EE&C Best practice in energy and chemical industry

EE&C Best Practice in Japan
for Petrochemical Industries in Singapore

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EE&C Symposium held by EDB

ECCJ Hidetoshi Suzuki

Energy Conservation Center Japan

一般財団法人省エネルギーセンター
The Energy Conservation Center, Japan

Japan is one of advanced country of energy savings

Introduction

Through the Best Practice

EECJ awards outstanding practices.
You can utilize these to improve your plants.
We’d like to provide you hints of improvement.

Advanced **Effective**

Versatile **Sustainable**

ENERGY CONSERVATION GRAND PRIZE
平成30年度
省エネ大賞
(省エネ事例部門)
主催：一般財団法人省エネルギーセンター

Investigating 10 winners' best practices

NO.1	Energy Saving by **Pinch Technology**
NO.2	Energy Saving by **utilization of LNG Cold Energy**
NO.3	**Reduction of Steam Leakage** from 100,000 Steam Traps
NO.4	Energy Conservation by **Additional Boiler Installation** to Gas Turbine
NO.5	Energy Conservation of Hydrogen Plant by Utilization of Petrochemical **by-product Hydrogen**
NO.6	Energy Conservations by **Surplus Steam Utilization**
NO.7	Energy Conservation for Liner Alkyl-benzene(LAB) **Reaction optimization**
NO.8	Aromatic Plant Energy Conservation by **Operating Supporting System**
NO.9	Energy Conservation of Hydrogen Plant by **Reduction of Reformer Catalyst Deterioration**
NO.10	**Recovery of Unused Waste Heat** and Energy Conservation by Energy **Optimization**

