

Japanese Energy Saving Measures and ECCJ's Activities

-- The way to Stimulate the Motivation to Energy Conservation Activities --

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The Energy Conservation Center, Japan

Framework of Energy Efficiency Policy of JAPAN

	Industry	Commercial	Residential	Transport
Regulation	Regular Reports, Medium to Long-term Plans, 1% Annual Energy Efficiency Improvement			Regular Reports, 1% Annual Energy Efficiency Improvement
	Compliance with EE Standards			
	Top Runner Standard, Performance Labeling System			
	Benchmark System			
	Voluntary Action Plan			
Economic Incentives	Subsidy Systems (Equipment Investment, Interest Subsidy, Housing Insulation Retrofit, Clean Energy Vehicles, etc.)			
	Green Investment Tax Cut, Special Depreciation			
	Free Energy Conservation Audit for SMEs			
	Information Provision, National Campaign, Award System			
	R&D Subsidies (High-Performance Heat Pumps, Highly Efficient Gas Engines, Innovative Batteries, IoT Technologies, Autonomous Driving Systems, etc.)			

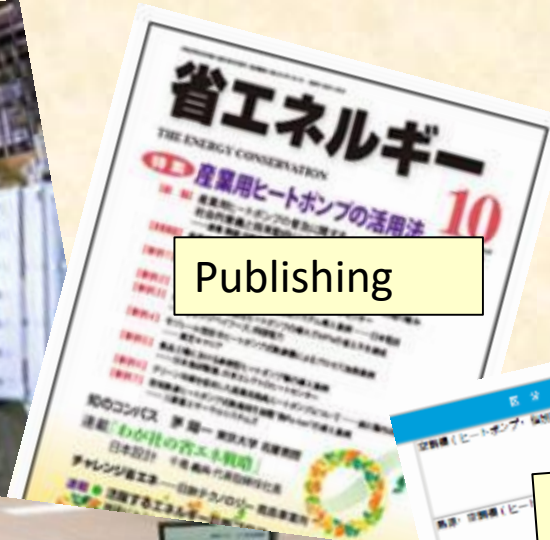
Energy Conservation Center、Japan

Legal status :
Establishment :
Office location :
Staff :
Business size :

General Incorporated Foundation
1978
Tokyo Head office & 8 branches
90 persons (as of 2018)
23 million US\$ in 2018FY



Audit, Consult



Publishing



Factory Investigation



Seminar

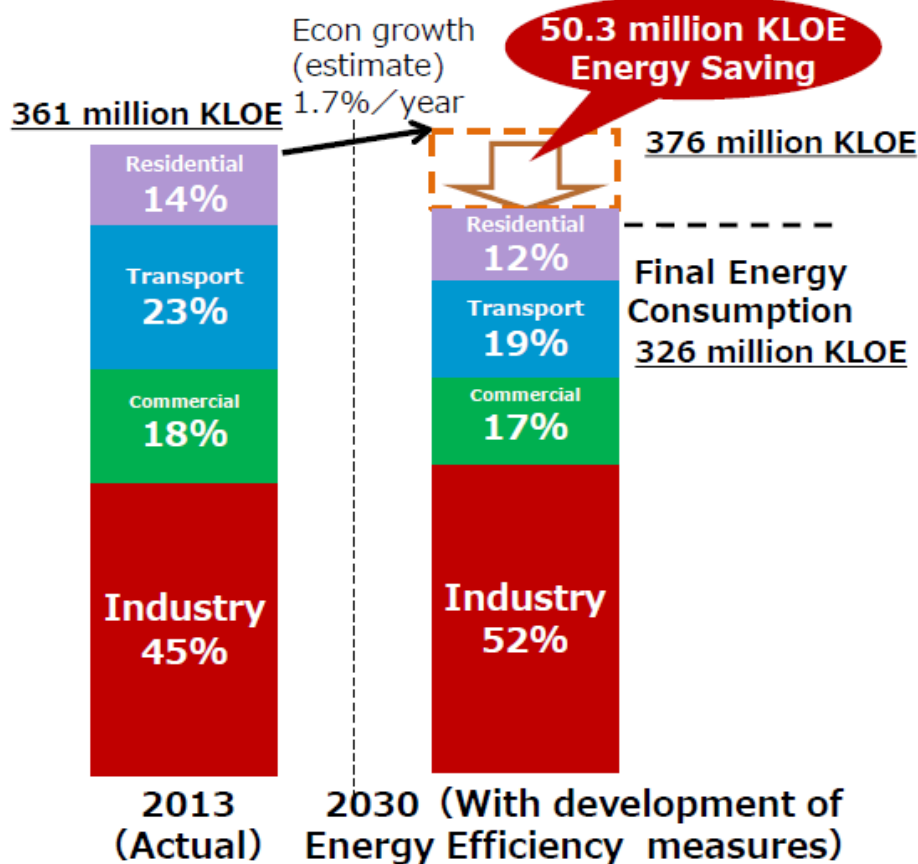
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Analysis Data base

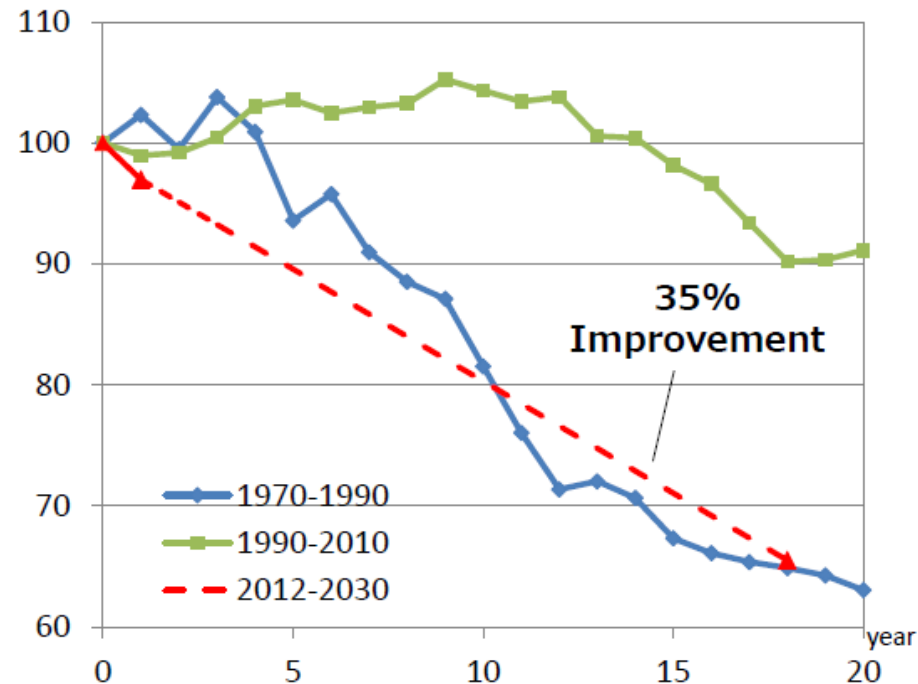
Energy Efficiency improvement towards 2030

Japan pledged to reduce energy consumption by 50.3 million KLOE by 2030 compared to 2013.

Final energy consumption (Long-term energy demand & supply outlook)



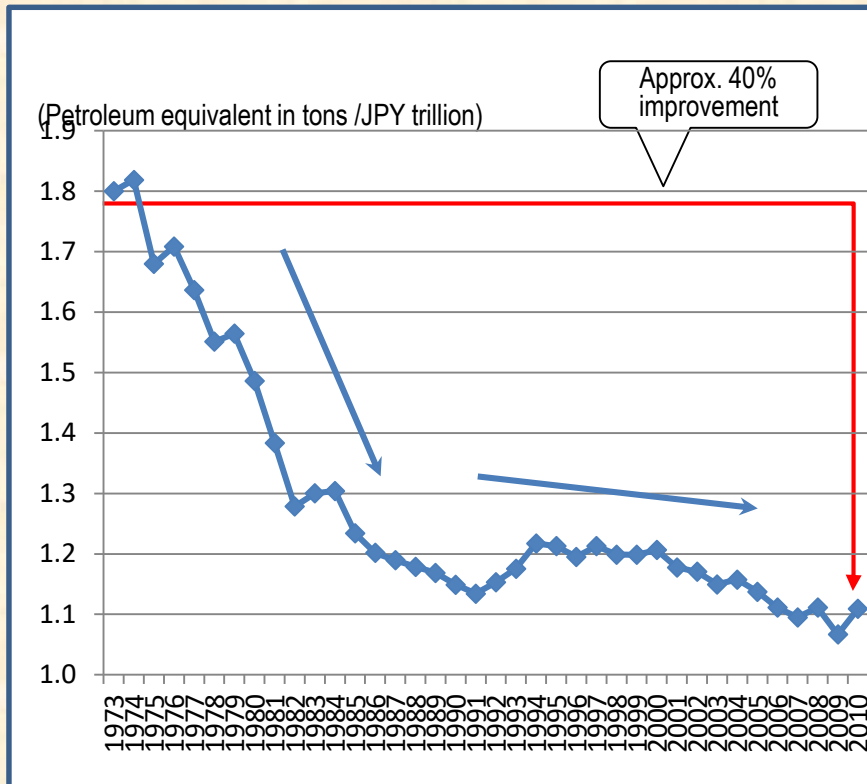
Energy Efficiency Improvement



Energy efficiency rate = Final energy consumption / real GDP

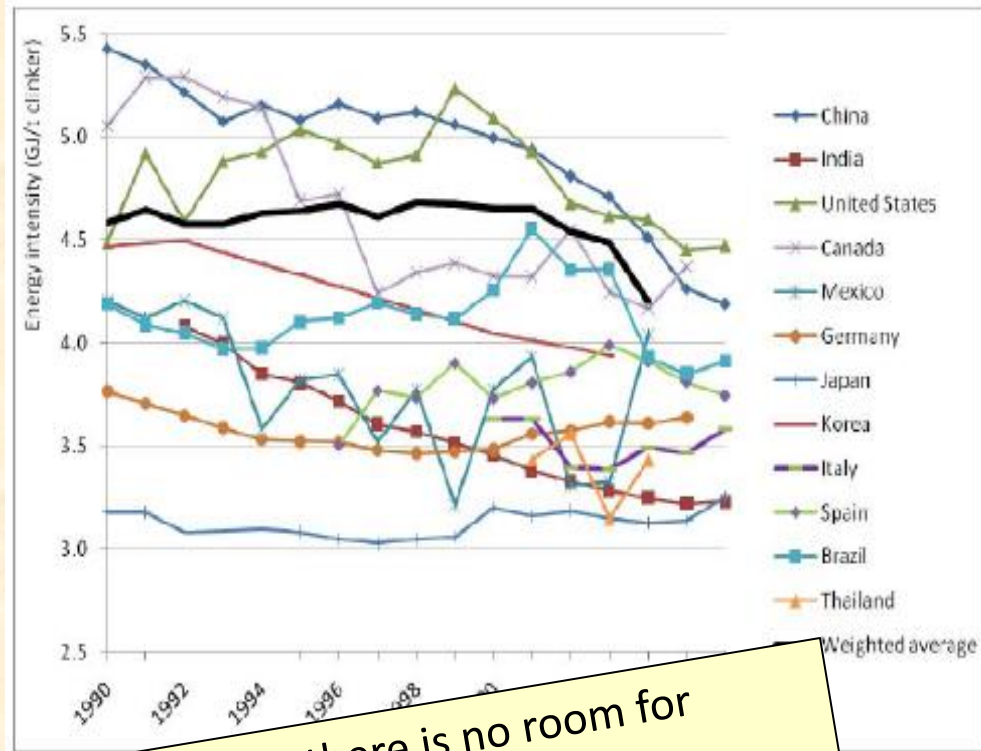
Current Situation of Energy Conservation in JAPAN

Primary energy consumption per real GDP in Japan



Source: "Comprehensive Energy Statistics" of EDMC/Agency for Natural Resources and Energy, estimates of EDMC and the "Annual Report on National Accounts" of the Cabinet.

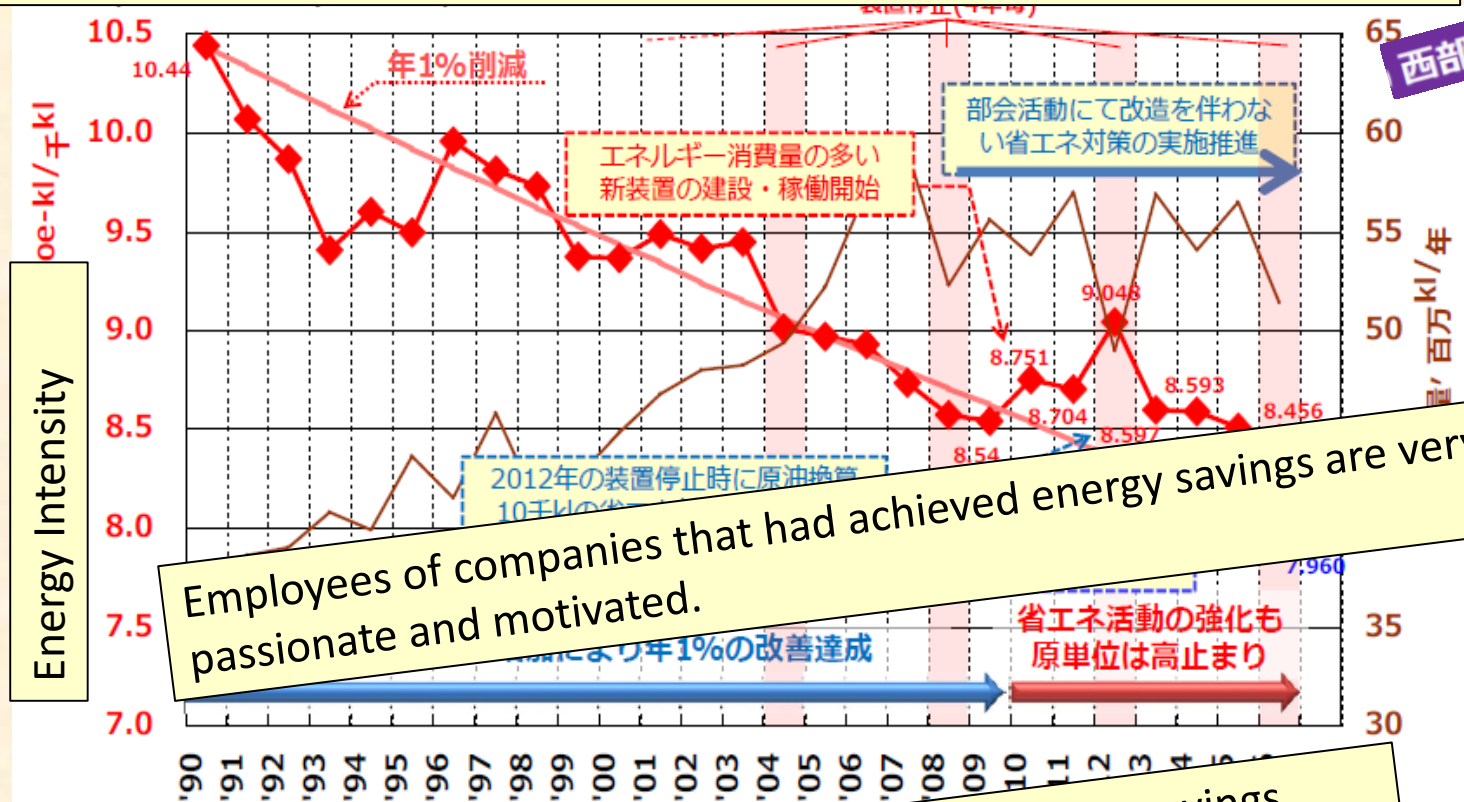
Energy Intensity – Cement Industry



You may think that there is no room for further improvement in Japan. But.....

