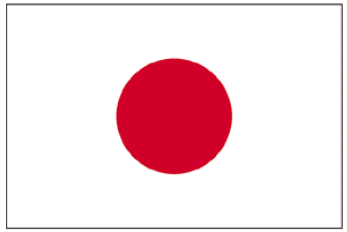
S1-1

EMAK9 : The 9th Workshop of Energy Management Action Network (EMAK9) under IPEEC
Outline and Outcomes of the "Japan – Brazil Cooperation Project"



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1. Project and Background

Japan – Brazil Cooperation Project for EC

(1) Established in FY 2015 between Ministry of Industry, Foreign Trade and Services of Brazil (MDIC) and Ministry of Economy, Trade and Industry of Japan (METI) under the "Smart Community Working (WG)"

(2) Completed in March 2018.

Purpose

To Establish the Energy Efficient Basis with "Demand Management" and "Demand Response", Especially for "Peak-cut and Saving of Electric Power"

Abbreviation :
EC (Energy Conservation), EE&C (Energy Efficiency and Conservation)

Process to Have Established the Japan – Brazil Cooperation Project for Energy Conservation

(1) Brainstormed in Inception Workshop in Japan (Feb. 2014)
(2) Studied by METI-ECCJ to Develop Proposed Project
(3) MDIC-METI Seminar in Brasilia to Discuss "Proposed Project" (May 2014)
(4) 2nd Japan-Brazil Smart Community WG Meeting in Tokyo to Establish the Project (Sept. 2014)

Project on "Peak-Cut and Saving of Electric Power"

Significance

- Measures & Management Required for "Smart Grid / Community"
- Met Brazilian Situations of Electricity (76% Is Shared by Hydro Power Affected by Climate Change)
- Application of Japanese Experience after the Big Earth in 2011

Inception Workshop in Japan (*) to Direct Japan - Brazil EC Cooperation (Feb. 13th – Feb. 20th, 2014)

(*) BEC BR3

Outcome

1. Established "Smart Network" Between Brazil and Japan

Key Persons from 4 Brazilian Ministries and Governmental Organizations

2. Identified Possible Cooperation Based on Useful Inputs by METI-ECCJ

Lectures, Exchanges and Visits to Best Practices & Smart Community

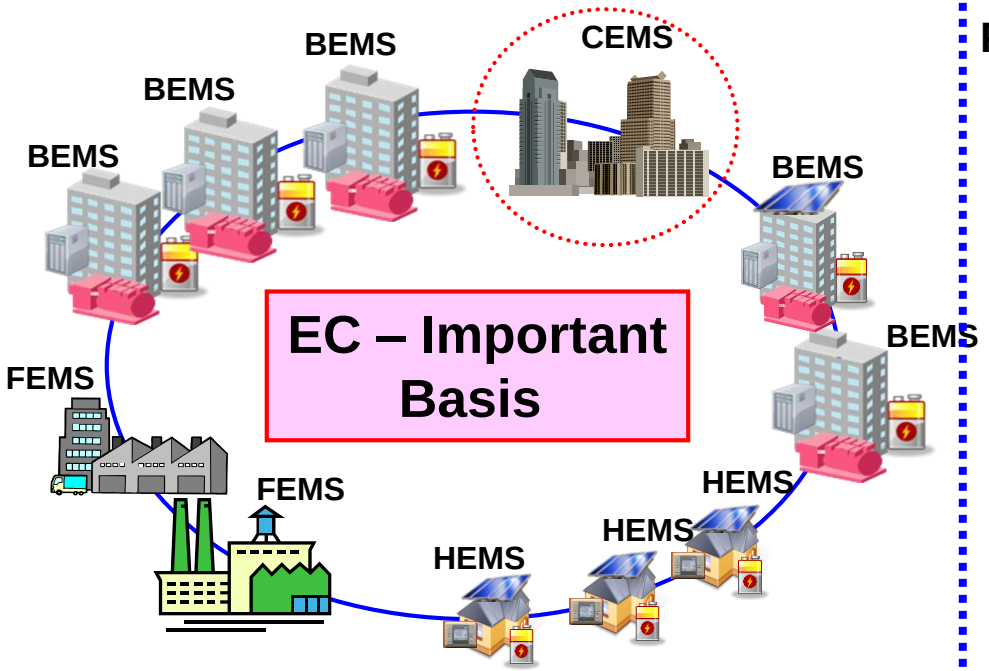
Workshop in Japan (BEC BR4) to Kick-off Japan - Brazil EC Cooperation Project (January 2015)

- **Participants : 11 Key Persons from Brazilian Organizations**

Outcome

1. Organized “Steering Taskforce” (Members from Public & Private Sector)
2. Finalized “Basic Plan of The Program and Developed “Action Plan”
3. Started Preparation for Implementing Activities in Brazil

Points of EC Cooperation Project – Basic Scope



EC – Important Basis

With Systematic Management of Operation in Each Factory / Building

Smart System

EnMS : Energy Management System
EE&C : Energy Efficiency and Conservation
CEMS : Community Energy Management System
BEMS : Building Energy Management System
FEMS : Factory Energy Management System
HEMS : Home Energy Management System

Policy/Law System to Promote EE&C

Step – 1 Build Foundation

- Establish EnMS for Each Factory / Building (Inc. "Management Standard" etc.)
- Implement Good EM Practices & introduce Effective Equipment / Technologies under EnMS

Step – 2 Establish / Manage Single Systems

- Systematized Individual Management by FEMS, BEMS

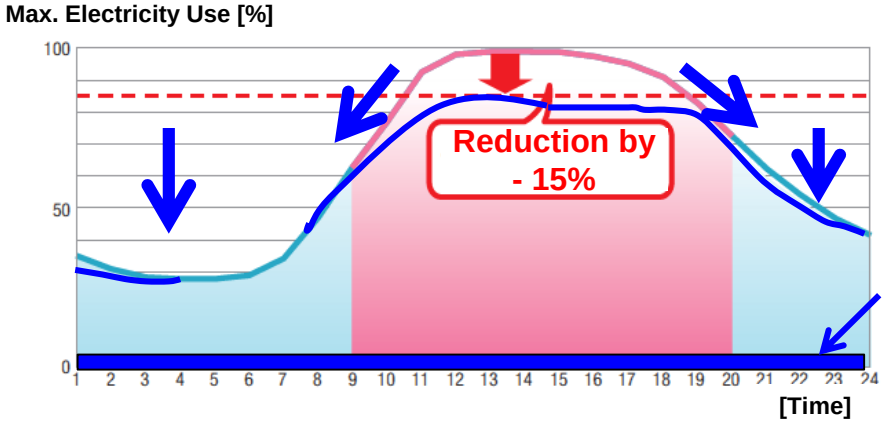
Step – 3 Integrate Systems

- Integrated Management by CEMS

Key : Demand Management / Demand Response

Points of EC Cooperation Project – Basic Solutions

Peak-cut & Saving of Electric Power : Basic Solution & Measure



Shift & Shave

Cut Fixed Energy

(Solution – 1)

By Energy Management System

1-1. Operation / Maint. Considering Cost
(1) Operation in Off-Peak Time & Days
(2) Maintenance to Keep Efficiency
(3) Control to Improve Productivity and Loss Reduction (Stop Idling etc.)
1-2. Systematization of Measures with Using EM Tools Such as Database

(Solution – 2)

By Introducing Efficient Process/Equipment

2-1. Change in Energy Use
(1) Ice Storage AC, PV Cells & Battery / Solar Heater
(2) Regenerative Burner (from Elect. Heater), etc.
2-2. High Efficiency Equipment / Process
(1) Heat Pump – Inverter AC and LED Lighting
(2) Cogeneration / Waste Heat Elect. Generation
(3) VSD (VVVF), Efficient Transformers / Motors, etc

(Solution – 3)

By Enhancing Public Awareness

3-1. Simple Electricity Saving Manual
(1) Showing how to Change Way of Use, Setting Values, Life Style with Merits
3-2. Purchasing Efficient Appliances
(1) Labeling with Values of Effects/Merits

(Solution – 4)

By Introducing Managing and Controlling System of Power Demand

4-1. FEMS, BEMS and HEMS with Demand Controller with Good Guidelines for Operation

2. Outline of Project (1)

1. Name of Project

Project on Peak-cut and Saving of Electric Power

2. Expected Effects

Through Establishing Energy Efficient Basis with “Demand Side Management” and “Demand Response” in Brazil,

(1) To Secure 1) Stable, Efficient and economical Supply of Electric Power / 2) Efficient Use - Lower Demand of Power

(2) To Realize the Sustainable Development through Items (1)

3.Duration

January 2015 – March 2018 (For Approx. 3 Years)

2. Outline of Project (2)

4. Counterpart

Ministry of Development, Industry and Foreign Trade (MDIC)
with Cooperation from Ministry of Mines and Energy (MME)

5. Sub-Programs

(Program-1)
Establish and Disseminate Showcase Energy Management System (EnMS) Based on ISO 50001

(Program-2)
Establish and Improve the Legal Framework on Energy Management and Support System to Promote EE&C

(Program-3)
Develop and Disseminate Tools for Electricity Saving

EC Cooperation Project – Programs for Solutions

Peak-cut and Saving of Electric Power : Key 3 Sub-Programs

Specifics of the 3 "Programs" to Have Achieved the Solutions

(Program-1) Establish and Disseminate Showcase Energy Management System (EnMS) Based on ISO50001 and Best Practices in EE&C

- ♦ Establish Showcase EnMS in the Cooperating Factories (With Cooperation by CNI etc.) (Including Introduction and Utilization of Energy Management Tools (Energy-Material Balance & Cost Management Database, Portfolio Analysis, EC Guideline and Energy Management Standard etc.)
- ♦ Implement EC Measures including Projects Identified in Practicing EM under EnMS
- ♦ Realize EC Best Practices to Develop Guideline to Introduce Effective Technologies
- ♦ Disseminate Showcases of EnMS and EE&C Best Practices (Led by MDIC)

