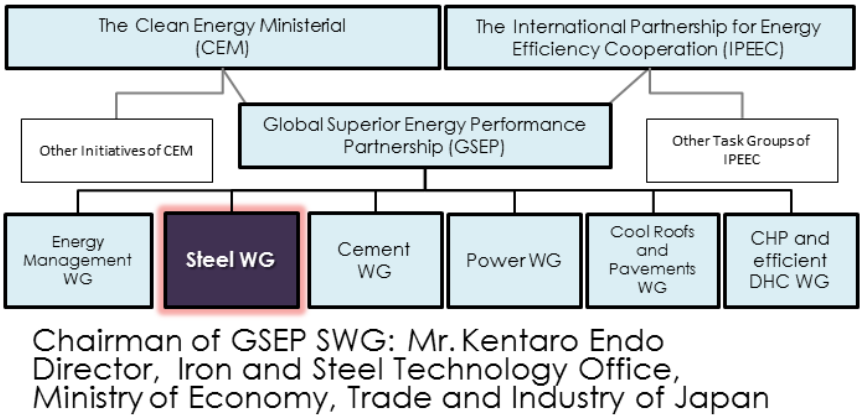
3.2. The 1st GSEP Steel WG held in Tokyo

Japan, the USA, South Korea, China and Australia were amongst the nations that participated in the 1st Steel WG convened in Tokyo between 12 and 13 March 2012. On this occasion, the guidelines were adopted and Mr. Kentaro Endo (director, Iron and Steel Technology Office, Ministry of Economy, Trade and Industry) was appointed as Chairman of the Steel WG.

Comments followed on the expectations for GSEP from the U.S. Department of Energy, the China Iron & Steel Association, POSCO (Korea), the Japan Iron and Steel Federation (JISF), Alezz Dekheila Steel Co. (Egyptian steel manufacturer), and worldsteel (the World Steel Association) and, in conclusion, five concrete project proposals were put forward by the Japan Iron and Steel Federation (JISF).

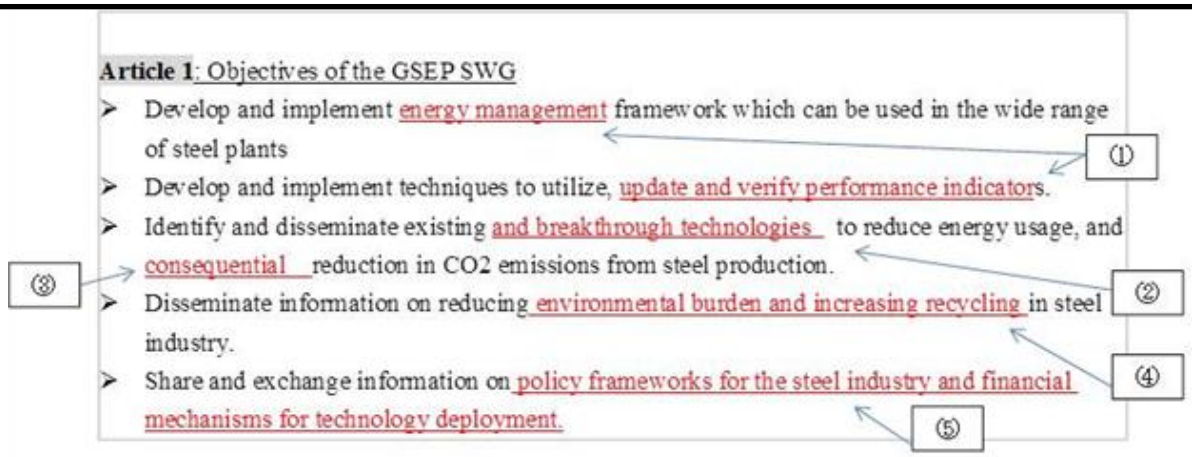
As for future steps, Japan, as chair country, is to prepare a communication paper in accordance with the proposal made by the USA and member country registration is to be solicited.

In the next chapter we provide a general outline of the GSEP Steel WG on the basis of a summary of the communication paper.



Source: Communication Paper of GSEP Steel WG

Fig. 9 Organogram of GSEP Steel WG



① Energy management system (EMS) is newly referred since the United States played a leading role for EMS (ISO 50001).