Many Companies has achieved good performance

This oil company has saved 1% energy every year. They implement recovering exhaust heat and adopting inverters. Not necessary to adopt special technology.



Employees of companies that had achieved energy savings are very passionate and motivated.

Motivation is very important to improve energy savings.

Behavior Analysis (Psychological way)

Why people do what they do ?

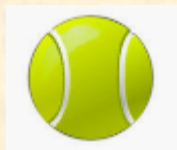
ABC: Antecedent, Behavior, Consequence

“Consequences determine one’s behavior”
Strengthen the favorable consequence
Remove the bad consequence



Prof. Sugiyama

Antecedent



Behavior



Consequence

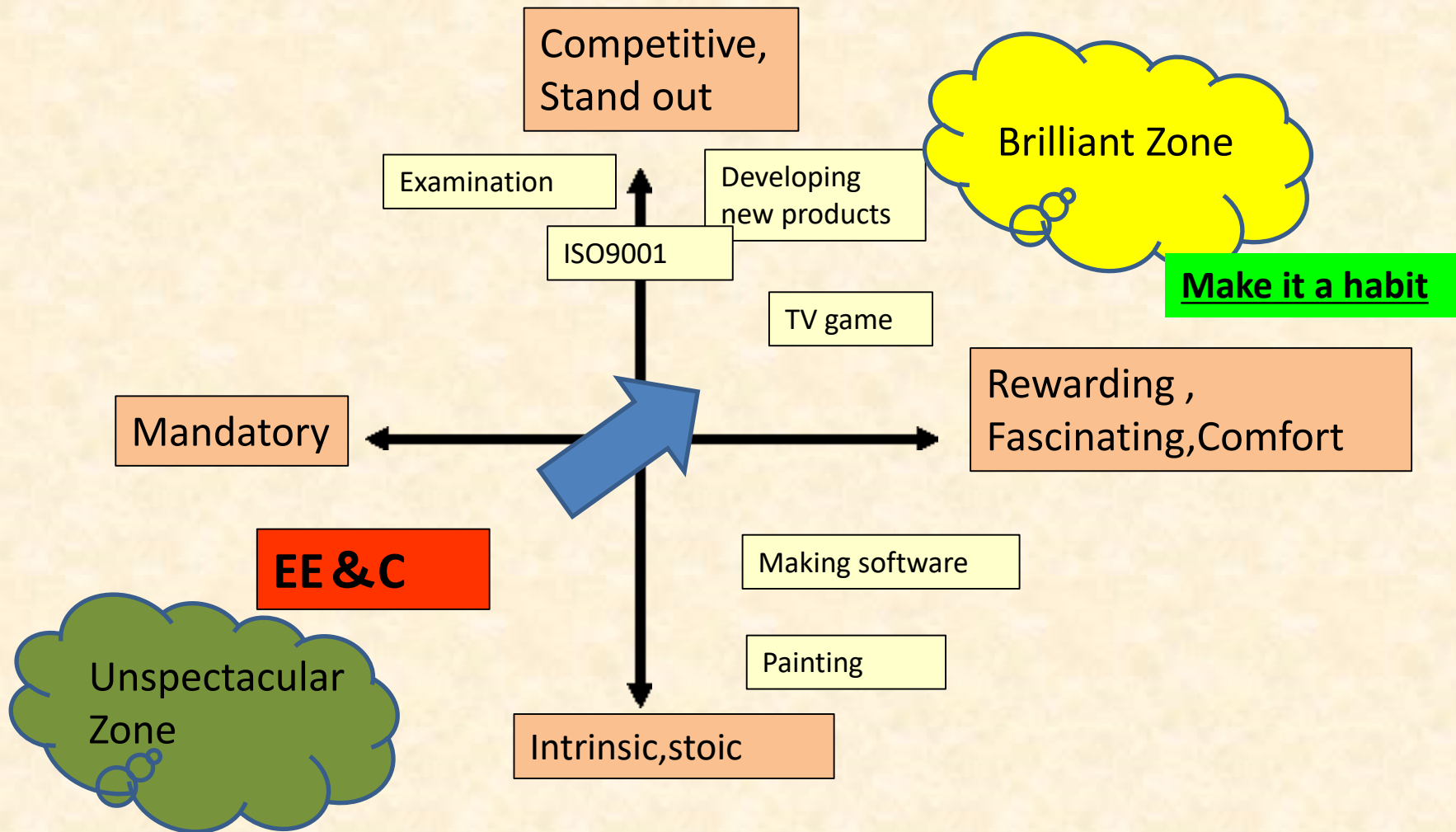


Behavior Analysis Matrix for Energy Conservation

We need to set up good consequences for each position relevant to energy conservation

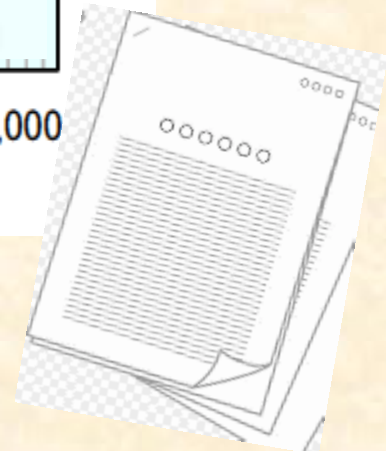
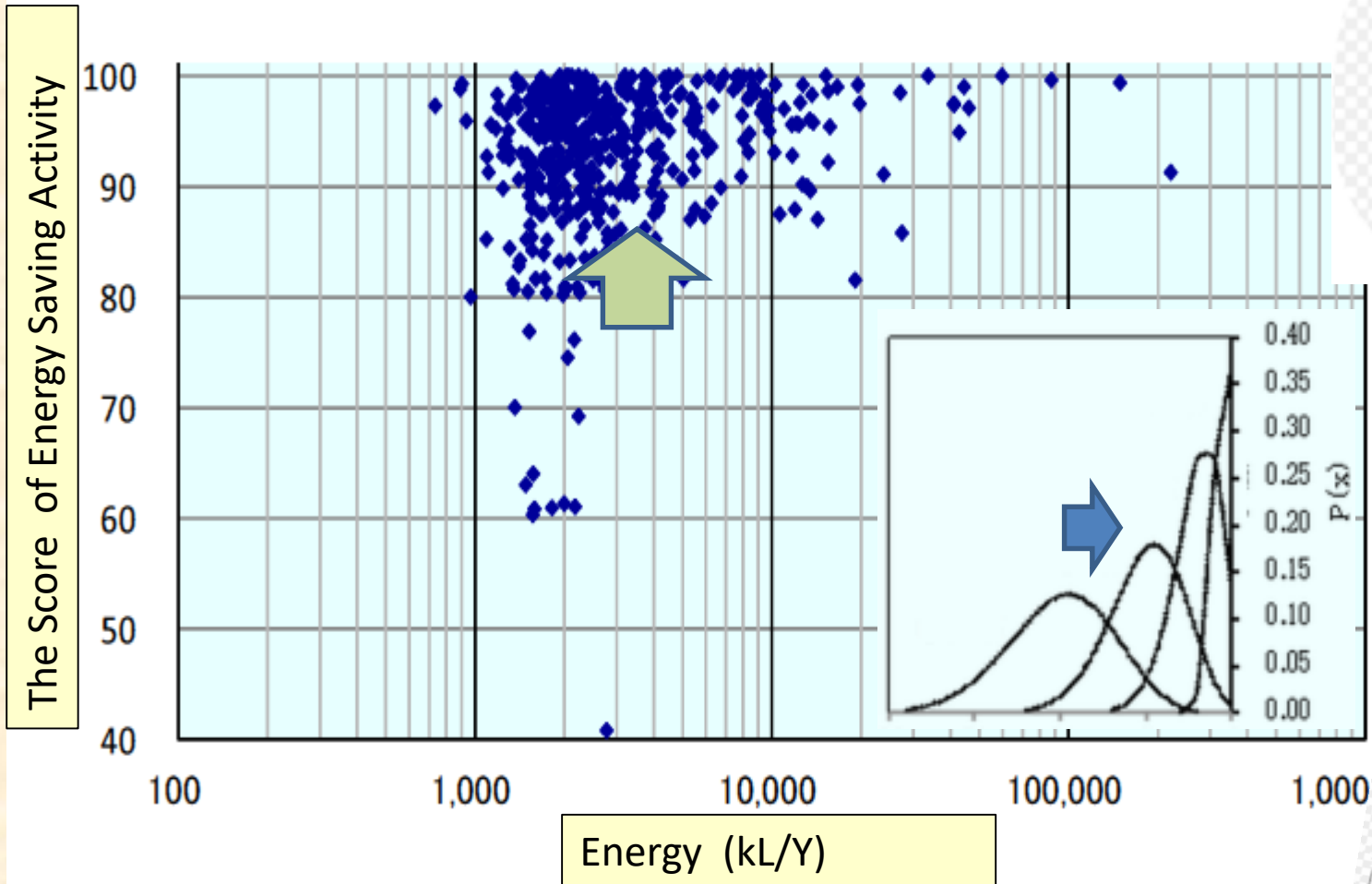
Consequences	Top Management	Energy Manager	Operator, Tennant
Good			
Nothing	Energy saving is not a competitive issue. Not challenging	No reward	No interest
Bad	Initial cost	Busy, Claim from Operators in the factory	Bad influence for Product quality, Bad working environment

What kind of consequences would be attractive?



1. Classification, Benchmark

Distribution of EE&C Activity Level (Factory Investigation)



Classification system for business operators

Class S

*1

[Levels]

- (i) Having achieved the reduction of specific energy consumption by 1% /y
- (ii) Having achieved the benchmark target

Class A

*1

[Levels]

Not falling under Class S nor Class B

Class B

*1

[Levels]

- (i) Having failed to achieve the target and increased specific energy consumption in recent two years or
- (ii) Having increased specific energy consumption by 5% or more on average for five years

Class C

[Levels]

Among business operators classified into Class B, those that are especially bad at complying with judgment standards

[Measures]

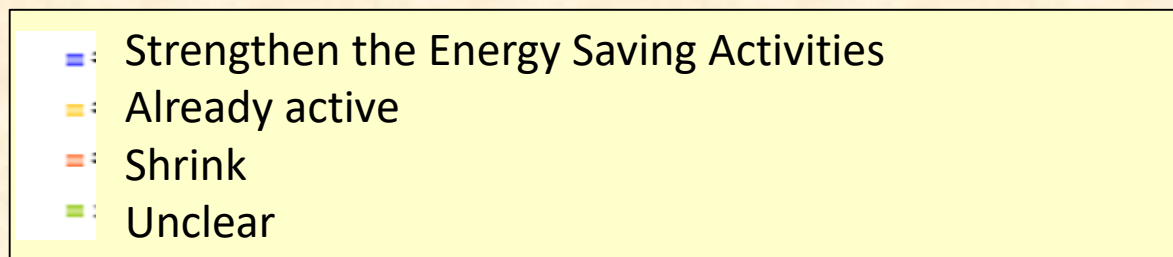
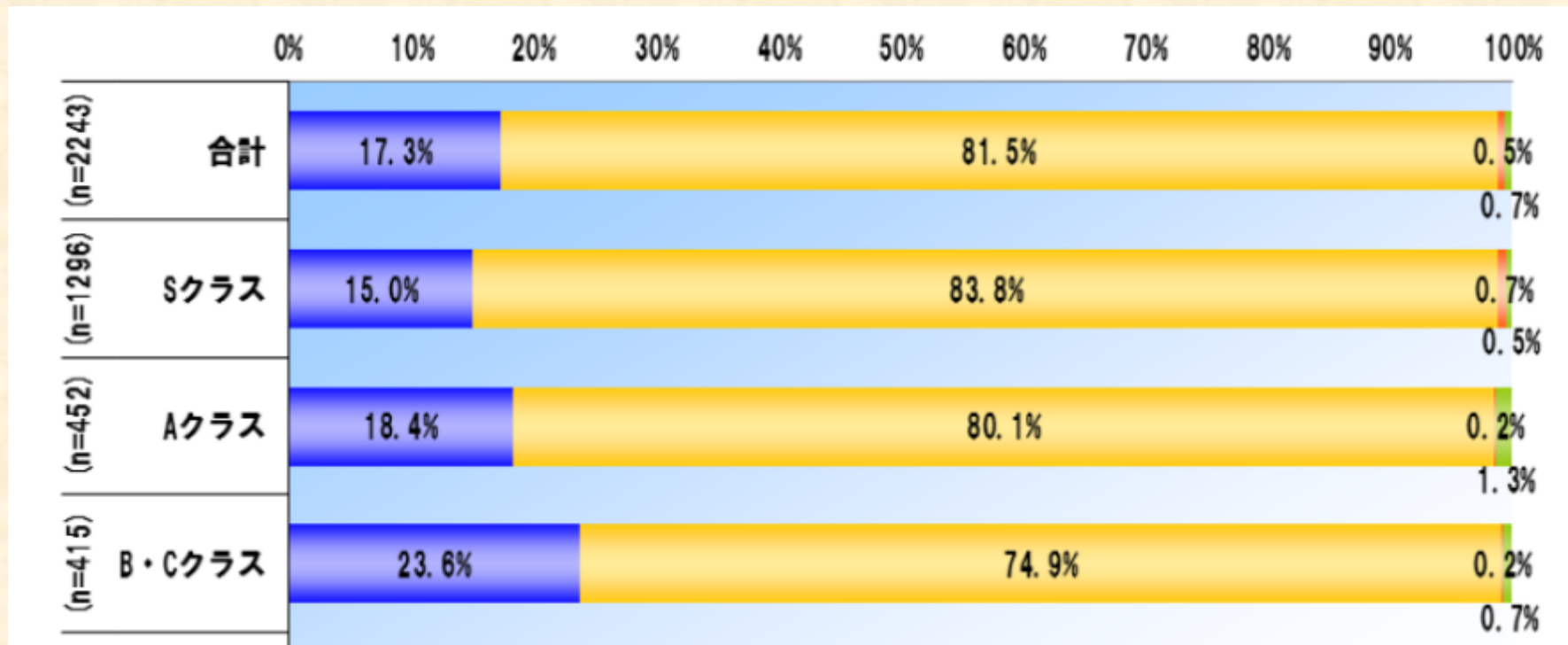
Guidance based on Article 6 of the Act on the Rational Use of Energy is provided.