Categorize

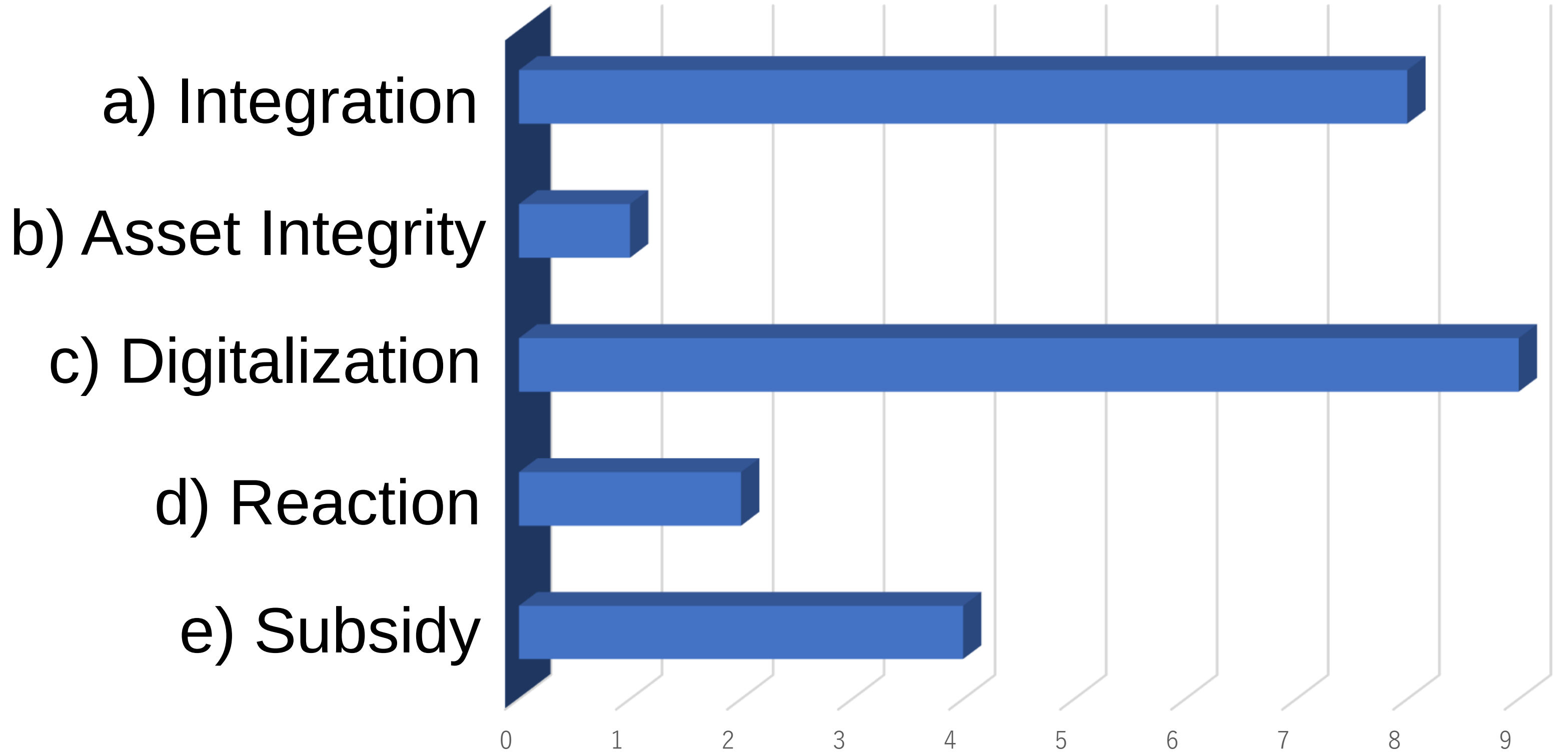
5 Key issues

to realize energy conservation

a) **Integration** (Heat /Material)
b) **Asset Integrity**
c) **Digitalization**
d) **Reaction**
e) **Subsidy/Fund** (Governmental support)

Analyzing 10 practices

10 practices categorize into 5 keys



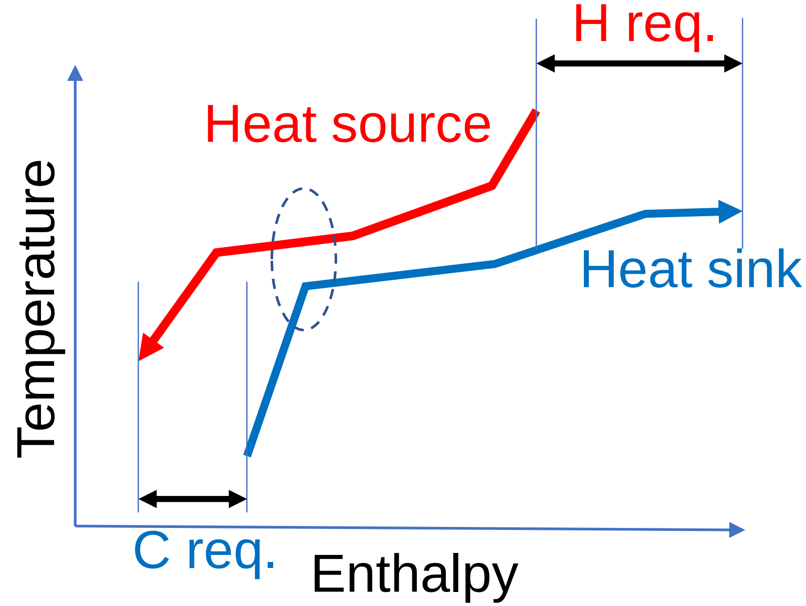
a) Integration

Pinch Technology

Pinch technology has been widely utilized from 1980s

It is a way to find an idea of "**Integration**"

