Asia-Pacific
Economic Cooperation

2015/SCSC/WKSP2/006
Session: 3

Steel Industry's Challenge Against Climate Change: Cooperative Sectoral Approach (Part 1)

Submitted by: Japan

APEC
PHILIPPINES
2015

Multilateral Recognition Arrangement Readiness in ISO 50001: Workshop for Organization and Internal Auditors
Bangkok, Thailand
6-9 April 2015

APEC-ISO50001 Bangkok Workshop

Steel industry's challenge against climate change
Cooperative Sectoral Approach

Wednesday/Thursday 8-9 April 2015

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4-DAY WORKSHOP TRAINING FOR INTERNAL AUDITORS (6-9 APRIL 2015)

Training agenda	Activities	Topics	Remarks
Day-1 Mon 6 April	Requirement of ISO50001	Introduction/energy ISO50001 Requirements of ISO50001	
Day-2 Tue 7 April	Application to Energy system Requirement of management system Requirement of ISO50003	Application of Energy system Competencies for third party certification auditors	
Day-3 Wed 8 April	・Energy audit and its benefit ・ISO50001 and with other ISO standard, ISO14404 ・Case study with energy audits **Group exercise 4**: Expected competences for internal auditors. **Group exercise 5**: Developing the internal audit plan. Output sharing.	・Energy audit and its benefit ・**Energy Audits and its benefit with using ISO50001 and ISO14404** (9:00~11:15). **Presentation**: ・Energy Audits and its benefit with using ISO50001 and GHG reduction(11:15-12:00). ・What is the expected or required competency for internal auditors? How to identify the personnel in the organization and train the potential internal auditors; qualification, education, working experiences(13:00~14:00 discussion and presentation by group 14:00~15:00). **・Developing the internal audits plan for the case study, steel industry** (15:15~17:00). ・Presentation by each group(16:15~17:00).	**①日本における省エネ法（温対法）及び自主行動計画の中でのPDCA実施** ～各主体の役割⇒事務局による内部監査機能と主要な経験能力など **②それらによる、改善実績（ベネフィット）** ～世界最高水準のエネルギー効率の維持発展（鉄鋼だけでなく、経団連・・・） **③事業所のエネルギー効率（CO2原単位、排出量）の算定方法比較、鉄鋼事例としてのISO14404(国際比較の尺度として・・・・)** ～アクションに結びつく指標定義（算定方法： 算定式、境界、変換係数） **④省エネルギー対策（および環境対策）技術の世界共通リストと地域条件へのカスタマイズ（鉄鋼事例と考え方の汎用性）** ～具体的な推奨アクション・導入技術
Day-4 Thu 9 April	Sectorial approach with ISO50001 **Group exercise 6**: (group discussion) Closing remarks.	・Sector activity of ISO50001 and its benefit **・When the organization will develop the ISO50001 activities across the group company or sector activity, what point will be relevant.**	**⑤各社の活動と業種共通の活動、温暖化対策における帰朱** ～連携して活動することの意義とその PDCA(GOVERNANCE)

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Contents (iso50001 related)

1. Energy Audits and its benefit with using ISO50001 and ISO14404
2. Developing the internal audits plan for the case study, steel industry
3. When the organization will develop the ISO50001 activities across the group company or sector activity, what point will be relevant
4. Other issues related to the agenda above.

1. Introduction/steel in general
2. Background information
   -Climate negotiation/national schemes
   -National action during Kyoto1(2008~2012)
3. A Commitment to a Low Carbon Society
   - Phase-Ⅰ(2020)
   - Phase-Ⅱ(2030)
4. Energy Management in APP/GSEP
   - Cooperative Sectoral Approach in APP/GSEP
   - Technology Full List and Customized List
5. ISO and Steel Industry
   - ISO14404 (calculation methodology for CO2 intensity of steelworks)
   - ISO50001 (certification of Energy Management for JISF's action program)
   - ISO14040/44+α (LCI calculation methodology of steel-products)
6. Other issues
   - Benchmarking in energy saving law in Japan
   - Data Flow (measurement/reporting/verification)
   - JCM

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1. Energy Audits and its benefit with using ISO50001 and ISO14404.