② APP-STF focused on only existing technologies i.e. BAT/State-of-art clean technologies. GSEP also considers long-term viewpoints and breakthrough technologies in addition to existing technologies.

③ GSEP focuses more on energy saving as it referrers to “reduction of energy consumption and consequential reduction in CO2.” “Green House Gases (GHG).”is not mentioned on the guideline.

④ “Environmental burden” and “increasing recycling” are newly referred.

⑤ Sharing and exchange of information on financial mechanisms which eliminate main financial barrier is newly referred. This financial mechanism includes not only international financial mechanism for technology diffusion under the United Nations, but also the concepts of appropriate financial supports from governments for domestic technology diffusion in each country.

Fig. 10 Objectives of the GSEP SWG

4. About the GSEP Steel WG

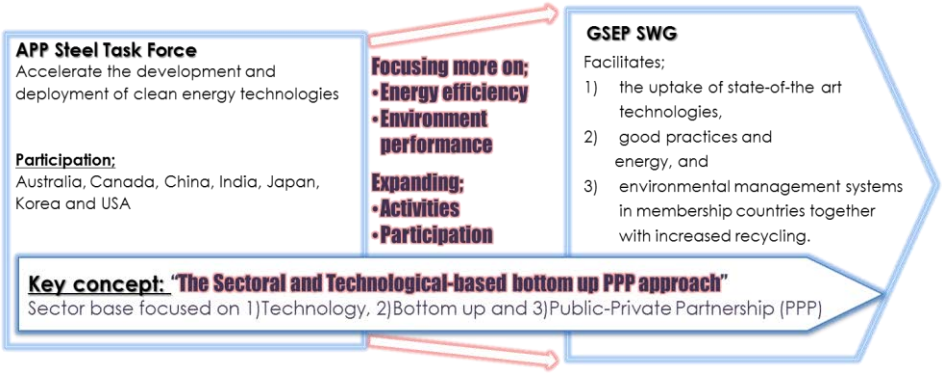
4.1. Outline of the GSEP and 5 objectives

The GSEP Steel WG is defined in the guidelines as 'The GSEP Steel Working Group (SWG) members account for significant portion of the world's steel production. SWG shall facilitate the uptake of state-of-the art technologies, good practices and energy and environmental management systems in membership countries together with increased recycling. The SWG provides a unique forum for public-private dialogue and cooperation, which will contribute to the development of a viable long-term clean energy strategy, addressing energy security, economic development, and environmental challenges'.

The passing on of the basic principles of 'bottom-up thinking based on technology' and 'public-private cooperation' referred to above are points worthy of special mention. (Fig. 11)

In line with the basic principles mentioned above, the five objectives that the GSEP Steel WG is aiming to achieve are outlined below.

(1) Develop and implement energy management framework which can be used in the wide range of steel plants
(2) Develop and implement techniques to utilize, update and verify performance indicators.
(3) Identify and disseminate existing and breakthrough technologies to reduce energy usage, and consequential reduction in CO2 emissions from steel production.
(4) Disseminate information on reducing environmental burden and increasing recycling in steel industry.
(5) Share and exchange information on policy frameworks for the steel industry and financial mechanisms for technology deployment.



Source: Communication Paper of GSEP Steel WG

Fig. 11 From APP Steel Task Force to GSEP Steel WG

4.2. Principles and membership of the GSEP

PPP is the major principle underpinning the GSEP Steel WG and this is reflected not just in its operations but also in its guidelines since there are at least two representatives elected from each member country (one from the public sector and one from the private) and so it is clear that it has been established on the basis of a close cooperative relationship between public and private interests.

The membership qualifications are that the GSEP is open to all IPEEC and Clean Energy Ministerial members and that, in the case of new affiliates, having demonstrated their consent to cooperate with and participate in the GSEP's activities, such new affiliates should agree with the concept of public-private cooperation with the key requirement that being that all members agree to these conditions. In other words, the door is open to all nations provided that they participate on the basis of a tightly knit coordination between government and private interests.

