Bilateral Mechanism for Steel Industry

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Abstract

Considering the rapid increase of steel production capacity in the developing countries, the diffusion and penetration of best energy efficient/CO2 saving technology to such countries is critically important for the control and reduction of CO2 emission from global steel sector. Bilateral Approach proposed by Japanese government is a mechanism to accelerate such process. To implement the mechanism, Japanese Steel industry is now developing and promoting the Positive List Approach and Total Energy Efficiency Approach as practical methodologies for the technology transfer.

1. Background

Global steel demand has shown rapid growth in the past decade and the trend will continue as the developing countries such as China, India, and Brazil continues expanding economy. (Fig.1)

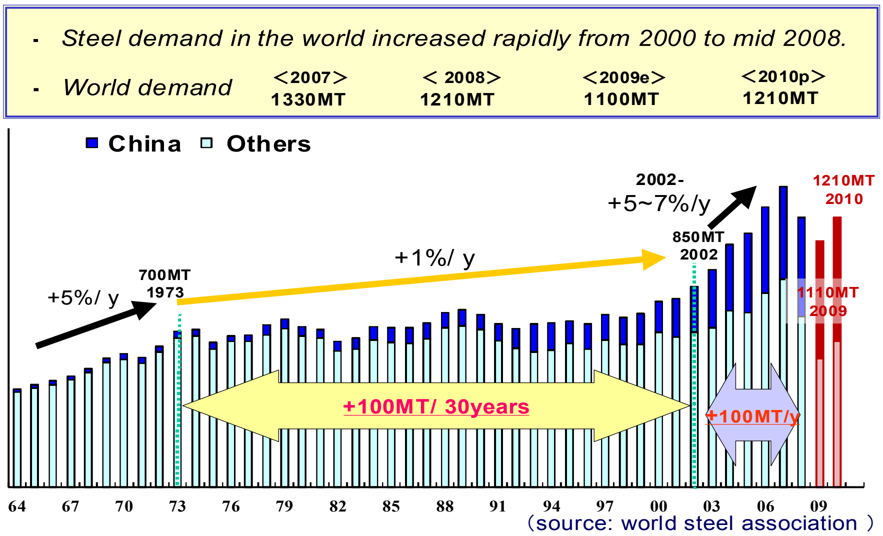


Fig.1 Growth of global steel demend

Since the steelmaking process inevitably emit vast amount of CO2 while reducing iron ore (Ferrous Oxidation) by Carbon (Cokes), how to minimize the CO2 emission from this growing steel production particularly in the developing world is critically important.

Japanese steel industry has a long history of investing energy saving (and CO2 saving[1]) technologies after oil shock in 1970s. As much as $52 Billion has been spent on energy saving and on environmental protection process. (Fig 2)

1 Energy consumption and CO2 emission are deeply correlated and almost equivalent for steelmaking process using Blast Furnace.

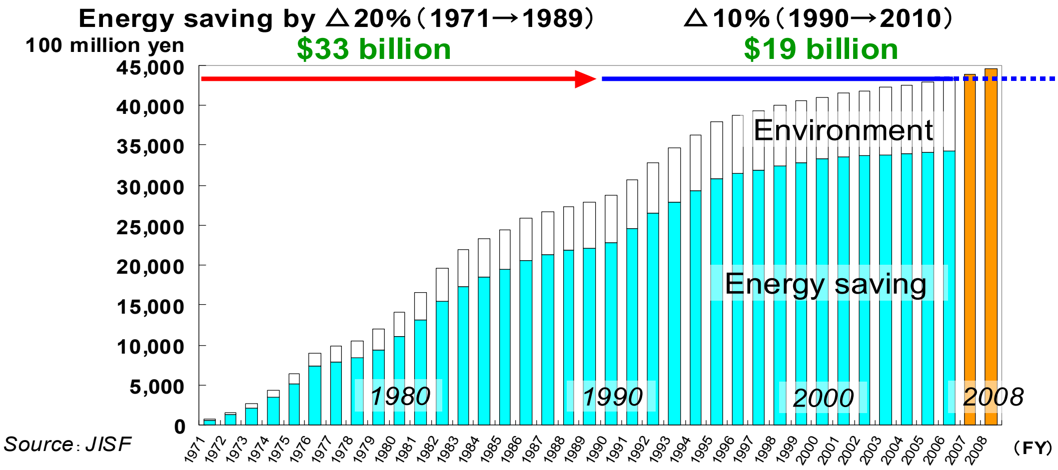


Fig.2 Japanese Steel Industry's Investment on Energy Saving and Environmental Process