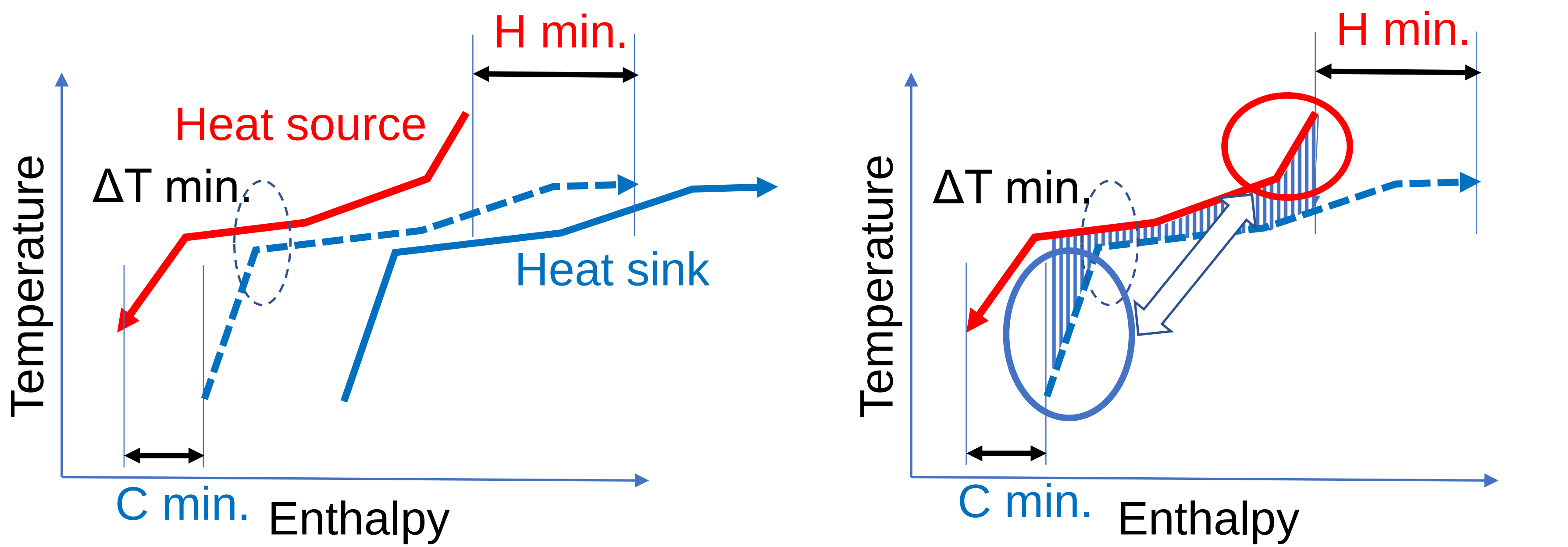
It cannot use only for Heat integration but also Materials one.



Composite Curve

a) Integration

Targeting (Principles)



Heat source: Streams to be cooled

Heat sink: Streams to be hot

Ideal state: Vertical exchange

a) Integration

Integration brings

- Effective use of energy
  - Heat Exchanging more
- Effective use of waste
  - Waste value up
- Reduction in environmental load
  - Energy conservation , Minimize losses