Designated Companies:12,412

Measures

A notice is sent and on-site inspection is conducted intensively.

Effect of Classification (by questionnaire)



Public Announcement of Classification Results

標準産業分類 中分類 ※本制度における評価は、特定事業者の工場・事業場におけるエネルギーの使用状況等に基づいた評価であり、必ずしも各業種におけるエネルギー使用状況等を反映したものとは限りません。	特定事業者 番号	主たる事業所の 所在地	事業者等名	☆ : S Class			
				2015年	2016年	2017年	2018年
16 化学工業	0000111	北海道	苫小牧共同酸素株式会社	☆	☆	☆	☆
88 廃棄物処理業	0000121	秋田県	大館エコマネジ株式会社	☆		☆	
16 化学工業	0000131	埼玉県	株式会社 科高	☆		☆	☆
16 化学工業	0000141	三重県	株式会社エムイーピーコム四日市				
16 化学工業	0000151	大阪府	富士酸素株式会社	☆	☆		
1 農業	0000161	広島県	世羅菜園株式会社	☆	☆	☆	
16 化学工業	0000171	愛媛県	松山酸素株式会社				
9 食料品製造業	0000181	福岡県	株式会社デリカフレンズ	☆	☆	☆	☆
37 通信業	0000191	沖縄県	ファーストライディングテクノロジー株式会社				
35 熱供給業	0000211	北海道	苫小牧熱供給株式会社				
36 水道業	0000221	福島県	福島地方水道用水供給企業団	☆			
22 鉄鋼業	0000241	愛知県	株式会社 岡島パイプ製作所				
1 農業	0000261	岡山県	有限会社美咲ファーム		☆	☆	☆
18 プラスチック製品製造業（別掲を除く）	0000271	徳島県	四国トーセロ株式会社		☆		
75 宿泊業	0000281	宮崎県	青島リゾート株式会社	☆	☆	☆	☆
16 化学工業	0000291	沖縄県	株式会社おきさん				
69 不動産賃貸業・管理業	0000311	北海道	札幌駅総合開発株式会社	☆	☆	☆	☆
41 映画・音楽・文字情報制作業	0000321	香森県	株式会社東亜日報社	☆	☆		



The top cares about this and makes efforts to take the S class.

Benchmark System (Legal System)

The benchmark system is a system that determines the target value to be achieved in each industry.

		Level to be aimed at	Number of achievers	Number of reporters	Achievement ratio
1A	Steel industry by blast furnaces	0.531 kl/t	0	3	0%
1B	Ordinary steel manufacturing industry by electric furnaces	0.413 kl/t	5	32	16%
1C	Special steel manufacturing industry by electric furnaces	0.36 kl/t	5	19	26%
2	Electric utility industry	100.3% or more	0	11	0%
3	Cement manufacturing industry	3.891 MJ/t	5	17	29%
4A	Paper manufacturing industry	8.532 MJ/t	4	20	20%
4B	Paperboard manufacturing industry	4.944 MJ/t	5	31	16%
5	Petroleum refining industry	0.876	4	13	31%
6A	Basic petrochemicals manufacturing industry	11.9 GJ/t	1	10	10%
6B	Soda industry	3.45 GJ/t	8	22	36%

(Note) The foregoing is the result of the analysis conducted based on the periodical report of FY2013.

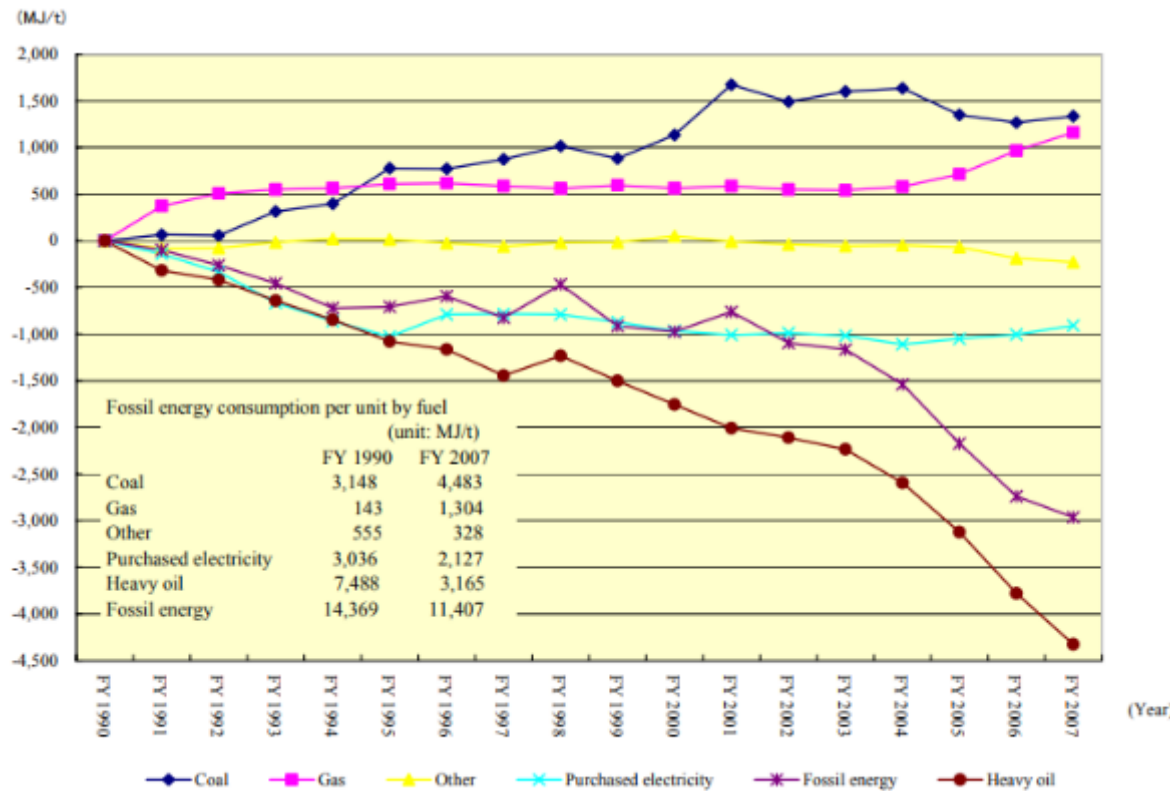
Public Announcement of Benchmark Results

(6 A) : Field :Petrochemical

Target	: 11.9 GJ/t 以下
Average	: 11.3 GJ/t (前年 11.3 GJ/t)
σ	: 2.0 GJ/t
No. of Achievement	: 5/10 (割合 50.0 %)
Company name	: 住化コベストロウレタン(株) 東燃化学(同) 三井化学(株) 三菱ケミカル(株) 三菱ケミカル旭化成エチレン(株)



Palp and Paper Field



定格発電出力 9,000kW

蒸気量 70t/h

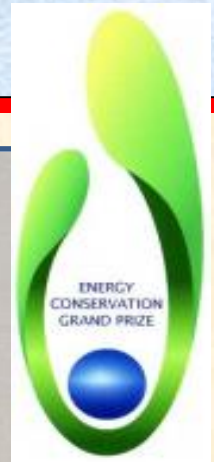
CO₂削減 約65,000t-CO₂/年

Under this system, some factories introduced biomass power generation.



2.Awarding

“SyoEne Taisyo” Energy Conservation Grand Prize Award



Motivation

Motivation

From May to July

Application

1st Evaluation:
Document
Reviews

In October

Public Presentation
Competition

2nd Evaluation:
Questions from
Judging Committee

In next year January

Award Ceremony

Optional Evaluation:
Site visit by Judging
Committee

Energy Conservation Grand Prize Award

Category

- Best Practice
- Products, BAT



Evaluation Items

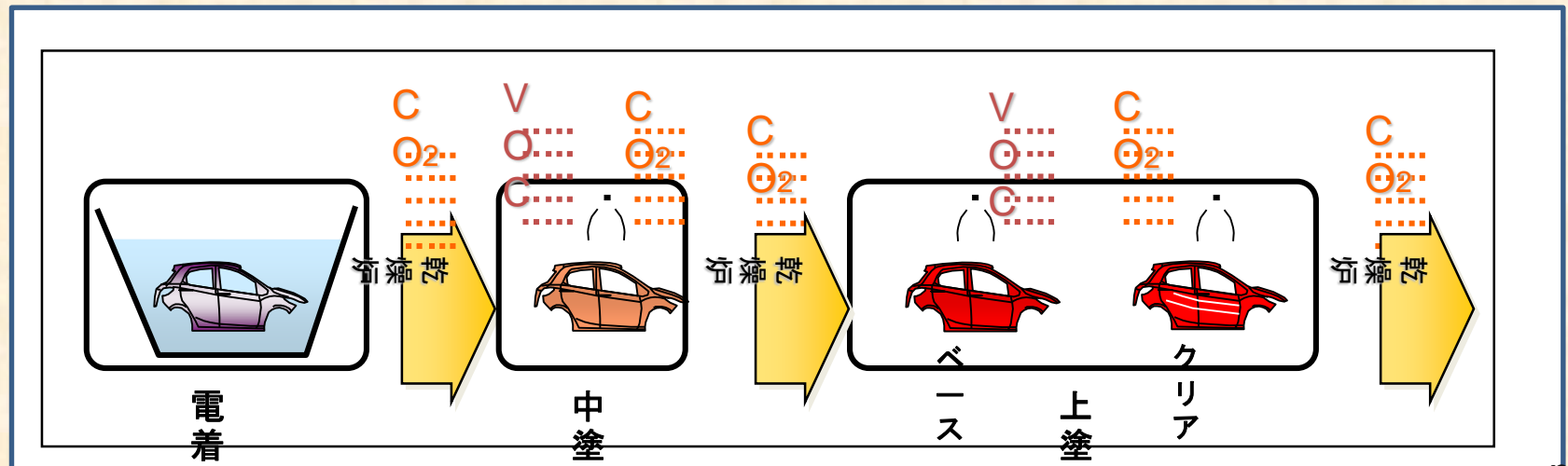
- Innovative
- Energy efficiency
- Versatile
- Environmental
etc.