(Program-2) Establish / Improve Legal Framework on EM etc. and Support System

Organize Working Group to Prepare Proposals on the Following (Led by MME)

- ♦ Legal Framework for "Energy Management"
- ♦ Supporting / Incentive System to Introduce Equipment / Appliances Effective for EC, Considering Those Identified in Program-1

(Program-3) Develop "Action Guidebook" for Saving and Peak-cut of Electricity

Organize Working Group-2 to Prepare the "Action Guide" for Factories etc. (Led by MDIC) (As Per EC Guideline)

Workshop in Japan (BEC BR5) for Harmonized Implementation of the "Project" (January 2016)

- **Participants : 12 Key Persons from Brazilian Organizations**

Outcome

1. Established Basic Implementation Plan of Each Organization
2. Started Preparation for Specific Activities of Each Organization

3. Concept of Project : Program-1

Requirement of ISO 50001

Pilot Program To Establish Energy Management System

4	Energy Management System Requirements
4.1	General Requirements
4.2	Management Responsibility
4.2.1	Top Management
4.2.2	Management Representative
4.3	Energy Policy
4.4	Energy Planning
4.4.1	General
4.4.2	Legal and Other Requirements
4.4.3	Energy Review
4.4.4	Energy Baseline
4.4.5	Energy Performance Indicators
4.4.6	Energy Objectives, Energy Targets & Energy Management Action Plans
4.5	Implementation and Operation
4.5.1	General
4.5.2	Competence, Training and Awareness
4.5.3	Communication
4.5.4	Documentation
4.5.4.1	Documentation Requirements
4.5.4.2	Control of Documents
4.5.5	Operational Control
4.5.6	Design
4.5.7	Procurement of Energy Services, Products, Equipment and Energy
4.6	Checking
4.6.1	Monitoring, Measurement and Analysis
4.6.2	Evaluation of Legal Requirements and Other Requirements
4.6.3	Internal Audit of the Energy Management System
4.6.4	Nonconformities, Corrections, Corrective and Preventive Actions
4.6.5	Control of Records
4.7	Management Review
4.7.1	General
4.7.2	Input to Management Review
4.7.3	Output from Management Review

P-D-C-A Cycle

To Establish EnMS Showcases at Cooperating Companies in Energy Intensive Industries

Energy Management (E.M.) Tools

Participation by Companies

Energy-Material Balance & Cost Management DB

Portfolio Analysis

"Standard of Judgment"

Pilot EC Projects (To Prove Functions of EnMS)

Energy Management Standard

Manuals for Operation etc.

Advice etc.
- Activity on Site
- Workshop in JP

Cooperating Companies

Dissemination

Showcase Energy Management System

EC Best Practices Measures / Technologies

Larger EC Effects

MDIC, CNI etc.

3. Points of Project : Program-1

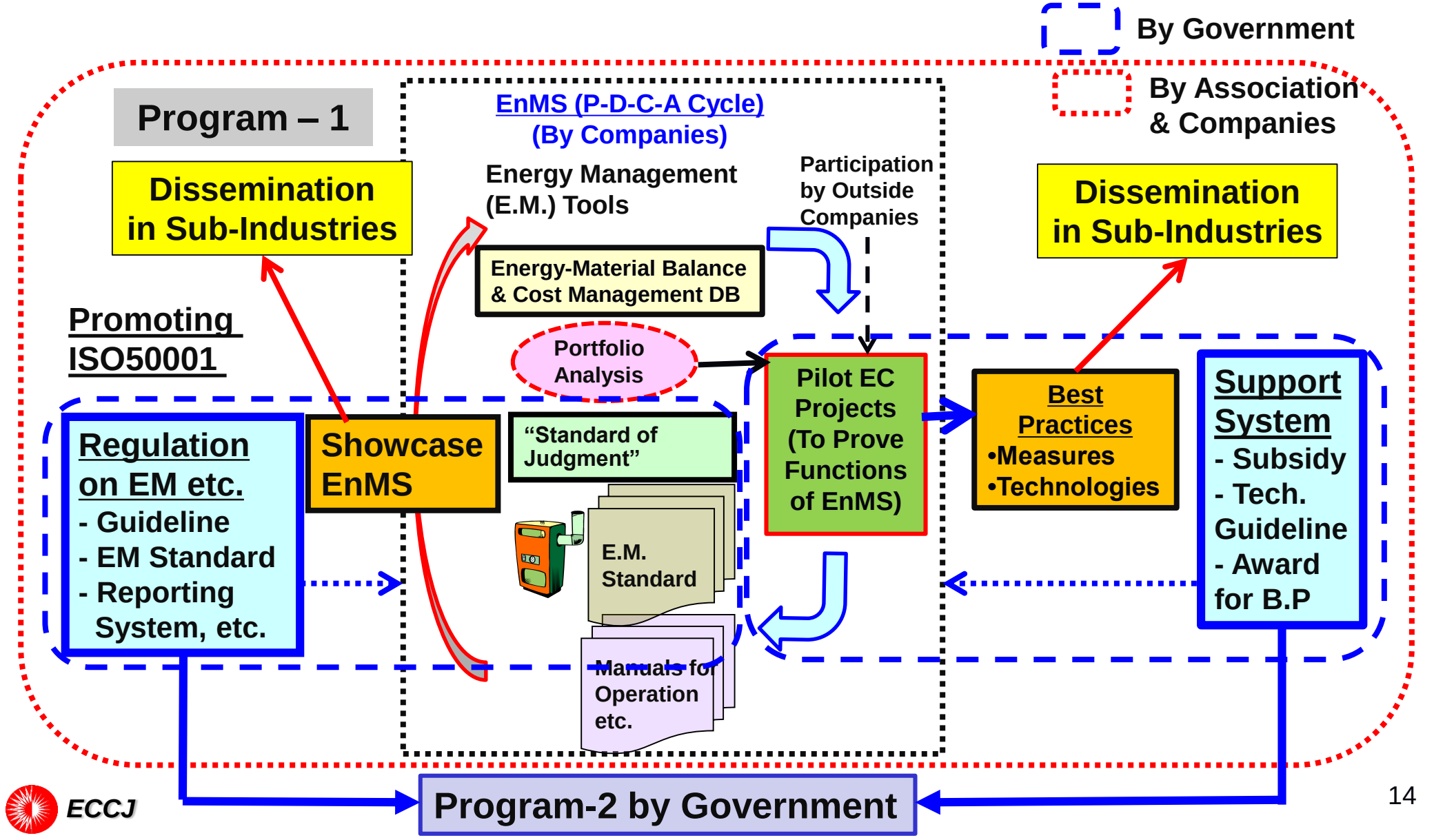
(1)Cooperating Companies – Finally 4 Companies
(2) Utilize / Refer to EM Tools Developed by ECCJ
- **Template to Develop Plan to Establish EnMS**
- **Energy, Material and Cost Management Database**
- **EC Gudelines, EM Standard and Analyses (Portfolio Analysis etc.)**
- **Report to Compile Important Data / Information to Diisseminate**

(3) Systematize / Implement Identified EC Measures to Prove EnMS Performance
(4) Disseminate by MDIC etc. Using "Reports"

4 Cooperating Companies (Featured by International / Conglomerate)

No.	Name of Company	Sub-Industry	Remarks
1	General Motors do Brasil Ltda.	Automobile Manufacturing	
2	Novelis do Brasil Ltda.	Aluminum Products Manufacturing	
3	Votorantim Cimentos	Cement	
4	Votorantim Metais	Zinc Metal Refining	Current Nexa Resources
	Company P	Textile	Declined in FY 2015
	Company F	Food Processing	Declined in FY 2016

3. Concept of Project : Program-2 Tied with Program-1



3. Points of Project : Program-2 (Reference)

	Industry Sector	Consumer Sector		Transportation sector
		Commercial Sector	Residential Sector	
Reference – Basic Structure of Energy Conservation Act (Japan)	✓Energy Management System (Energy Manager / Periodical Reports / Standard of Judgment by BusinessOperators (about 15,000) with 1,500 or more kl/y of Energy Consumption ✓Target Reduce Energy Unit Consumption by 1% / year / Achieve Benchmarks	✓Energy Efficiency Standards for Buildings and Houses (Floor Area of 300m^2 or more) ✓Top Runner Standard (Standard and Labeling) For Home Appliances, Equipment, Automobiles etc., 29 Items in Total (Managing 70% of Household Energy Consumption)		✓Periodical Reports by Freight Carriers and Consigners ✓ Efforts to Reduce 1% /y of Energy Unit Consumption

Combination – Regulation and Support

Supporting System | **Subsidy / Low Interest Loan / Tax Incentive to Promote EE&C**

3. Concept of Project : Program-3 Tied with Program-1

Comprehensive “Action Guide”

Check List : Recommended Measures and Effects

Electricity saving actions

Electricity Saving M… for Summer

(For Business Operators)

Tohoku, Tokyo, Chubu, Hok…
Kansai, Chugoku, Shikoku, K…

(1) Request for cooperation in implementing electricity saving for this su…

(2) Features of electricity demand in summer

(3) Examples of electricity saving menus by business type

- Office buildings
- Wholesale/retail stores (department stores, drugstores, etc.)
- Food supermarkets
- Medical institutions (hospitals, clinics)
- Hotels, inns
- Restaurants (family restaurants, drinking establishments, etc.)
- Schools (elementary, junior high and high schools)
- Manufacturers

Sample description

(Reference) Electricity Saving Manual (Japan)

April, 2013

Ministry of Economy, Trade and In…

21 Manufacturers

** As the form of electricity use by manufacturers greatly varies depending on the business type, the electricity saving ratio is described for each equipment below.*