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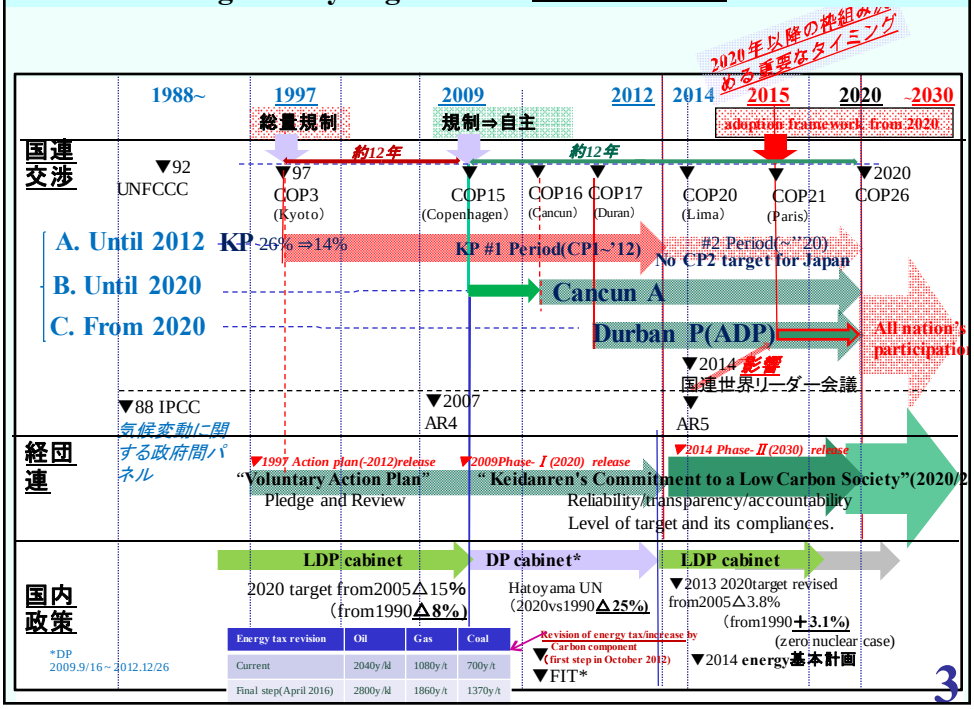
Climate Change Policy/negotiations *toward COP21*



KP1(2008~2012) Action Plan

JISF* Voluntary Initiatives

Pledge and Review (commitment and progress)

3.KP1(2008~12)

In 1996, JISF launched *JISF: Japan Iron and Steel Federation

① Energy-saving by △10% (1990→2010) ≒CO2 △9%
~ "Eco-process"

② Utilization of Waste Plastics etc.
(utilization of 1 million-ton).

③ Utilization of Waste Energy outside.

④Contribution to society by products and by-products
~ "Eco-products"

⑤ International Technology Transfer(diffusion)
~"Eco-solution"

+ CO2 Breakthrough R&D

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1. Climate Change Policy

Performance Report for Voluntary Action Plan

Voluntary Action Plan of Steel Industry

1. Conserve energy with more efficient steel production processes

- Assuming annual crude steel production of about 100 million tons, the goal is to achieve a 10% reduction in energy consumption used by steel production processes by fiscal 2010 compared with fiscal 1990, the reference year.
- However, even if crude steel output exceeds 100 million tons, the steel industry is determined to do what is needed, including use of the Kyoto Protocol mechanisms, to reach this target.
- The 10% reduction is to be achieved based on average energy consumption for the five-year period ending in fiscal 2012

* A 10% cut in energy consumption is viewed as equivalent to a 9% cut in CO_2 emissions.

2. Contribute to energy conservation outside the steel industry

(1) Reuse one million tons of waste plastics and other materials, assuming that the required collection system can be established.
(2) Use steel products and byproducts to contribute to energy conservation
(3) Use international technical cooperation to contribute to energy conservation
(4) Utilize unused energy at steel mills in neighboring areas (5) Increase activities involving consumers, businesses and transportation

3. Development of revolutionary technologies

- Technology to separate CO_2 from blast furnace gas for recovery
- Iron ore reduction technology using modified hydrogen from coke oven gas

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1. Climate Change Policy [Appendix 2]

Results of Voluntary Action Plan Activities
(Average for FY08-FY12)

Totals for companies participating in the plan

- **Crude steel production: 101,846,000 tons/year (down 2.7% vs. FY90)**
- **Energy consumption: Down 10.7% vs. FY90 (target achieved)**
  CO_2 emissions: Down 10.5% vs. FY90
- **Unit energy consumption: Down 8.2% vs. FY90**
  Unit CO_2 emissions: Down 8.0% vs. FY90

* CO_2 emissions in this presentation are calculated by using electric power coefficients after reflecting emission credits. (The same shall apply hereafter)

Reference: Totals for Japanese steel industry

FY08-FY12 crude steel production:	105,301,000 tons (down 5.7% vs. FY90)
Energy consumption:	Down 11.0% vs. FY90
CO_2 emissions:	Down 10.7% vs. FY90

* Energy consumption is total of steel producers. CO_2 emissions were estimated based on "Current Survey of Energy Consumption".

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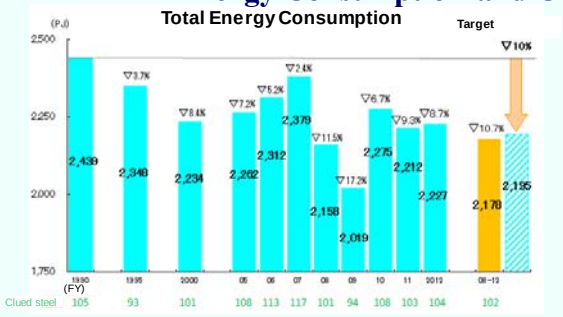
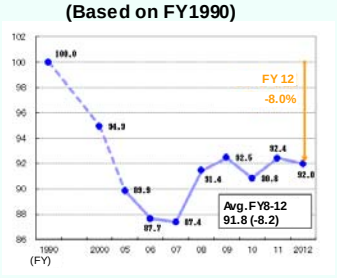
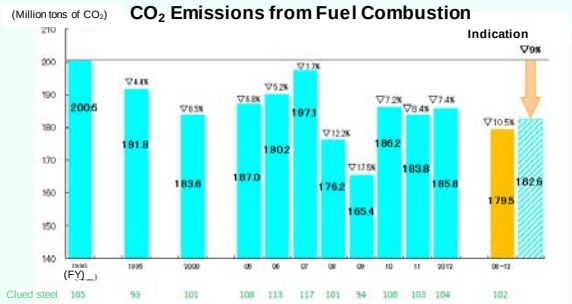
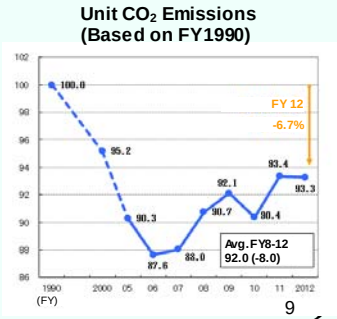
1. Climate Change Policy [Appendix 2]