	Best practice category	Product and business model category
Minister Prize of Economic, Trade and Industry	At most 4 cases	At most 4 cases
Director General Prize of Agency of Natural Resources and Energy of METI	At most 5cases	At most 4cases
Chairman Prize of ECCJ	Approx. 10	Approx. 10
Special Prize from Judging Committee	Approx. 1	Approx. 1

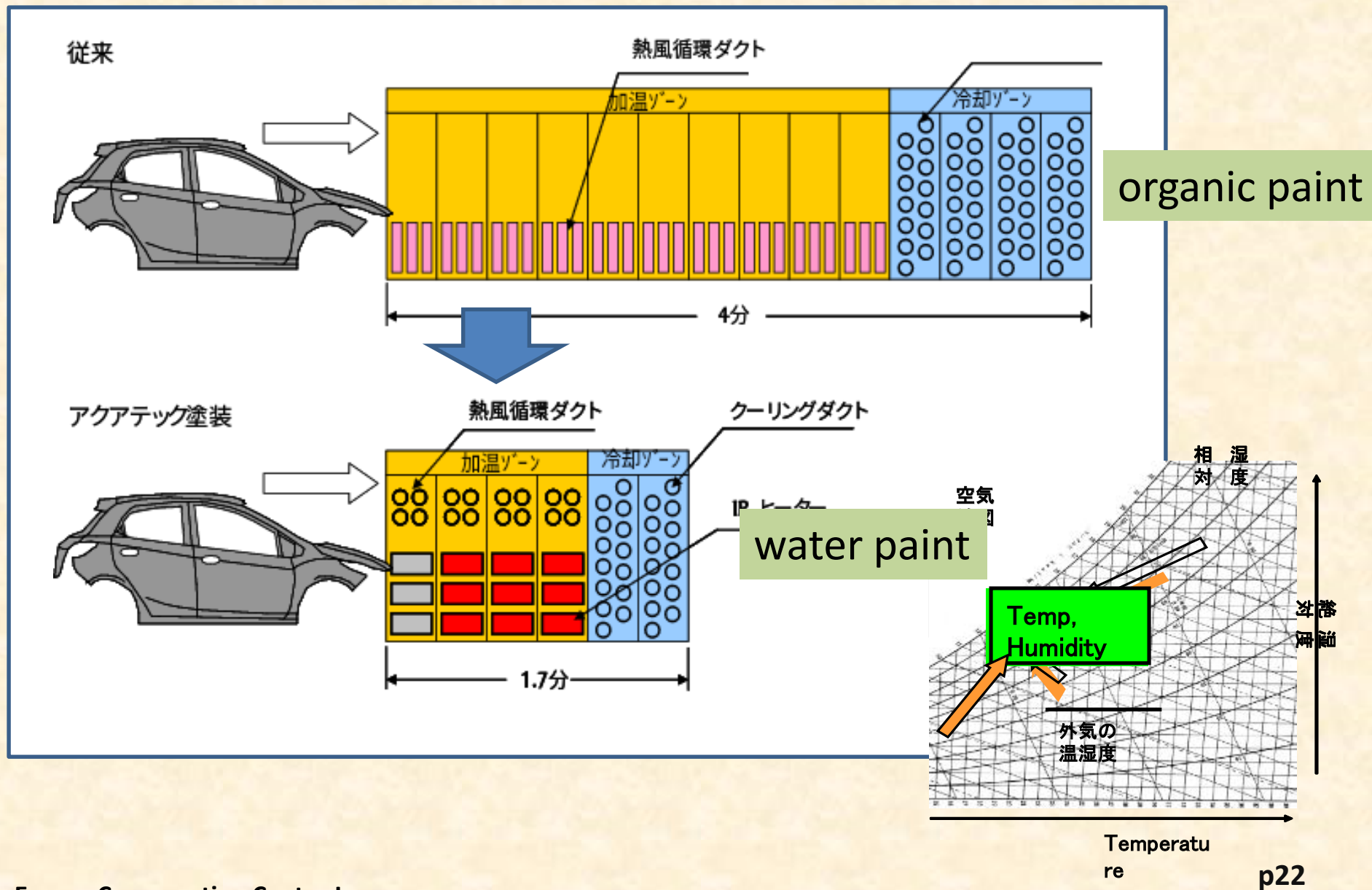
Good Practice (MAZDA)



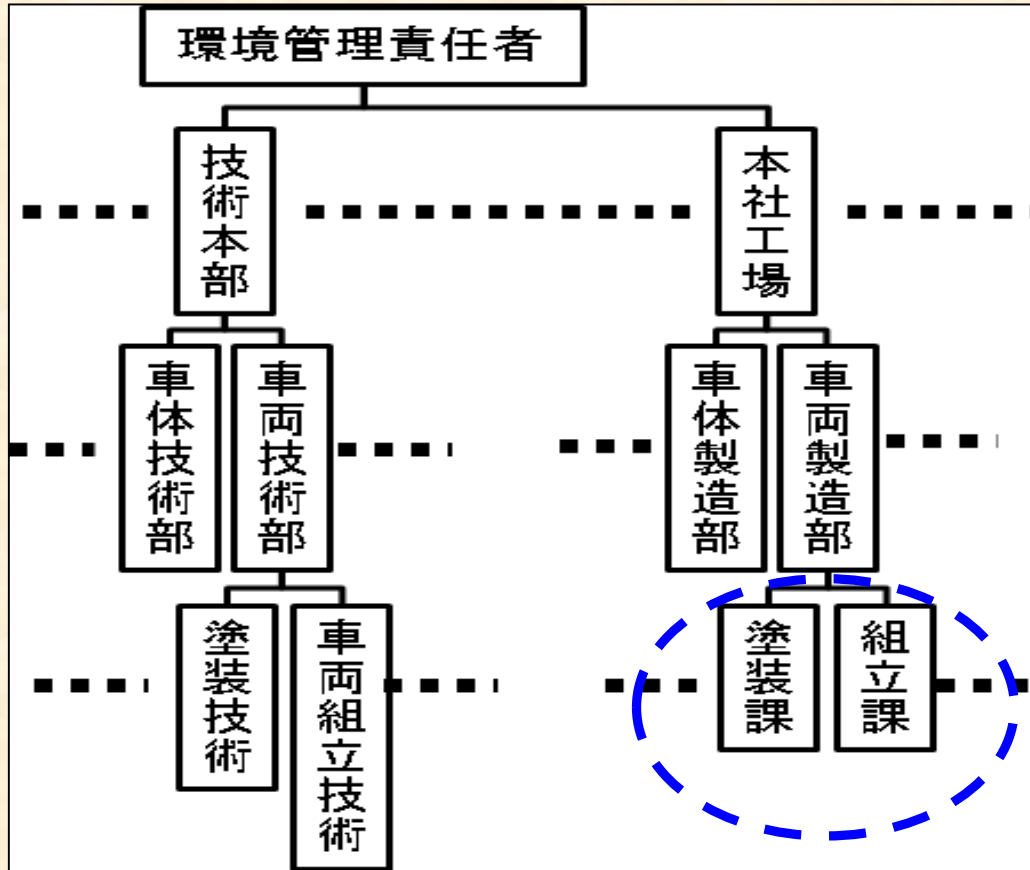
They wanted to reduce VOC and CO₂ emission of a car painting process



Good Practice (Innovative!!)



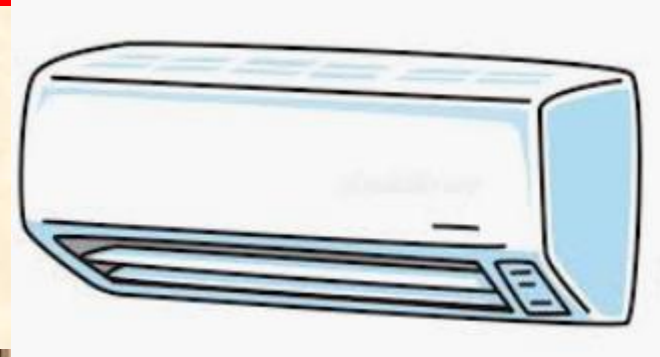
Sunlight to the Operators in the factory



Our visit and Award improved the motivation of people who are usually in inconspicuous

3. Essential Approach, NEB (Non Energy Benefit)

What is drain water?



Mass of
Energy????

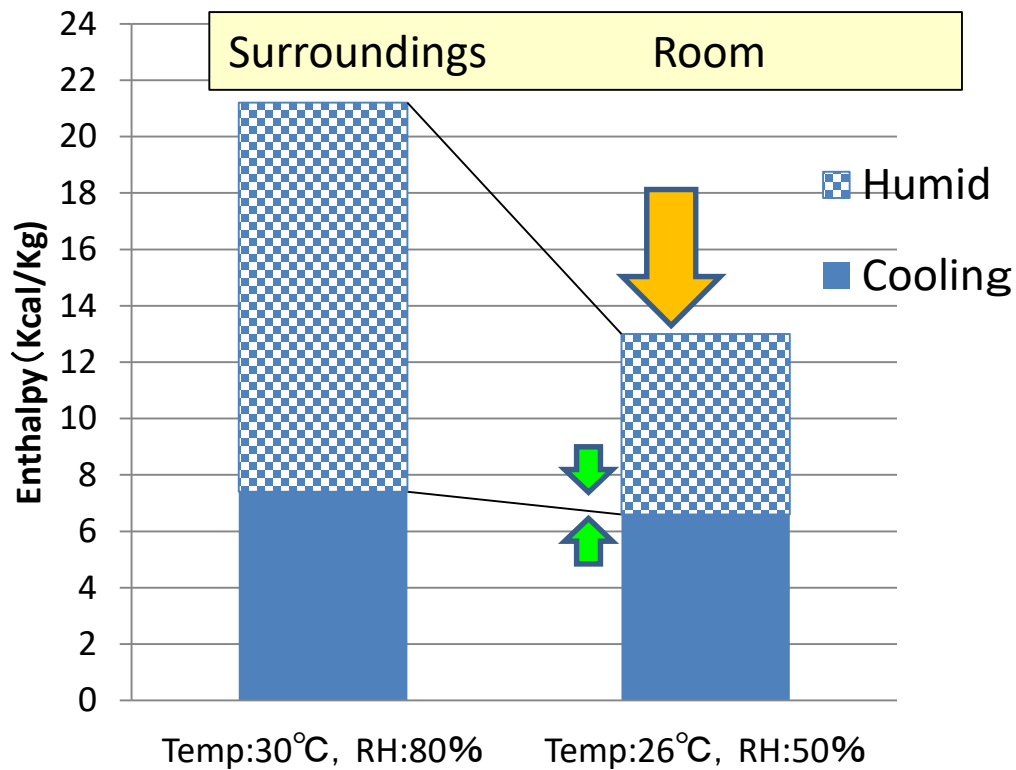


Moisture has huge energy



Air Conditioner is used for making water(drain)

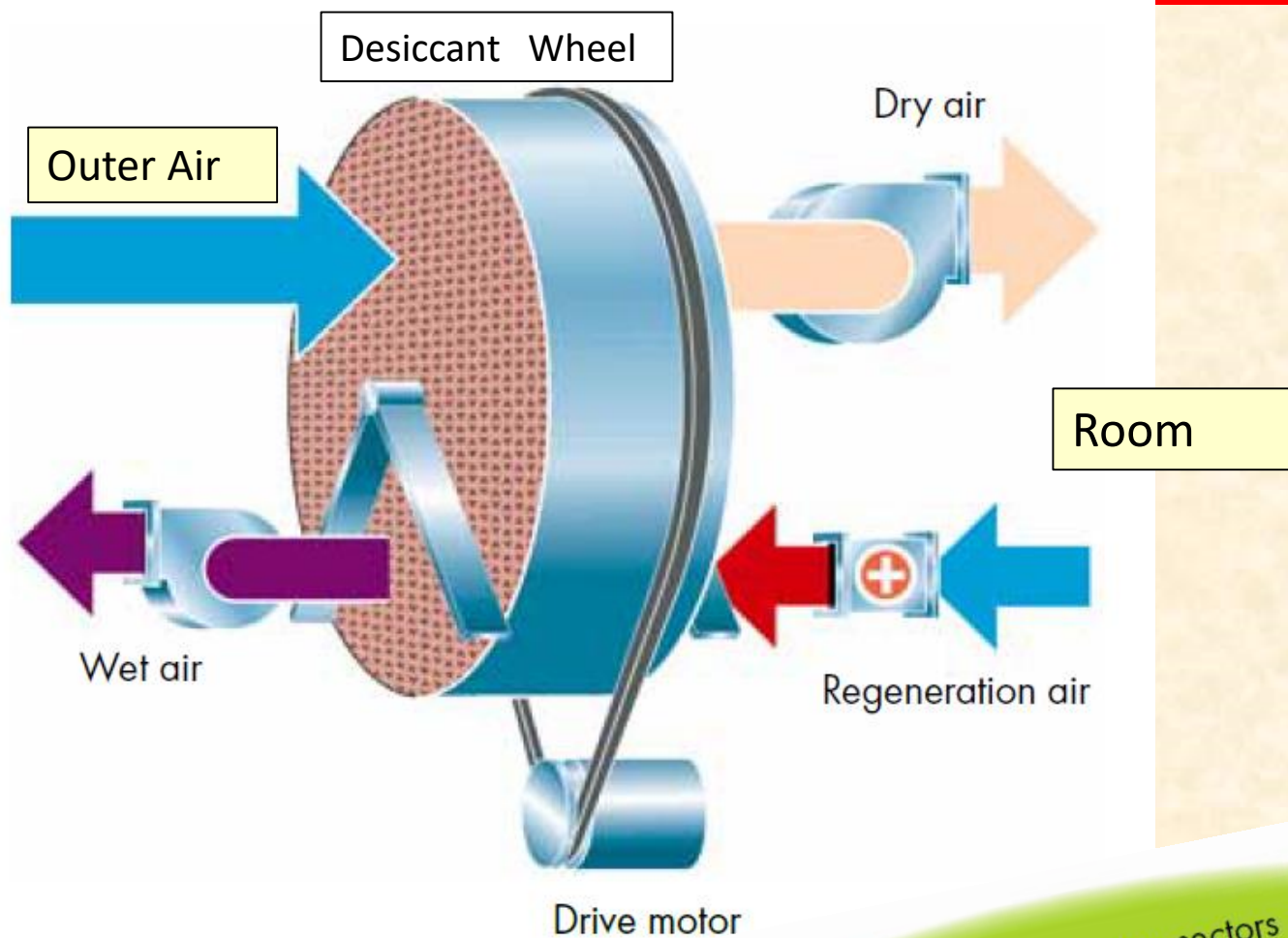
How much energy is used for Air cooling ?



The energy used for air cooling is very small !!
Most energy is used for making water drain !!