		Electricity saving effect of each machine and equipment	Implementation check
Electricity saving menu for production equipment			
	- Certainly switch off electric equipment which is not used or in a stand-by state and prevent revolving machines such as motors from revolving idle.	-	
	- Strengthen thermal insulation of electric furnaces, electric heaters, etc. (Electricity saving effect: If heat retention is applied to)	7%	
Electricity saving menu for utility equipment			
	- Reduce the supply pressure of compressors by reviewing the pressure of the user side. (Electricity saving effect: If the pressure is reduced by 0.1 MPa for a single unit)	8%	
	- Lower compressor’s air-taking temperature (to match the room temperature of the installation place with outside temperature). (Electricity saving effect: If the air-taking temperature is lowered by 10℃ for a single unit)	2%	
	- Control the number of compressors, pumps and fans according to load. (Electricity saving effect: If the peak load is 60% to 80% in a 5 compressor system)	9%	
	- Review the operation method for pumps and fans with inverter function. (Electricity saving effect: If the total pressure becomes 80% as a result of using the inverter function by confirming and adjusting the open/close state of valves)	15%	
	- Reduce the motive power of turbo chillers, heat pumps, etc. by setting the cold water outlet temperature of chillers high. (Electricity saving effect: If the temperature is changed from 7℃ to 9℃ while confirming the state of the user side)	8%	
Electricity saving menu for general equipment (lighting, air conditioning, etc.)			
Lighting	- Certainly turn off lights of unused areas.	-	
Lighting	- Change incandescent lamps to bulb type fluorescent lamps or LED lamps. (Electricity saving effect: If incandescent 60 W lamps are changed to (1) bulb type fluorescent lamps or (2) LED lamps)	(1) 76% (2) 85%	
Air Condi-tioning	- Set the factory temperature to 28℃ (or slightly higher than 28℃ considering the indoor environment such as ventilation) (Electricity saving effect: If the room temperature setting is raised by 2℃)	6%	
Air Condi-tioning	- Reduce the power for ventilation or heat load by adjusting outside air to be taken. (Electricity saving effect: If the outside air taken is reduced by 30% by intermittently operating or stopping ventilation fans)	8%	
Air Condi-tioning	- Remove obstacles placed around outdoor units and avoid direct sunlight. (Electricity saving effect: If a bamboo blind is hung over an outside unit affected by sunlight)	10%	
Other electricity saving menus			
Others	- Introduce a demand monitoring system to implement prescribed electricity saving measures when there is a warning.		
Others	- Reduce loss by appropriately and periodically implementing maintenance of equipment and machinery.		
Under-standing of electricity saving	- Appoint personnel in charge of electricity saving and implement follow-up meetings and electricity saving patrols involving managers (president, factory managers) and all related departments.		
Under-standing of electricity saving	- Provide employees with information on the necessity and method of electricity saving in homes.		
Control of electricity peak by shifting the operation of motive power for production			
Operational shift	- Shift the start of production motive power to time which is before the time zone for electricity saving.		
Operational shift	- Adjust the time for office work, etc. to shift the electricity peak.		
Operational shift	- Peak adjustment based on supply and demand adjustment contract (price incentive), use of private power generation, operation shift, etc.		

* Note
- The above-mentioned electricity saving effects are estimated ratio of electricity saving effect in the electricity consumption of each machine and equipment. Therefore, the effect may differ depending on the state of equipment, the state of use, etc.
- As regards the air conditioning, electric air conditioning is being assumed.
- Take care that actions do not become irrelevant in respect of health and hygiene, safety and management because of excessing consciousness of electricity saving.

21

Actions Based on “EC Guideline”

3 Electricity saving menu

Please check the items you can implement in your home and implement the electricity saving by aiming at the following values estimated as fixed electricity saving.

Tohoku Electric Power area	▲3.8%	Tokyo Electric Power area	▲10.5%	Chubu Electric Power area	▲4.0%
Kansai Electric Power area	▲8.7%	Hokuriku Electric Power area	▲4.0%	Chugoku Electric Power area	▲3.6%
Shikoku Electric Power area	▲5.2%	Kyushu Electric Power area	▲8.5%		

* Compared with FY2010

Basic 10 electricity saving menus		Electricity saving effect (Saving ratio)	Check
Air conditioners	(1) Try to make the room temperature 28℃. (If the setting temperature is increased by 2℃)	10%	
	(2) Mitigate the sunlight coming through windows by using blinds or bamboo blinds. (Electricity saving of air conditioner)	10%	
	(3) Turn off air conditioner in an affordable way and use fans.	50%	
	* Note that dehumidification run or frequent on-off operation results in the increase of electricity consumption.		
Refrigerators	(4) Change the setting from “strong” to “medium”, reduce the time when the door is opened and do not fill the refrigerator with too much food. * Be careful of perishable food.	2%	
Lighting	(5) Turn off unnecessary lights in daytime.	5%	
Televisions	(6) Set the energy saving mode, lower the brightness and switch off when not used. * In case the mode is changed from the standard to the energy saving and the time to watch is reduced to two thirds	2%	
Warm water washing toilet seats	(7) Use the warm water off function and the timer electricity saving function.	Less than 1% in either case	
	(8) If there are no above-mentioned functions, take out the plug from the outlet when not used.		
Jar rice cookers	(9) Cook the amount for a whole day early in the morning, using the timer function, and store the cooked rice in a refrigerator or freezer.	2%	
Stand-by electricity	(10) Turn off the main power supply of the main body instead of the power supply of the remote control. Take out the plug from the outlet if not used for a long time.	2%	

For people who are out during daytime

Please implement electricity saving of (4) refrigerators, (7) warm water washing toilet seats and (10) stand-by electricity during daytime.

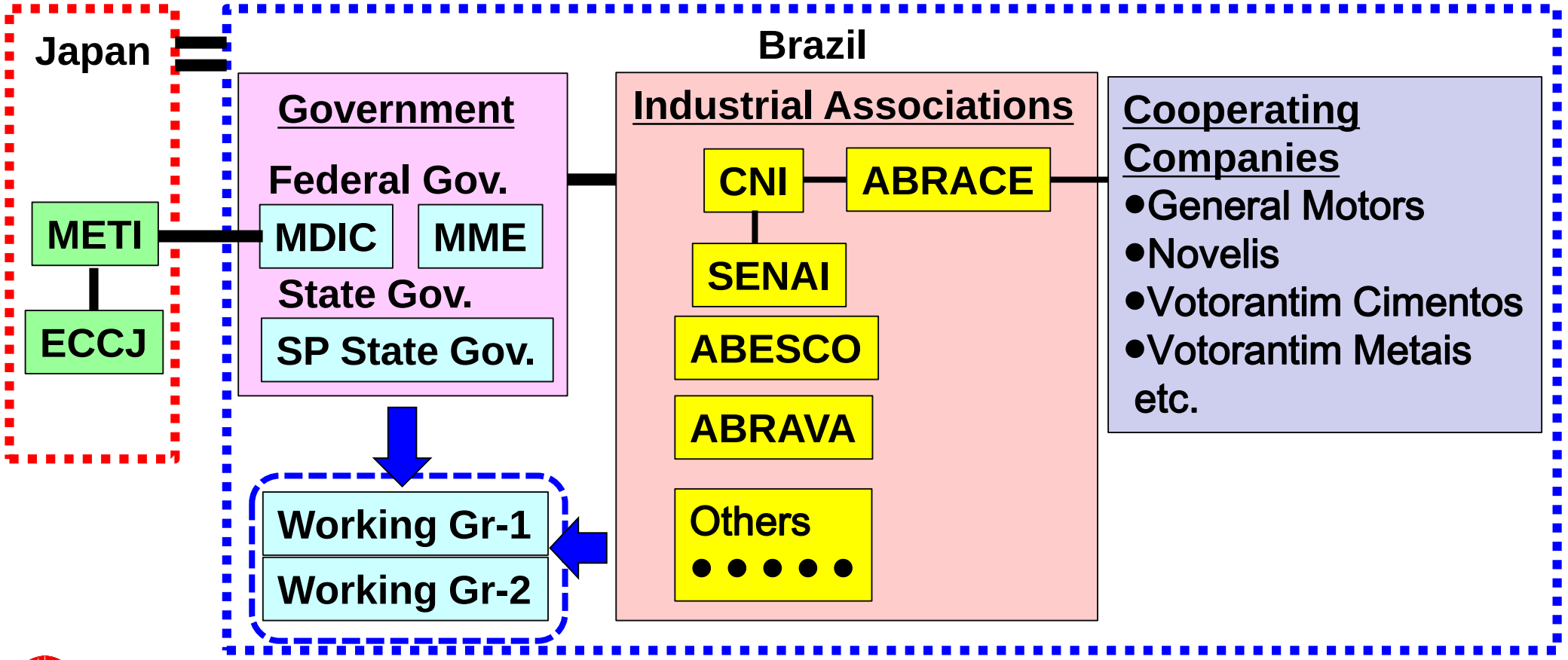
Estimation by Agency for Natural Resources and Energy: Reference saving ratio in the maximum use (approximately 1,200 W) in daytime of homes where people are in.

Actions Based on “EC Guideline”

ECCJ

4. Achievements of Project : Functional Group for EC

Established The Effective and Functional Group to Promote EC in Brazil, Involving the Concerned Public and Private Organizations through Joint Implementation of The Project.



4. Achievements of Project : Program - 1

(1) Established Showcase EnMS by the 4 Cooperating Companies "General Motors", "Novelis do Brasil", "Votorantim Cimentos" and "Votorantim Metais"

- Large Impact to Prove Effectiveness of EnMS
  ← EnPIs Improved by 2%-36% Regardless of Recession Experienced
- Featured Policy to Globally Develop Established EnMS
  → Expectation of Larger Benefit
- Customized Application of Useful EM Tools Prepared by ECCJ
  ← Energy-Material-Cost Management Database / Standard Roadmap to Establish EnMS / EC Guidelines - EM Standard / E.E Targets etc.