Energy Consumption and CO_2 Emissions









*PJ is a petajoule (10^{15} joules). One joule is 0.23889 calories. 1PJ is equivalent to about 2.58 million kiloliters of crude oil.

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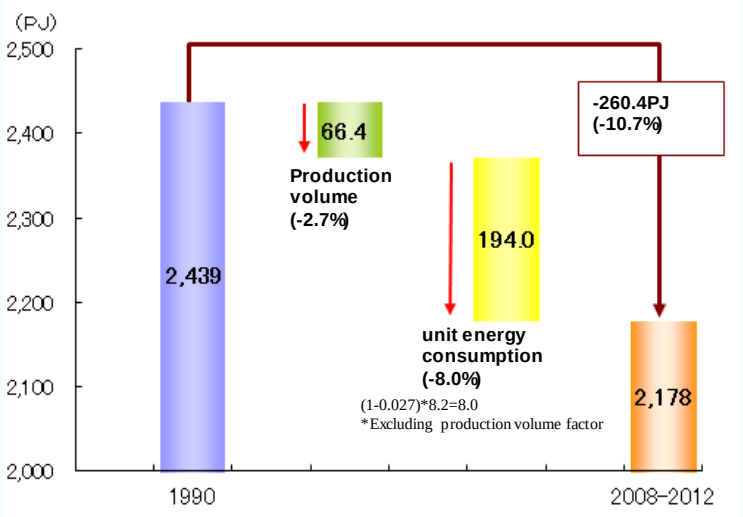
1. Climate Change Policy [Appendix 2]

Causes of Change in FY08-FY12 Energy Consumption

- FY08-FY12 energy consumption was 10.7% less than in FY90 because of a 2.7% decrease in crude steel production and a 8.0% improvement in unit energy consumption.



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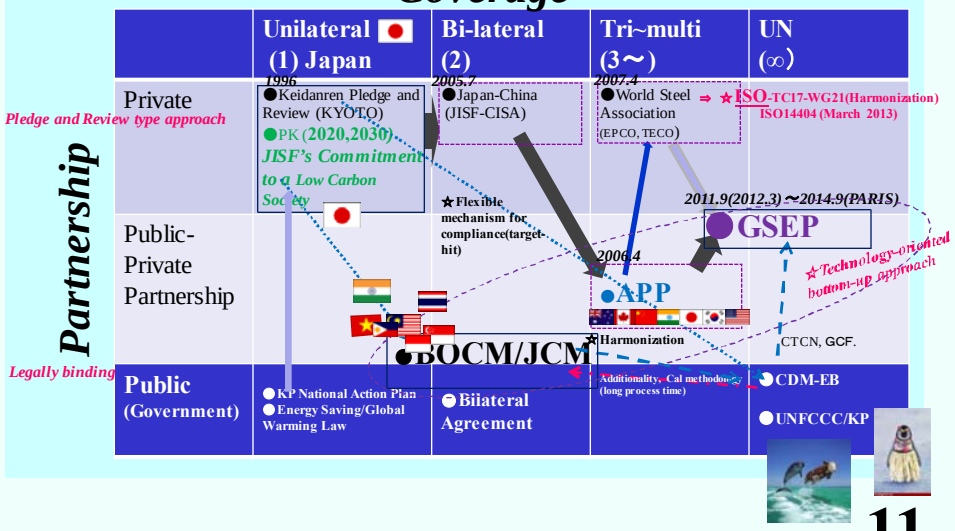
Cooperative Sectoral Approach

GSEP and BOCM(JCM)

APP: Asia-Pacific Partnership on Clean Development and Climate
GSEP: Global Superior Energy Performance Partnership
BOCM [jcm]: Bilateral Offset (Credit) Mechanism

Summary

Coverage



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Flagship Project-2 Establishment of 6. GSSA (7-lateral-APP)

Common Methodology to Identify Reduction Potential and Performance Benchmarking

•Expert Group (EG) is working closely with **HATCH**, consulting firm contracted with US DOS.

