Energy Intensity in Industrial Sub Sectors

1. General concept on "Energy Intensity in Industrial Sub-sectors " and difficulties & limitation of statistics accuracy
2. Practical approach for calculation of Energy Intensity using statistics
3. "In-house Bench-mark Activity" using In-house Energy Intensity for a factory
4. Example of "bench-mark activity" in a factory

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Tsuzuru NUIBE

The Energy Conservation Center, Japan

What is the Energy Intensity in Industrial Sub-sectors ?

* "Energy Intensity in Industrial Sub-sectors " may be an evaluation indicator for EE&C achieving rate and one of the effective guide-lines of EC policy for factories and buildings.

But, it is beleaguered with difficulties to get *accurate* energy intensity.

It needs precise and complete product statistics and energy consumption statistics by individual sub-sectors (ex. textile, food, chemical, cement, steel-making, paper, --------).

Cooperation of industrial sector and enterprises is needed to get accurate data.

Generally speaking, it is difficult to get energy intensity figures linked to cost information directly from enterprises.

Accuracy of statistic data is different among countries concerned, so we should accept some intent of compromise.

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On the other hand, "Energy Intensity " can be very useful tool for energy conservation activity in factories/enterprises.

In Japanese enterprises, "in-house Energy Intensity" (not "government-statistical Energy Intensity") has been utilized through "In-house Bench-mark Activity " or "Target Management Activity ".

"government-statistical Energy Intensity" ----- the Energy Intensities in Industrial Sub-sectors, which are calculated by the government based on the national statistics, are rather difficult to use in factories because of some defects, for example, accuracy lack, difference of producing process and product quality etc.

Generally, the in-house Energy Intensity is used as the bench-mark or the target value for EE&C improvement activities. (For example the figure of "best in the past " or "result of the previous year " etc. are often used for the in-house Energy Intensity.)

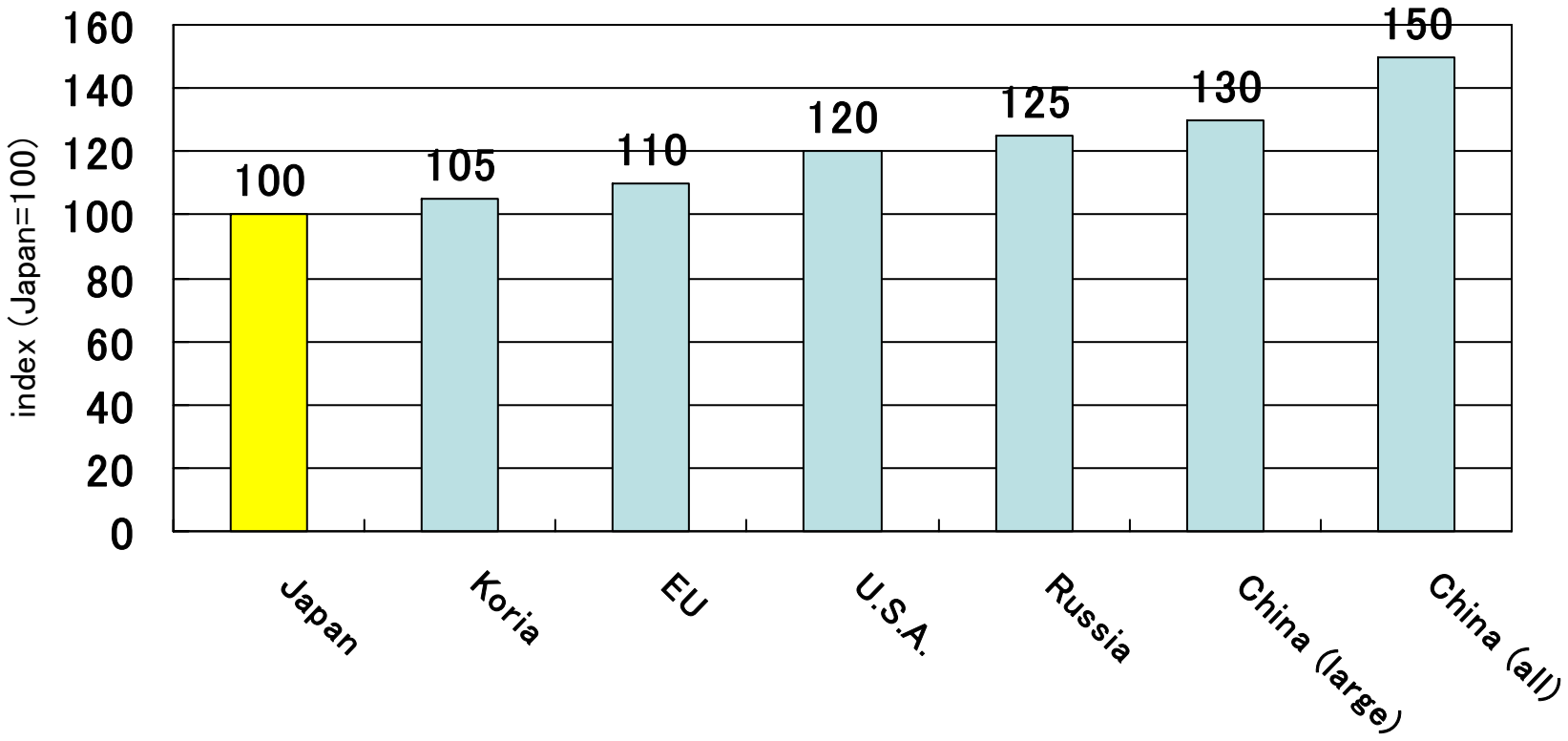
From the view point of EE&C essence, these activities are welcomed to be standardized as soon as possible and implemented popularly.