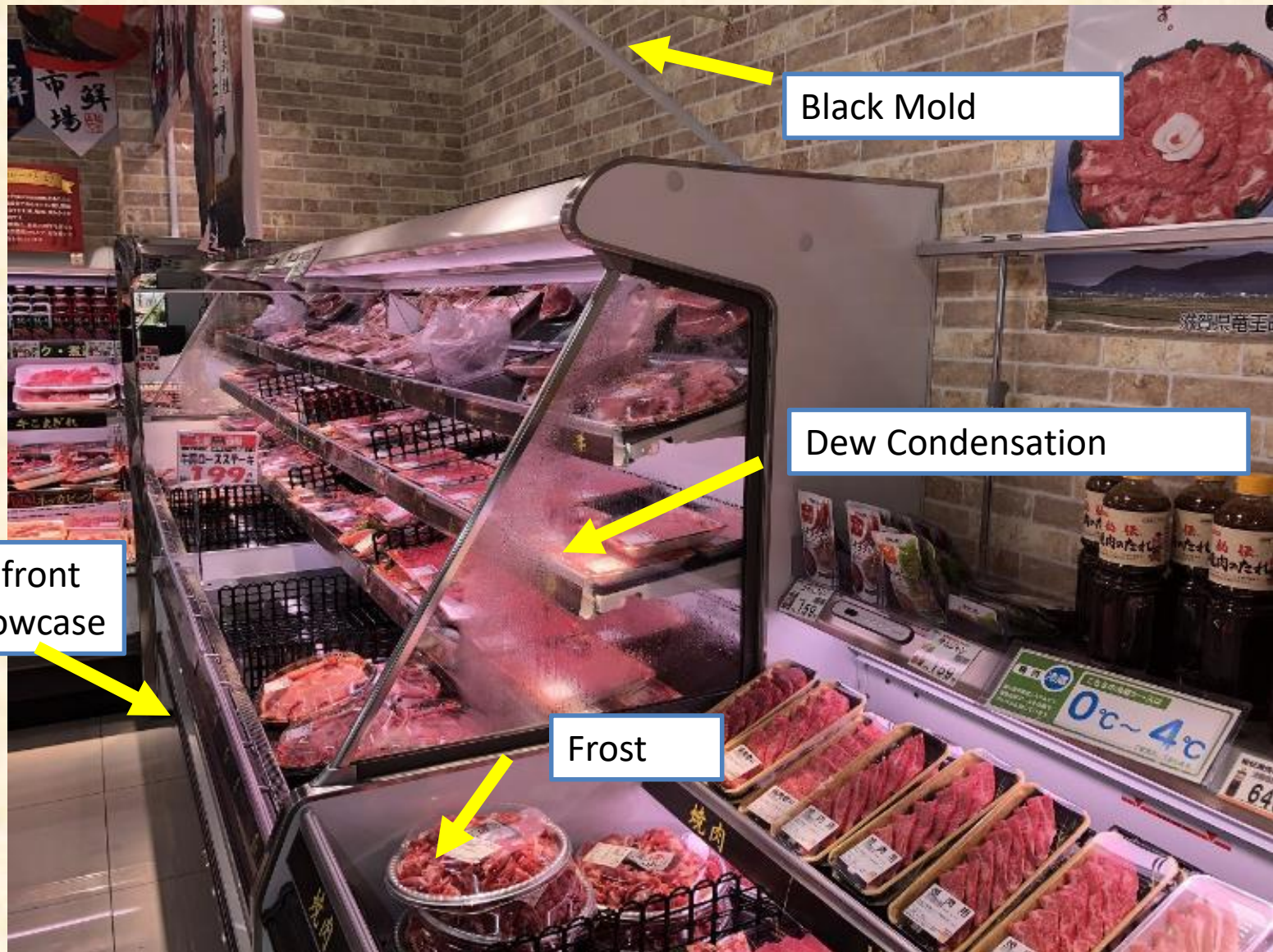


Dehumidifier



Energy recovery sectors
for enhanced performance available
- saving up to 30% energy

Super Market Challenges



Optimization for Energy saving & Comfort

Ene-CAT (byECCJ)

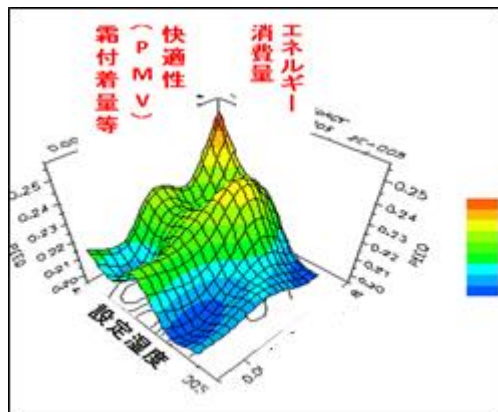
Optimization
AI



○Target Function
Energy, Comfort(PMV)

○Input Parameter

- ✓ 設定温度・湿度
- ✓ 外気温度・湿度
- ✓ 顧客数 など



Optimization
tool: AMDESS

BEMS

食品スーパー 設備・機器

Data Base



Control



Air Conditioner



空調
温度

Dehumidifier



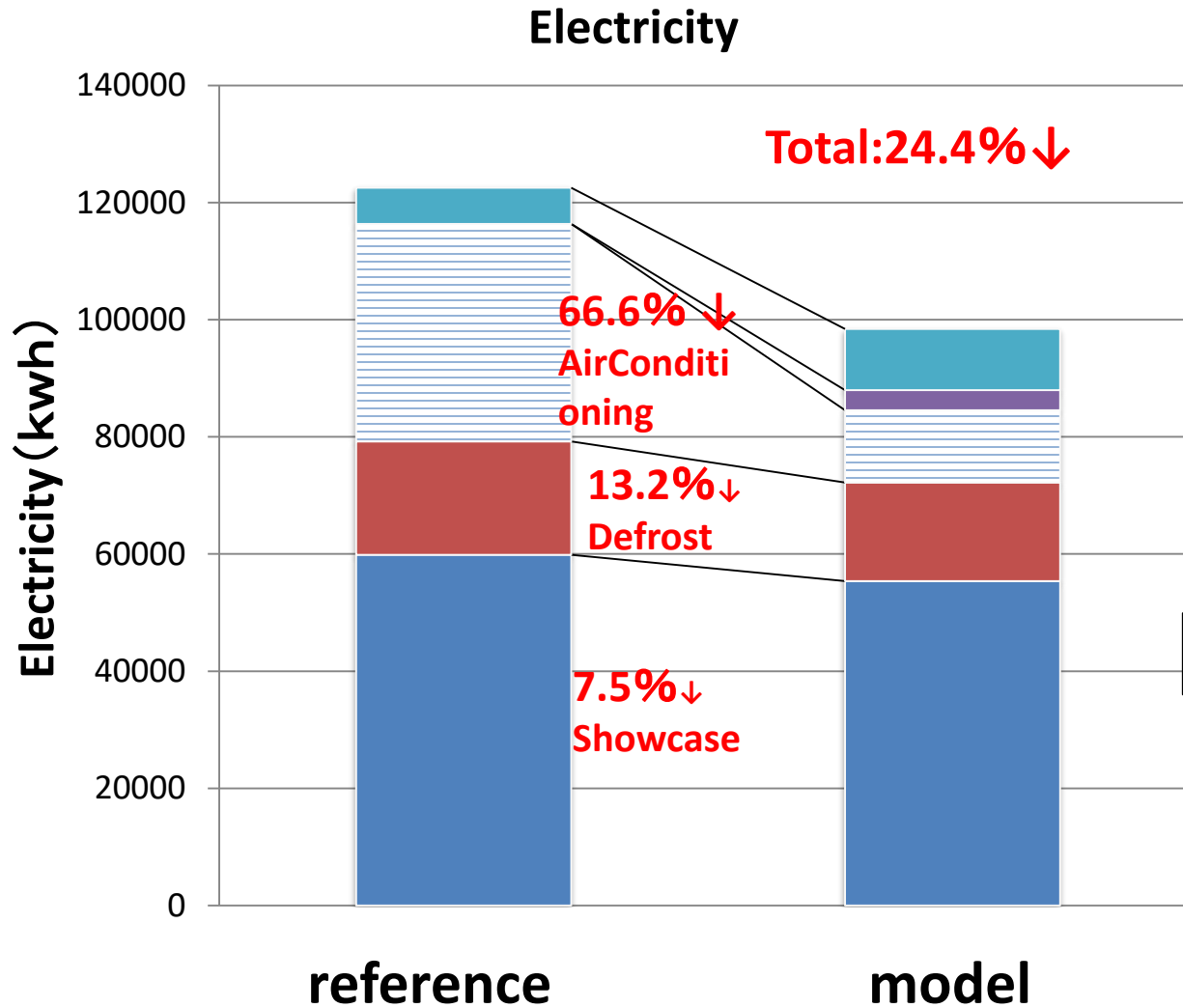
除湿
湿度

Showcase



Air conditioner should be used for air cooling
Dehumidifier should be used for dehumidifying
Show-case should be used for food cooling

Energy Analysis of the Supermarket



Cost Saving: \$40K /y



NEB:Clean,Hygienic



Frost



Black Mold



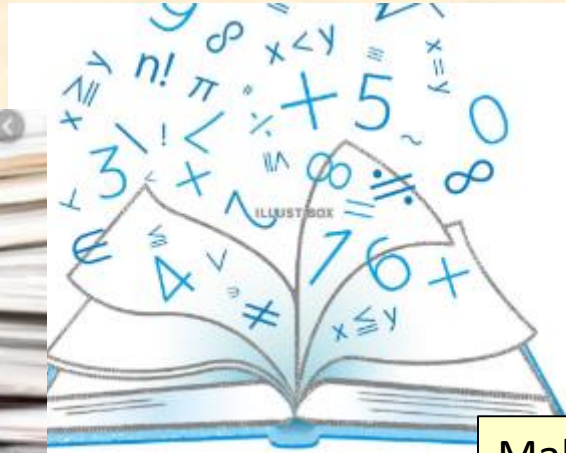
4. Supporting Tool

Energy Management in Steelworks



Energy managers

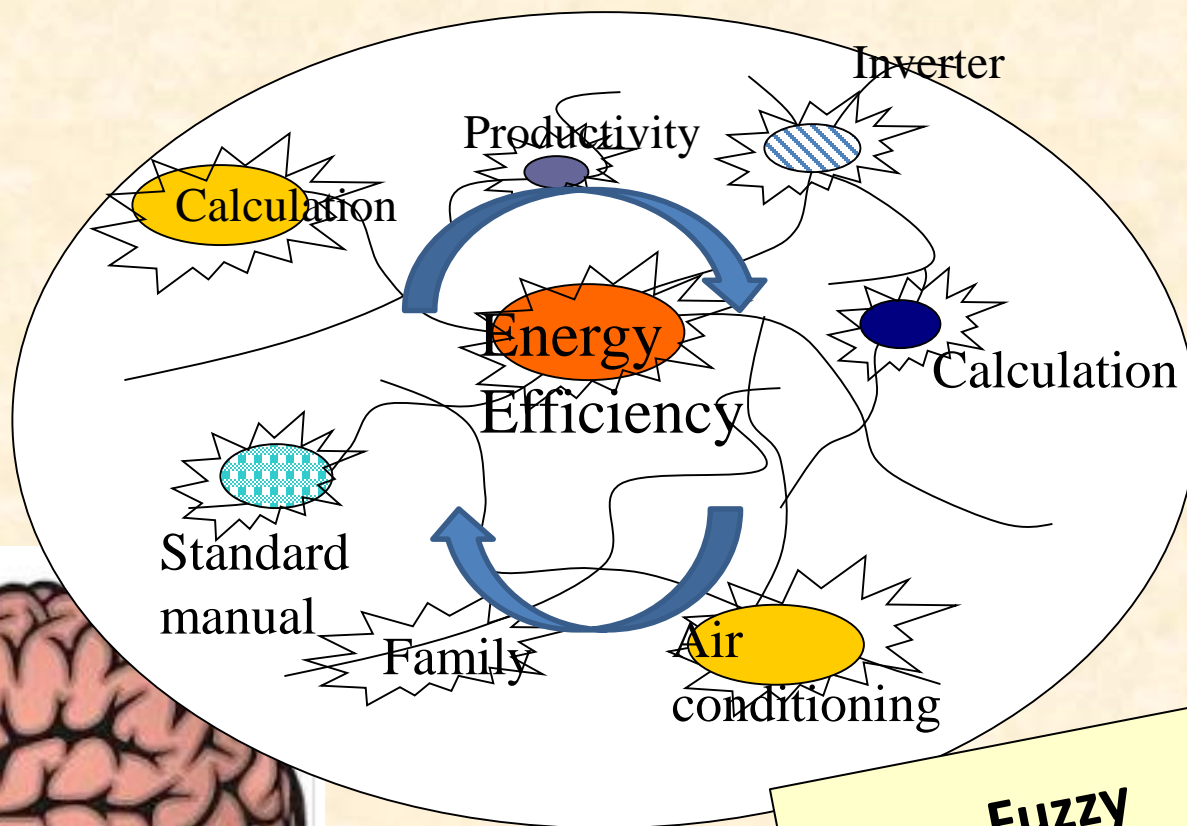
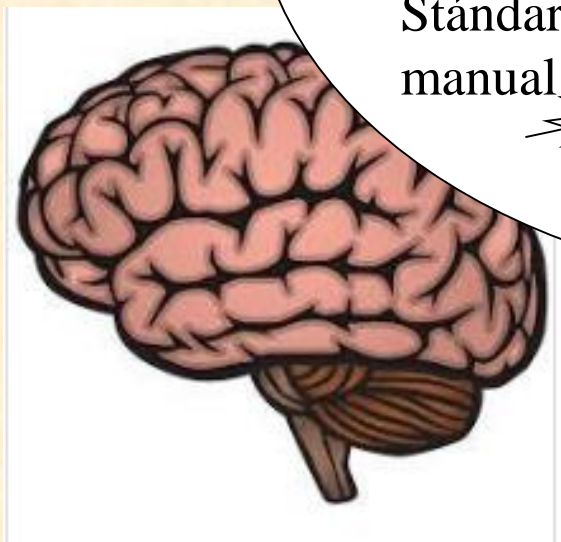
Many energy managers don't understand which is the first step.