●Step-by-step approach for target setting, a common method. -

Step-1: Status Review

Diffusion rate of technologies

Selection of technologies for survey

Intensity benchmarking

A common Methodology settir for benchmarking

- Formula
- Boundary
- Conversion Factors

- Diffusion Survey
- Barriers Survey
- Intensity Survey

EG & HATCH

Step-2: Theoretical Reduction Potential

Step-3: Mid-term Target setting

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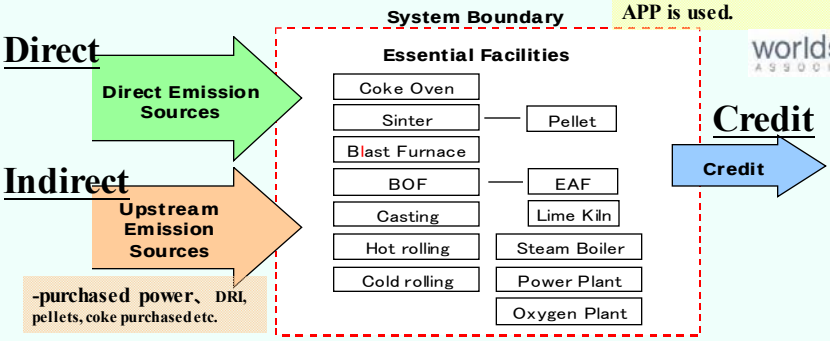
A global common methodology for CO2 intensity calculation, steel industry ⇒ standardization

GSSA

● Formula = (Direct + Indirect – Credit) / Crude steel production

● Boundary Definition

- The same boundary as APP is used.



● Conversion Factors : Material Balance⇒Energy ⇒ CO2

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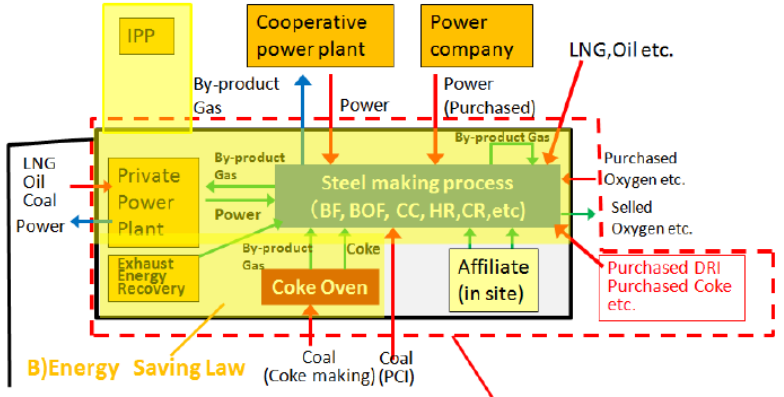
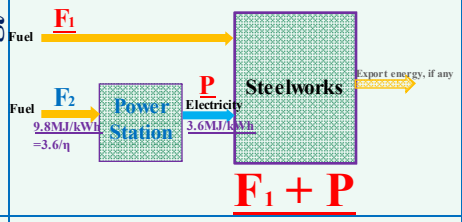
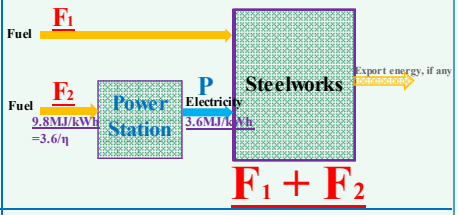
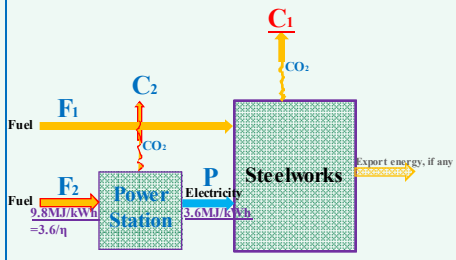
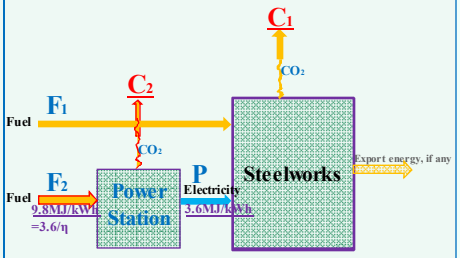
Report to third parties from each steel company

Reporting object (to whom ?)	Concept	Boundary Definition	CO2 coefficient of purchased electricity
A) Voluntary Action Plan (to JISF)	・Define the whole steel plant as a boundary ・Calculate CO2 emission by using input/output of energy/materials to the boundary (Don't add up each facility)	・Steel plant including basic steel making process	・Japanese power company average
B) Energy saving Law (to government)		・Company including another facilities which don't affect steel production (IPP : independent power producer)	・Each power company related to each steel plant
C) worldsteel CO2 data collection (to worldsteel)		・Steel plant including basic steel making process considering CO2 from production of outsourced materials	・World average



1. Conversion factors for power, "3.6 or 9.8MJ/kWh"?

	Direct emissions	Direct + Indirect emissions
Energy	Use: General Statistics(Japan, IEA- - -), **ISIT (final energy consumption)**	Use: ISO14404, JISF's voluntary initiative, Energy saving law (**primary energy consumption**)
	 **$F_1 + P$**	 **$F_1 + F_2$**
CO2	Use: **EU-ETS** accounting	Use: ISO14404, JISF's voluntary initiative, Energy saving law
	 **C_1**	 **$C_1 + C_2$**

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1. Conversion factors for power, "3.6 or 9.8MJ/kWh"?