4.3. Future initiatives

Once a formal register of members has been compiled on the basis of the collected communication papers, the following action plans, having been revised to reflect the opinions expressed by the member nations, are to be put into effect with a view to collaboration with the GSEP Energy Management WG. (Table 3)

Table 3 Action plan

Source: Communication Paper of GSEP Steel WG

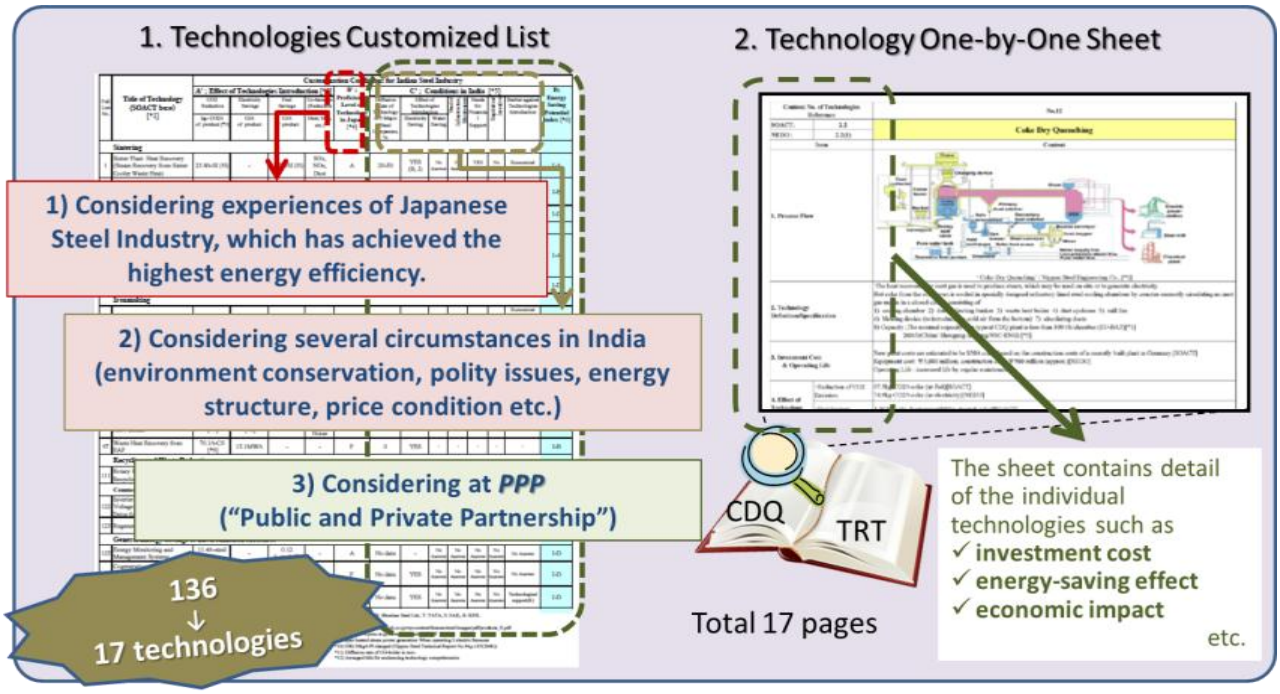
1. Develop and implement energy management framework which can be used in the wide range of steel plants
2. Develop and implement techniques to utilize, update and verify performance indicators.
3. Identify and disseminate existing and breakthrough technologies to reduce energy usage, and consequential reduction in CO2 emissions from steel production.
4. Disseminate information on reducing environmental burden and increasing recycling in steel industry.
5. Share and exchange information on policy frameworks for the steel industry and financial mechanisms for technology deployment.

Reference

Bilateral discussions between Japanese and Indian steel industry based on PPP are underway together with APP/GSEP and other bodies. Given this situation, the creation of a 'customised technology list' has begun. This is a selective, customised list created from the 'full technology list' (which encompasses worldwide energy conservation technologies), the contents of which make great use of information shared by the abovementioned APP/GSEP and is really designed to be particularly suitable for India's steel industry by satisfying the three points itemized below.

- Joint initiatives based on public-private cooperation between Japan and India
- Exploiting the 'experience' of Japan's global top-class steel industry. At present, the list has been distilled down to 17 technologies from the 136 technologies included in the 'full technology list' and further revisions to the list are scheduled. (Fig)
- Various Indian terms and conditions (environmental conservation, policy/technical problems and issues, energy configuration, pricing terms etc.)

At present, the list has been distilled down to 17 technologies from the 136 technologies included in the 'full technology list' and further revisions to the list are scheduled. (Fig)



Source: The Japan Iron and Steel Federation

Fig. Technologies Customized List (draft) appropriate for Indian Steel Industry