Calculating the energy savings

Making documents(Periodical reports, Mid term plan)





**Fuzzy
never-ending cycle**

Integrated supporting system is needed



1. Energy Review (Energy flow, etc)

ISO50001

Energy Review

Data Analyses

Significant Energy
Use (SEU)

Affecting
Parameters

Identify
Improvement

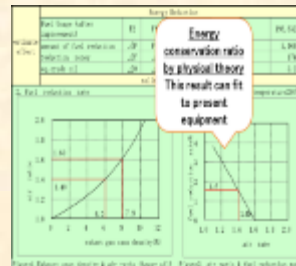
Energy
Conservation
Assisting Tool

Integrated

2. Energy Management Manual for Equipment

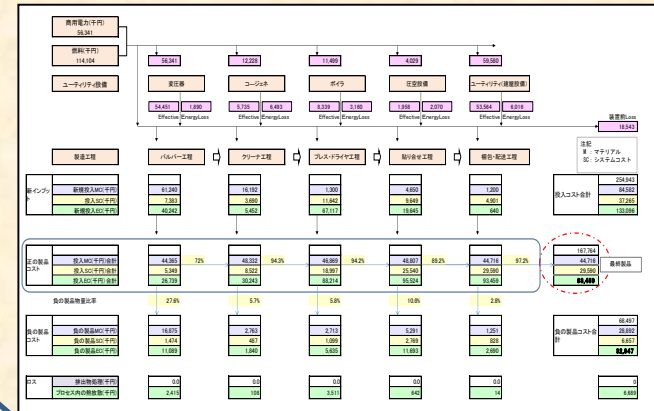
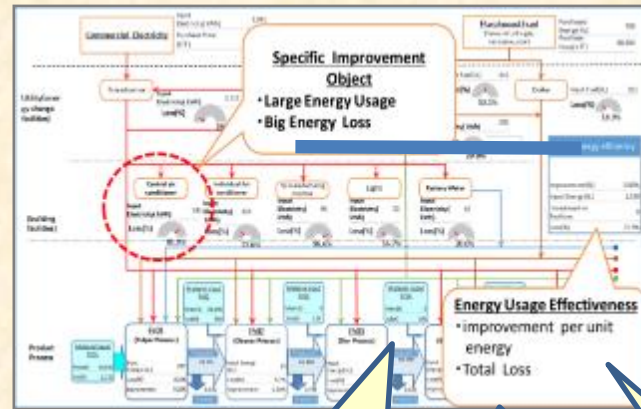
3. Calculation of Energy Saving Effect

Boiler: Energy
Management Manual
(Criteria, Measurement &
Record, Maintenance,
Improvements)



The structure of Ene-CAT® patented

Visualization of Energy Flow and Loss



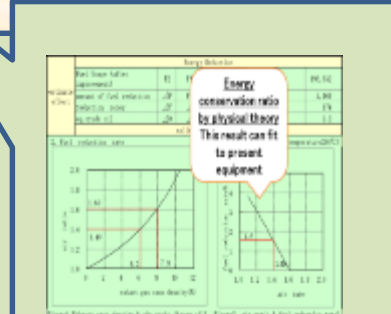
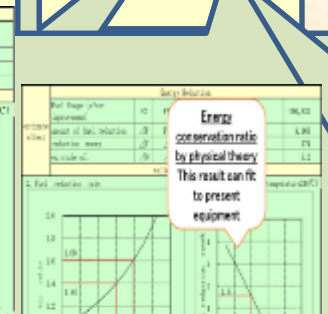
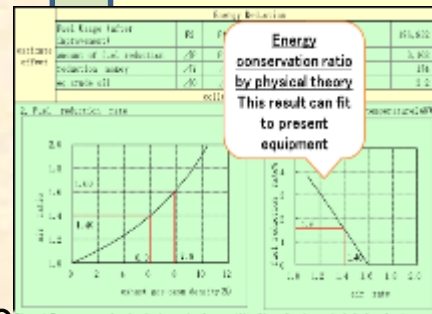
Energy Management Manual for Equipment (50sheets)

科目名・科目コード	担当教員名・所属部署	履修年次	履修学期
経済学Ⅱ	経済学部	2年次	第2学期
<p>この授業科目は、①②③④⑤⑥⑦⑧⑨⑩⑪⑫⑬⑭⑮⑯⑰⑱⑲⑳㉑㉒㉓㉔㉕㉖㉗㉘㉙㉚㉛㉜㉝㉞㉟㊱㊲㊳㊴㊵㊶㊷㊸㊹㊺の20個の科目と 選択科目の合計で、経済学Ⅱの履修単位を構成することになっている。</p>			
2. 履修科目			
①②③④⑤⑥⑦⑧⑨⑩⑪⑫⑬⑭⑮⑯⑰⑱⑲⑳㉑㉒㉓㉔㉕㉖㉗㉘㉙㉚㉛㉜㉝㉞㉟㊱㊲㊳㊴㊵㊶㊷㊸㊹㊺	履修科目名	履修単位数	履修科目の分類
①	経済学Ⅱ	1	経済学Ⅱ
②	経済学Ⅱ	1	経済学Ⅱ
③	経済学Ⅱ	1	経済学Ⅱ
④	経済学Ⅱ	1	経済学Ⅱ
⑤	経済学Ⅱ	1	経済学Ⅱ
⑥	経済学Ⅱ	1	経済学Ⅱ
⑦	経済学Ⅱ	1	経済学Ⅱ
⑧	経済学Ⅱ	1	経済学Ⅱ
⑨	経済学Ⅱ	1	経済学Ⅱ
⑩	経済学Ⅱ	1	経済学Ⅱ
⑪	経済学Ⅱ	1	経済学Ⅱ
⑫	経済学Ⅱ	1	経済学Ⅱ
⑬	経済学Ⅱ	1	経済学Ⅱ
⑭	経済学Ⅱ	1	経済学Ⅱ
⑮	経済学Ⅱ	1	経済学Ⅱ
⑯	経済学Ⅱ	1	経済学Ⅱ
⑰	経済学Ⅱ	1	経済学Ⅱ
⑱	経済学Ⅱ	1	経済学Ⅱ
⑲	経済学Ⅱ	1	経済学Ⅱ
⑳	経済学Ⅱ	1	経済学Ⅱ
㉑	経済学Ⅱ	1	経済学Ⅱ
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㊺	経済学Ⅱ	1	経済学Ⅱ

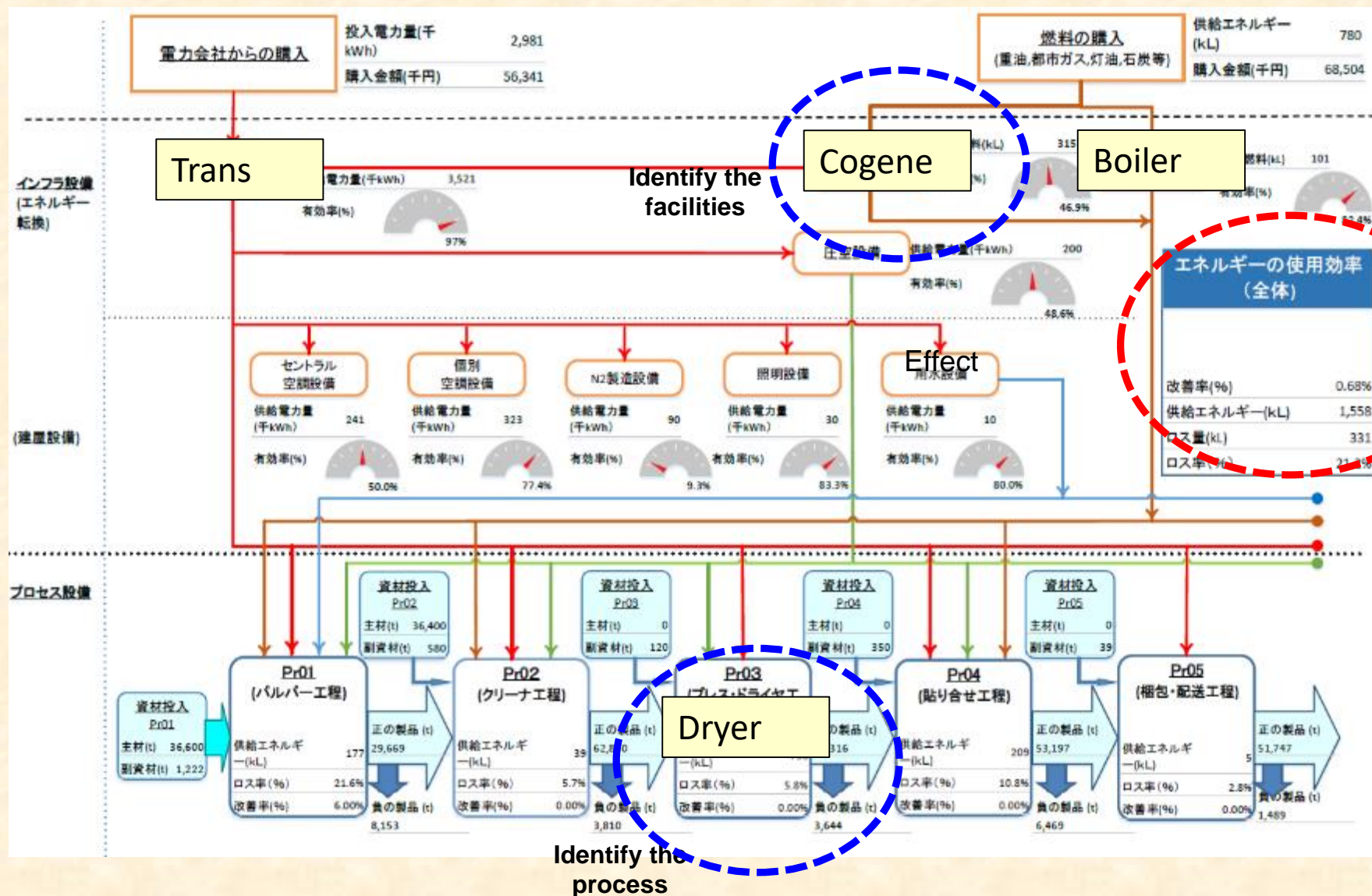
科目・学年	教科書	参考書
国語・1年生	国語は基本が読解力と語彙力	読解力 2冊
英語・1年生	英語は基礎が重要	基礎英語 2冊
数学・1年生	数学は基礎が重要	基礎数学 2冊
理科・1年生	理科は基礎が重要	基礎理科 2冊
社会・1年生	社会は基礎が重要	基礎社会 2冊
体育・1年生	体育は基礎が重要	基礎体育 2冊
音楽・1年生	音楽は基礎が重要	基礎音楽 2冊
美術・1年生	美術は基礎が重要	基礎美術 2冊
保健・1年生	保健は基礎が重要	基礎保健 2冊
職業・1年生	職業は基礎が重要	基礎職業 2冊
外国語・1年生	外国語は基礎が重要	基礎外国語 2冊
総合・1年生	総合は基礎が重要	基礎総合 2冊
情報・1年生	情報は基礎が重要	基礎情報 2冊
芸術・1年生	芸術は基礎が重要	基礎芸術 2冊
その他	その他は基礎が重要	基礎その他 2冊

[illegible]

Calculation of Energy Saving Effect (200-300sheets)