	Direct emissions	Direct + Indirect emissions
Energy	Use: General Statistics(Japan, IEA- - -), **ISIT (final energy consumption)**	Use: ISO14404, JISF's voluntary initiative, Energy saving law (**primary energy consumption**)
	This conversion factor is used usually in Statistics world-wide.	In the action oriented scheme (CDM, JCM, voluntary action plan etc.), this conversion factor is used.
CO2	Use: **EU-ETS** accounting	Use: ISO14404, JISF's voluntary initiative, Energy saving law
	Steelworks is in charge of emissions C1 only. Power station is in charge of emissions C2. It's a "Chimney-rule", which actual/physical emissions are counted.	Steelworks is in charge of both emissions C1 and C2.

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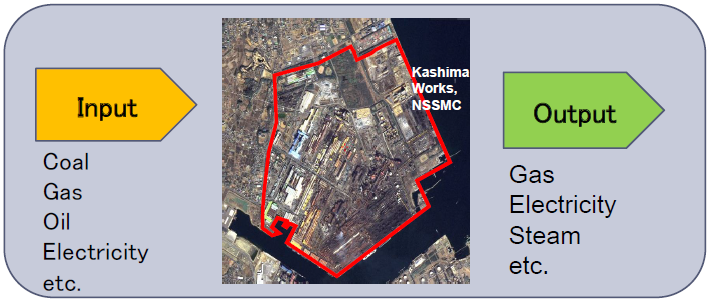
Question-5 *What is one of the major defects in EU-ETS?*

1) *Direct emissions only.*
2) *One excellent point but so many other defects.*

Basic concept of Voluntary Action Plan



$$CO_2\ \text{Intensity} = \frac{\Sigma\ CO_2\ \text{Emission from Input Energy} - \Sigma\ CO_2\ \text{Emission from Output Energy}}{\text{Crude Steel Production}}$$

$$\text{Energy Intensity} = \frac{\Sigma\ \text{Input Energy} - \Sigma\ \text{Output Energy}}{\text{Crude Steel Production}}$$

Methodology-Format-A

Format-A(Easy-entry-Survey sheet)

1. Plant Data

Region	
Integrated/EAF	
pig-iron/crude-steel ratio	
Caude Steel Production	kt

IISI COMMON METHODOLOGY
for CO2 Calculation
based on APP/Eurofer methodologies

2. Consumption Data

Items			Physical value		Energy Conversion Factor		CO2 Emission Factor		
Direct Emission	Coal	for coking		kg	28.4	MJ/kg	92.2	g-CO2/MJ	Regional/country-wide authorized value
		for BF injection		kg	27.5	MJ/kg	92.2	g-CO2/MJ	
		for BOF, sinter		kg	25.9	MJ/kg	92.9	g-CO2/MJ	
		for Boiler		kg	25.9	MJ/kg	92.9	g-CO2/MJ	
		for EAF		kg	25.9	MJ/kg	92.9	g-CO2/MJ	
	Purchased Coke(Physical)			kg	30.1	MJ/kg	107.7	g-CO2/MJ	
	Natural Gas	for BF injection		m3	35.9	MJ/m3	74.9	g-CO2/MJ	Not discussed in detail, but global average can be used if there are no significant difference among regions
		fuel		m3	35.9	MJ/m3	74.9	g-CO2/MJ	
	Heavy Oil	for BF injection		l	37.7	MJ/l	79.2	g-CO2/MJ	
		fuel		l	37.7	MJ/l	79.2	g-CO2/MJ	
	Coal Tar			kg	37.0	MJ/kg	77.2	g-CO2/MJ	
	Oil Coke			kg	32.0	MJ/kg	103.3	g-CO3/MJ	
	Light Oil			l	35.1	MJ/l	74.7	g-CO2/MJ	
	Kerogene			l	34.7	MJ/l	71.7	g-CO2/MJ	
	LPG			kg	45.6	MJ/kg	65.8	g-CO2/MJ	
	Lime Stone			kg			440.0	g-CO2/kg	
	Dolomite			kg			471.0	g-CO2/kg	
	Others (Specify)								
Sub total					0.0	MJ	0.0	kg-CO2	
Upstream	Purchased Electricity			kWH	9.8	MJ/kwH	50.4	g-CO2/MJ	For utilities, including power, global average value
	Purchased Oxygen			m3	6.9	MJ/m3	50.4	g-CO2/MJ	
	Purchased Nitrogen			m3	2.0	MJ/m3	50.4	g-CO2/MJ	
	Purchased Steam			kg	3.8	MJ/kg	50.4	g-CO2/MJ	
	Purchased Coke(Upstream)		0	(Auto input)	4.0	MJ/kg	92.2	g-CO2/MJ	
	Purchased Pellet			kg	2.1	MJ/kg	180.5	g-CO2/kg	
	Purchased	Natural Gas roots		kg	12.4	MJ/kg	780.0	g-CO2/kg	
		Coal roots		kg	13.2	MJ/kg	1,210.0	g-CO2/kg	
	Purchased			kg	13.2	MJ/kg	1,210.0	g-CO2/kg	
	Burnt Lime			kg	3.6	MJ/kg	880.6	g-CO2/kg	
	Burnt Dolomite			kg	3.6	MJ/kg	911.6	g-CO2/kg	
	Others								
Sub total					0.0	MJ	0.0	kg-CO2	