Practical activity of EE&C in factories/buildings is the base of nationwide EE&C.

< usable information for bench-mark >

International comparison of energy intensity at integrated iron and steel works

It is supposed that some kinds of revision are added to be effective for comparison.



Source: the Japan Iron & Steel Federation (information from Korea Iron & Steel Association and the China Iron and Steel association, unofficial information from many companies)

International comparison of energy intensity in other sub-sectors

<heat efficiency at thermal power station (o/p electricity per i/p fuel) source: COMPARISON OF POWER EFFICIENCY ON GRID LEVEL 2004 (ECOFYS), General Aspects for Demand & Supply of Electricity in Japan 2002 (ANRE/METI) >

Japan	Scandinavia	U.K.	France	Germany	U.S.A.	China
100	93	92	83	83	82	74

<electricity intensity of manufacturing sodium hydroxide by dissociation method source: SRI Chemical Economic Handbook, Soda Handbook.>

Japan	Taiwan	Korea	china	U.S.A.	W-Europe	E-Europe
100	100	104	108	113	120	123

<energy intensity of paper and cardboard manufacturing source: Japan Paper Association, American Forest & Paper Association, Forest Product Association of Canada, Confederation of European Paper Industries>

Japan	U.S.A.	Canada	Sweden	Germany
100	144	135	124	52

<energy intensity of manufacturing cement clinker source: CLIMETE CHANGE Mar.2002 (Battelle) >

Japan	W-Europe	Korea	M&S. America	China	U.S.A.	Russia
100	130	131	145	152	177	178

<energy intensity at copper refining factory source: based on hearing information from some factories>

Japan	Europe	Asia	N. America	S. America
100	130	140	160	210

<energy intensity of aluminum plate rolling source: International Aluminum Institute>

Japan	World
100	127

Attention: these information are disclosed non-official base by associations and institutes, not by governments.