(2) Dissemination Kicked off by 1st Dissemination Workshop

- Shared Showcased EnMS and EC Best Practices with Participants
- Used "Report" (Formated by ECCJ) Prepared by the 4 Companies
- Preparing Database to Compile Summary of "Report" → MDIC's Web.

(3) Strategic Transfer of "Program-1" to "Alliance Program" by CNI

- CNI Developed "Alliance Program" Consistent with Program-1.

EnPI : Energy Performance Indicator / EE : Energy Efficiency

Impacts of EnMS Established by the Cooperating Companies (Summary : Data of EnPI Given by "Report" for Dissemination)

Company	Baseline			Actual Results		Effect
	EnPI	Year		Year		
General Motors do Brasil Ltda	MWh/unit Kg-CO_2/unit	No Info.	1.25 308	No Info.	1.05 198	16% 36%
Novelis do Brasil Ltda	GJ/Sales Metric-ton	FY 2015	9.45	FY 2018	9.04	4.3%
	kWh/N-ton Nm^3/N-ton	Oct. 2015	134.32 30.63	Mar. 2017	131.85 30.71	1.8% -0.3%
Votorantim Metais	ton-CO_2eq/t	No Info.	0.834	No Info.	0.819	1.8%
Votorantim Cimentos	CO_2 (Mton/y) MJ/t-clinker) Fossil Fuel (%)	2014	27.7 3495 90.7	2016	23.7 3475 88.2	14.4% 0.6% 2.8%

EnPI (Energy Performance Indicator)

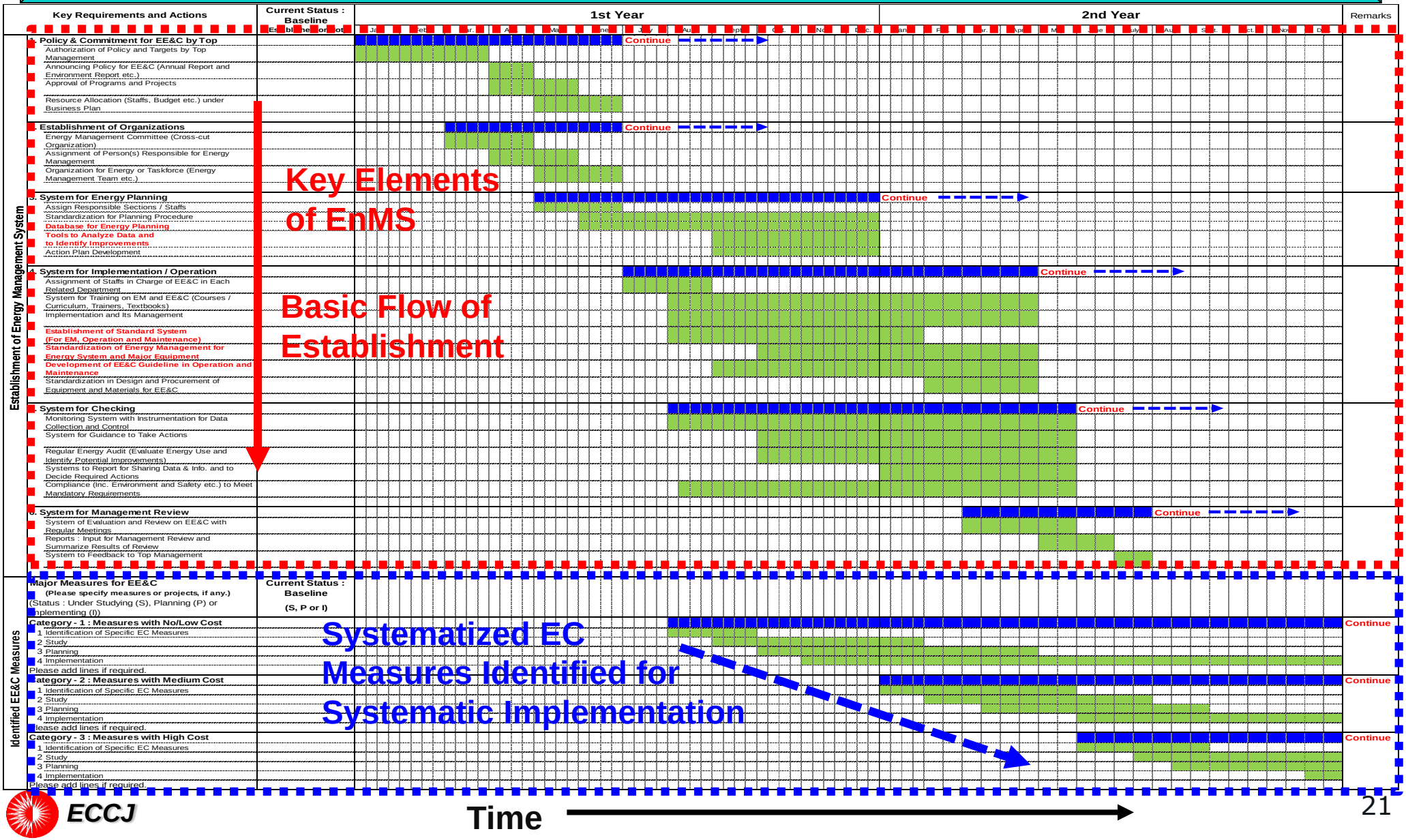
Summary of Typical EC Measures Identified / Implemented (From "Report" Submitted by the Cooperating Companies)

Energy Conservation Measures Identified / Implemented		EC Guideline
Optimization of Energy Utility System	Improvement in Metering	General
	Fuel Switching (Natural Gas ← Oil etc.)	#1
	New Fuel System (Biomass for Boiler)	#1 & #3
	Addition of PV System	#1
Improvement in Combustion / Heating	Installation of Automatic Combustion Control	#2
	Temperature Control for Heating Crucible etc.	#2
Improvement in Waste Heat Utilization	Maintenance System of Regenerator	#3
	Installation of Heat Exchangers for Furnaces	#3
Prevention of Heat Loss	Repairing Lining of Furnaces	#5-1
Application of Variable Control of Flow / Speed	Flow Control Applied for Exhaust Fans of Furnace	#6
	Control of Flow & Operation for De-dusting System	#6
	Control of Air Ventilation Fan for Mining	#6
Improvement in Compressed Air System	prevention of Leakage / Improved Maintenance	#5-2, General
	Optimized Operation of Compressors	#5-2
	Control of Distribution of Air	#5-2
	Replacement with More Efficient Compressors	#6
Process Specific Improvement	Improvement in Electrolysis (Zinc Metal Refining)	#6
	Improvement in Grinding Mill (Cement)	#6