As the result, Japanese steel industry has achieved the lowest energy intensity among the major steel producing nations. (Fig.3)

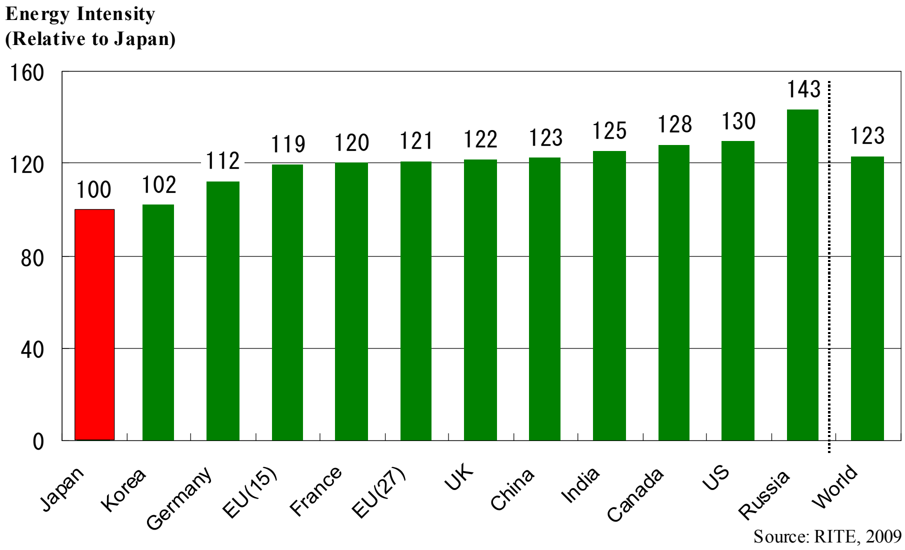
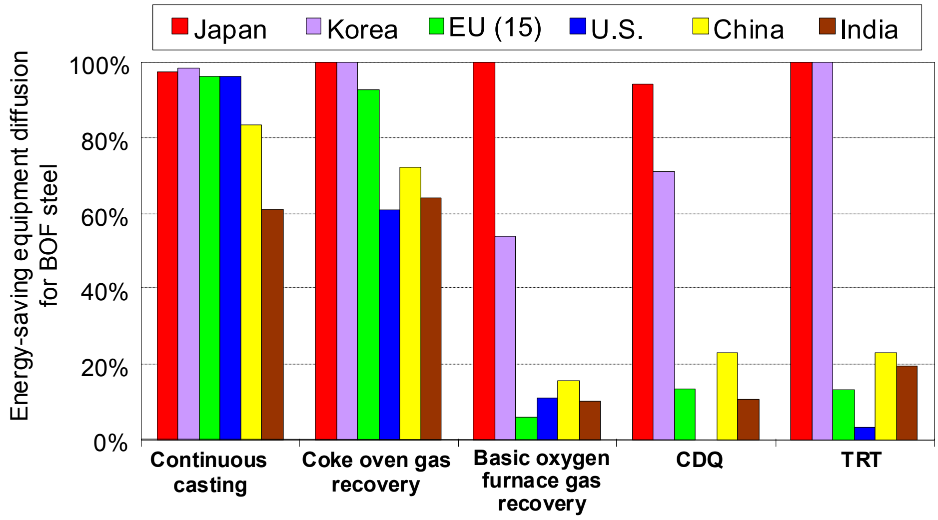


Fig.3 Energy Intensity Comparison among major steel producing countries

This superior energy intensity of Japanese steel industry is explained by the diffusion of various energy saving equipments such as Coke Dry Quenching (CDQ), and Basic Oxigen Furnace gas Recovery. Fig.4 shows the comparison of the diffusion rate of major energy saving technologies among major steel producing nations. As shown in the figure, Japan has already installed those equipments to the level of almost 100%, while other countries still have a room to further invest for the better energy performance.