炭素電極追加

3. Credit Data

Credit			Intensity over crude steel		Energy Conversion		CO2 Emission		
Byproduct Gases		Blast Furnace Gas		m3	3.3	MJ/m3	141.0	g-CO2/MJ	Regional/country-wide authorized value
		Coke Oven Gas		m3	20.1	MJ/m3	44.0	g-CO2/MJ	
		BOF Gas		m3	8.4	MJ/m3	154.0	g-CO2/MJ	
Electricity				kWH	9.8	MJ/kwH	50.4	g-CO2/MJ	
Other Sources		Coke		kg	34.1	MJ/kg	105.9	g-CO2/MJ	For utilities, including power, global average value
		Coal Tar		kg	37.0	MJ/kg	77.2	g-CO2/MJ	
		Coal Light Oil		l	37.0	MJ/l	77.2	g-CO2/MJ	
		Steam		kg	3.8	MJ/kg	50.4	g-CO2/MJ	
		Oxigen		m3	6.9	MJ/m3	50.4	g-CO2/MJ	
		Nitrogen		m3	2.0	MJ/m3	50.4	g-CO2/MJ	
		Pig Iron		kg	13.2	MJ/kg	1,210.0	g-CO2/MJ	
		Others (specify)							
Sub total					0.0	MJ	0.0	kg-CO2	
Total			0	kt-steel	0.0	MJ	0.0	kg-CO2	

Monday 27 August 2007

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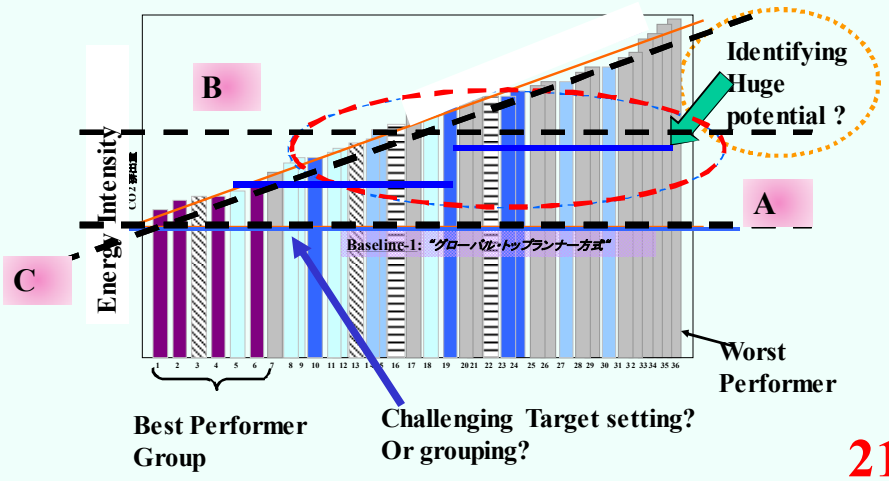
Main difference between Voluntary Action Plan and ISO14404

	Voluntary Action Plan	ISO14404-1 (BF-BOF)	ISO14404-2(EAF)
Emission coefficient of By-product gas	Based on effective carbon	electricity or NG equivalent	electricity or NG equivalent
Emission coefficient of purchased electricity	Power company average	World average	World average
○ : Direct only ● : Upstream only ◎ : Direct+Upstream			
Coke	○	◎	○
Nitrogen	×	●	●
Argon	×	●	●
Lime stone	×	○	○
Dolomite	×	○	○
Burnt lime	×	●	●
Burnt dolomite	×	●	●
Pellet	×	●	×
Sinter	×	●	×
DRI (Gas)	×	◎	○
DRI (Coal)	×	◎	○
Pig iron	×	◎	○
Ferronickel	×	○	○
Ferrochrome	×	○	○
Ferromolybdenum	×	○	○

A common methodology for target setting

- *Using collected data, target setting will be issue.*

  A common methodology, "St.Louis Agreement" (May 2009)



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Question *What do you think appropriate target setting methodology? Why?*

1) *Challenging target setting with politically and socially binding (similar to Keidanren's initiatives)? ~ "pledge and review type approach"*
2) *Legally binding strict target but reasonably achievable target. ~ incremental improvement for each participant*
3) *Cap and Trade type target setting. ~ average target (buyer/seller balanced)*

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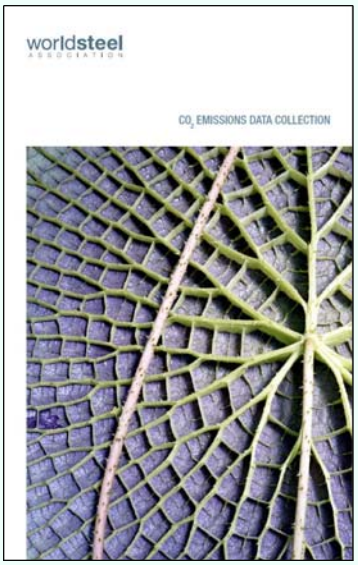
CO2 Emissions Data Collection by worldsteel