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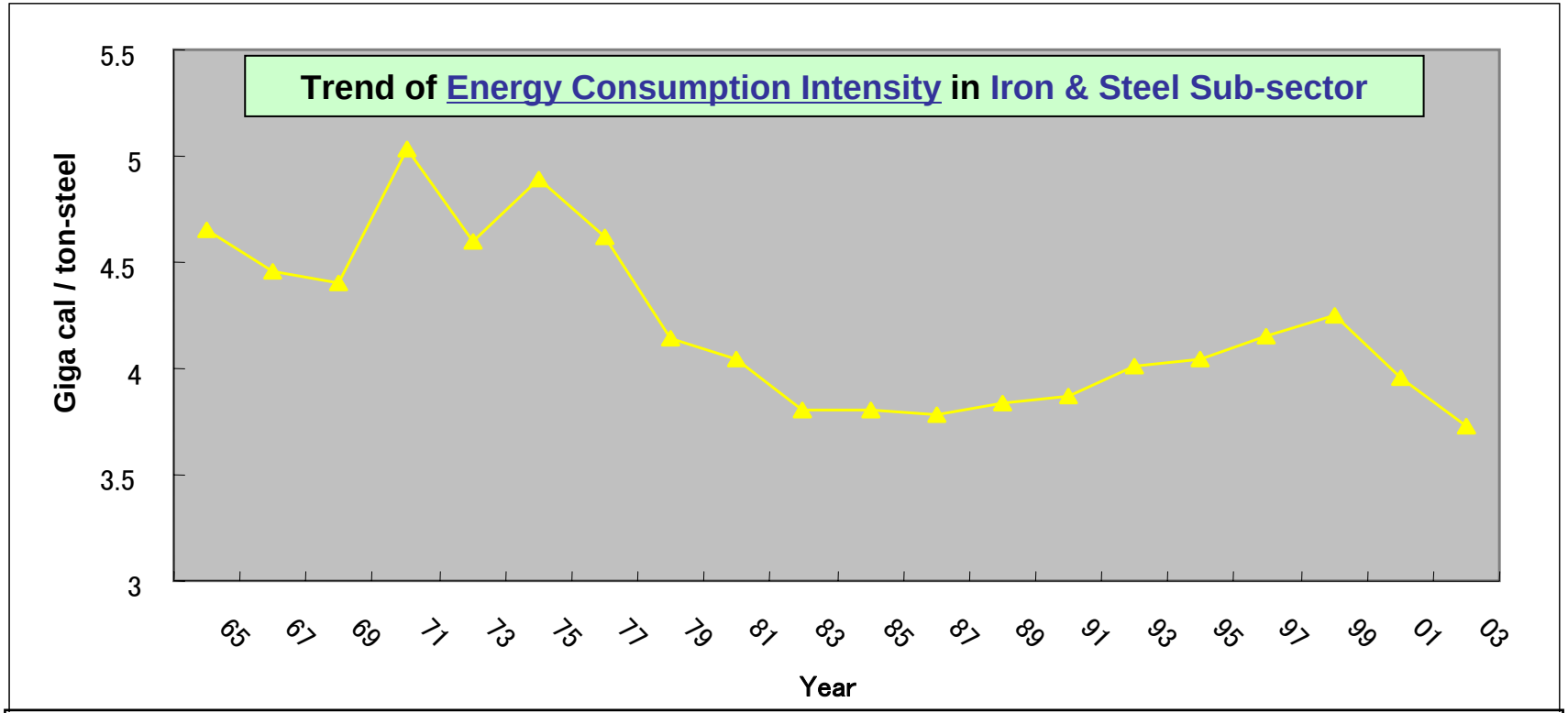
Trial to calculate the energy intensity

We can calculate "total energy consumption ÷ total crude steel production"

from the following data source: monthly of iron & steel etc. statistics (METI), and energy balance tables in Japan (METI, estimated by EDMC),

Note: This statistics includes integral steel makers and electric furnace steel makers.

<these data are provided by the EDMC Handbook, the Energy Data and Modeling Center/ the Institute of Energy Economics, Japan>



But, this information (Energy Consumption Intensity) is not suitable for direct use, because it contains many disputable subjects.

to explain the reason in the next page.

Difficulties of "Energy Bench mark" <continued>

It is very difficult to use the statistical figures straightly for "Energy Bench mark".

for example in iron and steel sub-sector (*see the previous page*),

- **Mixture of product species (ex. : conventional steel, special steel)**
- **Variation in the share of product species (between years)**
- **Change of product quality (consumer's demand for higher quality)**
- **Change of product value (change of monetary value)**
- **Difference of producing system (integral steel making, electric furnace process) , etc.**

So, the previous page's information

Trend of Energy Consumption Intensity in Iron & Steel Sub-sector
(total energy consumption / total crude steel production) < Giga cal / ton-steel >

should not be utilized directly, because it contains many disputable subjects above mentioned.

what is counter measure?