a) Integration

Japanese Traditional Integration

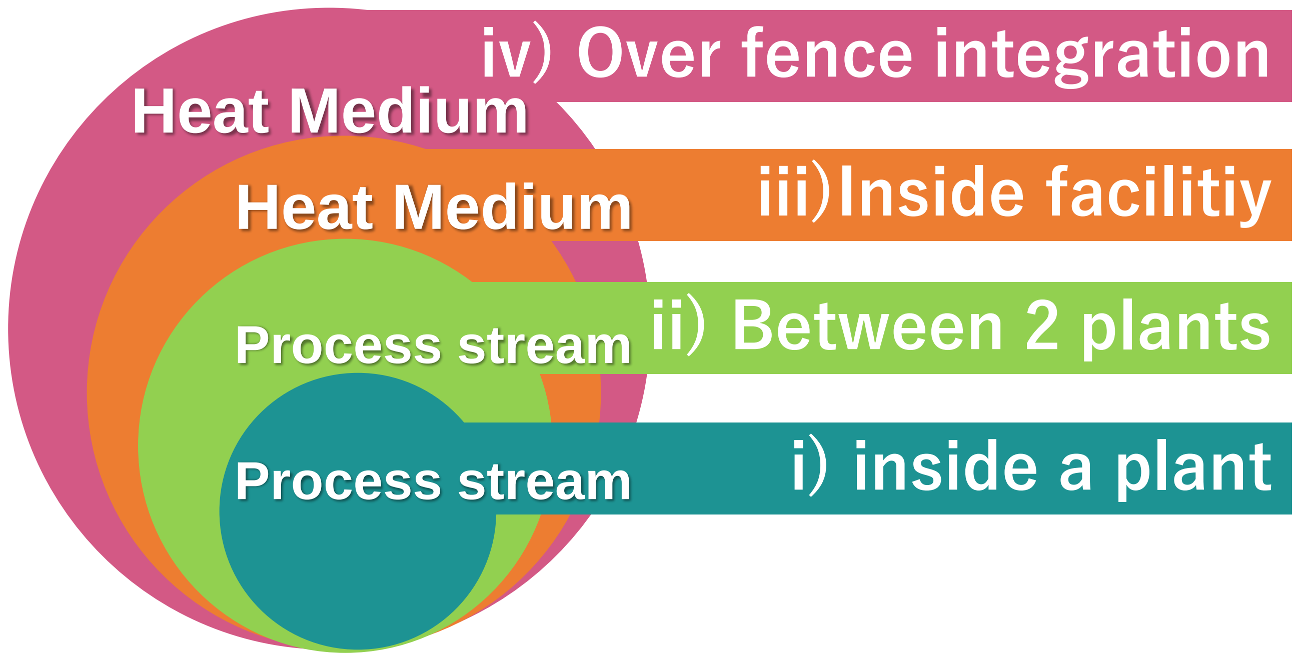
The bigger the better in its effectiveness

Japanese Garden “Shakkei” : Borrowed scenery

a) Integration

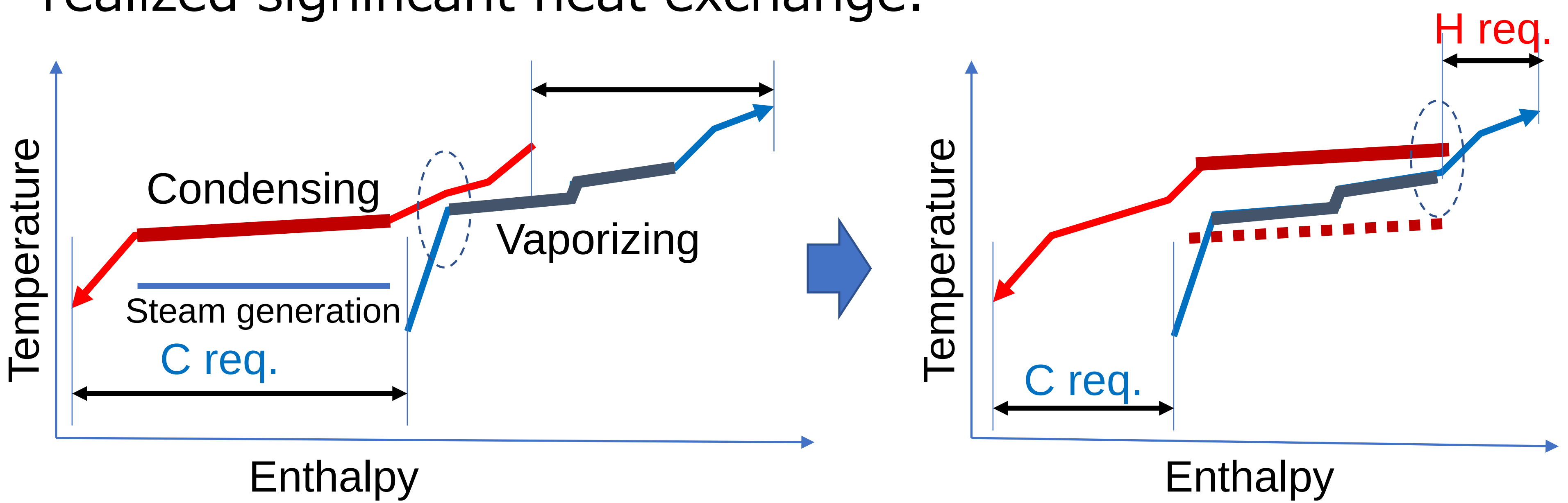
Integration range and effect

The bigger range challenge brings the bigger fruit.



i) Inside a plant

Heat source temperature arrangement can be realized significant heat exchange.