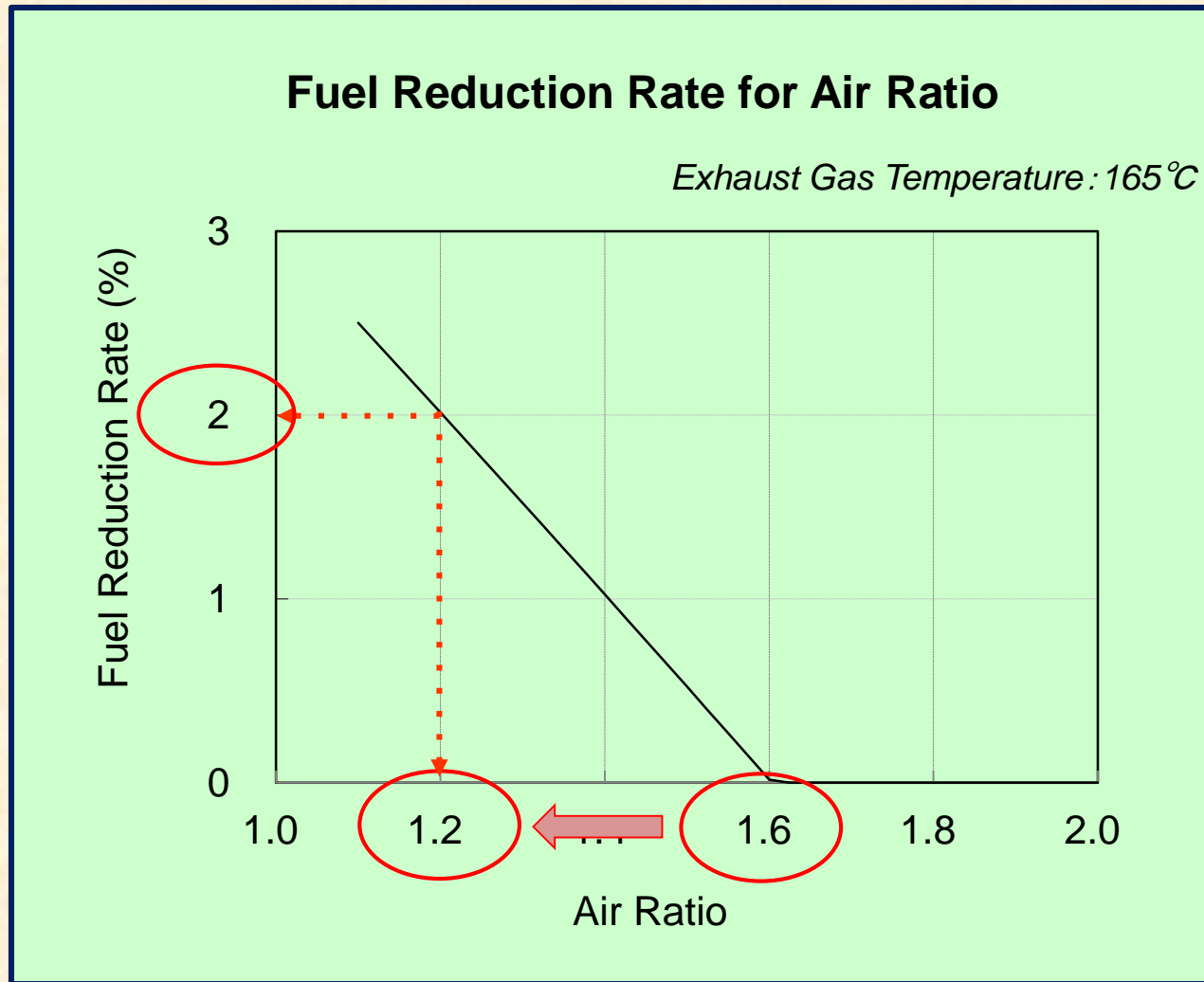
Specific Improvement Objectives



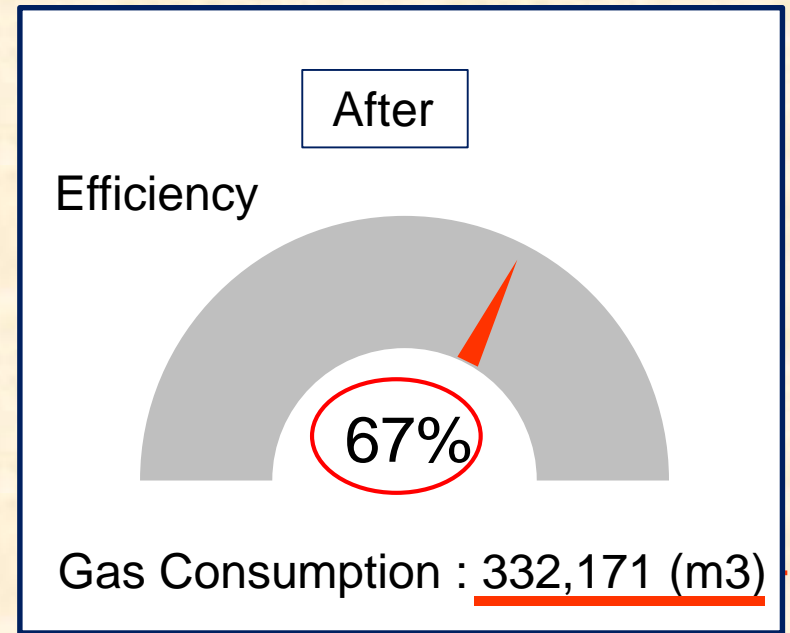
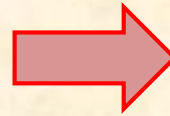
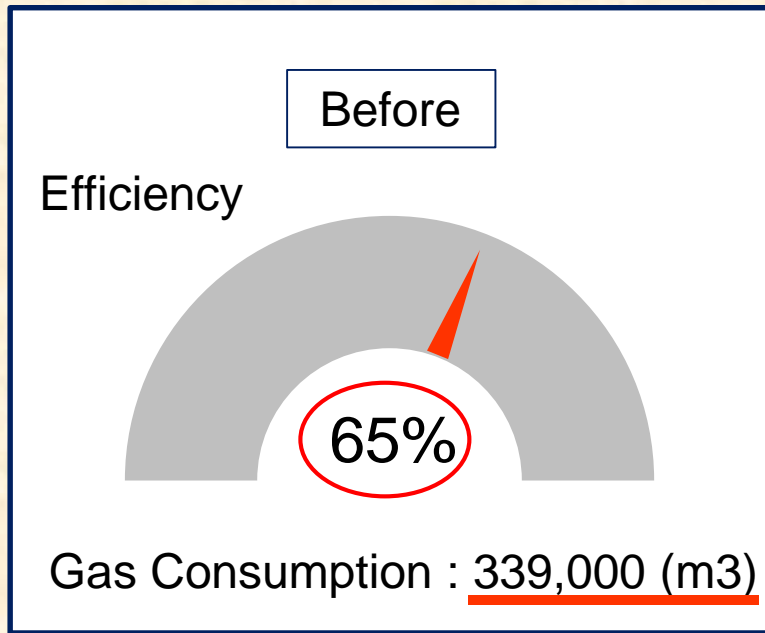
Demonstration

Management manual based on "Act on the Rational Use of Energy"		Management manual for Boiler		Reference No.:	
				Revision :	
1 . Purpose					
This management manual establishes rules for the management, measurement, recording, maintenance and inspection for managing the boiler of XXX building to realize rational use of energy					
2 . Scope					
This management manual is applied to the boiler of XXX building.					
Item	Contents			Management value and frequency	
Management	1.Conbustion Management				
	The following items are managed to implement efficient operation according to the load.				
	(1) Air ratio (voluntary management)			Exhaust gas air concentration (%)	7.9
				Air Ratio :	1.6
	(2) Vaper pressure			Vapor Pressure (MPa)	0.50
	(3) Steam temperature			Steam Temperature (℃)	145

Air Ratio :	1.2
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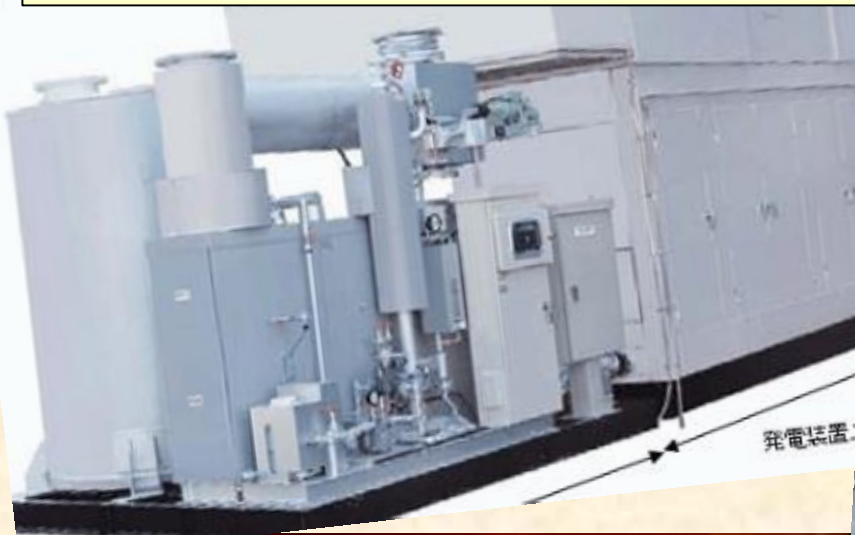
Demonstration



AFTER	
Total Energy Efficiency	
Improvement (%)	1.125
Investment (k¥)	0
Loss (%)	8.56

EneCAT assist Decision Making

They decided to install cogeneration.
It was an investment of 10 million dollars.



Image

Energy saving requirement by the government

Japan fell into the large electricity shortage under the influence of the big earthquake in 2011.

→Energy Saving Actions in Electricity (Office building) was announced by METI

5 actions

METI : Ministry of Economy, Trade and Industry

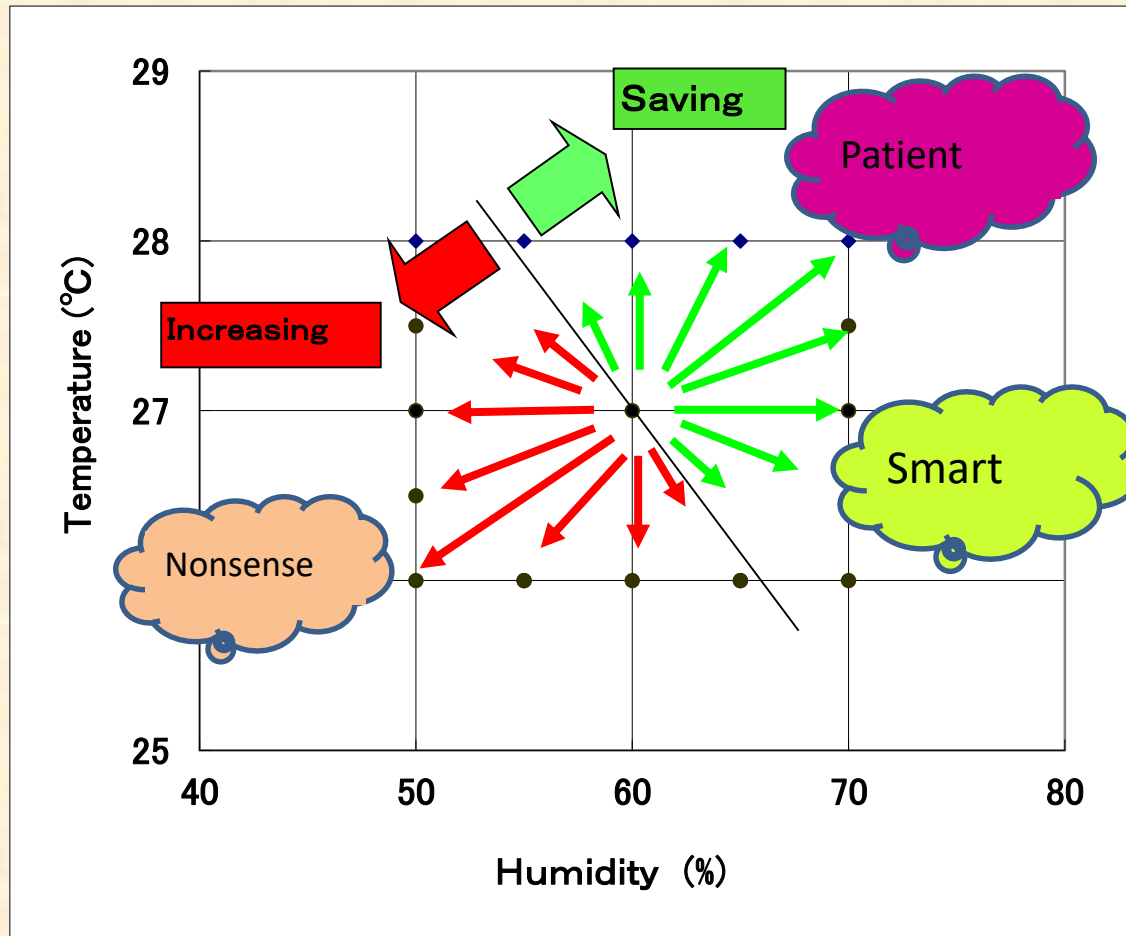
Lighting	• Dismantle or turn off the light-equipment by half
	• Make sure of turning off the lights with no occupants
Air conditioning	• Set the temperature at 28°C(←25-26°C)
	• Turn off the air conditioner of the room with no occupants
OA (office automation)	• Turn off or set standby-mode for OA when you leave your desk

28°C : People pay attention only to “temperature”.

This will lead people to misunderstanding the air conditioning and that Energy saving is something patience.

EneCAT recommends for energy efficient air conditioning operation

EneCAT tells the best air condition : "Smart zone"



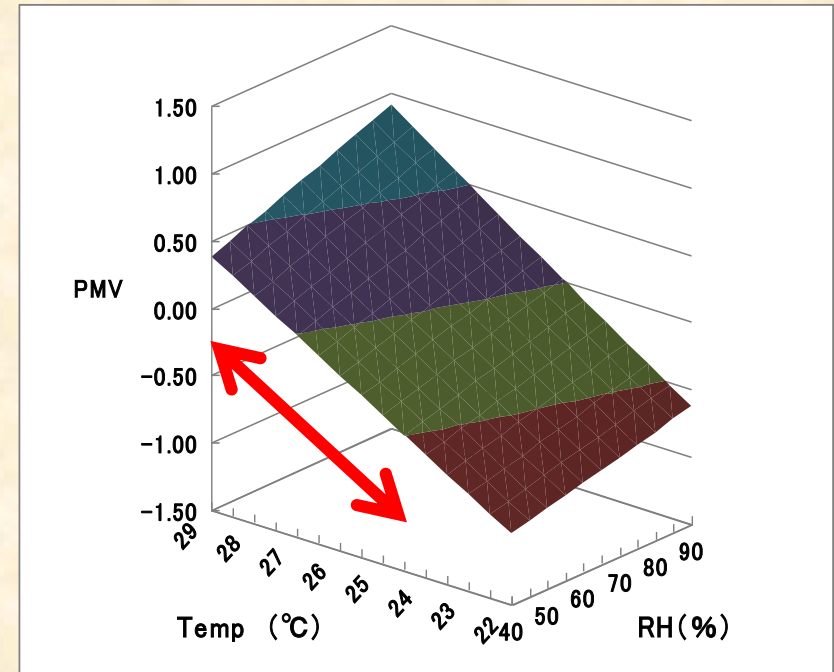
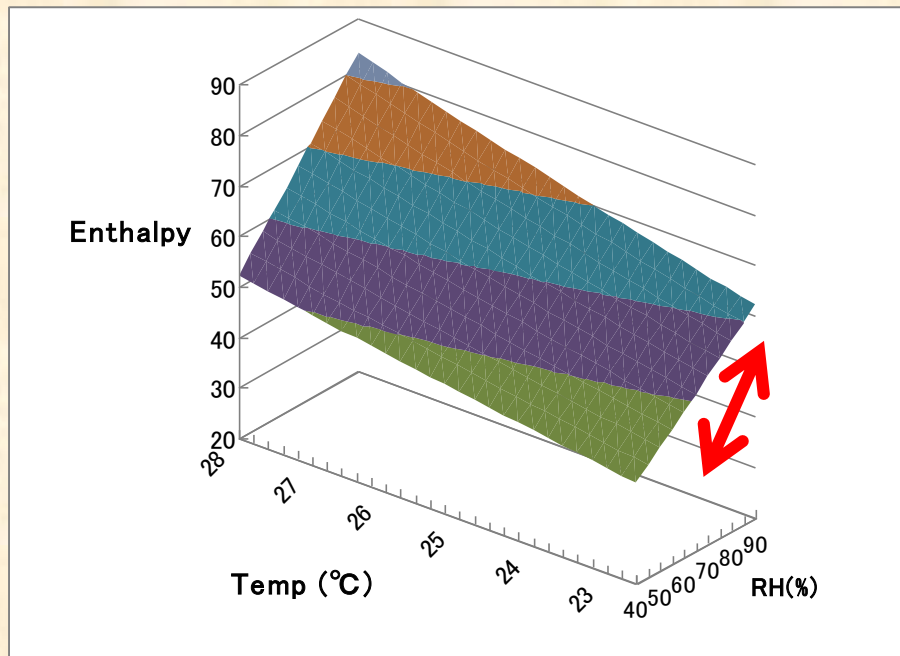
→ Saving
→ Increasing

The length of each arrow shows the volume of energy change

What is the best air condition from the viewpoint of Energy savings?

The Enthalpy of the air highly depends on Humidity than Temperature.

While, Comfortability(PMV) depends on Temperature.



Air is cooled by the chilled water in the AHU (Air Handling Unit) .
Raising the temperature of the chilled water increases the humidity of the air.

