Awareness Workshop on Energy Efficient Japanese technologies and Best Practices

25th September, 2014 at Bangalore

Organised by

The Energy and Resources Institute (TERI)
Institute for Global Environmental Strategies (IGES)

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IGES
Institute for Global Environmental Strategies

Summary of the awareness workshop on Energy Efficient Japanese technologies and Best Practices,

25th September 2014, Bangalore

An awareness workshop on 'Energy Efficient Japanese technologies and Best Practices' was organised on 25th September 2014, at Hotel Chalukya, Bangalore under the 'MRV and Capacity Building in India Project' being undertaken by TERI, with support from IGES. A summary of the discussions at the workshop is presented below.

Welcoming the participants to the workshop, Mr Prosanto Pal, TERI mentioned that the objective of the event was to raise awareness of Indian stakeholders with regarding to Japanese low carbon technologies related to the metal casting sector as well as regarding JCM scheme and JCM MRV methodologies. He mentioned that TERI and IGES have been working for several years on capacity building of India stakeholders on CDM. Presently, new bilateral mechanisms like JCM are emerging which would be useful for promoting energy efficient technologies among industries in India.

Welcoming the Japanese experts to Bangalore, Dr H Sundaramurthy, IIF (Institute of Indian Foundrymen) thanked IGES and TERI for organising the event. He mentioned that IIF has an MOU with JFS (Japanese Foundrymen Society) and this can be used to develop further cooperation between the two sides.

Mr S Rudre Gowda, a leading foundryman from Shimoga cluster gave an over view of the Shimoga foundry cluster which is located about 280 km from Bangalore. The cluster has about 45 foundries and produces about 65,000 tpa (tonnes per annum) of castings. The cluster produces ductile iron, grey iron and steel castings. Some of the foundries in the cluster are also exporting castings. Mr Ramaswamy, KFA (Karnataka Foundry Association) mentioned out the new foundry park which has come-up in Hospet near Bangalore. The foundries relocating to the new location has an opportunity to adopt new technologies in their operation.

Dr Rabhi Abdessalem, IGES made a detailed presentation about the recently concluded ALCT project, undertaken by IGES and TERI with support from JICA/JST. Under the project, hard technologies from Japan like Gas Heat Pump (GHP) and Electric Heat Pump (EHP) as well as soft technologies/best operating practices in compressed air and induction furnaces were demonstrated by Japanese experts among SMEs in India. He also explained the working of the a proposed bilateral scheme called Joint Crediting Mechanism (JCM). He mentioned that JCM, when signed by Government of India, would provide a good opportunity for financing of new energy efficient Japanese technologies among industries in India. A copy of his presentation is attached.

Mr Junichi Takeuchi, IGES/ Sintokogio expert made a presentation on 'Energy saving measures in casting'. He mentioned that Japan has about 1,500 foundry units and produce about 5.5 million tonnes of castings, whereas India has about 4,500 foundry units producing about 10 million tonnes. He presented details of different fuels consumed in Japanese foundry industry and felt that India should also collect cluster level details of energy consumption. Melting accounts for nearly 72 per cent of energy consumption in a foundry unit. In 1997, 34 per cent of foundry units in Japan use cupola, 63 per cent of the foundry units use induction furnace and 3 per cent of foundry units use electric arc furnace. In the recent years, there has been a trend to shift to cupola furnace due to electricity shortage with the closing down of many nuclear power plants. He mentioned that Japanese foundry industry has been able to save substantial amount of energy through Kaizen activities. These activities have helped foundries reduce reduction and improve yield leading to energy savings. A copy of his presentation is attached.

Mr Kenji Shiotani, IGES/Ishikawa Malleable Co. Ltd., Japan made a presentation on 'Energy saving operation in foundry'. His company (Ishikawa malleable) is one of the major producers of ductile iron castings for the automobile sector. It producers about 7,600 tonnes of casting per month from two plants – one located in China and the other in Japan. Induction furnaces are used for producing ductile iron of various grades (FG 450, 500 and 600). He outlined various energy efficiency best practices from his company such as differential metal tapping, better matching of melting with moulding operation, marking of the grade on the runners and risers, full power operation, no stoppage for lunch and so on. A copy of his presentation is attached.

The workshop concluded after a question and answer session.

Annexure 1: Agenda of the event

Awareness workshop
Energy efficient Japanese technologies and best practices

Chalukya Hotel, Bangalore
25th September 2014, 4:00 – 8:00 pm

Program

4:00 – 4:30 pm	Registration	
4:30 – 4:45 pm	Welcome address	**Mr Prosanto Pal** TERI, New Delhi **Dr H Sundaramurthy** Past President – IIF
4:45 – 4:55 pm	Scenario of Foundry Industries in Shimoga and Bangalore	**Mr S Rudre Gowda** Representative, Shimoga Foundry Cluster **Mr. V. Ramaswamy** Past Chairman, KFA
4:55 – 5:15 pm	Overview of TERI-IGES project	**Mr. Abdessalem RABHI,** IGES
5:15 – 6:30 pm	Presentation on Japanese technologies and practices	**Mr Junichi TAKEUCHI/** **Mr. Kenji SHIOTANI** IGES, Japan
6:30 - 6:45 pm	Assistance to MSME units from Ministry of MSME and NSIC	**Mr P Ravi Kumar** Zonal General Manager, NSIC
6.45 - 7.05 pm	Open house/ Discussion	
7:05 – 7:10 pm	Vote of thanks	**Prof. Ranganath** Hon Secretary, IIF Bangalore
8.00 pm	Dinner	

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Energy-saving Measures in Casting

(Mainly Focusing on Induction Furnace Melting)

～Case of Japan and Her Situation～

September, 2014
Shintokogio, Ltd.
Junichi TAKEUCHI

SINTOKOGIO,LTD. www.sinto.co.jp

Junichi TAKEUCHI amigotake@gmail.com

1973 Completed faculty of science and engineering, Waseda University, Japan. (Castings Res. Lab., Waseda Univ.)
Joined Japan Casting Co., Ltd. (Nippon Chuzo Co.,Ltd.)

2001 Was dispatched as JICA, JETRO expert to South-east Asia and Mexico for technical guidance.
Took his new post at Universidad Autonoma de San Luis Potosi, Mexico

2004 Joined Japan Foundry Society, Inc.

2009 Joined Sintokogio. Ltd. has worked as adviser

Other activities: Central Trade Skill Test Commissioners
Chief of editorial committee of journal “Casting Journal”

Casting Production Top-10 Countries

TOP-10 CASTING PRODUCERS

1. China — **41,260,000 million tons**
- Gray iron: 2,009,500 million tons
- Ductile iron: 10,375,000 million tons
- Steel: 5,395,000 million tons
- Nonferrous: 5,395,000 million tons

2. U.S. — **10,008,000 million tons**
- Gray iron: 3,064,000 million tons
- Ductile iron: 3,841,000 million tons
- Steel: 977,000 tons
- Nonferrous: 2,126,000 million tons

3. India — **9,994,000 million tons**
- Gray iron: 6,864,000 million tons
- Ductile iron: 1,090,000 million tons
- Steel: 1,140,000 million tons
- Nonferrous: 900,000 tons

4. Japan — **5,474, 008 million tons**
- Gray iron: 2,229,758 million tons
- Ductile iron: 1,635,500 million tons
- Steel: 218,181 tons
- Nonferrous: 1,390,569 million tons

5. Germany — **5,466,696 million tons**
- Gray iron: 2,576,150 million tons
- Ductile iron: 1,698,235 million tons
- Steel: 217,548 tons
- Nonferrous: 974,763 tons

6. Russia — **4,300,000 million tons**
- Gray iron: 2,198,160 million tons
- Ductile iron: 897,840 tons
- Steel: 731,000 tons
- Nonferrous: 473,000 tons

7. Brazil — **3,343,685 million tons**
- Gray iron: 1,986,733 million tons
- Ductile iron: 812,467 tons
- Steel: 270,302 tons
- Nonferrous: 274,183 tons

8. Korea — **2,340,200 million tons**
- Gray iron: 1,076,600 million tons
- Ductile iron: 652,000 tons
- Steel: 160,600 tons
- Nonferrous: 451,000 tons

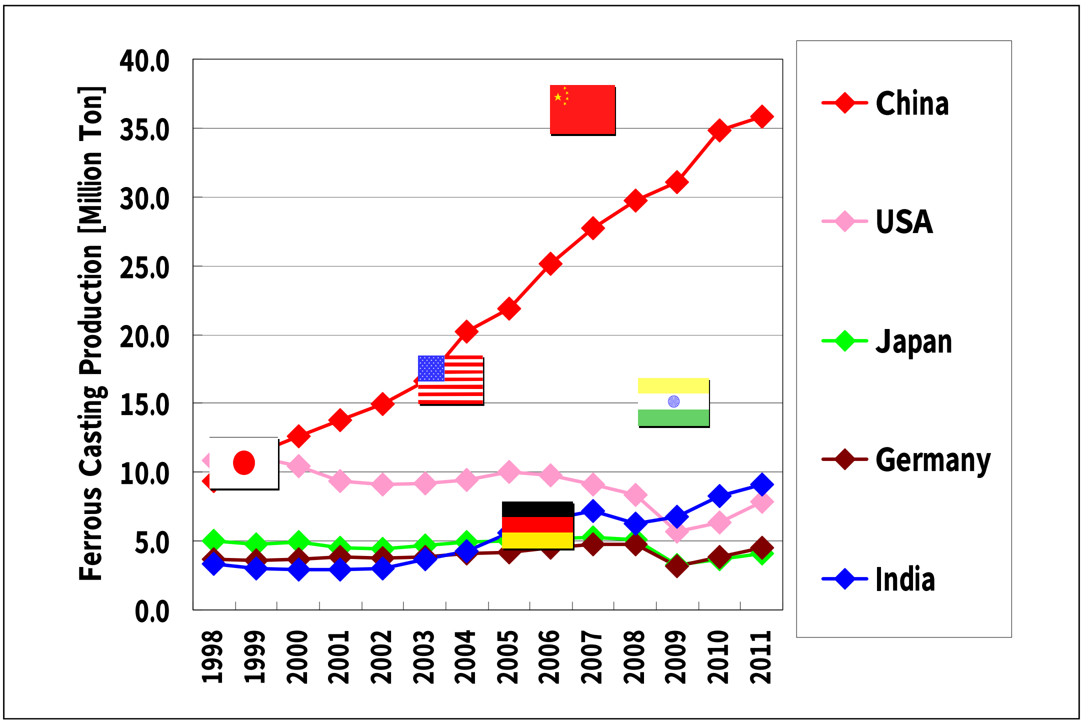
9. Italy — **2,213,287 million tons**
- Gray iron: 692,298 tons
- Ductile iron: 469,051 tons
- Steel: 73,658 tons
- Nonferrous: 978,280 tons

10. France — **2,046,826 million tons**
- Gray iron: 734,500 tons
- Ductile iron: 831,600 tons
- Steel: 108,900 tons
- Nonferrous: 371,826 tons

The 2011 census shows annual casting production's return to pre-2008 levels.
A MODERN CASTING STAFF REPORT