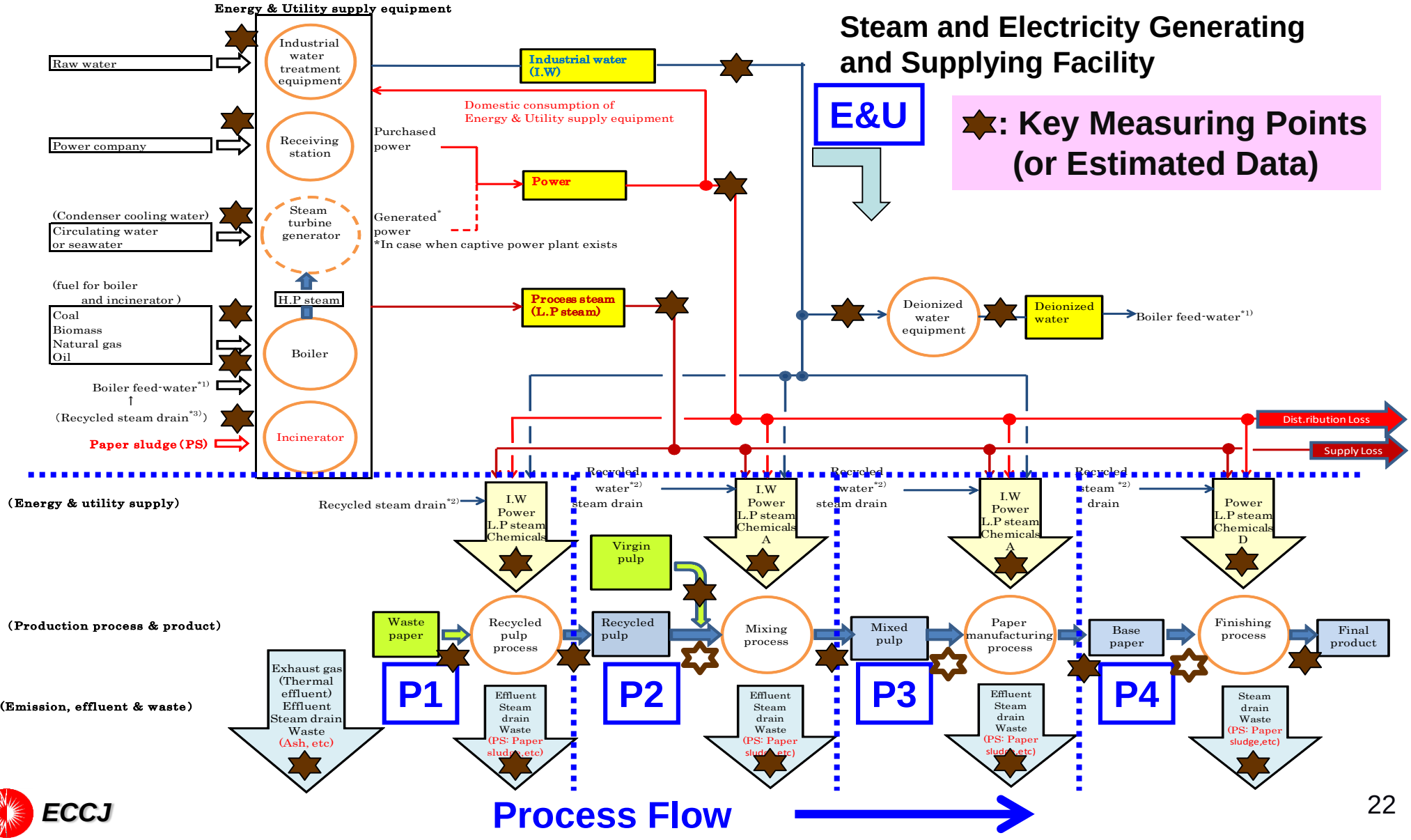
EC Guideline : Refer to Slide No. 24

Useful Energy Management Tools by ECCJ

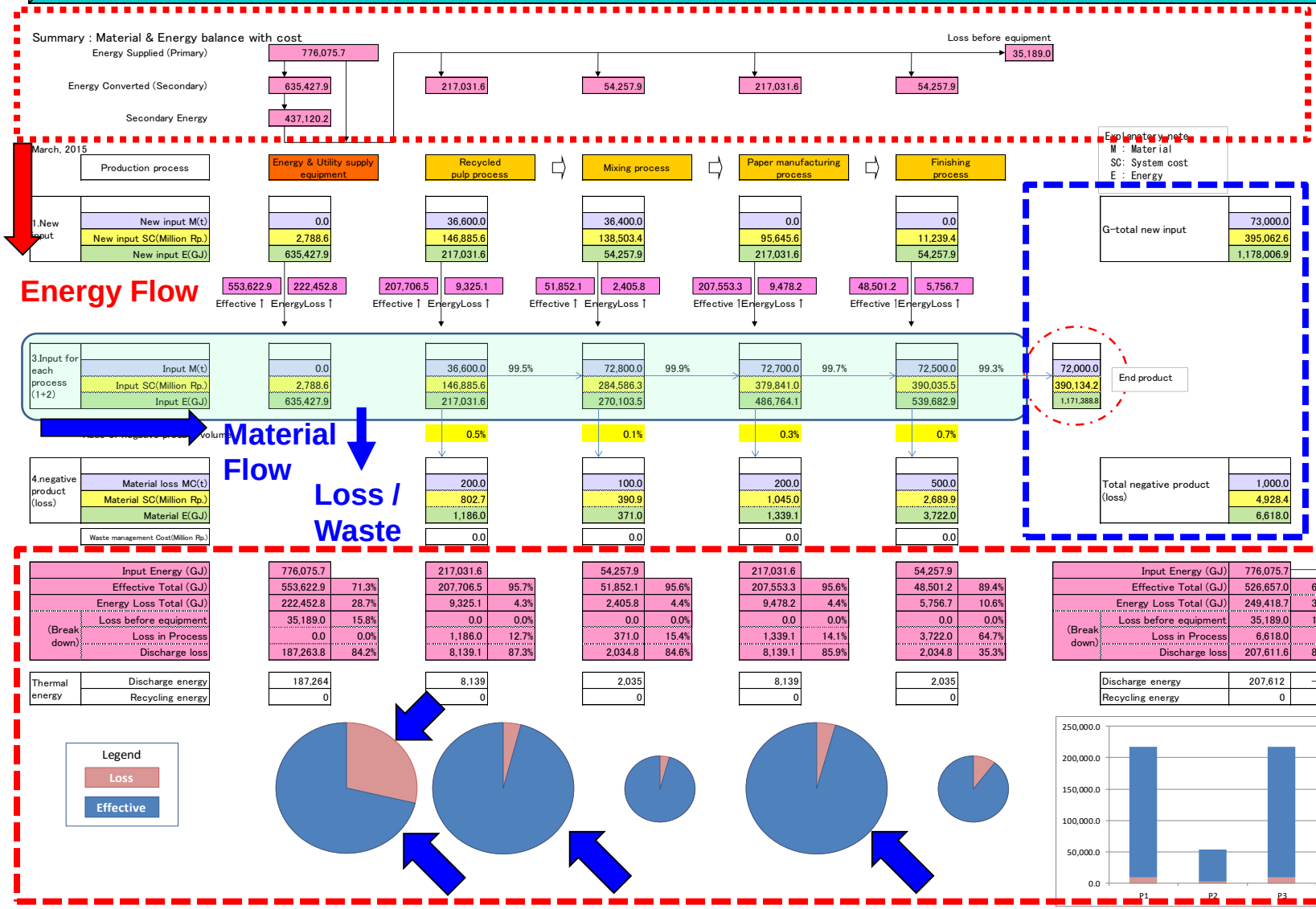
Standard Roadmap to Establish EnMS Based on ISO50001



Useful Energy Management Tools by ECCJ
Process Flow – Key Measurements



Useful Energy Management Tools by ECCJ (Data Visualization)
Process Flow – "Energy / Material / Cost Management Database



Energy Supply Energy Flow

Total Material
Input Material

Oood Products (Finial Product)

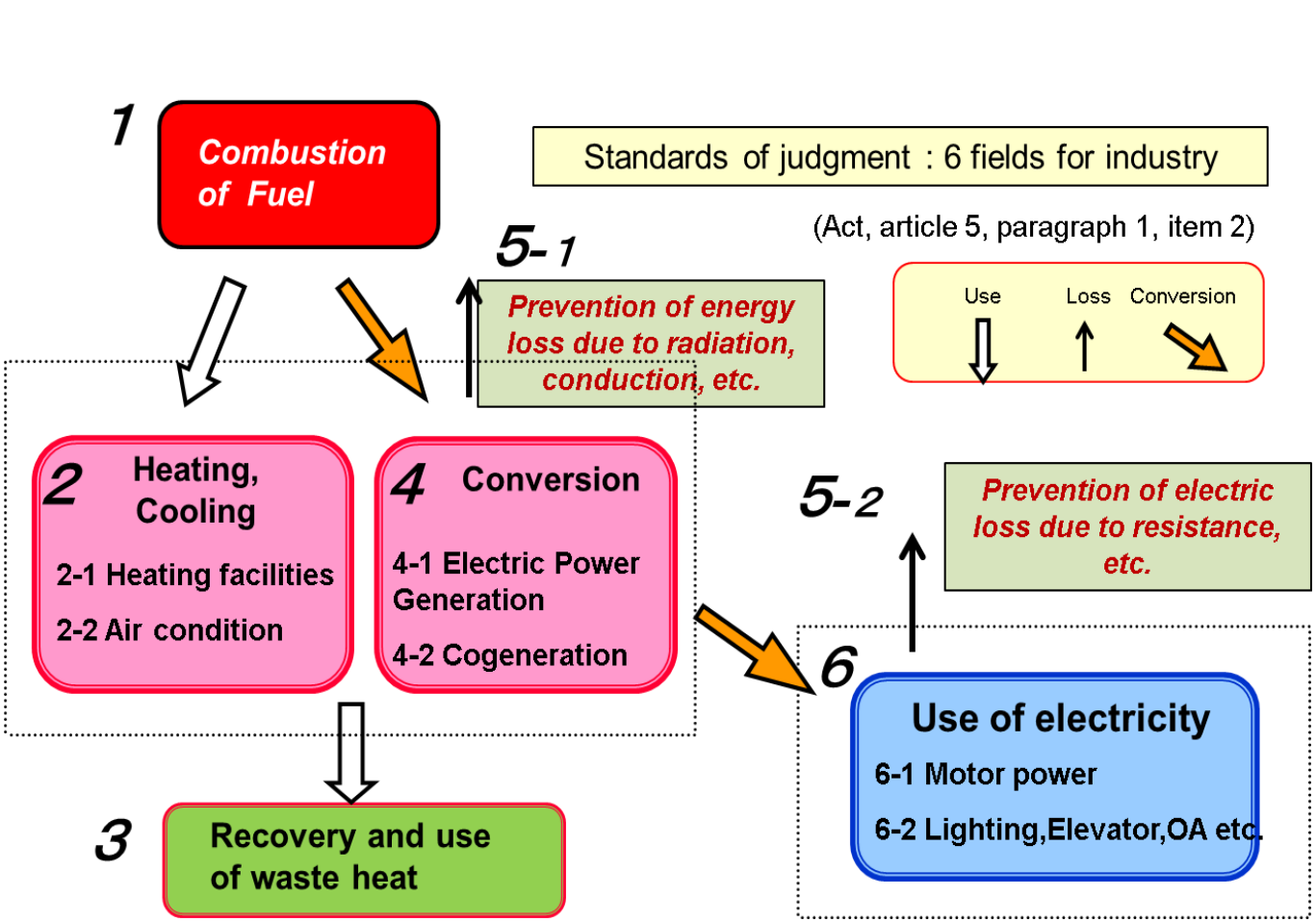
Negative Product (Loss / Waste)

Energy Balance (Sub-Process and Total)

Points : Identify "SEU" : Amounts of Consumption, Loss and Cost

Useful Energy Management Tools by ECCJ
Basic Guideline for Energy Conservation (EC) – Energy Flow

6 Key Guidelines Based on Basic Energy Flow (Applied in Japan under the "Energy Conservation Act" – Reference)



- **Viewpoints for EC**
- **To Include in "EM "Standards" too**

Rationalization of

1. Fuel and Combustion
2. Heating, Cooling and Heat Transfer
4. Conversion of Heat to Driving
6. Conversion of Electric Power to Driving Force and Heat, etc.
3. Recovery and Utilization of Waste Heat
5. Prevention of Energy Loss by Radiation, Conduction and Resistance etc.