Source: Oda et.al. Energy Economics,Vol.29, No.4, pp.868-888, 2007

Fig.4 Diffusion rate of major energy saving process among countries

This diffusion gap of technologies provides a huge energy saving/CO2 saving potential in global steel industry. Based upon the calculations by Asia Pacific Partnership for Clean Energy and Environment (APP) Steel Taskforce, if the major energy saving technologies are fully penetrated to the 7 membership countries of APP (Australia, Canada, China, India, Korea, Japan and US), as much as 130 million ton CO2 emission can be reduced.

APP Steel Taskforce also identified 42 major energy saving technologies and the detail information about those are published in the SOACT (State-of –the Art-Clean Technologies) Handbook, which is now publicly available on the APP website. (http://www.asiapacificpartnership. org/english/tf_steel.aspx) Most of those technologies listed on the SOACT are developed to the industry scale and commercialized by Japanese steel industry.

2. Bilateral Mechanism

Japanese steel industry is now developing and testing the Bilateral Mechanism together with the government of Japan. Under this mechanism, Japan are to enter into a bilateral agreement with a developing country, which wish to utilize Japan's superior energy saving technologies for their domestic industry development. Japan will help promoting efficient and effective technology transfer by providing technical support and financial incentives.

Based upon the past experiences at APP Steel Taskforce and various technology exchange/transfer/benchmarking activities at worldsteel Association and others, Japanese steel industry proposes two approaches for the energy saving technology transfer and CO2 saving calculation methodologies. One is the Positive List Approach and the other is the Total Energy Efficiency Approach. The Positive List Approach is the base for implementation and execution of such mechanism, but the Total Energy Efficiency Approach can provide the appropriate indicators and the very useful tool for the self-improvement by the steel mills in developing countries.

3. The Positive List Approach

The Positive List Approach is the bottom-up technology-based approach. Once a bilateral agreement is established for steel in a host country and Japan, the Customized Technology List is to be developed based upon the Full Technology List (a list of major energy/CO2 saving technologies such as SOACT Handbook), which subsequently should be narrowed down to the short list considering the local conditions of the host country and the pecific requirement of the local steel facilities. This selection process to make the Customized Technology List should be conducted and supervised by the Bilateral Technology Committee, to be established under the Bilateral Agreement between the counties. The Customized Technology List identifies the nature of the technology, economics feature of it and standard energy saving/ CO2 saving amounts expected from the technology and methodologies to calculate them.

Under this Positive List Approach, once a steel mill in the host country decides to invest into a project to introduce a specific Japanese technology on the list, the estimate CO2 saving amount is calculated based on the Customized Technology List. The expected CO2 saving amount is regarded as "Bilateral Offset Credit" of the project and the financial incentive shall be provided to the project by Japan in exchange for using the credit for offsetting the CO2 emission of Japan. Once the project is implemented and the technology starts operation after installment, an appropriate adjustment for the amount of credits and the verification process shall be applied to keep the environmental and economic integrity. The schematic drawing of this process is shown in Fig.5.