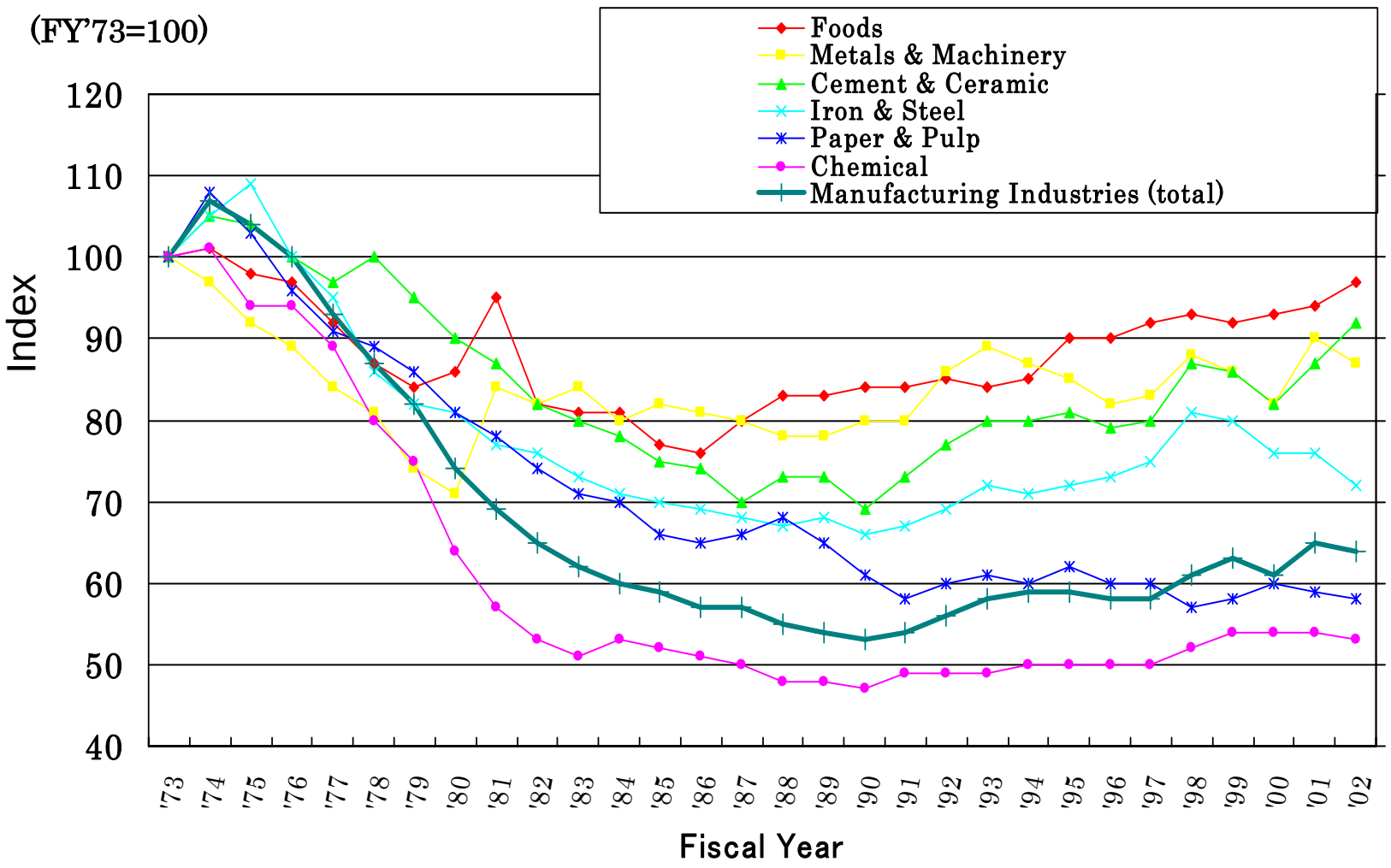
Following page's statistics is useful to observe the energy intensity trend of Japan by sub-sectors, because it is revised by IIP.