Useful Energy Management Tools by ECCJ
EM Standard – Key Management Factors with EC Guideline

EM Standards to Prepare for Energy Intensive Processes / Facilities / Equipment

(Management Items) EC Guideline (Basic Guidelines)	(1) Management with Targets	(2) Measurement and Record	(3) Inspection and Maintenance	(4) Necessary Criteria & Measures when Replacing / Newly Installing Equipment
(1) Rationalization of Fuel and Combustion	Key Management Factors			
(2) Rationalization of Heating, Cooling and Heat Transfer				
(3) Recovery and Utilization of Waste Heat				
(4) Rationalization of Conversion of Heat to Driving Force and Electric Power, etc.				
(5) Prevention of Energy Loss through Radiation, Conduction and Resistance etc.				
(6) Rationalization of Conversion of Electric Power to Driving Force and Heat, etc.				

Useful Energy Management Tools by ECCJ (Exp. – Cement)
Identify Targets / Measures: Matrix of "SEU" Affecting Factors

Factors to Affect EE&C \ Process		Raw Material Pre-treatment	Clinker Making (Pre-heating / Calcining / Sintering / Cooling)		Finishing / Shipping
			Pre-Heater / Kiln	Cooler	
Raw Materials	Reutilized Waste - Waste Tire - Steel Slag - Fly Ash - Sludge etc.		Utilization of Recycled Wastes (Tire, Oil, Plastics, Biomass and Other Materialas)		Mixing Conditions - Gypsum - BF Slag, Fly Ash etc.
	Limestone - CaO Contents Clay : Quality etc.	Sizing Blending	**Conditions (Material etc.)**		
	Coal - Total C / Ash Content, etc.				
Utilities	Fuel / Electricity / Gas / Water etc.	Electricity / Water etc.	Electricity / Fuel / Water etc.	Electricity / Water etc.	Electricity / Water, etc.
Products		(Quality and Size etc.) Pre- Traeted Raw Meals Pulverized Coal		Clinker	Kinds / Qualities / Lot Size etc. (Portland Cement, Mixing Cement etc.)
Typical Technologies	For Process	Dry Process Blending / Sizing Control - Vertical Type of Mill with Efficient Classifier etc. (Wet / Semi-Wet Processes Remain.)	Kiln Heat Utilization - Suspension Pre-heater (SP) - Caiciner (New Suspension Pre-heater(NSP)) Efficient Kiln Burner Combustion Control Heat Recovery of Waste Gas Vertical Type of Coal Mill	Cooling Control Efficient Cooler	Additive Mixing Control Size Control - Pre-grinding Control - Efficient Separator - Management of Mill Efficient Cement Mill
Technology	For EE&C (Common)	Application of VVVF for Blowers etc.	Heat Recovery of Kiln Usage of Recycled Fuel etc. (Including Pre-Treatment)	Heat Recovery of Coolant Air	Mixtrure of Recycled Slag etc.
	Common : FEMS (Factory Energy Management System) / BEMS (Building Energy Management System)				
Unit Energy Consumptions		MJ / t - Mixture		MJ / t - Clinker	MJ / t - Finished Cement MJ / t - Shipped Cement

Check & Evaluation of Effectiveness / Cost for Possible Action

Process Flow →

ECCJ

Useful Energy Management Tools by ECCJ
Guideline of Technologies – EC Basic Guideline (Example)

Tech. / Equip Commonly Used

(Items) (EC Guideline No.)

Tech. / Equip. for Specific Industry

(Other Guideline) (Other Guideline)

(Iron & Steel) (Cement)

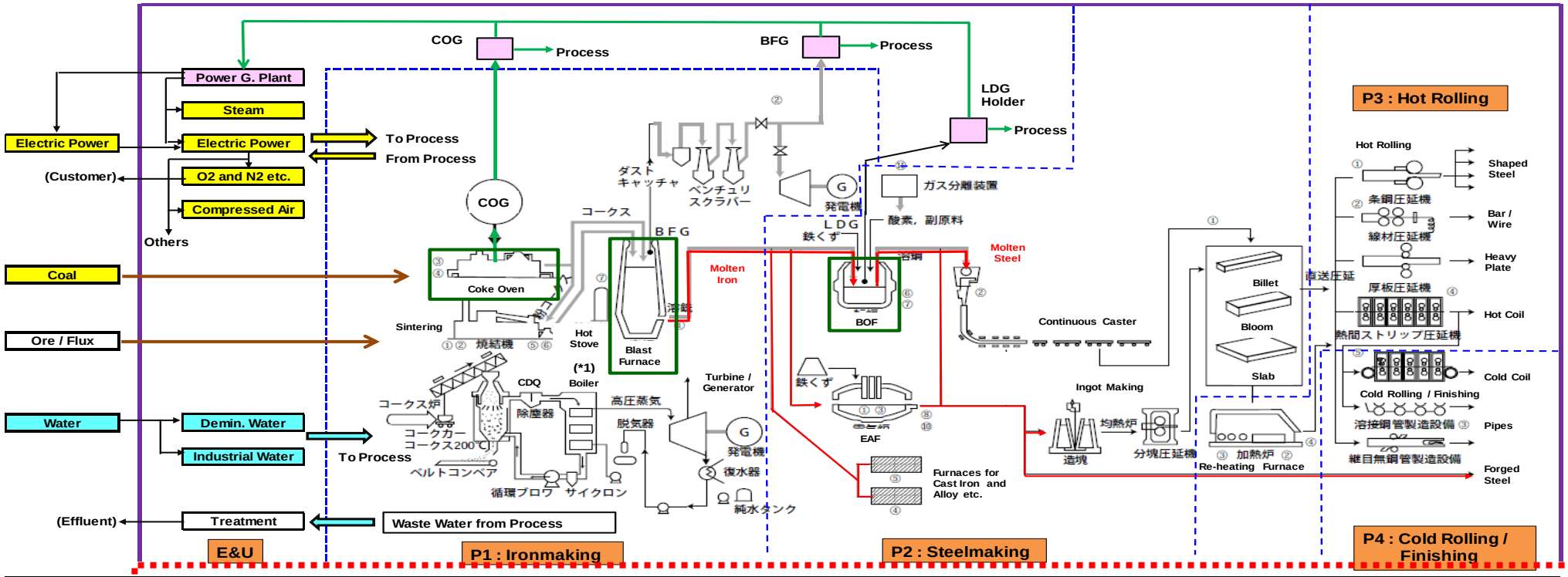
Technology / Equipment \ Field / Industrial Sectors		Basic EC Guideline No.	A. Inter-Sector (Common to Many Industries and Buildings)	B-1. Iron & Steel: Specific Technologies Applied (BF : Blast Furnace, LD / BOF : Steel Converter)	B-1. Additional Basic EC Guideline No.	B-2. Cement / Ceramics: Specific Technologies Applied	B-2. Additional Basic EC Guideline No.
1	Combustion Equipment	#1					
1-1	Air Ratio Improvement	#1	✔	Coke Oven, Hot Stove, Re-heating Furnaces etc.		Kiln Burner, Calciner	Process
	Gas Analyzers	#1					
	Fuel - Air Flow Rate Measurement & Controllers	#1					
	Air Ratio Controllers	#1					
1-2	Thermal Efficiency Improvement	#1, #2, #3		Coke Oven, Hot Stove, Re-heating Furnace etc.		Pre-Heaters and Calciner (New Suspension Pre-heater (NSP)), Kiln, Clinker Cooler	Process
	Combustion Air Preheaters	#3	✔			Utilization of Waste Air of Clinker Cooler	Process
	Regenerative Combustion Equipment	#3	✔				
	Atomizers (by Steam and Gas)	#1		Oil Injection, Pulverized Coal Injection (PCI) to BF	Process Guidelines		
	Ceramic Radiant Tube	#1 & #2					
	Oxygen (Enriched) Burners	#1		, EAF			
	Catalyst Combustion Burners	#1					
	Merged Heating Burner	#2					
	Efficient Combustion Air Blower	#1	✔	ombustion Air Fans for Various Furnaces			
	Fluidized Combustion Equipment	#1	✔				
1-3	Air Blower / Ventilation	#1	✔	ot Stove		Blowers for De-dusting System and Pneumatic Transportation, Various Mills	
	Automatic Draft Controller	#1					
	Blowers of Soot etc.	#5-1		Pre-heaters for Combustion Air			
	Volume Controlling Exhaust Fans (VSD)	#5-1					
	Dehydration Blowers (Re-heater for Dehydrated Air)	#2					
1-4	Combustion Control	#1	✔	oke Oven, Hot Stove, BF, Re-heating Furnace etc.	Process Guidelines	Kiln, Calciner (New Suspension Pre-heater (NSP))	Process
	Measuring Sensors of Fuel Flow Rate	#1					
	Controllers for Fuel Feeding	#1					
	Controllers for Combustion Air Volume	#1					
	Automatic Combustion Controllers	#1					
1-5	Others (Boilers etc.)	#1, #3, #5-1		oilers for Power Generating Plant,, Various Waste Heat Recovery Boilers		Waste Heat Recovery Power Generation System	
	Economizer and Combustion Air Pre-heater	#3	✔				
	Latent Heat Recovery Type Boilers	#1, #3	✔				
	High Efficiency Boilers	#5-1	✔				
	Distributed Boiler System	#5-1	✔				
	Boilers Utilizing Sensible Heat of Waste Gas etc.	#3					
2	Equipment of Heat Utilization	#2, #3, #5-1					
2-1	Effective Heat Recovery	#3	✔	Coke Oven (CDQ, CMC), Sintering Plant, Hot Stove, BOF, Ladle Heaters	Process	Suspension Pre-heater (SP), Kiln, Re-Utilization of Waste Air from Clinker Cooler	Process
	Corrosion Resistant High Efficiency Heat Exchangers	#3					