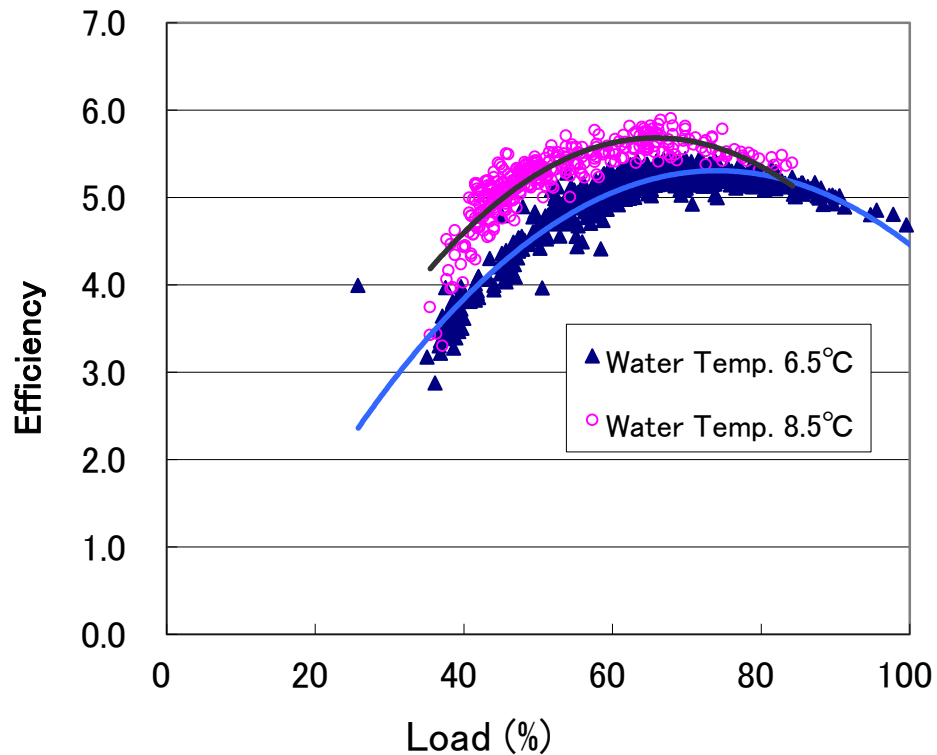


Proof of the effect of higher humidity by increasing chilled water temperature

Object: Office Building in Tokyo

Action: Chilled water temp. $6.5^{\circ}\text{C} \rightarrow 8.5^{\circ}\text{C}$

Results: Energy saving 15-20%



EneCAT has been applied for many office buildings ,hospitals and factories

EneCAT is not a control system , but a supporting system for energy managers.

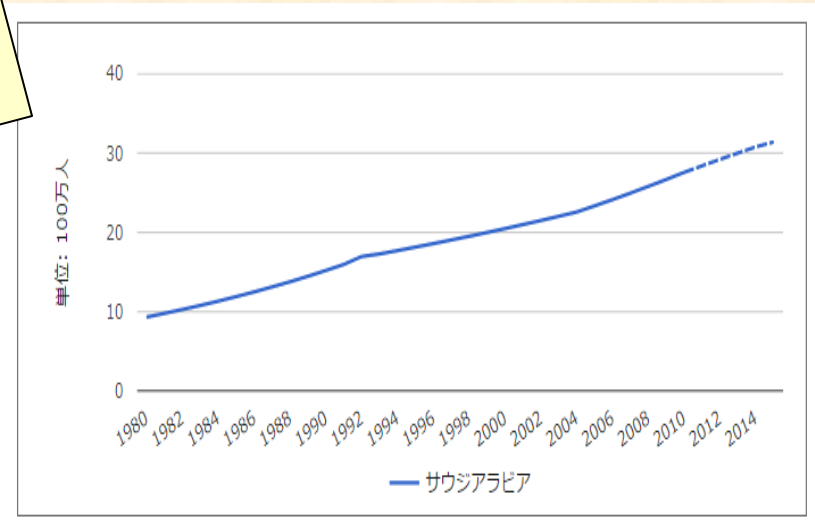


5. Practical training

Energy Saving is also important for Oil-producing countries

“The population of Saudi Arabia is exploding. So domestic oil consumption is increasing rapidly. If this situation continues, there will be no oil to export. So energy saving is very important.”

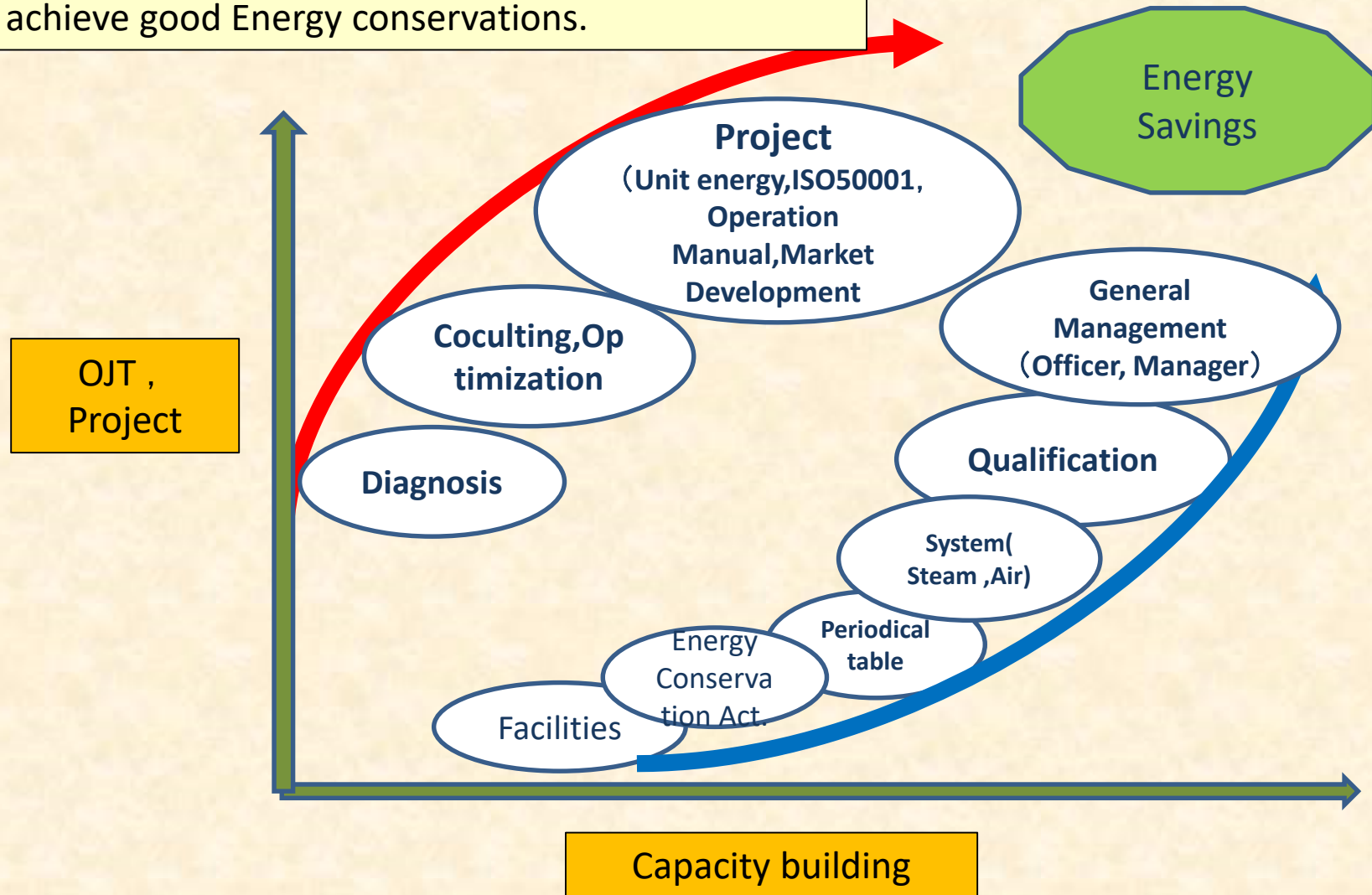
“Education is most important for Energy Saving!!”



Saudi Arabia Population Trend

Capacity Building and Project by ECCJ

Both Capacity building and Project are important to achieve good Energy conservations.



Capacity Building and Project by ECCJ

	ECCJ's Proposals of EE&C Implementation Support Measures					
Step	Stage	Purpose	Measures	Intended for	Specific items of support	Business operator
Level 4	Project forming	To aim for the rank "S" in the Business Operator Classification Assessment System by trying to reduce the energy intensity by 10%.	To review the energy intensity.	Energy managers and Upper management such as factory superintendent and general managers	To support optimization of the numerator and denominator of the energy intensity allowing proper analysis of the actual usage of energy.	Company F
			To consider EE&C measures		To support EE&C activities from a viewpoint of the energy intensity.	Company S
		To establish the user-friendly Energy Management Manual suitable for the actual workplace situation in a cross-sectoral manner by complying with the EE&C Guideline of the Act.	To prepare the Energy Management Manual.		Promotion of EE&C training for the on-site personnel in the head office, each factory and factories of affiliated company etc.by way of multiple times of step-by-step training . To develop an EE&C mind in all the persons including the factory managers and on-site workers and staffs so that they can tackle with EE&C related tasks on their own.	Company I
					To build a management system so as to allow internal self-promotion of EE&C.	To help acquire the ISO 50001 certification.
		Level 3	Establishment of operation meaures and renewal of equipments and facilities		To educate people responsible for EE&C so that they can implement EE&C measures by doing practice with actual motors and pumps To find EE&C subjects to be studied	To practice EE&C measures at your own factory.
To practice EE&C measures at the training center of a service company, etc.	To put into better practice of the steam system at one's own factory by taking a steam system training course at the training center of a steam related company.			Company M, etc.		
To implement EE&C measures on to the factory equipment	To have a training course for the production personnel regarding the EE&C oriented operation method of each equipment			Company H		
To find the EE&C subjects to be studied	To explain how to find EE&C measures including basic idea of EE&C to the facility security personnel (mid-level). Background is saturated situation of the EE&C improvement on site.			Companies H and S		
To tune up the equipment from the viewpoint of EE&C	Optimum operation of boilers, air-conditioners, etc.			Company N		
	EE&C viewpoints and methods			To educate the EE&C promotion committee members of each department about basic idea and promotion method of EE&C, and EE&C viewpoints and methods by way of examples.		Company D

Capacity Building and Project by ECCJ

ECCJ's Proposals of EE&C Implementation Support Measures						
Step	Stage	Purpose	Measures	Intended for	Specific items of support	Business operator
Level 2	EE&C Audit of factories, etc.	Experts visit and walk through factories, etc. to propose how to find the target equipment and promote EE&C operation.	EE&C Audit of the production process.	Energy managers, workers and staffs	To conduct an EE&C Audit and propose EE&C measures of the calcination process, and that of the food production process, etc.	Company J, etc.
			EE&C Audit of university buildings.		To conduct an EE&C Audit and Propose an EE&C measure for buildings.	Each university
			EE&C Audit of the equipments and facilities owned by government		To conduct an EE&C Audit and propose EE&C measures of the equipments and facilities possessed by the government offices.	Each government agency
Level 1	Improvement of awareness in workplace and entire company	To raise more awareness of all the related parties in terms of EE&C advantages and roles of management class in the energy management work To raise awareness of the management class by informing them of national policy trends and the EE&C best practices of the company.	To clarify the role of each level of the office organization.	All the related parties (factory superintendent, general affairs dept., energy managers, workers & staffs)	To Gather and train each factory superintendent by clarifying the actual situation of EE&C in Japan and the role of each office organization, and introducing EE&C support tools, ISO 50001, etc.	Company S
			Trend of energy policy and EE&C technology		Lectures on the energy policy trends	Company O
			Economic benefits of EE&C		To hold a lecture on introduction of factory EE&C for energy managers, etc. of the own factory. Develop human resources systematically.	Company K
			EE&C viewpoints and methods		To educate the EE&C promotion committee members of each department about basic idea and promotion method of EE&C, and EE&C viewpoints and methods by way of examples.	Company D

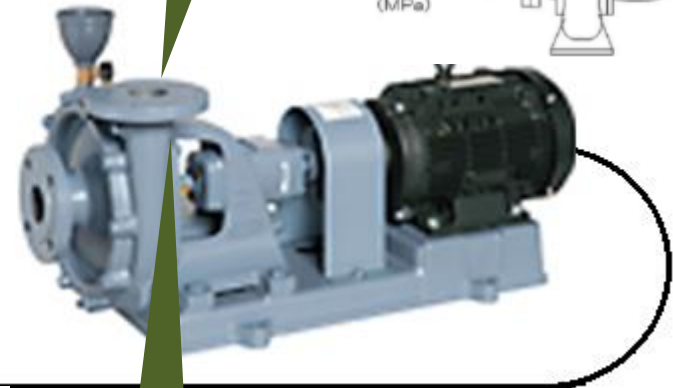
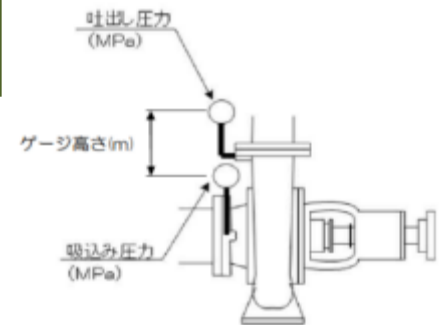
Practical trainings by ECCJ are very popular

Inverter



Pressure

既存の圧力計を利用

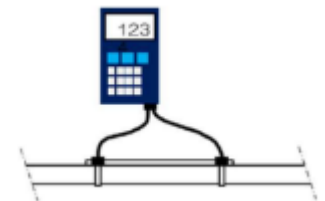


Electricity Use



電力計を設置

Water Flow



超音波流量計を設置

Measures to improve the motivation for EE&C activities

Consequences	Top Management	Energy Manager	Operator, Tennant, Customer
Good	Classification, Benchmark	Award, Curiosity Practical Training	NEB(Comfort, Hygienic) Practical Training
Nothing			
Bad		Busy, → EneCAT	Bad influence for Product quality → Hybrid

Having motivation leads to promotion of energy saving!!

Thank you for your attention !!!