- ✓ Developed 2007 by worldsteel as a part of sector-base activity of steel industry
- ✓Conducting CO2 data collection by the uniform procedure annually and sharing aggregated data among participants from 2008
- ✓Data confidentiality strictly kept, Accessible only to the own data and aggregated results
- ✓Allow participants to know their position by comparing with the aggregated data set

worldsteel :World Steel Association



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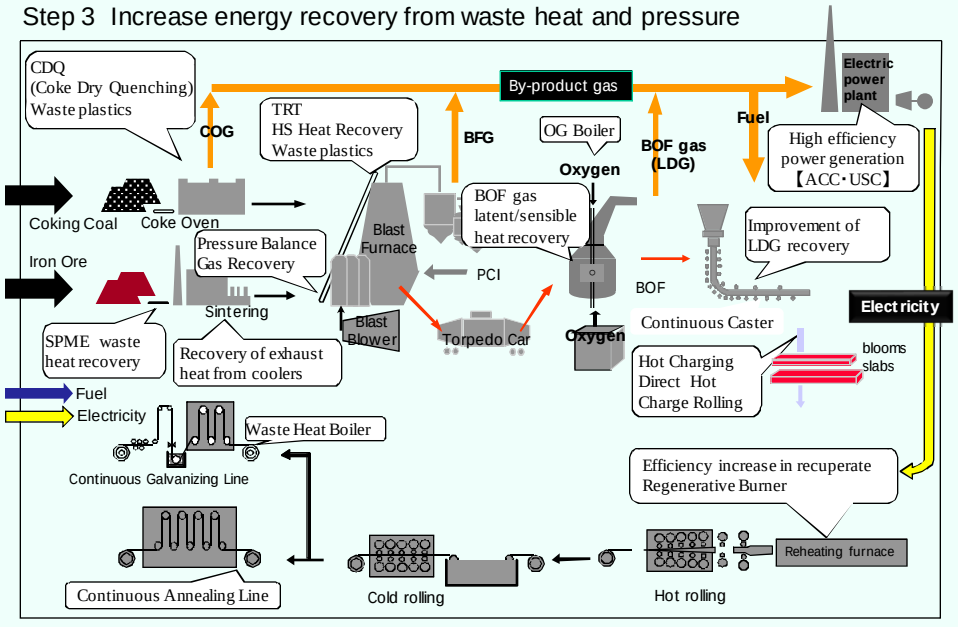
Energy – Saving Technologies in Integrated Steel Works

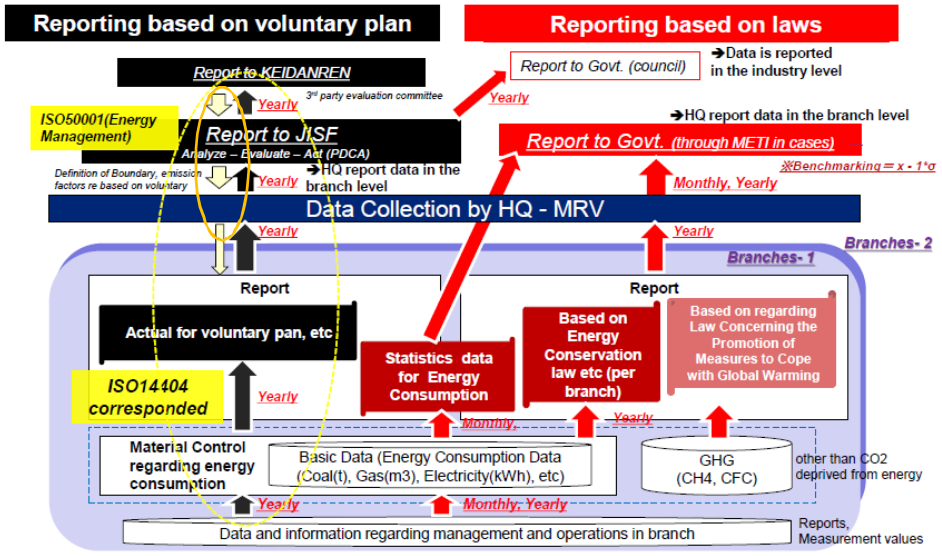
Step 3 Increase energy recovery from waste heat and pressure



N.NAKANO 24

ISO14404-related/data flow(iso50001 & iso14404-like)

Reference: Energy and GHG management flow in case of Japan



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Steel's COMMITMENT TO A LOW CARBON SOCIETY

(Pledge and Review) Reliability/transparency/accountability, Level of target and its compliances.

ISO50001(JISF's PDCA/Governance)

(1) 2020(Japan Iron and Steel Federation)

2030 target 9 million-tCO2/y

Eco process⇒ **Reduction target 5 million-tCO2/y** ⬅ -15 mtCO2/y reduction in FY2010 (vs'90)

- Aiming for a further improvement in energy efficiency of steel production processes, which are already the highest in the world

ISO14404(Steelworks)

The 2020 goal is to aim for a reduction of about 5 million tons of CO2, which is based on the maximum use of the latest technological advances and 2020 crude steel production 120 million tons.

ISO14040/44+α(LCI/steel products)

2030 aiming 42million-tCO2/y

Eco product⇒ **Estimated reduction potential 33 mtCO2/y** ⬅ -20 mtCO2/y contribution in FY2010

- By supplying high-performance steel, which is vital to creating a low-carbon society, Japanese steelmakers contribute to cutting CO2 emissions when finished. Cross-sectoral cooperative actions

2030 aiming 80million-tCO2/y

Eco solution⇒ **Estimated reduction potential 70 mtCO2/y** ⬅ -40 mtCO2/y contribution in FY2010

- Contribute worldwide by transferring/diffusing the world's most advanced energy-saving technologies to other countries.