(IIP : "Indices of Industrial Production" This index expresses overall productive activity. It is shown in % as base-year 100%. It is based on the sum of production weight-averaged by share of industrial production items and revised by deflator/change of monetary value.) .

＜Manufacturing Sector＞

Trend of Energy Consumption Intensity per IIP by Sub-Sector

< IIP : Indices of Industrial Production >



(Source: EDCM Handbook of Energy & Economic Statistics in Japan 2004)

In-house Bench-mark Activity in a factory

Bench-mark activity is one of improvement methodologies and it is carried out for various improvement activities.
We call "Bench-mark" as "**Target management**" in Japan.

Bench-mark activity (target management activity) **for energy conservation**

It is very effective because it is practically carried out on the sight where energy is consumed.

(So, "Bench-mark Activity" have been promoted combined with P-D-C-A circuit activity, sho-shudan activity, TQM activity etc..)

< to establish a **target value** for improvement : >

- **Target Value is decided based on Bench-mark**

T.V. = B.M. **or**
T.V. = B.M.+ α **or**
T.V. = B.M.- α

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Candidates for **Energy Bench-mark** (**energy intensity / energy unit consumption**) :

*** actual value in own factory**

best result in the past, result of the previous year, etc.

* actual value ? <outside own factory> --- non official information
in the competitive company, in the country, in the world, etc.

*** theoretically calculated value**

*** facility design value (nominal capacity value)** * etc.

We usually use the actual value in own factory.

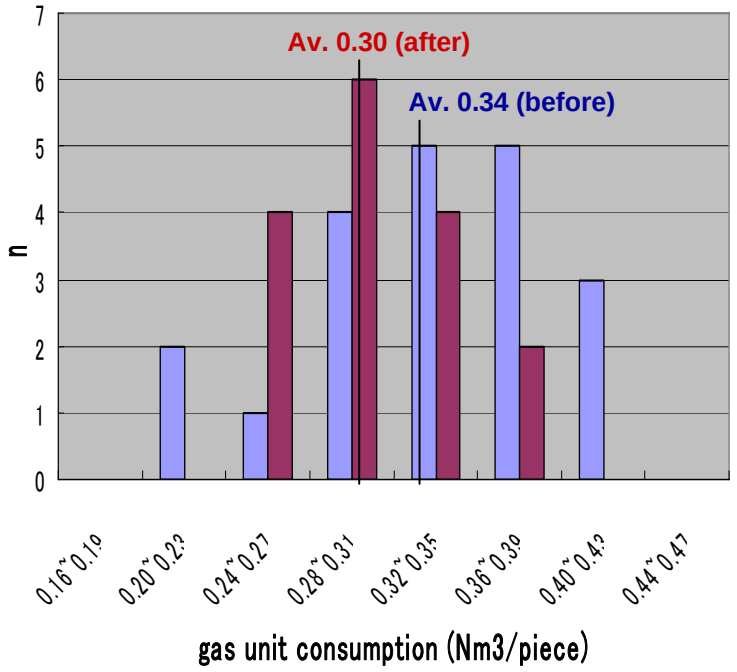
1st stage: Improving activity for operation of **Heat treatment furnace** (line A)

Result of fact-finding: air/fuel ratio = 1.6, fuel gas intensity (unit consumption) = 0.34 Nm3/piece

- <improving action> **to change air/fuel ratio: 1.6(before) to 1.3(after),**
  target value of **fuel gas intensity** (average): **0.31** (Nm3/piece)
- <result of activity> **fuel gas intensity** (unit consumption): **0.34**(before) **to** **0.30**(after) **(Nm3/piece)**