Iron Based Casting Production TOP-5 Countries

Rapidly increasing of productions in India and China



Source: Modern Casting

Current Situation and Problems Regarding Energy Saving in Each Field

Pig Iron Casting

Energy Consumption of Pig Iron Casting
(conversion of calorific value) MJ/t

	Average of 3 pig-iron-related organizations and 72 foundries		Average of 9 production lines in 7 foundries	
	Energy consumption	Percentage (%)	Energy consumption	Percentage (%)
Purchase power	4,558	55.6	5,831	61.0
Coke	2,118	25.8	2,544	26.4
City gas	145	1.8	462	4.8
Liquefied petroleum gas	261	3.2	647	6.7
Liquefied natural gas	2			
Volatile oil (Gasoline)	19	0.2		
Kerosene	246	3.0		
Light oil	65	0.8		
Heavy oil A	778	9.5	102	1.1
Total	8,192	100.0	9,642	100.0

Energy Consumption by Casting Process
(conversion of calorific value) MJ/t

	Energy consumption by process (MJ/t)	Percentage (%)	Percentage (% including "Other")
Material receiving / melting	6,130	72.1	66.2
Sand treatment	880	10.3	9.5
Core molding	359	4.2	3.9
Molding	611	7.2	6.6
Molten treatment / Pouring	157	1.8	1.7
Shake-out mold / cooling	18	0.2	0.2
Fettling	347	4.1	3.7
Sub-total	8,510	100.0	91.8
Others	763		8.2
Total	9,270		100

Usage of Melting Furnace

1997 (Unit)

	Less than 3 tons	3 tons or more but less than 10 tons	3 tons or more	Total
Cupola	39	175	26.0	592 (34%)
Induction electric furnace	733	340	25.0	1,098 (63%)
Arc furnace	44	4	5.0	53 (3%)
Total	1,168 (67%)	519 (30%)	56 (3%)	1,743 (100%)

Non-ferrous Casting

(1) Energy-saving by improving yields

(2) Improving energy efficiency by energy management technology

① Induction furnace

② Combustion furnace

(3) Energy-saving for process and facility

① Molding process

② Environmental problem

Casting Machine and Equipment

(1) Cupola melting

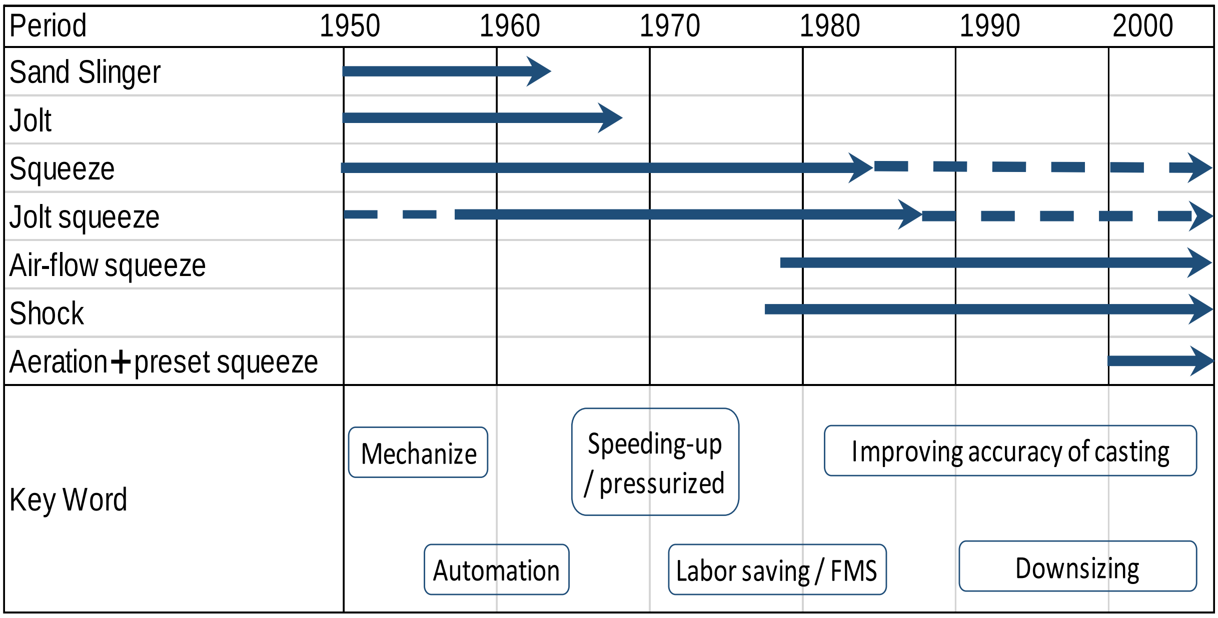
(2) Electric furnace melting

(3) Molding machine

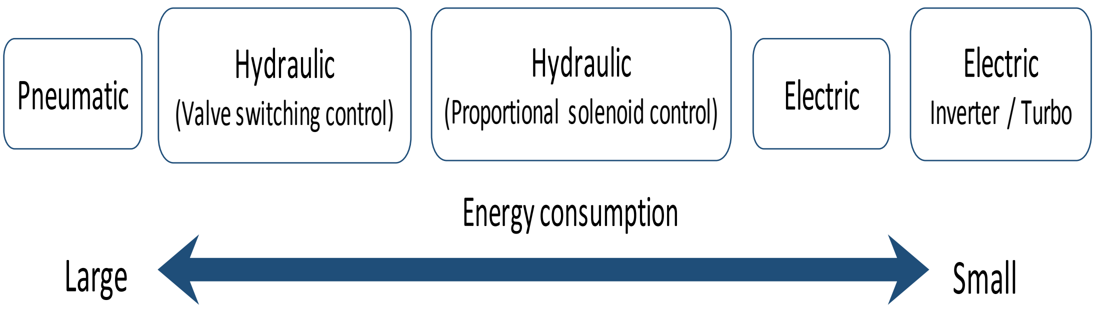
(Mass production=Green sand, self-hardening property)

(4) Other casting equipment

History of Green Sand Molding Machine



Power Source and Energy Consumption



Direction and Technical Development problems (issues) of Energy Saving in Casting

① Technology which makes the most of resources and facilitates recycling reuse

② Technology which minimizes emissions in production process

③ Technology for minimizing use energy and using effectively at the maximum

④ Technology which contributes to establishment of an information society, and construction of high-quality society with safety and security

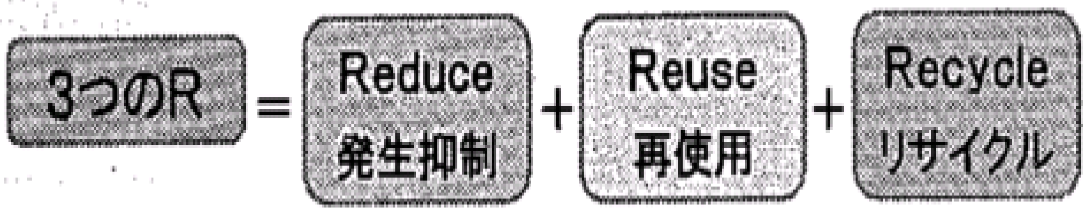
Recommendations of Problems

- Gathering of foundries
- Rapid melting and pouring system for one flask
- Measures for improving thermal efficiency

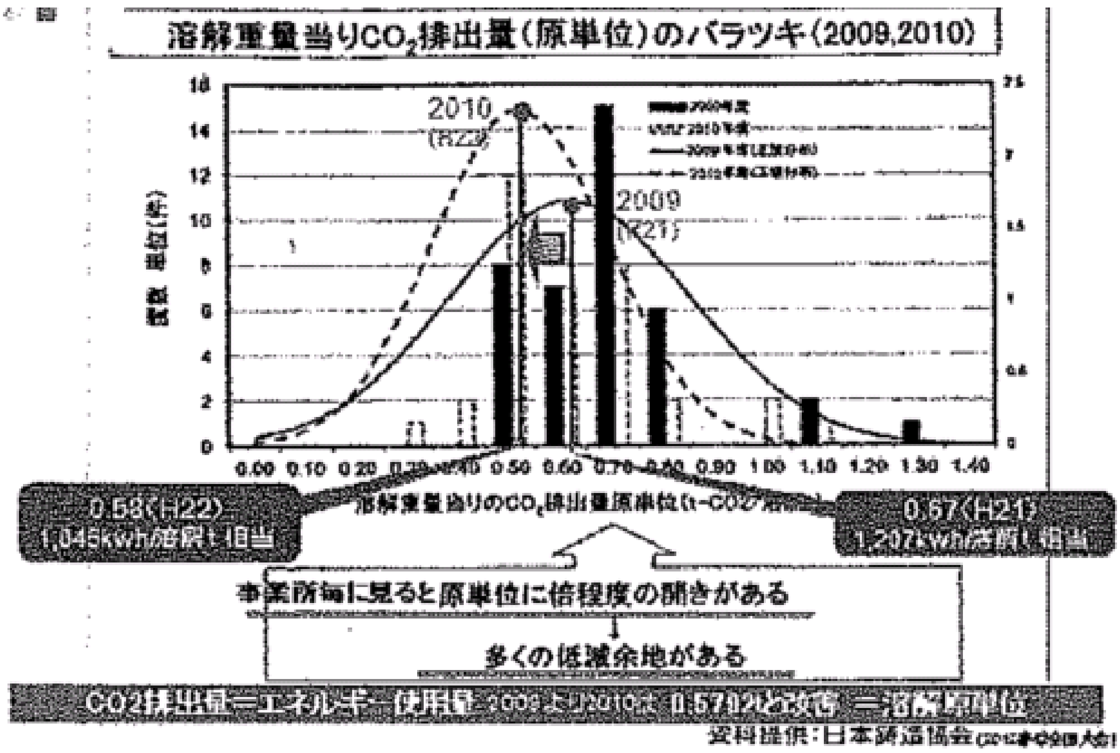
  (Example)

  Installation / improvement of furnace cap (cover), control of water-cooled temperature, decrease of melting temperature, thickness of lining, remaining heat of materials, others.
- Melting power setting and review of furnace
- Reduction of power consumption of compressor
- Heat retention and heat insulation of a heat radiation part