Standardization: Technology Full List and Technology Customized List

(2) Long term~ Breakthrough R&D

Development of innovative steelmaking processes (COURSE50)

Cut CO2 emissions from production processes about 30% by using hydrogen for iron ore reduction and collecting CO2 from blast furnace gas. The first production unit is to begin operations by about 2030*.

*Assumes establishment of economic basis for CO2 storage infrastructure and creation of a practical unit using these processes.

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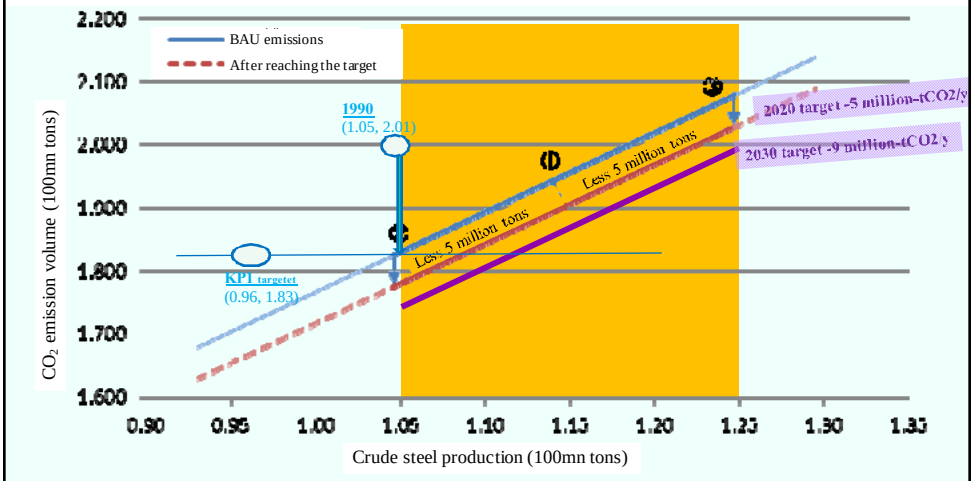
1. Climate Change Policy [Appendix 2]

BAU Emissions and Emissions after Reaching the Target



- Production volume for Voluntary Action Plan participating companies is calculated by multiplying total crude steel production in Japan by 95.9%, the ratio of this production accounted for by participating companies in FY2005.
- May be outside the anticipated range if there is a big change in production volume. If this happens, suitable levels for BAU and the reduction will have to be examined based on actual conditions.

BAU emissions and emissions after reaching the target for crude steel production in 1, 2, and 3 in the graph

(100mn tons)

	Crude steel production		CO_2 emission volume	
	Japan	Plan participants	BAU	After target reached
①	1.2	1.15	1.954	1.904
②	1.1	1.05	1.837	1.787
③	1.3	1.25	2.078	2.028

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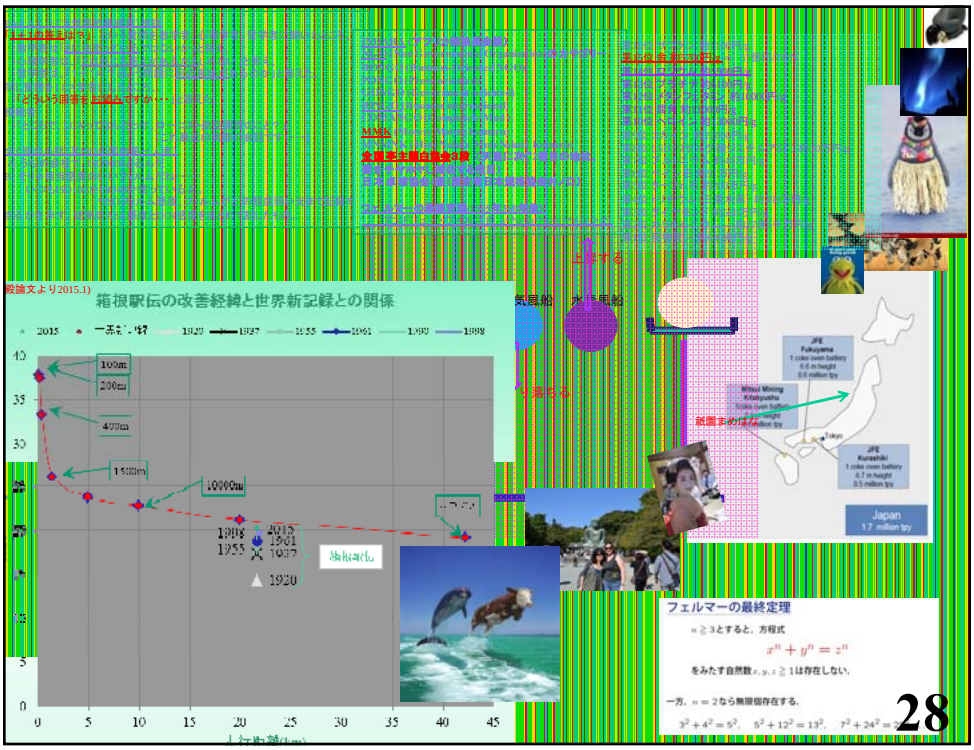

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