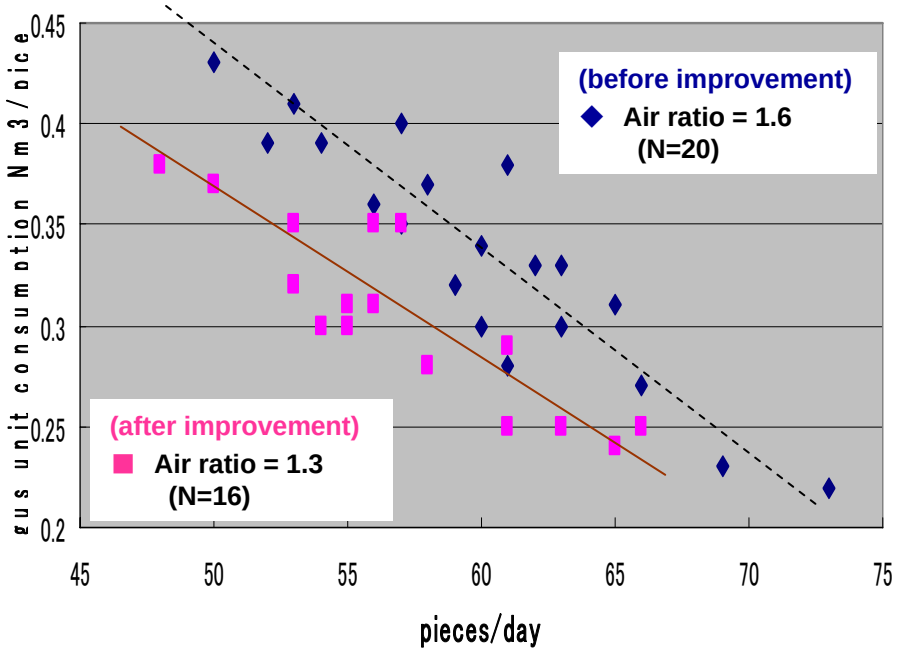
< Histogram (Classification / stratification) >

Comparison of gas unit consumption



< Correlation graph, stratified >

Fuel gas unit consumption



They decided the energy bench-mark (fuel gas intensity) of line A as 0.30 (Nm3/piece) .

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2nd stage: Application of the activity results at line A **for line B**

They can utilize the bench-mark achieved in line A for various purposes. for example,

< in their own Heat treatment factory >

the energy bench-mark (of fuel gas intensity) of this factory is 0.30 (Nm3/piece).

for operation standard (included in the energy management standard of the factory),
standard value (of fuel gas intensity) of the factory is 0.32 (Nm3/piece)

*** this standard value is usable for cost management annual-planning (P-D-C-A circuit) of the factory.**

Ex.2

< at Line A >

the bench-mark (fuel gas intensity) is 0.30 (Nm3/piece)

Ex.3

for advanced E-C activity,

the target value is 0.28

Ex.1

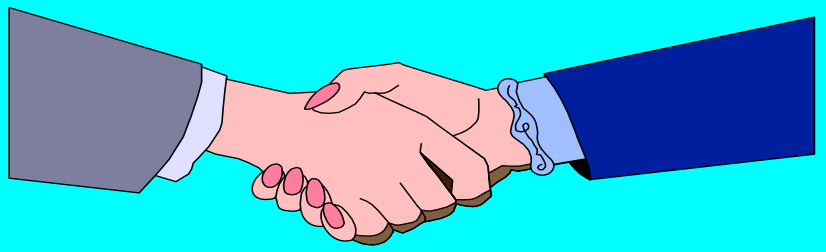
< at Line B >

the bench-mark (fuel gas intensity) is 0.30 (Nm3/piece)

for starting E-C activity, the target value is 0.40

(because operation rate of line B is lower than that of line A by 20%)