3Rs in terms of Resource Saving

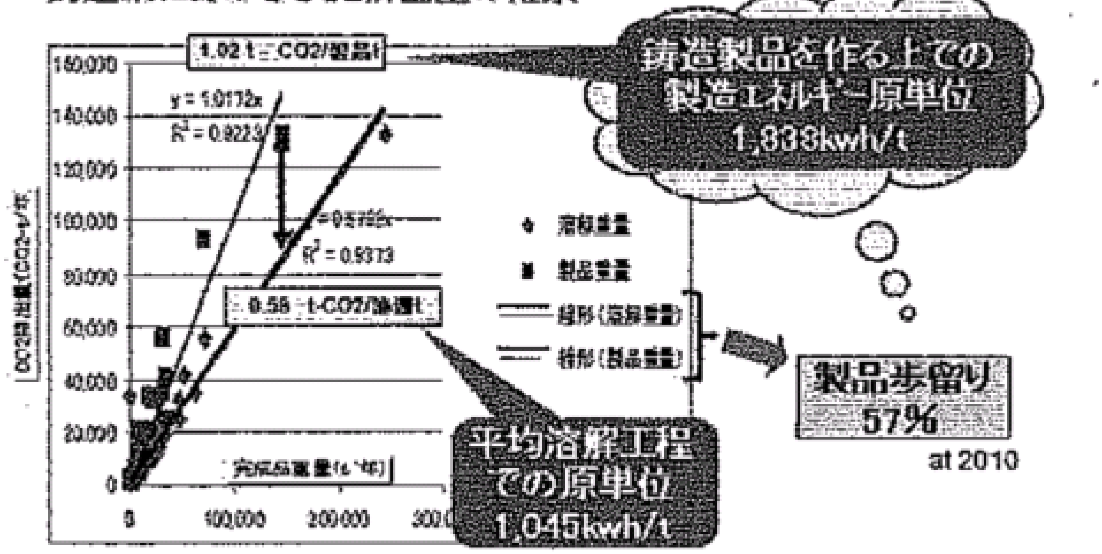


Present Situation of Actual Status of Energy Use



CO_2 Emission in Casting Industry

図 鋳造業におけるCO2排出量の推察



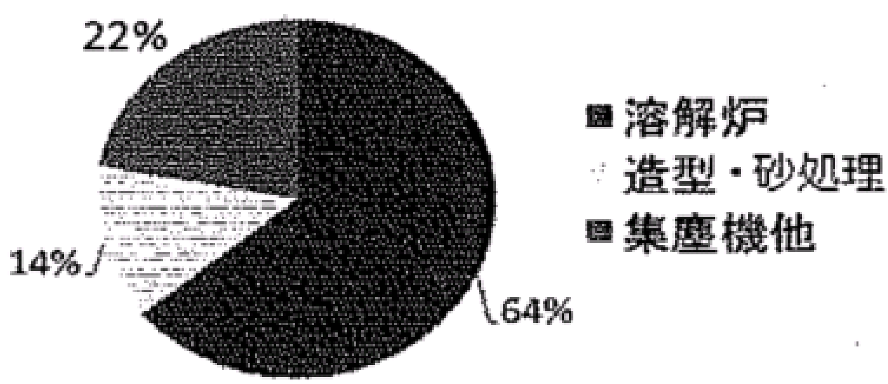
一概には言えぬが、2010は2009年度に比べ製品歩留りは2%悪化

2009 リーマンショック
2011/3/11 東日本大震災

資料提供:日本鋳造協会

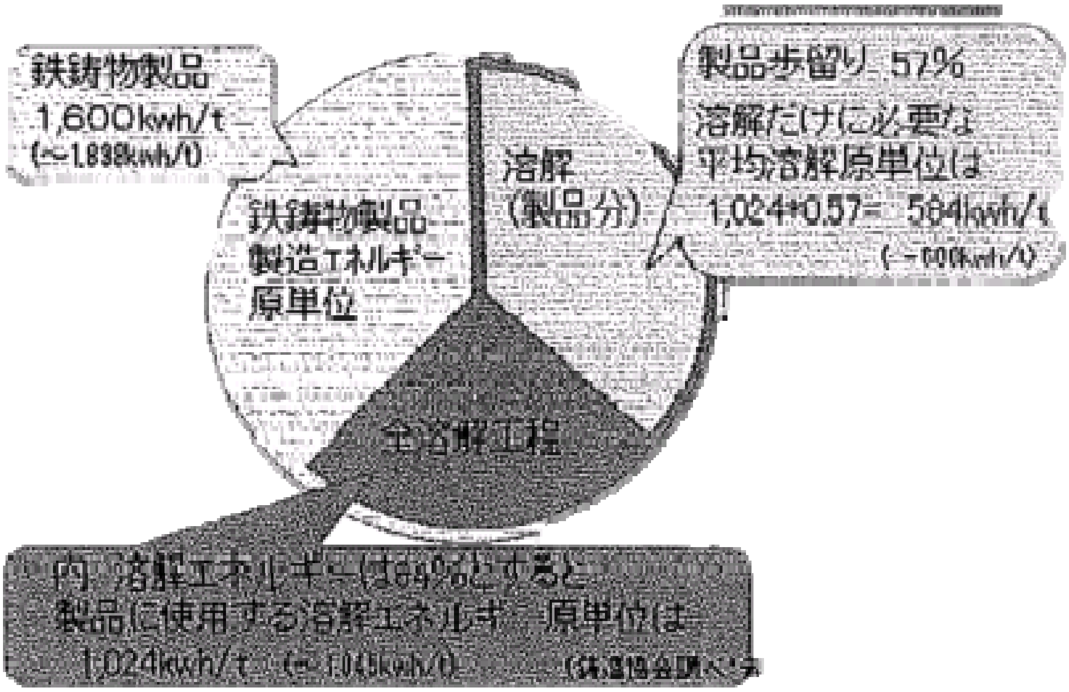
Energy Consumption in Foundry

工程別エネルギー使用量(各社の平均)

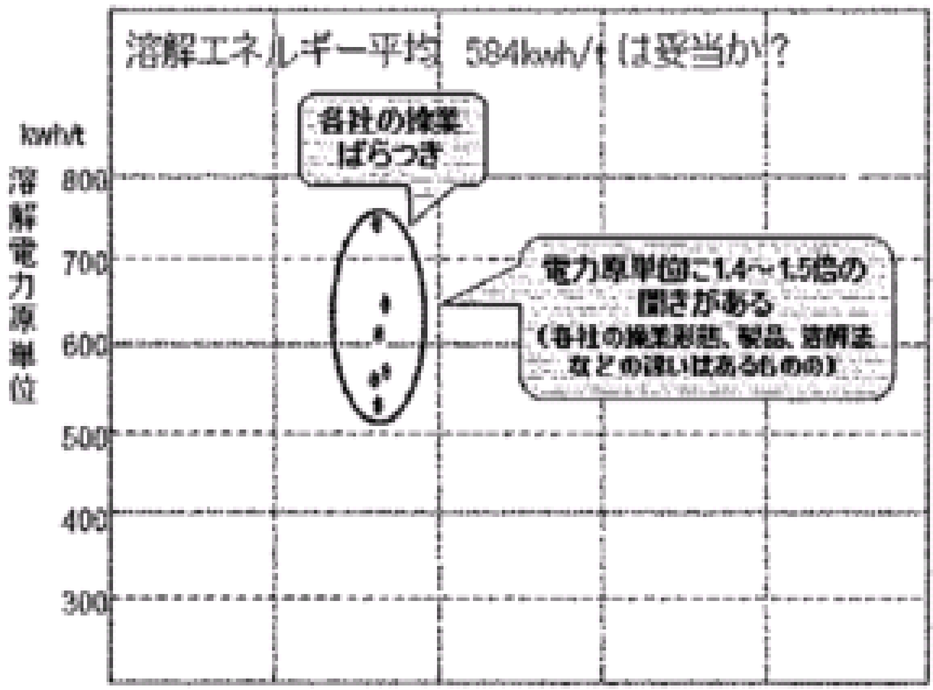


鋳造工場は溶解に多量のエネルギー(60~70%)を消費

Energy Required for Casting



Actual Condition of Melting Energy Investigated



For Reducing Energy Consumption

(1) Reducing amount of returned

(2) Reducing product weight itself

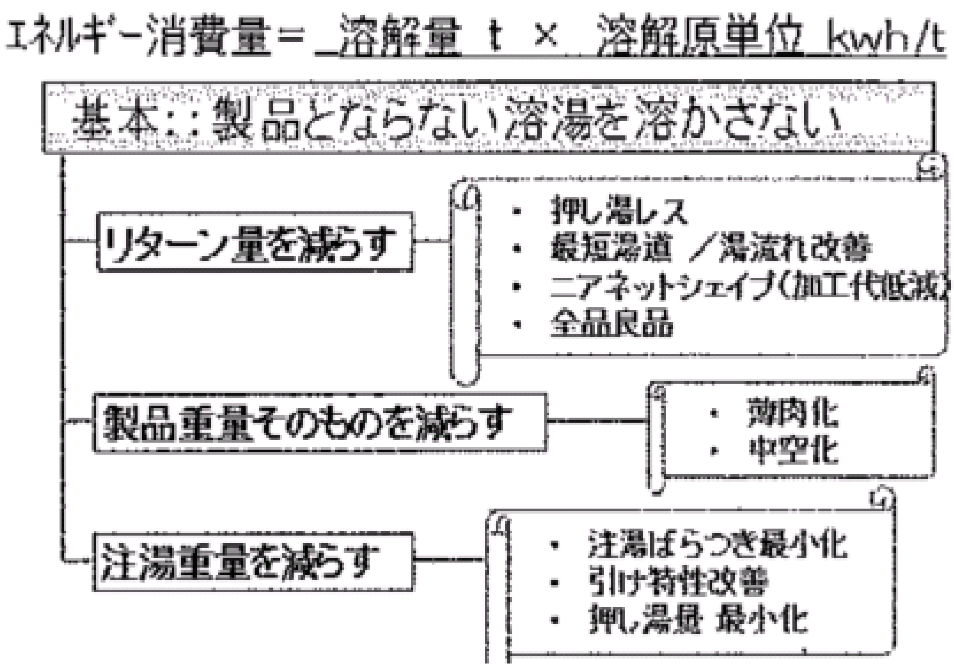
(3) Reducing pouring weight itself

(4) Melting consumption

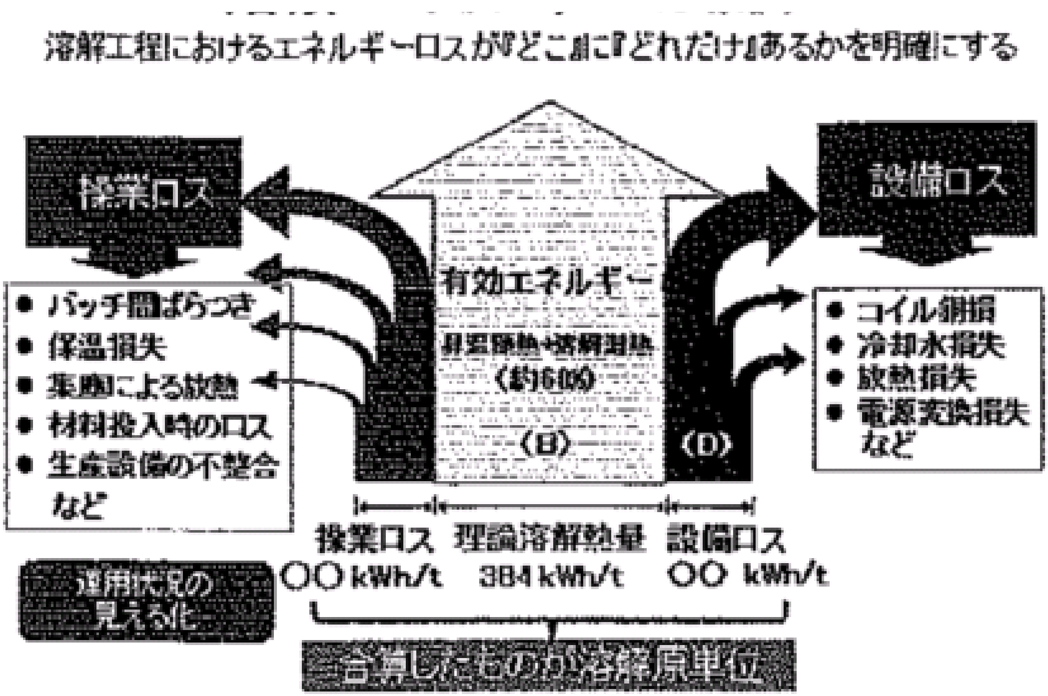
Melting consumption = Theoretical melting energy + Operation loss + Equipment loss