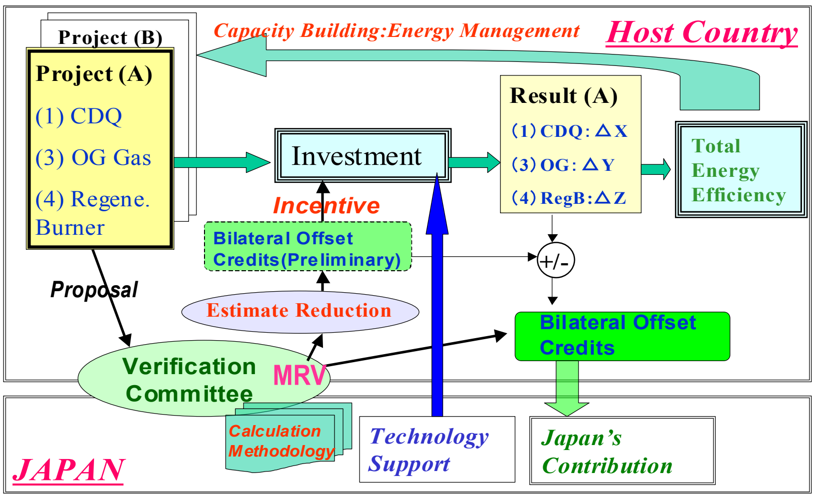


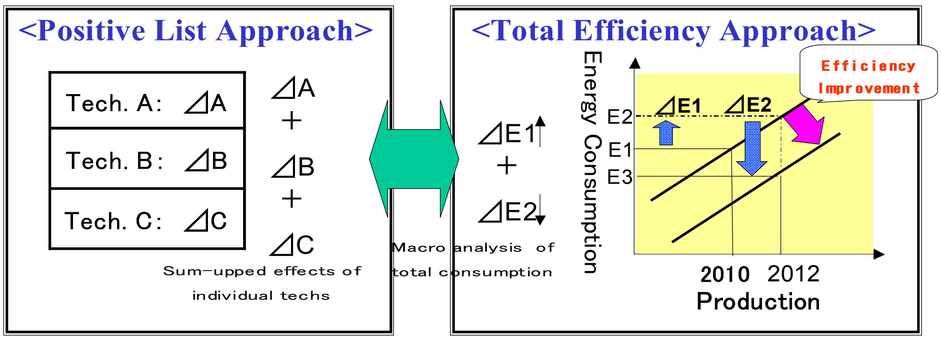
Fig.5 Bilateral technology transfer mechanism – the Positive List Approach

4. The Total Energy Efficiency Approach

Since the steelmaking process consists of various sub-process and each process has specific energy saving technologies to be listed on the Positive List, the total efficiency of the entire steel mill is an aggregation of existing process and several technologies introduced from the Positive List. However, the total energy efficiency of the steel mill is also strongly affected by the operation rate of the mill, because there are various “fixed cost” factors, which influence the total energy efficiency of the mill. The inter-relations of this “fixed cost” energy factors and technology specific energy saving factors is very much complicated and not easy to quantitatively evaluated.

Since the production conditions of a mill change and fluctuate day by day, only statistical data compilation and analysis, and empirical intuition will provide full understanding of what are really happening in the energy system of the mill and how much the mill performs better or worse than the past before the introduction of the new tchnologies.

This kind of learning process to evaluate the total efficiency of the mill, which is an aggregation of various technologies and process, is the Total Energy Efficiency Approach. In other words, the Total Energy Efficiency Approach is the Energy Management System for the mill and this is very important for the technology recipient mill since this provides the base for the self-improvement process to be implemented after the initial technology transfer by the bilateral mechanism with Japan. Fig.6 shows the relations between Positive List Approach and the Total Efficiency Approach.



- **Evaluation and Analysis of Performance = *Energy Management***
- **Comparison of individual process effects vs total energy intensity**
  - ***- Technical Reasoning: Fixed Energy Consumption, Volume Effects***
  - ***- Historical Data Analysis***
  - ***- Benchmarking***

Fig.6 Relations between the Positive List Approach and the Total Efficiency Approach

5. Conclusions

Green economic/industrial growth by developing countries is the key for the global solution for the Climate Change. Diffusion and implementation of the best efficient steelmaking technologies to the steel mills in such developing countries can minimize the global CO_2 emission from steel

production, which will be a major CO_2 source for the next decades. However such diffusion/transfer of superior technology is not automatic and there are various barriers for that.
For the efficient and effective technology transfer to achieve the real CO_2 emission reduction and energy efficiency improvement in the steel industry in developing countries, a bottom-up approach with specific technology list and practical methodology for technology transfer is necessary. The Bilateral Mechanism proposed by the Government of Japan and Japanese Steel Industry is an example of such approach. For the initial technology transfer, the Positive List Approach is proposed. For the future continuous self-improvement by the mills in developing countries after initial technology transfer, the Total Energy Efficiency Approach is to be implemented as a base for the total energy management.

Sector Crediting Mechanism, designed and proposed by EU, is a somewhat similar mechanism to promote efficiency improvement in industry sectors in developing nations. However, SCM only sets CO_2 emission target, either in absolute emission or in intensity, to be achieved by an industry sector such as steel in a host country. But in real world, such target can be achieved by the reduction of production in the case of absolute emission target, and by the expansion of production in the case of intensity target, since a strong “fixed cost” factors exist in the energy/CO_2 efficiency of steel mills. Those are nothing related to technology nor process improvement. Therefore, incentive mechanism under SCM does not necessarily guarantee the steel mills in developing countries to introduce the superior technology, only which can ensure the long-term efficiency improvement of the steel industry of the host country.