How to use this big Condense duty?

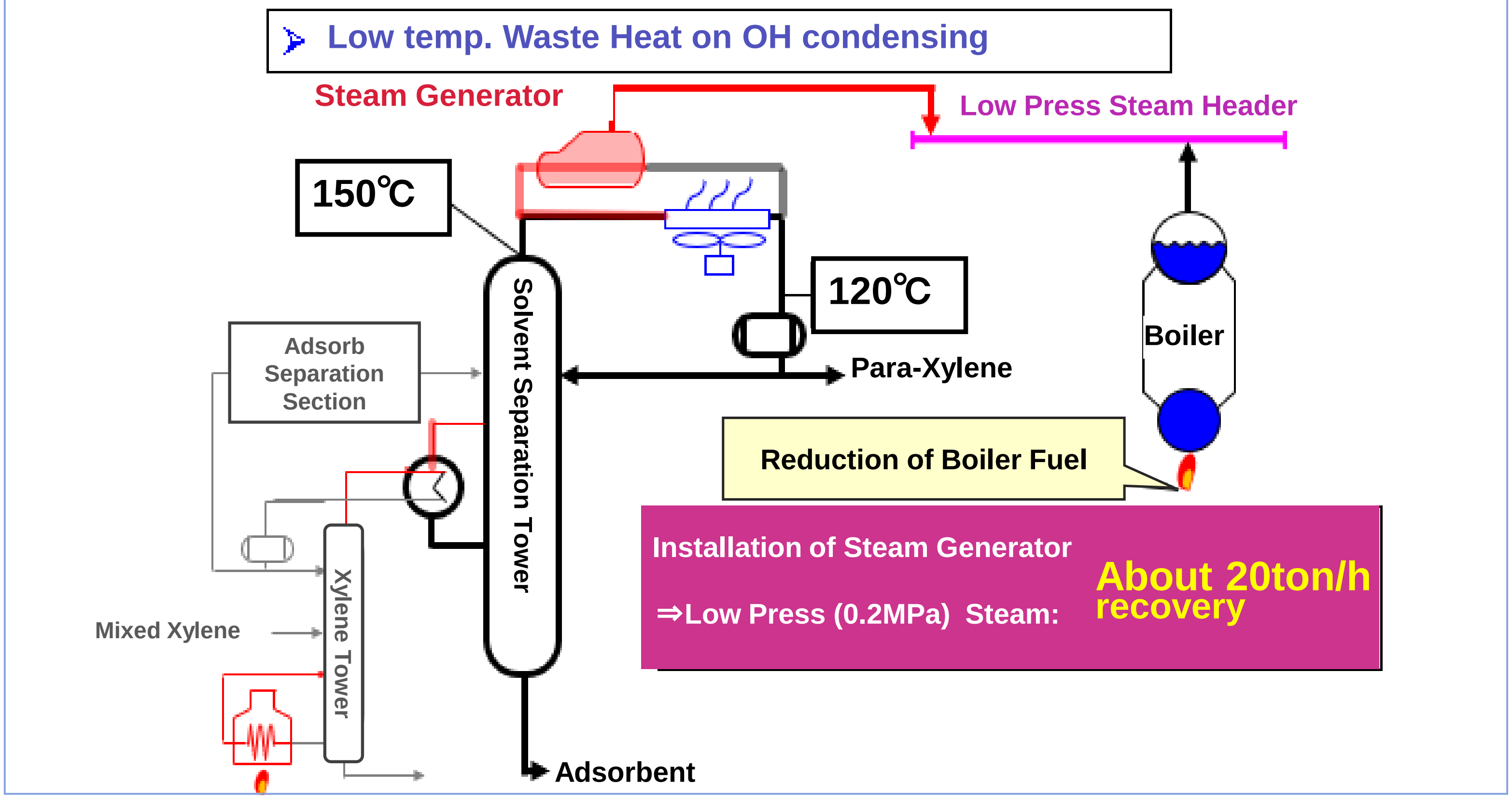
A: Column temperature up ! = Pressure up