$$P = e_o + L_o + L_m$$

Basics of Reducing Energy Consumption



Flow of Energy in Melting Process



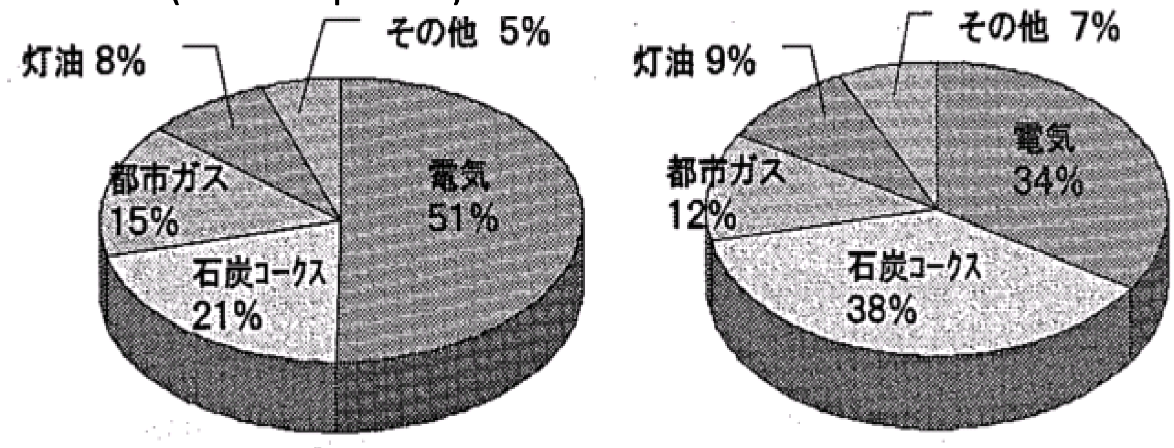
Views on Energy Saving

- Energy (Electric, Coal/Coke, Gas, Kerosene, Heavy oil, etc.)
- Viewpoint based on a variety of different condition, situation and circumstances
- How to deal with; oil crisis (shock), resource saving, relation with greenhouse gas, CO_2 emission
- Energy consumption

Comparison of Energy Consumption with CO_2 Emission

Ratio of Energy Consumption
(crude oil equivalent)

Ratio of CO_2 Emission



【図4-3】エネルギー使用量と CO_2 排出量の比較

Energy Saving and Capital Investment

- Large capital (capacity) investment
- Way of operation, strengthening of management
- "Clear goal setting" is carried out by "Participation by all“.

Thank you for
your kind attention!

Junichi TAKEUCHI

Energy-saving Operation in Foundry

Kenji SHIOTANI

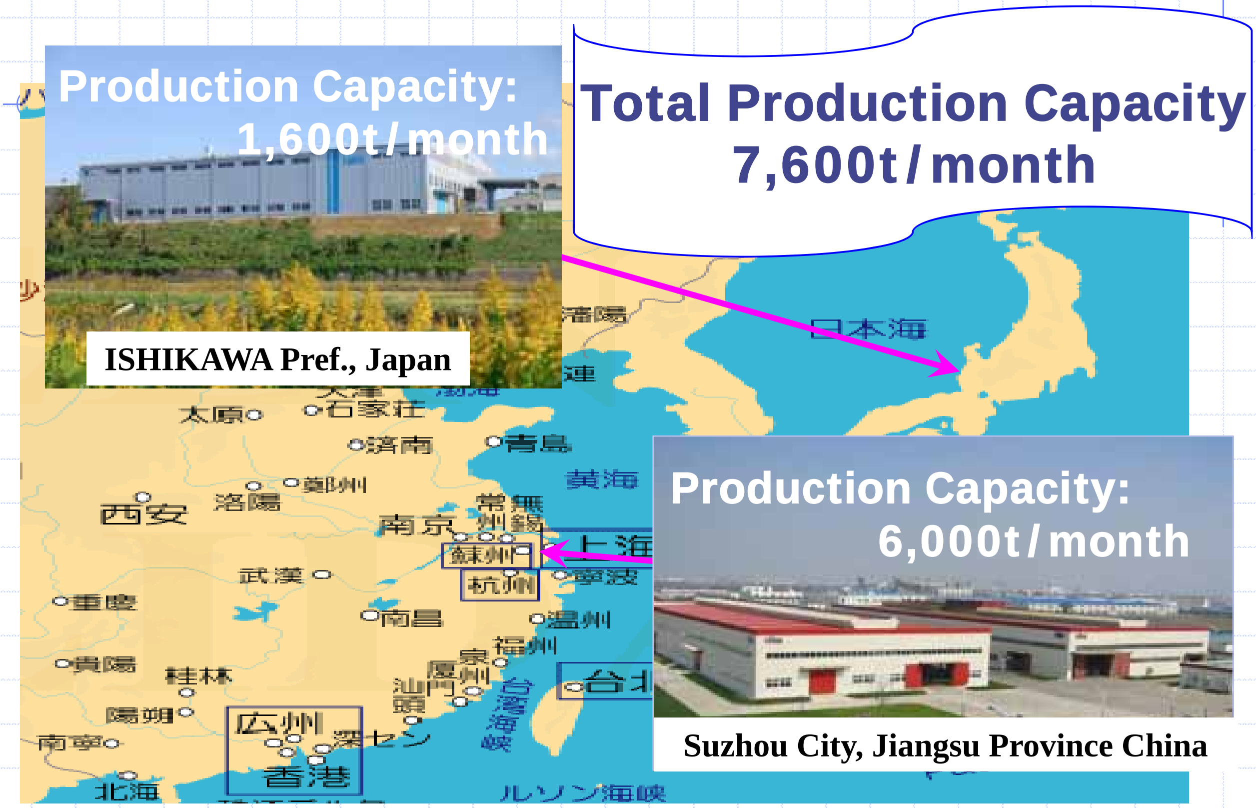
Ishikawa Malleable CO., LTD

Company Profile

- Establishment May, 1953
- Capital 48 Millions JPY
- President Tetsuo SHIOTANI
- Number of employees 134
- Business Casting Sec. (Manufacturing of casting)
  Machinery Sec. (Machining of metals of casting etc.)
  Import Sec. (Importing or selling of products made in China)

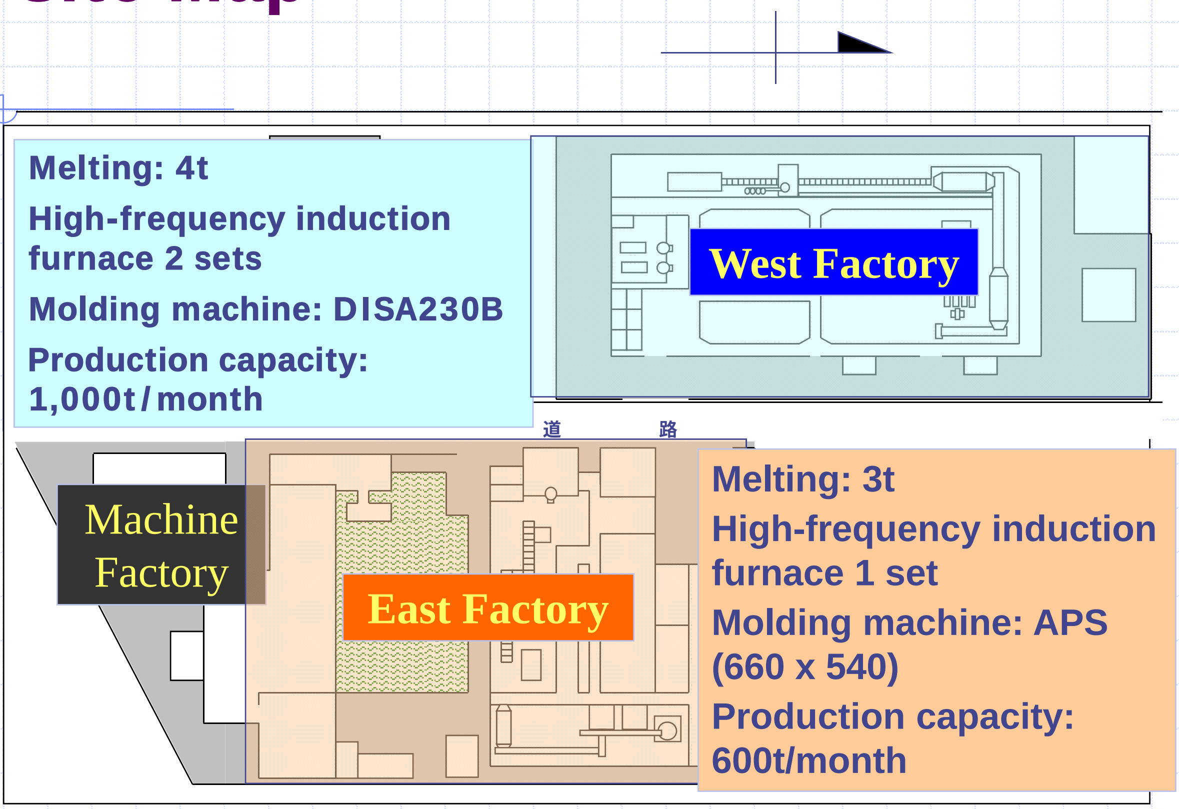
Production Base

IMC
Ishikawa Malleable CO.,LTD



Site Map

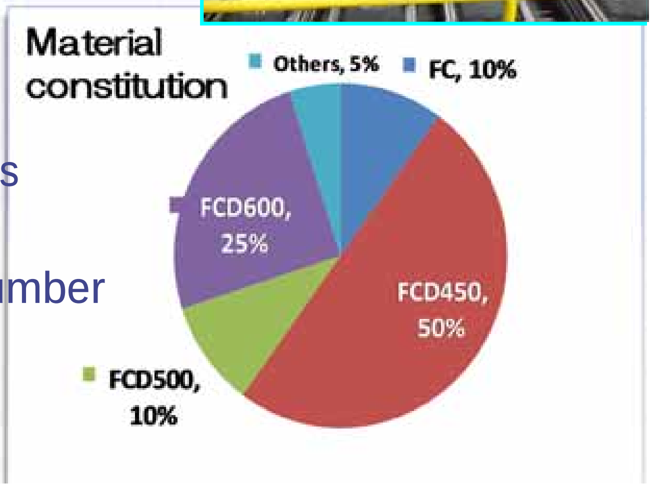
IMC
Ishikawa Malleable CO.,LTD



Equipment Specification and Material Constitution in East Factory

IMC Ishikawa Malleable CO.,LTD

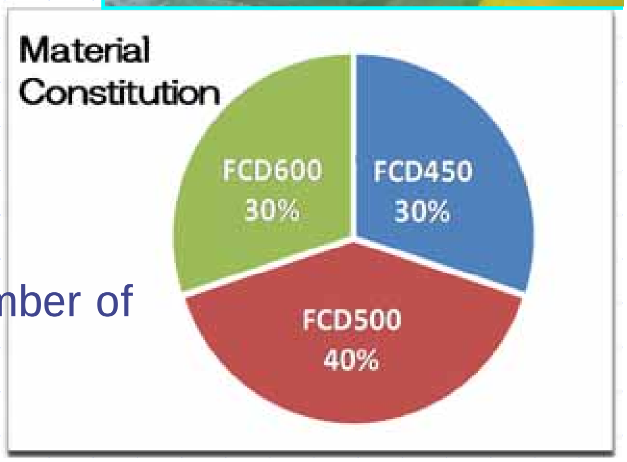
- APS of Shintokogio made
  (Manufactured in 1984)
  (660 x 540 x 180 x 180)
  High-frequency induction furnace
  Made of Fe 3t/2200kw
- Casting weight
  10kg/flask~60kg/flask
- Number of production items
  1,500 items
- Minimum and maximum number of lot flask per month
  5~300flask/product