Other Technologies / Equipment

Other Technologies and Equipment

Other Industries

Useful Energy Management Tools by ECCJ
Process Flow – Guideline of Effective Technologies (Exp.) Steel



Effective EE&C Technology

E&U

Energy and Utility Facility

36 Optimization of Industrial Gas Supply
37 Energy Center
38 Advanced Combined Cycle

P1 : Ironmaking

Coke Oven

1 Automatic Combustion Control
2 Coke Dry Quenching Facility (CDQ)
3 Coal Moisture Control Facility (CMC)

Sintering Machine

4 Segregated Charging of Raw Mix
5 Waste Heat Recovery System for Exhaust Gas Main
6 Heat Recovery System for Cooling Air at Cooler
7 Direct Ignition Burner

Blast Furnace (BF)

8 Waste Heat Recovery System for Hot Stove
9 Pulverized Coal Injection (PCI) System
10 Top Pressure Recovery Power Generating System
11 BF Gas Recovery for Pressure Equalization
12 Burden Distribution Control

Cast Iron

34 Trench Type of Induction Furnace to Melt Cast Iron

P2 : Steelmaking

Electric Arc Furnace (EAF)

13 DC EAF with Water Cooling
14 Scrap Pre-heating System
15 Advanced EAF

Converter (LD) and Continuous Caster (CC)

16 Continuous Casting Facility
17 Recovery System of LDG with Sealed BOF
18 Recovery of Sensible Heat of LDG
19 Ladle Heaters with Regenerative Burner

Ferro Alloy Manufacturing

35 High Efficiency Ferro Alloy (Fe-Cr) Refining Furnace

P3 : Hot Rolling

EAF - Hot Rolling (HR)

20 Regenerative Burner with Honeycomb Type of Re-generator

CC - Hot Rolling (HC)

21 Sizing Press
22 Direct Rolling and Hot Charging of Hot Slab

Hot Rolling

23 Edge Heater
24 Reheating Furnace with Regenerative Burner
25 High Efficiency Reheating Furnace
26 High Efficiency Descaling Pump
27 Convection Type of Heat Treatment Furnace (Steel Rod)
28 Continuous Rolling
29 Coil Box

P4 : Cold Rolling

Cold Rolling

31 Continuous Annealing Furnace
32 Electromagnetic Induction Heater for Forge Welding
33 High Frequency Induction Furnace

Effective EC Technology

4. Achievements of Project : Programs – 2 and – 3

Program - 2

(1) Confirmed Necessity of Regulative Framework and Main Components of Energy Management System and of Improvement in the Support System by the Federal and São Paulo State Governments

(2) Organized WG-1 to Study for Developing Proposals on Item (1)
(Point) Harmonization of Federal – State (São Paulo) Governments

(3) Prepared Proposals as Follows by WG-1 Based on the ECCJ's Guide

- Design of Energy Management System
- Improvement in the Support System

Including Roadmap for Legislation by Brazilian Government

Program - 3

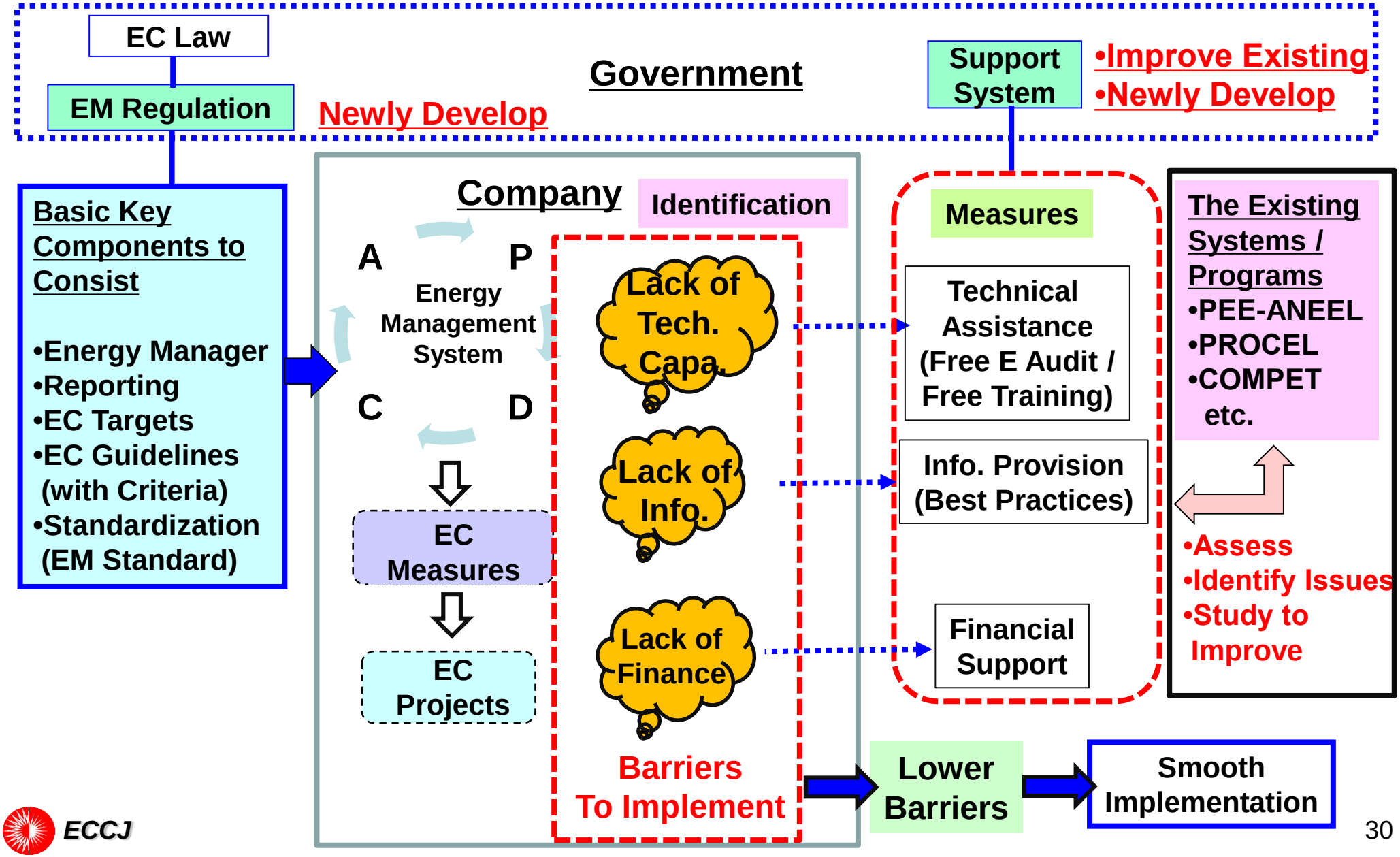
(1) Organized WG-2 to Study / Draft "Action Guide"
(Based on the Japanese "Electricity Saving Manual")

(2) Prepared "Action Guide for General Industry" by WG-2

(3) Using the "Action Guide for General Industry" by Approx. 300 SMEs

(4) Plan to Develop Other "Action Guides" for Office and Residence etc.

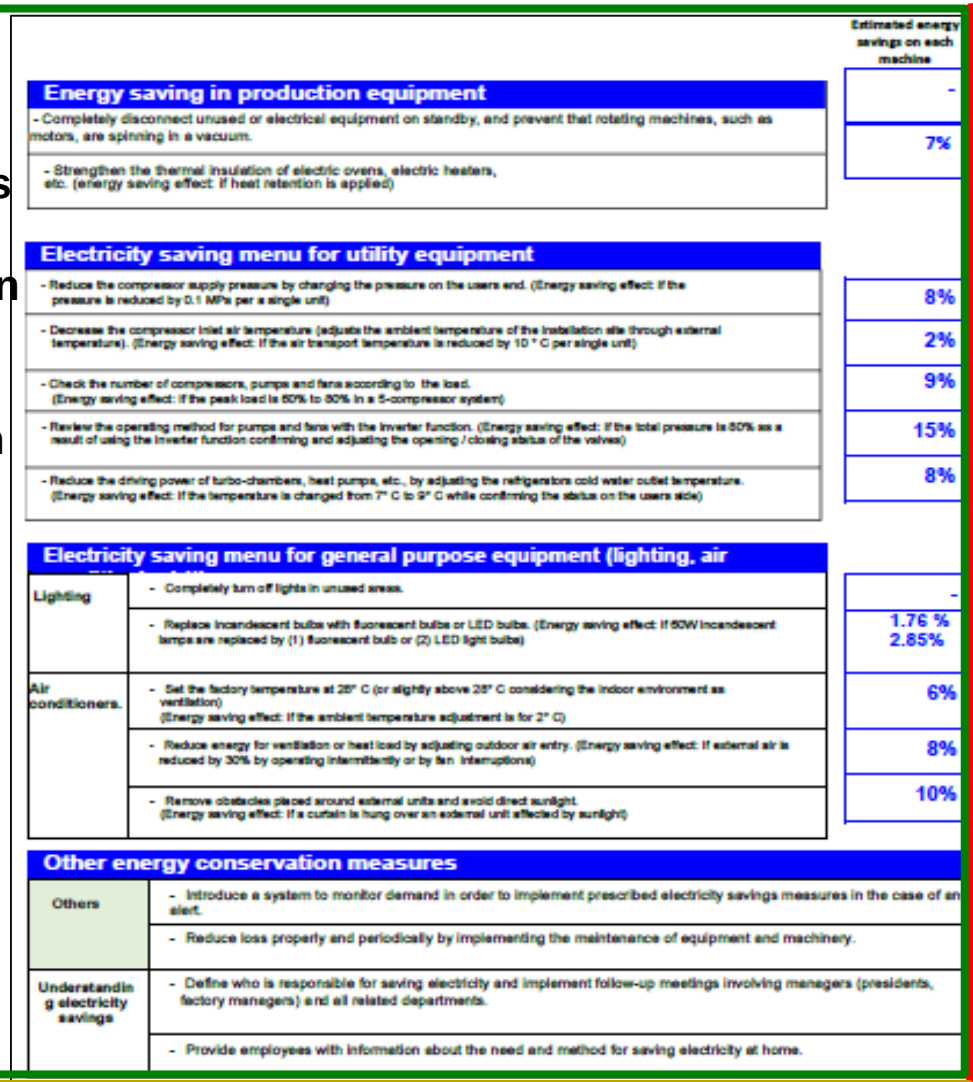
Program – 2 : Proposals (Points of Design)