NO.10 Recovery of Unused Waste Heat and Energy Conservation by Energy Optimization

Utilization of Waste Heat of Aromatic Distillation Tower

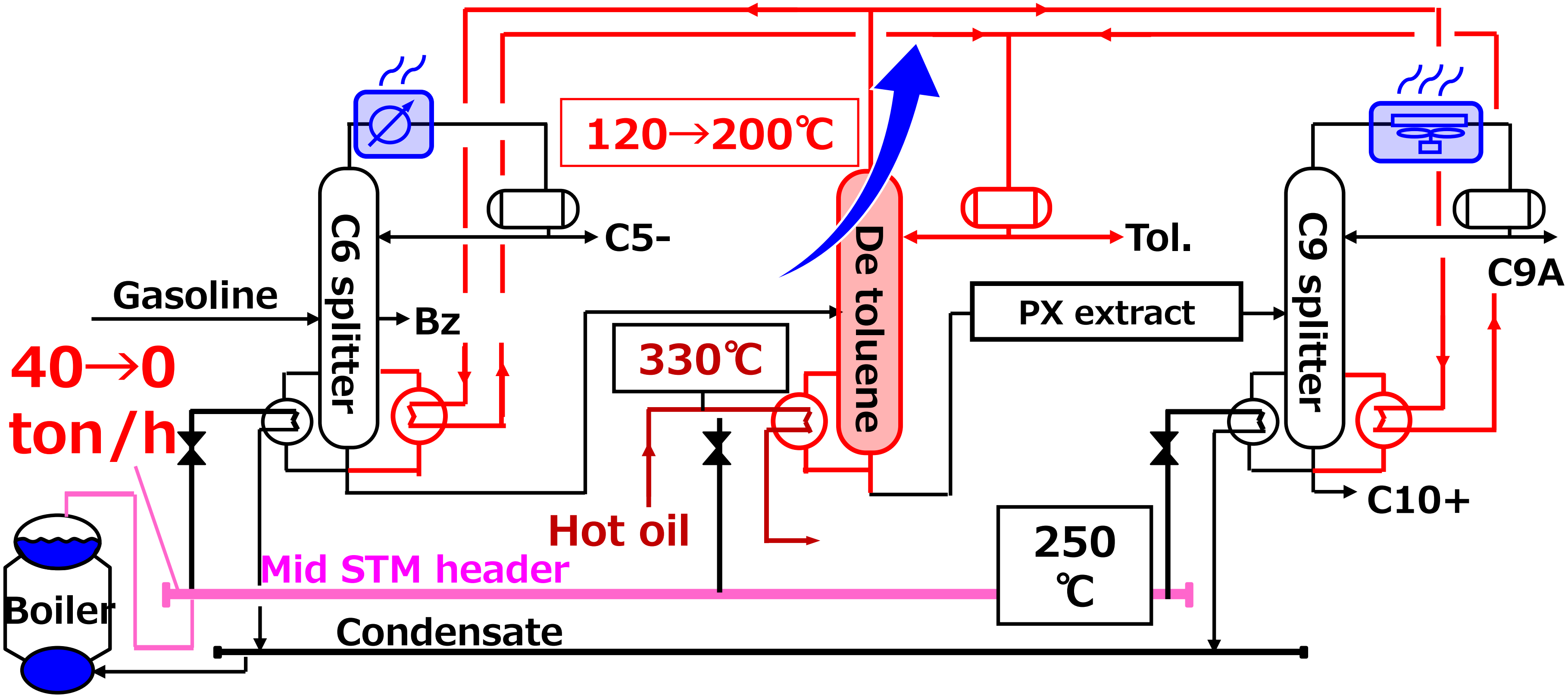
Air cooler → Kettle HX / Using Xy tower O/H heat

Low temp. Waste Heat recovery of Para-Xylene production apparatus



NO.10 Recovery of Unused Waste Heat and Energy Conservation by Energy Optimization