Equipment Specification and Material Constitution in West Factory

IMC Ishikawa Malleable CO.,LTD

- DISA230B (650 x 535)
  (Manufactured in 2007)
- High-frequency induction furnace
  Made of Fe 4t/3500kw
  2 sets with 1 power source
  (Melting, heat-retention)
- Casting weight
  10kg/flask~40kg/flask
- Number of production items
  Approx. 100 items
- Minimum and maximum number of lot flask per month
  50~14,000flask/product



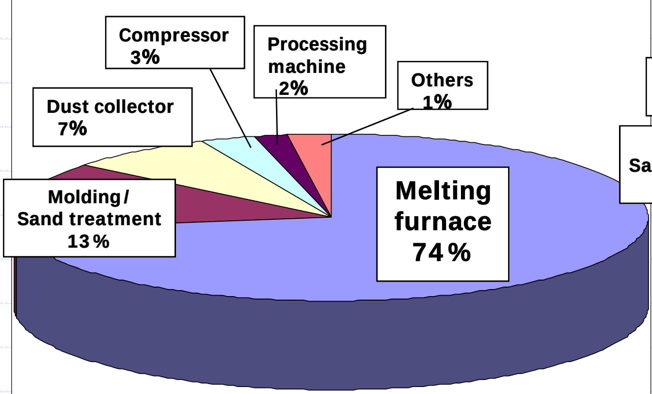
Report on Energy Saving at Our Company

- Percentage of CO_2 emissions

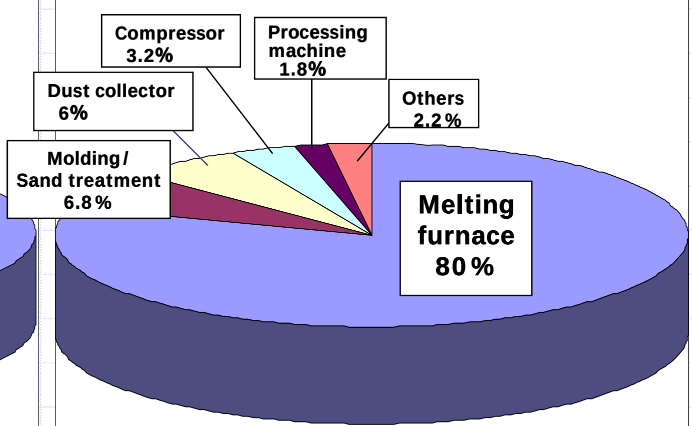
FY 2011		FY 2012	
Electric	95.7 %	Electric	95.9 %
Kerosene (Paraffin)	2.0 %	Kerosene (Paraffin)	1.8 %
Light oil	0.4 %	Light oil	0.4 %
LPG	1.9 %	LPG	1.9 %

Percentage of Use Power (Power consumption)

[East Factory] Contract demand: 3000kW



[West Factory] Contract demand: 4500kW



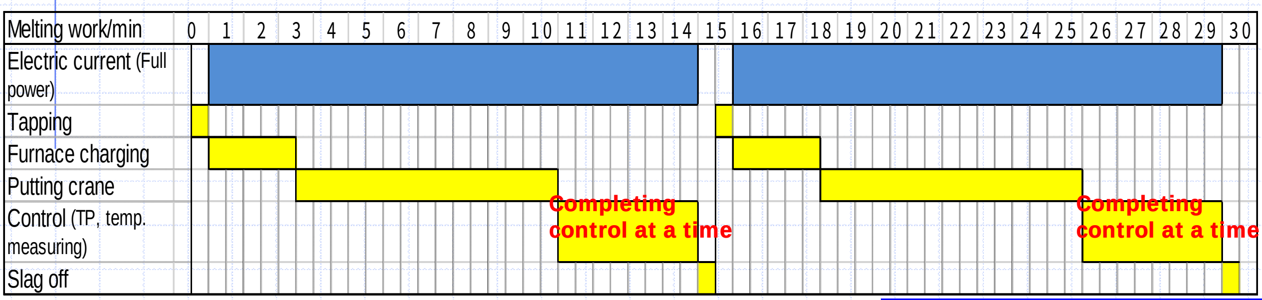
~Energy-saving Operation~
Productivity Evaluation of Factory (Goal)

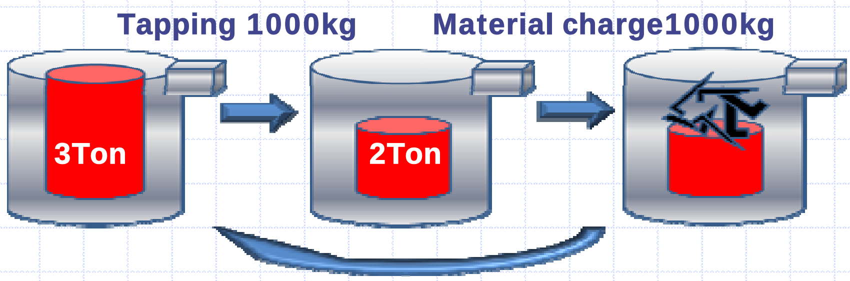
- To set the volume of accepted product (kg/hr) as management target
  (Production weight (kg) – Rejected weight (kg))
  / Operating hours (hr)
  To clarify about equipment capacity and target of each process
- To switch the operation mechanism from molding main operation to melting capacity main operation.

☆How to get the maximum of equipment capability?

~East Factory
Concept of productivity improvement~

【Target of Melting Process】
4000kg/h (Targeting 1000kg per tapping per 15min)
To targeting furnace operation without keeping warm by melting of leaving iron!





Melting of leaving iron by high-frequency induction furnace

Problems

- Melting capacity cannot be demonstrated due to variation in pouring weight.
- Timing of a tapping call is not clear.
- Certainty of quality governing of molten metal is required (control at a time).
- Re-checking of cycle time of the molding machine is needed since it does not demonstrate the maximum capability. (It follows the change of weight per flask.)

Improving the above four problems!

Unstable Melting Operation due to Variation in Pouring Weight

Pouring weight kg/flask	Molding capacity flask/h	Weight required kg/hr	Tapping weight kg/tapping	Melting capacity kg/hr	Difference in melting capacity kg/hr	Operation state
15	160	2400	600	4000	1600	Loss of melting heat-retention
25	160	4000	1000	4000	0	Melting and molding: full
35	160	5600	1400	4000	-1600	Melting: full, molding: waiting for tapping

Leveling this variation to 1000kg is needed.

Re-planning of Process to Increase Amount of Molten Iron at Manufacturing Section

IMC Ishikawa Malleable CO.,LTD

時間	位置	製品名	重量	鋳込数	出湯量
7：00	南	641ﾊﾝｶﾞｰ ①	17.5	20	
	北	E0010			900
		E0010			
					900
	北	E0021			
		①	17.5	20	
	北	②	27	2 [partly hidden]	1000
		②	27	7	
		①	17.5	20	1000
8： [partly hidden]					
		③	26	8	

Target Tapping Weight

1000kg

Challenge for leveling of melting tapping weight

Improving Measures Against Load of Changing Mold

IMC Ishikawa Malleable CO.,LTD

- ◆Using molds of casting small product and large product in turns per tapping is required.
  - ➢ As for mold change of molding machine, two molds can be set by adopting conventional shuttle type (manual operation). However, load is reduced by cylinder due to heavy burden for workers.
    (But having approx. 20 seconds of molding loss as mold change)

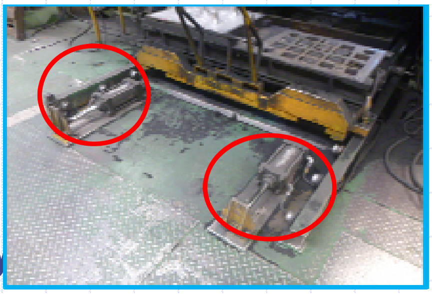
Before leveling of tapping

Approx. 20 taps/day

→

After leveling of tapping

Approx. 60 taps/day



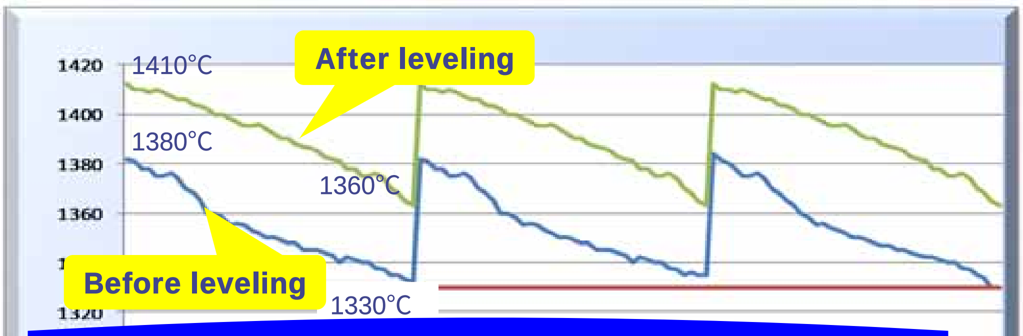
Ishikawa Malleable CO.,LTD

Ishikawa Malleable CO.,LTD

Impact:
Improving of Productivity and Increasing of Pouring Temperature

- As a result of leveling, improving of productivity is verified.
  - Productivity: 1558kg/h -> 1655kg/h (Approx. 6.2% up)

Furthermore, pouring temperature changes!



Temperature increase of approx. 30 degrees C. is verified.

Possible pouring time / tap can be extended by temperature increase though it was 13 minutes before leveling

【TRY】 Extending 2 min in possible pouring time

Before leveling (Fading 13min)
Production weight: 20kg/flask
Number of moldings: 40flask/charge
Tapping weight: 800kg/charge
Final flask pouring temp.: 1330°C

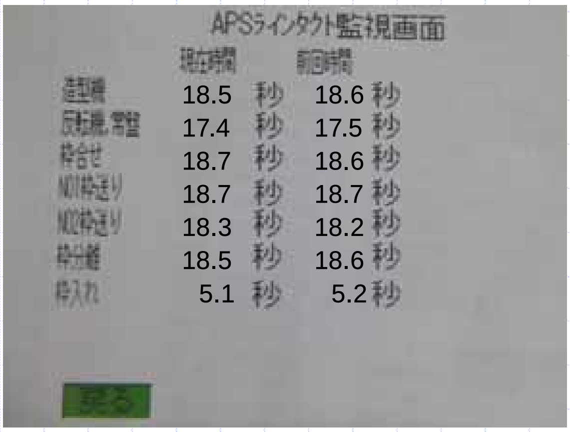
Aft… 5min)
Pr… k
N… charge
T… e
Fi… 50°C

2 min extension determined

Effect of heat-retention in ladle
and improvement of Mg yield
by increase of processed molten metal

Variation in Cycle Time of Molding Machine

Displaying cycle time in each process of molding-line



Control of each process, stop time for molten metal waiting and the number of times of molding-line.