Thank you

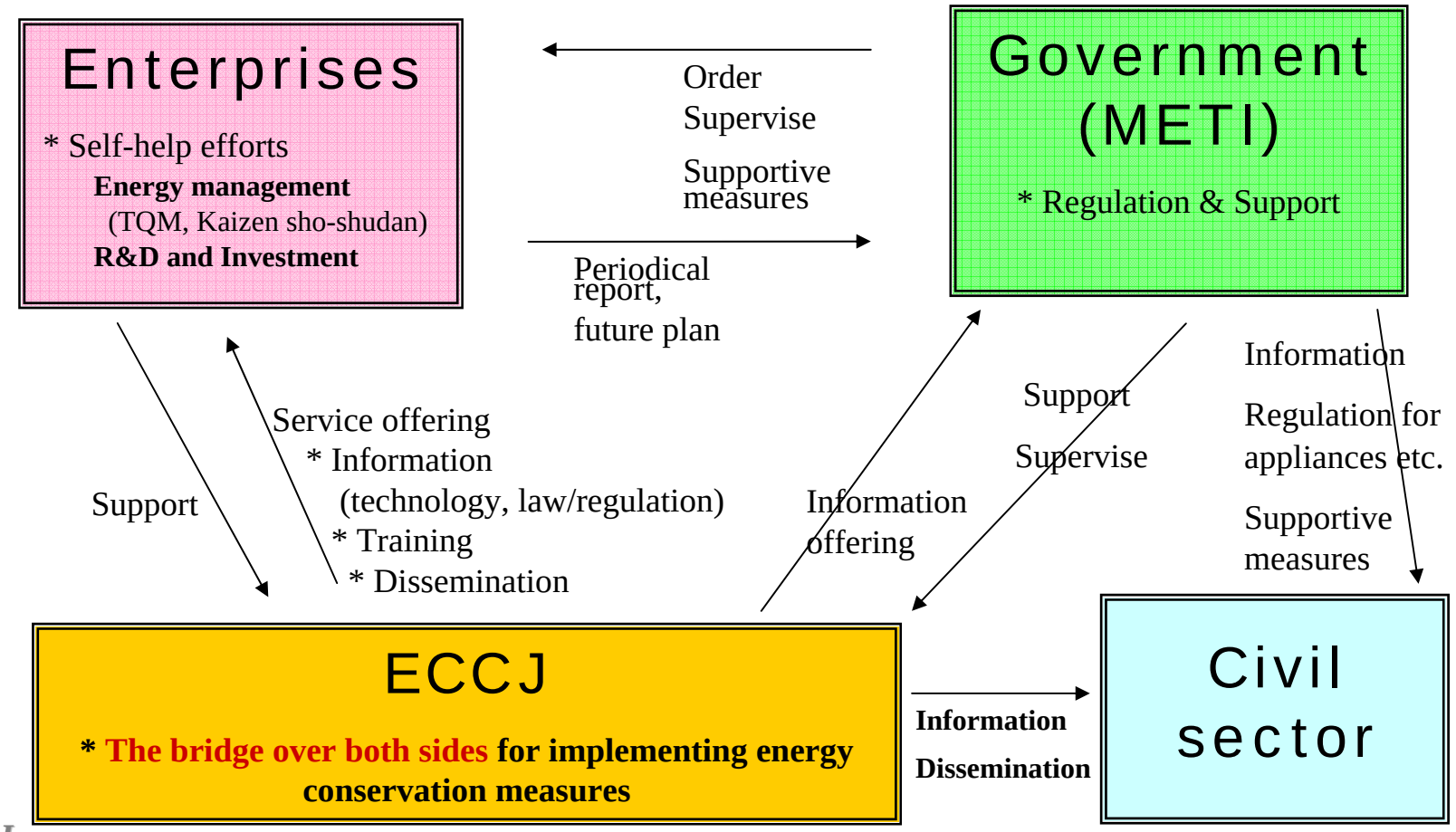


The Energy Conservation Center, Japan

Role of ECCJ

ECCJ is the core organization responsible for promotion of energy conservation. Its activities were authorized by the Diet when the Energy Conservation Law was enacted.

for Execution of "Energy conservation Law"



Main Activities of ECCJ

Industrial sector

① Dissemination (conference for successful cases of E-C activities, excellent energy conserving equipment, etc.)
② Technological development and spillover
③ Energy conservation audits services for factories
④ Education & training on energy conservation
⑤ State examination for energy managers (assigned by the Gov.)