Program – 3 : Points of "Action Guide"

(1) Recommended Actions & Measures to Reduce Electric Power Consumption

(2) Expected Effects (Customized to Match with Brazilian Conditions)



		Estimated energy savings on each machine
Energy saving in production equipment		
	- Completely disconnect unused or electrical equipment on standby, and prevent that rotating machines, such as motors, are spinning in a vacuum.	-
	- Strengthen the thermal insulation of electric ovens, electric heaters, etc. (energy saving effect: If heat retention is applied)	7%
Electricity saving menu for utility equipment		
	- Reduce the compressor supply pressure by changing the pressure on the users end. (Energy saving effect: If the pressure is reduced by 0.1 MPa per a single unit)	8%
	- Decrease the compressor inlet air temperature (adjusts the ambient temperature of the installation site through external temperature). (Energy saving effect: If the air transport temperature is reduced by 10 ° C per single unit)	2%
	- Check the number of compressors, pumps and fans according to the load. (Energy saving effect: If the peak load is 60% to 80% in a 5-compressor system)	9%
	- Review the operating method for pumps and fans with the inverter function. (Energy saving effect: If the total pressure is 50% as a result of using the inverter function confirming and adjusting the opening / closing status of the valves)	15%
	- Reduce the driving power of turbo-chambers, heat pumps, etc., by adjusting the refrigerators cold water outlet temperature. (Energy saving effect: If the temperature is changed from 7° C to 9° C while confirming the status on the users side)	8%
Electricity saving menu for general purpose equipment (lighting, air		
Lighting	- Completely turn off lights in unused areas.	-
	- Replace incandescent bulbs with fluorescent bulbs or LED bulbs. (Energy saving effect: If 60W incandescent lamps are replaced by (1) fluorescent bulb or (2) LED light bulbs)	1.76 % 2.85%
Air conditioners.	- Set the factory temperature at 28° C (or slightly above 28° C considering the indoor environment as ventilation) (Energy saving effect: If the ambient temperature adjustment is for 2° C)	6%
	- Reduce energy for ventilation or heat load by adjusting outdoor air entry. (Energy saving effect: If external air is reduced by 30% by operating intermittently or by fan interruptions)	8%
	- Remove obstacles placed around external units and avoid direct sunlight. (Energy saving effect: If a curtain is hung over an external unit affected by sunlight)	10%
Other energy conservation measures		
Others	- Introduce a system to monitor demand in order to implement prescribed electricity savings measures in the case of an alert.	
	- Reduce loss properly and periodically by implementing the maintenance of equipment and machinery.	
Understanding electricity savings	- Define who is responsible for saving electricity and implement follow-up meetings involving managers (presidents, factory managers) and all related departments.	
	- Provide employees with information about the need and method for saving electricity at home.	

Check Actions and Measures Possible to Apply

Measures to Reduce Peak Demand

Control of Peak Demand		
Operational changes	- Change the driving power production kickoff to a schedule that is before the period to save electricity.	
	- Adjust working time in the office, etc. in order to change from the electricity peak periods	
	- Maximum adjustment based on providing a supply and demand agreement (price incentive), use of private power generation, change of operation, etc.	

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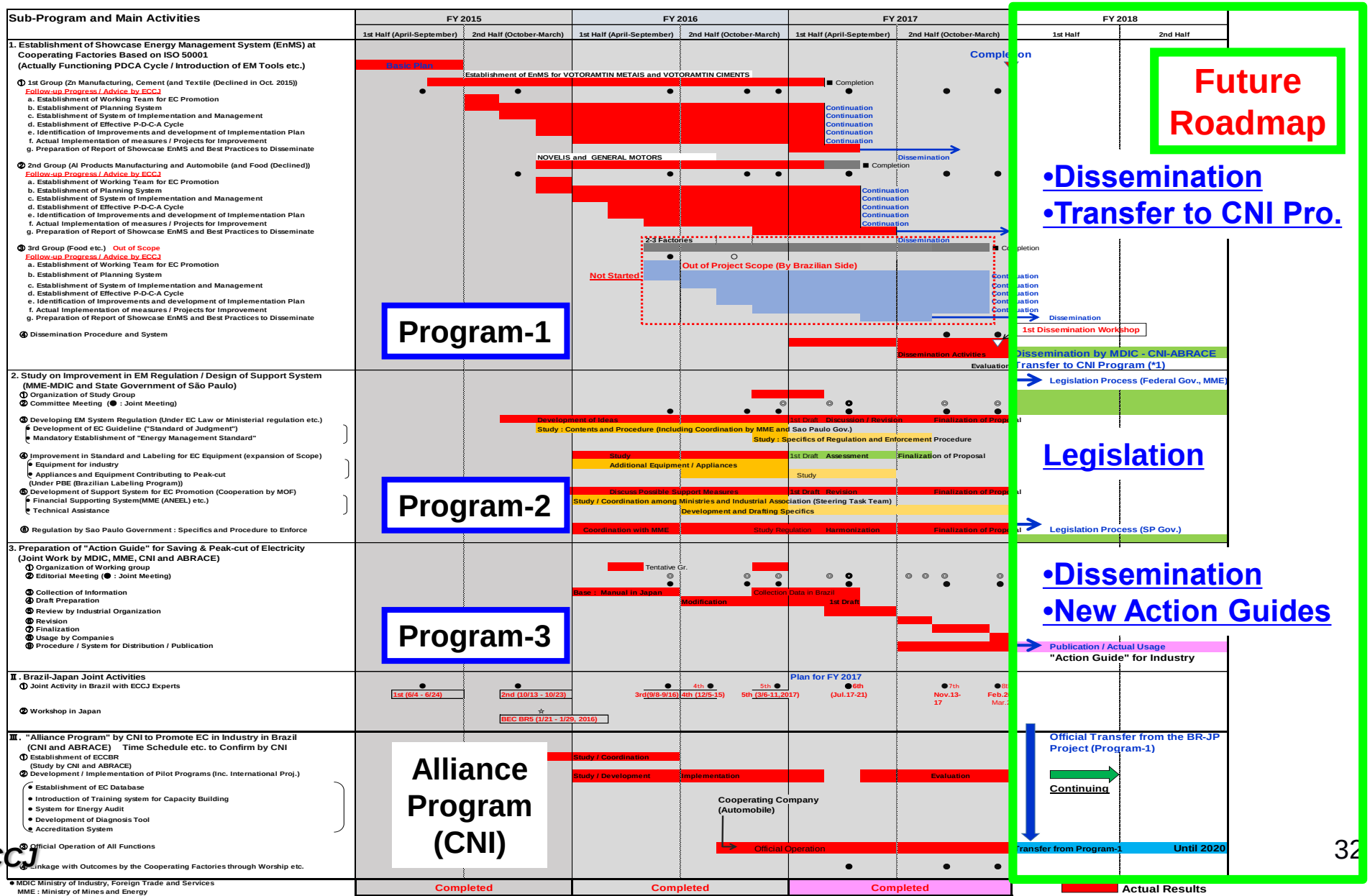
ECCJ

5. Actual Results and Future Roadmap after FY 2018



Conclusion

The Japan – Brazil EC Cooperation Project for over 3 years was successfully completed in March 2018.

1. Important Outcomes of the Project Established

1) Functional group consisted of public – private stakeholders to promote EC in Brazil

2) Showcase EnMS based on ISO 50001 and EC best practices with developed EM tools including dissemination of these

3) Proposal of EM regulation under EC Law / Improved support system to Promote EC

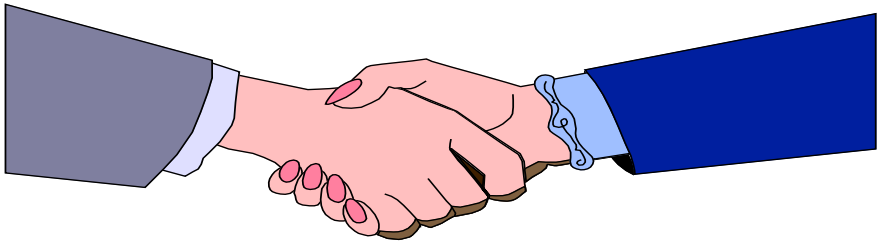
4) "Action Guide" for Industry to save and peak-cut Electricity

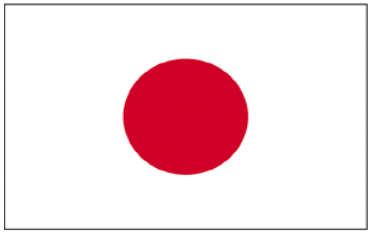
5) Transfer to "Alliance Program" by CNI utilizing outcomes

2. Developed Roadmap of Required Actions after FY 2018

Expected Discussion of Way Forward of Cooperation

Thank you very much





For More Information

The Energy Conservation Center, Japan (ECCJ)

http://www.eccj.or.jp

Asia Energy Efficiency and Conservation Collaboration Center (AEEC)

http://www.asiaeec-col.eccj.or.jp/index.html

Japanese Business Alliance for Smart Energy Worldwide

http://www.jase-w.org/english/top/