Shortening of cycle time and clarifying trouble point

Kaizen (Improving) Activity for Problem Point

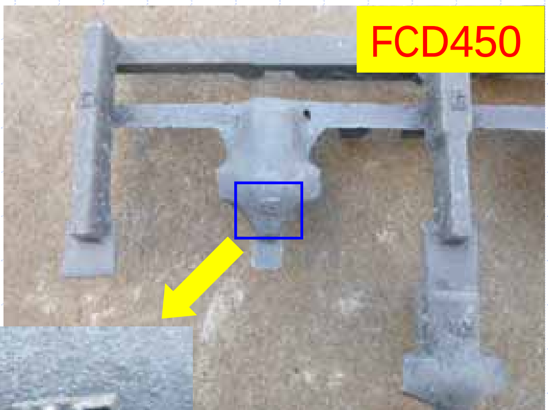
◆ History of line stopping

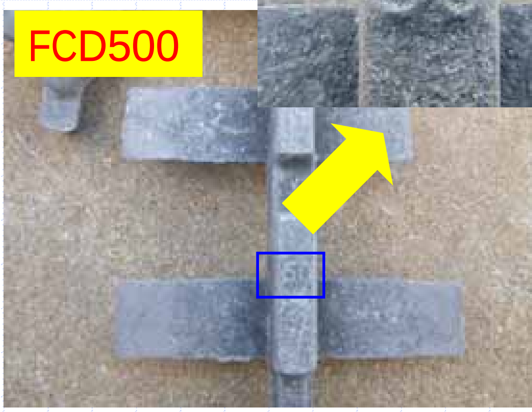
ライン停止日	ライン停止年月	停止No.	工程コード	工程									
2010/03/15	1003	22	2	APS									
2010/03/15	1003	24	2	APS									
2010/03/16	1003	24	2	APS									
2010/03/16	1003	22	2	APS									
2010/03/18	1003	28	2	APS									
2010/03/18	1003	21	2	APS									
2010/03/18	1003	26	2	APS									
2010/03/18	1003	21	2	APS									
2010/03/18	1003	31	3	砂場									
2010/03/19	1003	21	2	APS									
2010/03/23	1003	27	2	APS	7	NO2枠送り	チョコ停	13	4TR上で定盤ロ	定盤ローラー抜	定盤ボルト確認	3/25ボルト確認	1
2010/03/26	1003	21	2	APS	1	造型機	チョコ停	5	スピルサンド3過	朝一砂出し時ベ	ベルト状況確認	造型者	1
2010/03/26	1003	22	2	APS	2	反転機	チョコ停	2	上型反転①ウレ	ローラー回転、	点検強化で対	4月教育時予定	1
2010/04/06	1004	25	2	APS	5	重垂	チョコ停	11	重り確認近接不	重りのズレによ	対策案検討中		1

Little improvement should be made when repairing

Certainty of Quality Governing of Molten Metal

- Prevention from erroneous input of returned materials

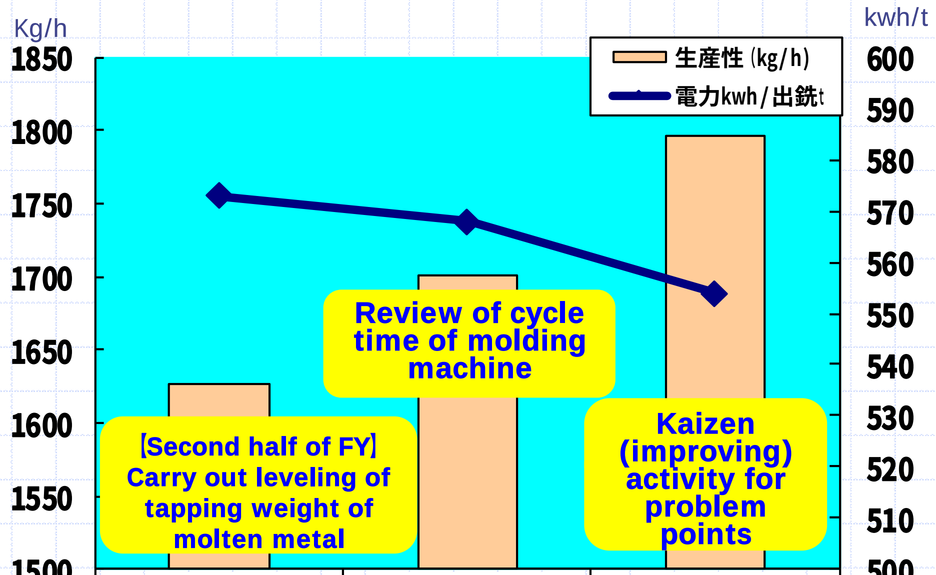




To put materials number on riser and runner
To double check with materials indication of each palette

Ishikawa Malleable CO.,LTD

Transition Graph Indicating Productivity and Melting Consumption



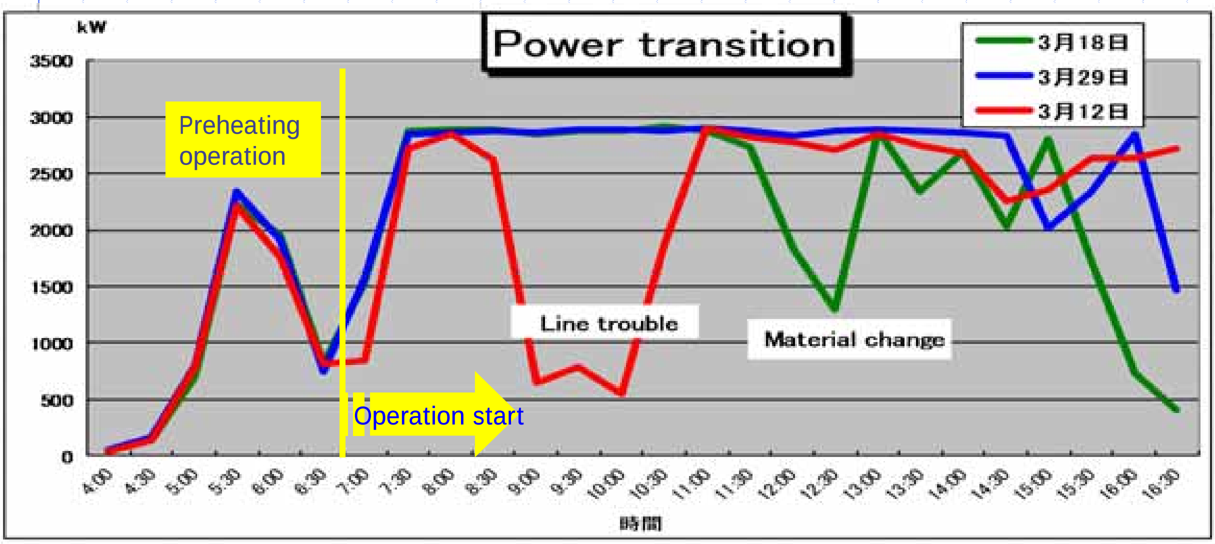
	FY2009	FY2010	FY2011
Productivity (kg/h)	1626	1701	1797
Power kwh/tap t	573	568	554

Ishikawa Malleable CO.,LTD

Graph Indicating Demand Transition per Day in East Factory

- Targeting constantly full-power operation

Year: 2013



Operating hours: 7: 00 - 16：00 (1 shift 8hrs)

- **Continuing operation without stopping even in lunch-time.**

Electric energy per tapping weight
March 18: 587.8kW/t (Material change / Trial manufacture)
March 29: 546.6kW/t (No material change)
March 12: 667.3kW/t (Line trouble)

~ Summary~

Ishikawa Malleable CO.,LTD

◆Electric furnace operation at the time of energy-saving operation

① Do not keep melting furnace warming, but tap immediately after temperature rising!

② Do not cool ladle by increasing each tapping weight as much as possible!

③ Make a system for working less line stops (equipment, quality, trouble)!

④ Improve final yield rate (sprue cup, casting plan, leaving iron, and reject, etc.)!

⑤ Do not stop lines even when taking a meal or break!

⑥ Increase tapping weights per day! Working in shifts.

⑦ Reconsider pre-heating operation! (electric furnace, ladle)

⑧ Check operating state daily and solve the problem immediately!

Ishikawa Malleable CO.,LTD

Thank you very much for your kind attention.

Energy Efficient Japanese Technologies and Best Practices

Overview of TERI-IGES project(s)

Rabhi Abdessalem
Sep. 25th 2014

About IGES: Outline

- **Name of the Institute**

The Institute for Global Environmental Strategies (IGES)

- **Establishment**

March 31, 1998

- **Location**

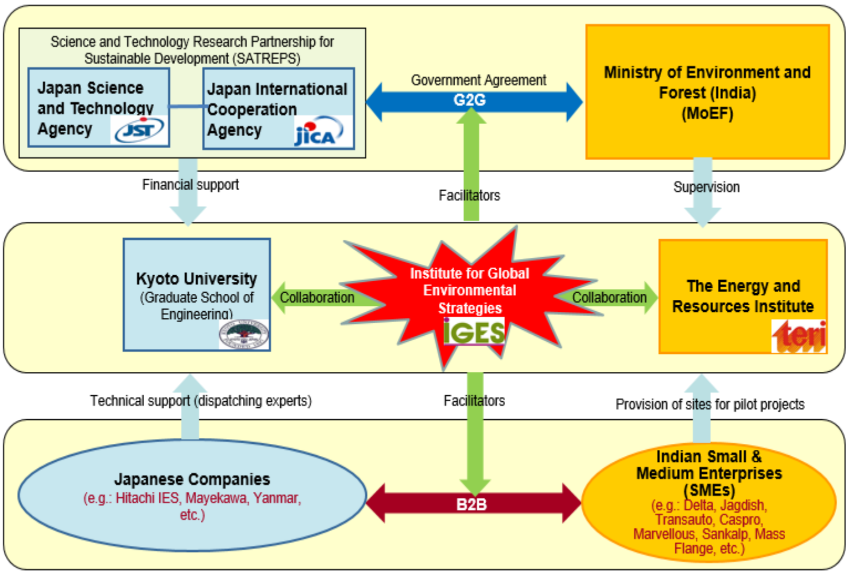
[Headquarters]: Hayama, Miura-gun, Kanagawa
[Tokyo Office]: Chiyoda-ku, Tokyo,
[Kitakyushu Office]: Kitakyushu-city, Fukuoka,
[Kansai Research Centre]: Kobe, Hyogo,
[Project Offices in Bangkok and Beijing]

IGES headquarters（Hayama, Kanagawa）

IGES-TERI main Objective

Research Application of low Carbon Technologies in India (ALCT)

ALCT Project: Research stakeholders



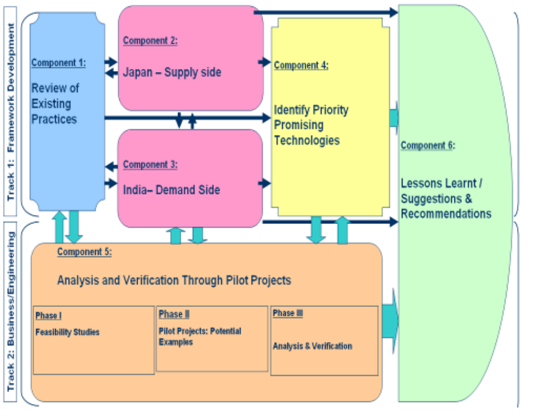
Overall objective

To promote the application of Japanese low carbon technologies at small and medium sized enterprises (SMEs) in India.