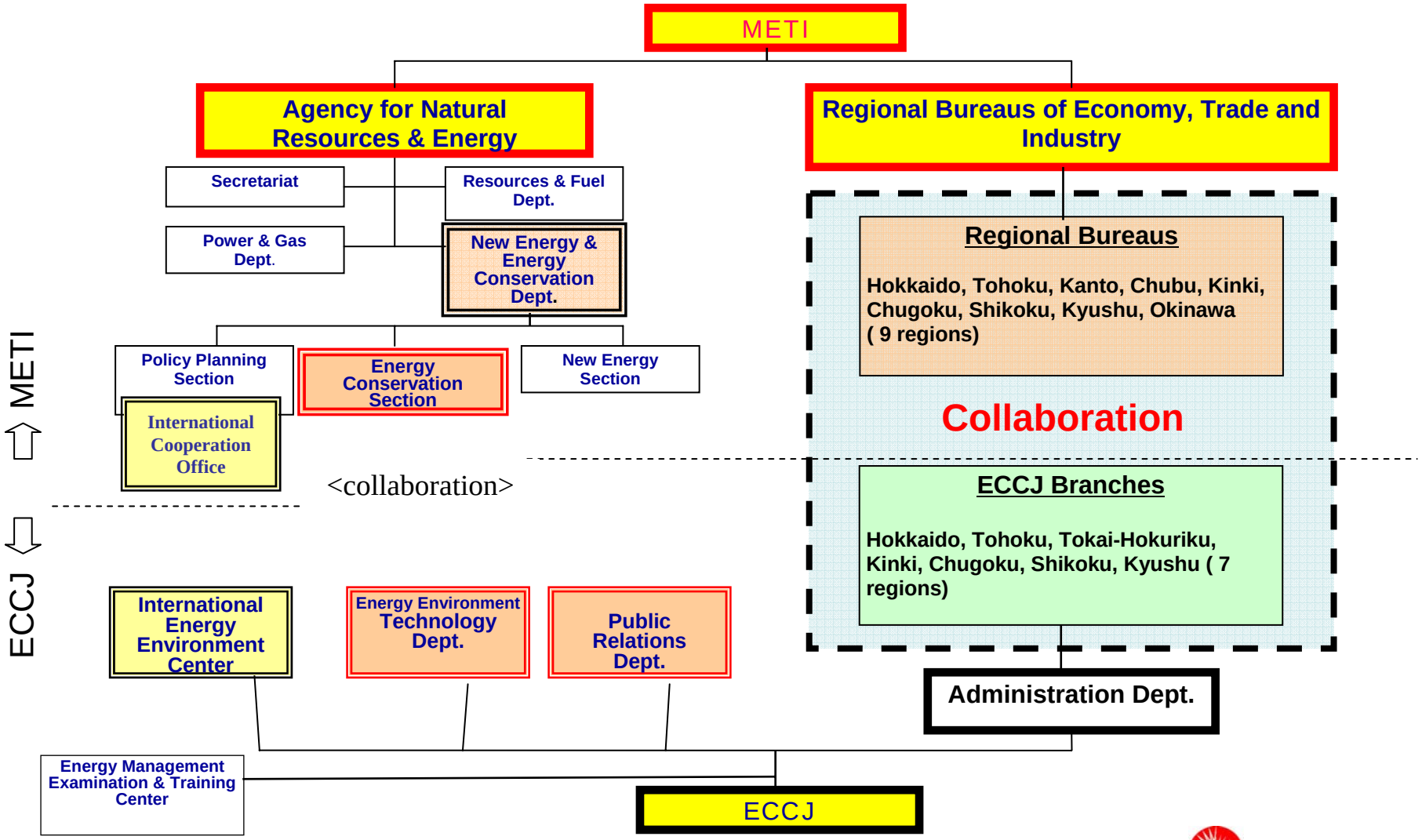
Consumer & Transportation sector

① Energy conservation audits services for buildings
② Ranking catalogue for energy efficient appliances
(dissemination of Top Runner Program)
③ Promotion of Energy labeling system
④ International Energy Star Program implementation
⑤ Energy efficiency product retailer assessment system
⑥ Dissemination of Energy conservation indicator "E-Co Navigator"
⑦ Energy efficiency education at elementary and middle schools
⑧ ESCO research and development

Cross sector

① Energy conservation campaign & exhibition (ENEX)
② Commendation (grand energy conservation prize)
③ Information & data base, Publicity and publishing
④ Survey and monitoring
⑤ International cooperation & Communications

METI-ECCJ Collaboration Framework to enforce Energy Conservation Policy and the Law in Japan



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METI and the Related Organizations in Japan

for International Cooperation on the Energy Conservation