Duration: 4 years (May 2010 - March 2014)

Components

1- Review of existing practices;
2- Study and analyze technologies and relevant conditions of Japanese side;
3- Study and analyze needs of technologies and relevant conditions of Indian side;
4- Select the appropriate Japanese technologies to be applied in India;
5- **Analysis and verification through pilot projects implementation**
6- Draw lessons learnt from the project and provide suggestions and recommendations.



Summary of selected sites and pilot projects

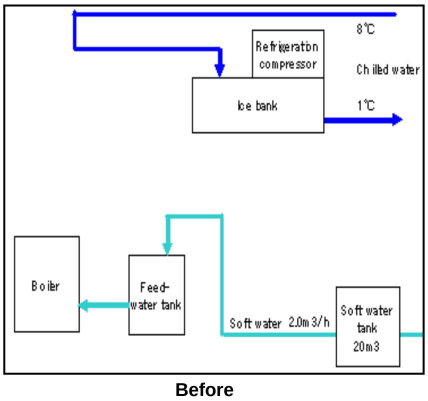
	Technology	Japanese Companies	Total number of investigated sites	Number of selected sites for pilot projects	Location of pilot projects	SME
Hard Technologies	Gas Heat Pump	Yanmar	11	2	Rajkot	-Delta Technocast -Jagdish Technocast
	Electric heat pump	Mayekawa	13	2	Anand	-Amul
					Chandigarh	-Milkfed
Best Practices (Soft technologies)	Compressed air system	Hitachi (IES)	13	4	3 in Pune; 1in Noida	-Sankalp -Transauto -Mass Flange -DIC
	Induction furnace	Expert from Kobe Steel	8	2	Kolhapur	-Marvelous Metals -Caspro Metal

Activities and Results

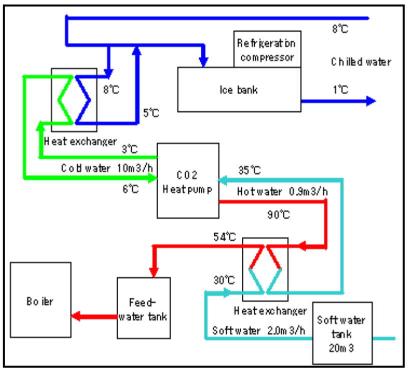
Results #1 : Demonstration of Electric Heat Pump (EHP)

❖ Application

- Preheating of boiler feed water & precooling of process chilled water
- Dairy, food processing, pharmaceutical, commercial buildings, etc.
- **Two pilot projects: 1 in "Milkfed" (Chandigarh) and 1 in "Amul" (Anand)**



Before



After

Results #1 : Demonstration of Electric Heat Pump (EHP)

❖ **Benefits**
- Reduction in fuel consumption of boiler and electricity consumption of chiller
- **Energy savings: 30%-40%**

Results #2: Demonstration of Gas Heat Pump (GHP)

❖ **Application**
- Space cooling applications in industry and commercial buildings
- **Two pilot projects: 1 "Delta" and 1 "Jagdish", both in Rajkot (Gujarat)**

Before **After**

Results #2: Demonstration of Gas Heat Pump (GHP)

❖ **Benefits**

- Switch from electricity to natural gas (NG)
- **Energy savings: 35%-45%**

Results #3: Best practices regarding compressed air

❖ **Application**

- **Four pilot projects: Transauto, Sankalp, and Mass flange (Pune), and DIC (Noida)**

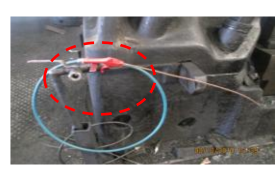
Examples of measures which have been taken by SME

Installation of new receiver and new air compressors (not inverter type)

Adjusting pressure setting

Reduce air leakage through installing foot switch

Reconsider pipe size and design



Start the use of efficient air gun

❖ **Benefits**

- **Energy Saving: 20% -30%**

Notes:
-SME have taken almost all the proposed measures in PS reports, except the installation of inveter type air compressor. Additional 10%-20% could be achived by installing inverter type air compressor.

Expected impact of installing inverter type air compressor

		Trans Auto	Iceburg	DIC India	Kansal	Sankalp	BOMBAY	CENTURY RAYON
Primary energy saving	Percentage	**17%**	**22%**	**15%**	**25%**	**17%**	**19%**	**17%**
	(KWh/year)	**53,196**	**96,624**	**99,360**	**135,360**	**223,994**	**84,230**	**79,076**
CO_2 emission reduction (ton/year)		**49.5**	**89**	**93**	**125**	**208**	**78**	**73**
Approximate pay back period		3 years, 3 months	4 years	3 years, 6 months	2 years, 6 months	3 years	3 years	3 years

Results #4: Best practices in electric induction furnace

- **Application**
  - **Foundry, sand casting units**
- **Observations**
  - Process parameters like product yield and rejection ratio have important influence on energy efficiency
  - Often data recorded is not linked to improvements in operation
  - Awareness on best practices among operators is not high
- **Major taken activities**
  - Onsite capacity building to SMEs, and Provide to them training material (in local language) on how to implement 3S/5S activities;
  - Training of Trainers (ToT) through training TERI experts, in India and Japan, on best practices so they can trainer SME later on.
- **Impact**

  Approximately, up to 20% have been achieved (based on TERI presentation)

Result 5#: Capacity building and awareness raising (level1)

❖ Targeting SME at unit level:

Onsite capacity building for managers and workers during site visits (in total, more than 50 sites visited)

Result5#: Capacity building and awareness raising (level2)

❖ Targeting SME at cluster/segment level

Several cluster workshops to introduce technology to business entrepreneurs and business associations

(in total 10 conducted)

IGES –TERI Joint Workshop
(Dec. 2011, Rajkot (India)

IGES –TERI Joint Workshop
Jan. 2012, Chandigarh (India)

Result5#: Capacity building and awareness raising (Level3)

- Targeting Indian experts:

Training workshops to Indian experts (In India and in Japan)

(in Total 3 (2 in India and 2 in Japan))

Result5#: Capacity building and awareness raising (Level4)

- Targeting Policy makers:

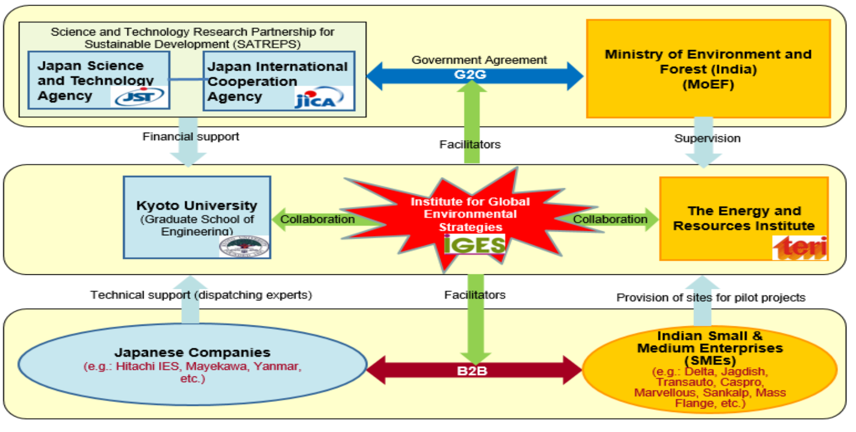
Interaction with policy makers through meetings, symposiums, etc.

IGES-TERI workshop
(Feb.2012 New Delhi- India)

India-Japan Energy Forum
(Sep.2013 New Delhi- India)

Summary of Major Achievements

Achievement1: A matchmaking processes with various stakeholders, including private sector, from India and Japan has been established; Most of them are ready to cooperate in the dissemination and follow up activities to be conducted in FY2014, and beyond



Achievement 2: Actual reduction in CO2 emission has been achieved;

Tech.	EHP		GHP		CA		IF	
Sites	Amul	Verka	Delta	Jagdish	Mass flange	Sankalp	Caspro	Marvello us
CO2 emission reduction	33%	40%	47%	43%	25%	30%	20%	20%

Achievement3: SAMEEEKSHA (Indian knowledge sharing platform) added IGES to its member list and has documented about the pilot projects repeatedly. check link:
http://sameeeksha.org/index.php?option=com_projects&task=level&title=iges&id=40

Achievement4: The implemented pilot projects have been widely covered by Indian media, **well evaluated by sponsors (A-)**, and had been disseminated at high level events such as India-Japan Energy forum, Delhi Sustainable Development Summit (DSDS); ISAP 2014, etc., which has attracted the interest of policy maker in India and Japan.
MOEJ (from Japan) and Shakti Energy Sustainable Energy Foundation (from India) are supporting the follow up activities which are taking place in FY2014.

ALCT project

Way forwards: Dissemination

Example of opportunities of scaling up the studied technologies

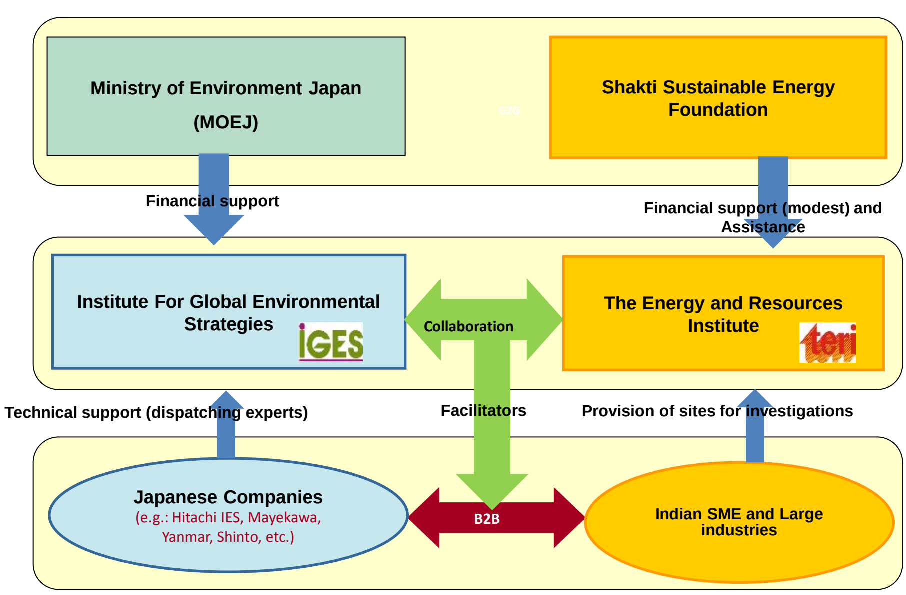
EHP: 50 Dairy Plants in just two states (Punjab and Gujarat).

GHP: 120 investment casting industries

CA: ~1200 forging units.

IF: More than 4,500 foundries in India.

Research stakeholders



Example of Programs to be used for dissemination and scaling up

Example of programs to be used for dissemination and scaling up

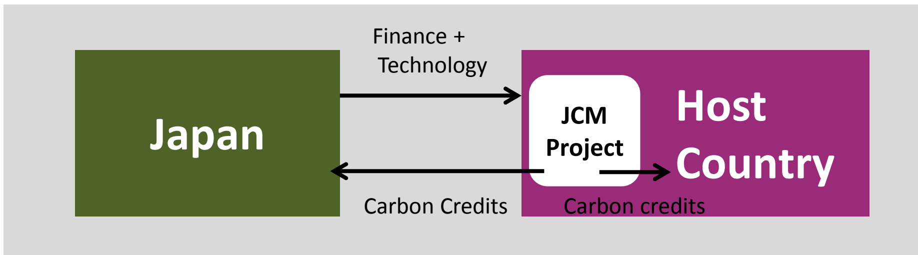
>E.g. of programs to be used for FS/DS and pilot projects (demonstration)

- MOEJ/GEC: **Joint Crediting Mechanism (JCM),**
- JICA: **Public Private Partnership (PPP),**
- ADB-UNEP-GEF: **Climate Technology Network and Finance**
- UNIDO-GEF:

>E.g. of programs to be used for commercialization (deployment & diffusion)

Examples of program from Indian side	• **Financial support through SIDBI** **-Technology Upgradation Fund for textile (TUFS)** **-Technology and Quality Upgradation Support to MSMS (TEQUP)** -**Credit Linked Capital Subsidies Scheme (CLCSS)** **-FPTUFS-scheme for food processing industries** • BEE can introduce these technologies to the designated consumers (DCs), who are identified under **PAT scheme, or by** exempting these technologies from import tax under the **FEEED** program. • **Energy Service Companies (ESCO)**
Examples of program measures by Japanese side	• **JBIC** : through their crediting J-MRV program. • **MOEJ: Joint Crediting Mechanism (JCM) (if signed)** • **Japanese makers**: Joint venture, Licencing, FDI
Others	**SAMEEEKSHA, LCS-RNet, LoCAR-Net, UNEP (CTCN),** are important channels through which these technologies could be deployed in India, whether through their funding options or through their information and knowledge dissemination activities to a wide range of stakeholders.

Japan: JCM mechanism



Benefits to Japan

- Contribution to the global GHG mitigation effort
- Market opportunities for Japanese firms

Benefits to host country

- Advanced Japanese technology made available at significantly lower cost
- Reduced fossil fuel dependency

Range of upfront financing for JCM

- **Global Environment Centre (GEC)**

Finances up to **50%** of the initial investment cost.

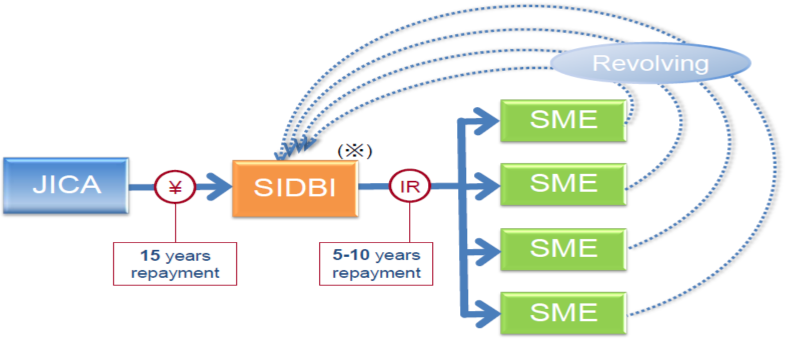
- **New Energy Development Organisation (NEDO)**

Provides full initial finance, and installed facilities are purchased by project participants at later stage.

- **Japan Bank for International Cooperation (JBIC)**
  - Co-financing with Japanese private bank to JCM projects.

- **Nippon Export and Investment Insurance (NEXI)**
  - Provision of trade insurance to JCM projects to cover risks (e.g. non-payment, shipping failure);

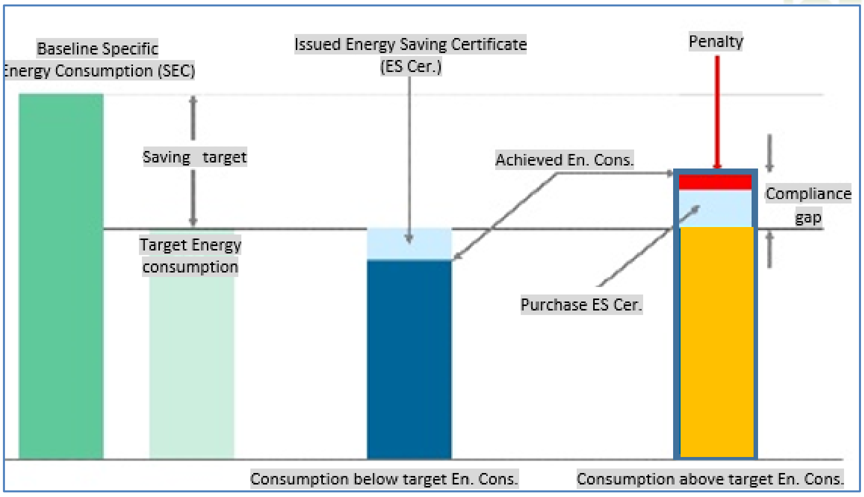
India: Financial support through SIDBI, such as TUFS, TEQUP, etc (SMEs)



(※)
SIDBI: Small Industries-Development Bank of India

Note:
Technologies should be included in list of technologies eligible of SIDBI finance

India: PAT Mechanism (Large industries)

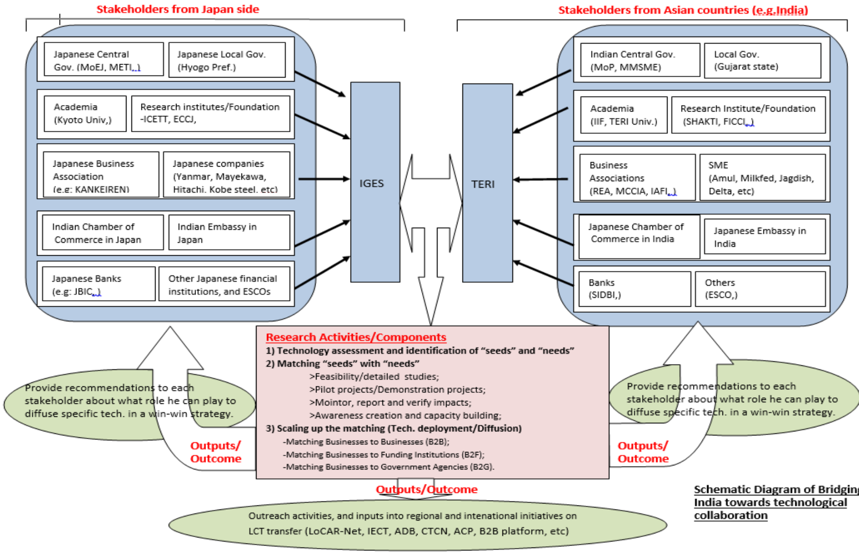


Note:

Only companies in the following sector are considered:
Cement, Power, Aluminium, Textile, Pulp and paper, Fertilizer, Iron and steel, Chlor-Alkali

Way forwards: 2015 and beyound

Creation and strengthening of cooperation among various stakeholders from India and Japan to promote low carbon technology application in India, especially through engaging private sector and funding institutions.



Schematic Diagram of Bridging Japan-India towards technological collaboration

IGES

Thank you for you attention

Exchange Between Japan and India

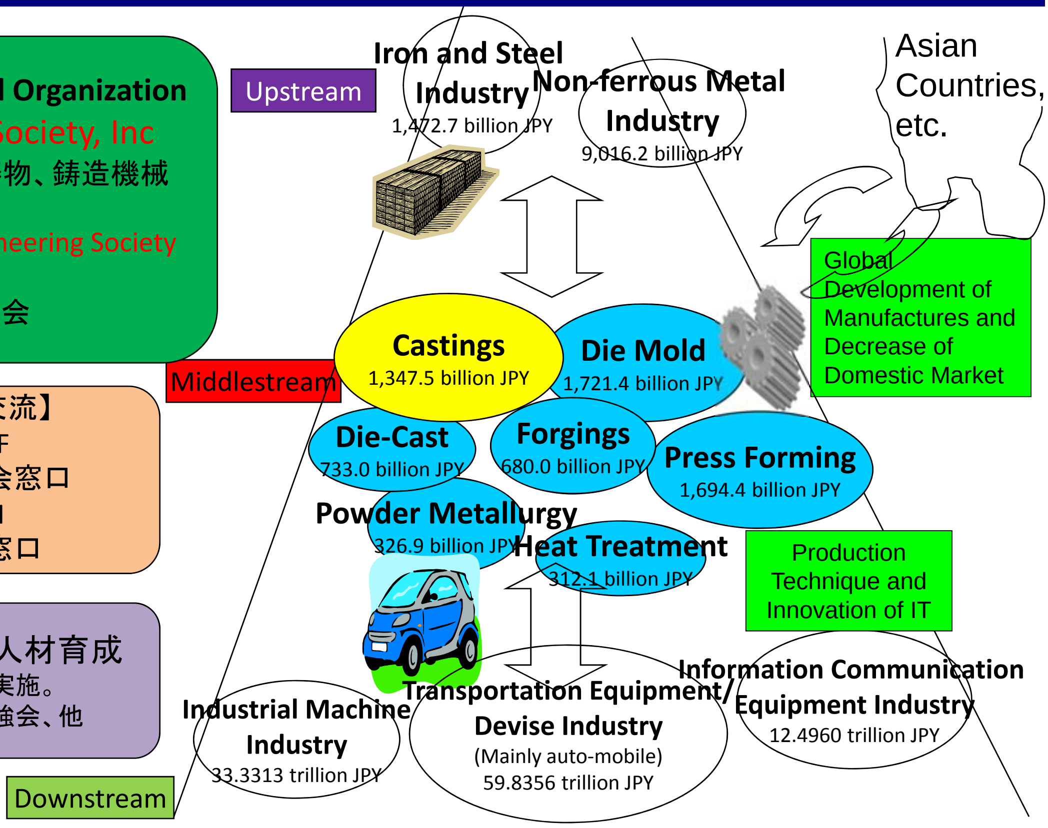
September, 2014
Junichi TAKEUCHI
Adviser, Sintokogio. Ltd.
Chief of editorial committee of journal, Japan Foundry Society, Inc.

Current State Analysis for Formed and Fabricated Materials Industries

○ Casting-related Organization
Japan Foundry Society, Inc
（可鍛鋳鉄、非鉄鋳物、鋳造機械工業会も統合）
Japan Foundry Engineering Society
Sokeizai Center
日本ダイカスト工業会
日本鋳鍛鋼会

【海外との交流】
●学会：　WFC、AFF
　日本鋳造工学会窓口
●産業界：　IFF、ICI
　日本鋳造協会窓口

「鋳造カレッジ」人材育成
は両団体が協力して実施。
年数回の講演会、勉強会、他



引用資料：出荷額は平成18年工業統計【概要版】 従業者4人以上の事業所に関する統計表より

Exchange Between Japan and India

- Participation in exhibitions of IIF
- Introduction of World Congress of Investment Castings (2011; Kyoto, Japan)
- Factory (Foundry) tours in each country
- Exchange through GIFA, Metal China, and AFF etc.
- World Foundry Congress 2016 (Nagoya, Japan)
- Japanese company in India, Sintokogio. Ltd.
- Mutual merits but not one-way relationship, win-win relations

Annexure 3: Selected photographs of the event