- 12,300coe-kl/y savings



Bottom temperature up ⇒ MP steam → Hot oil

The relative volatility goes down

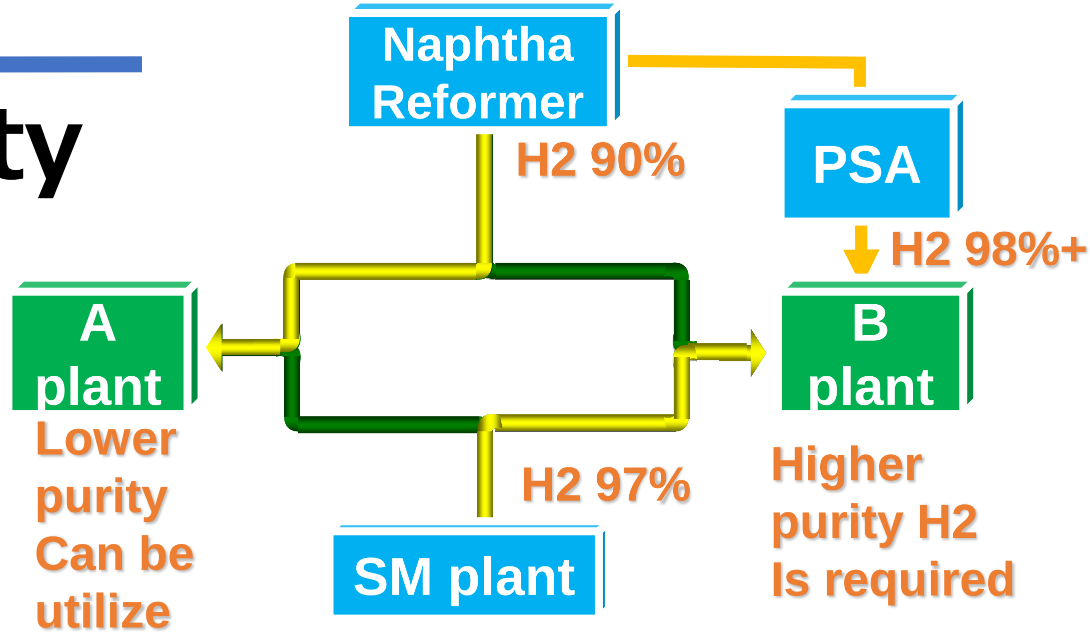
a) Integration

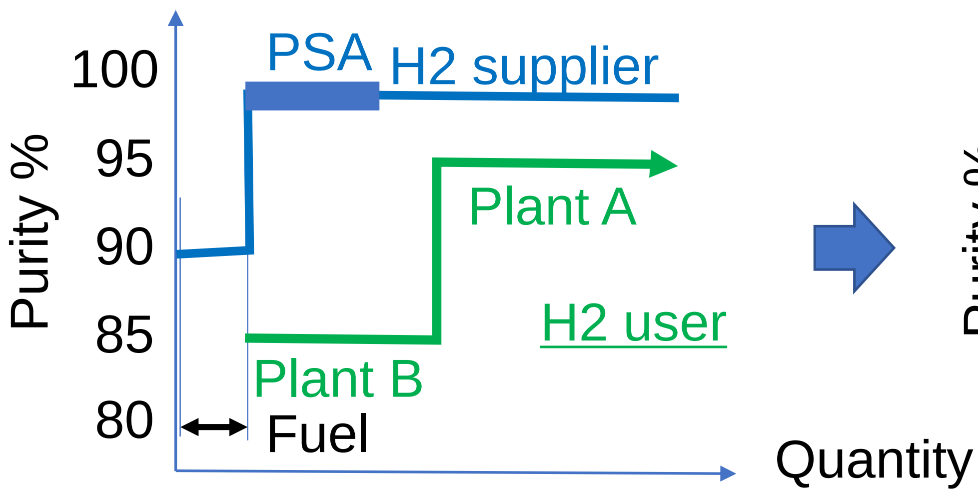
iii) Inside a facility

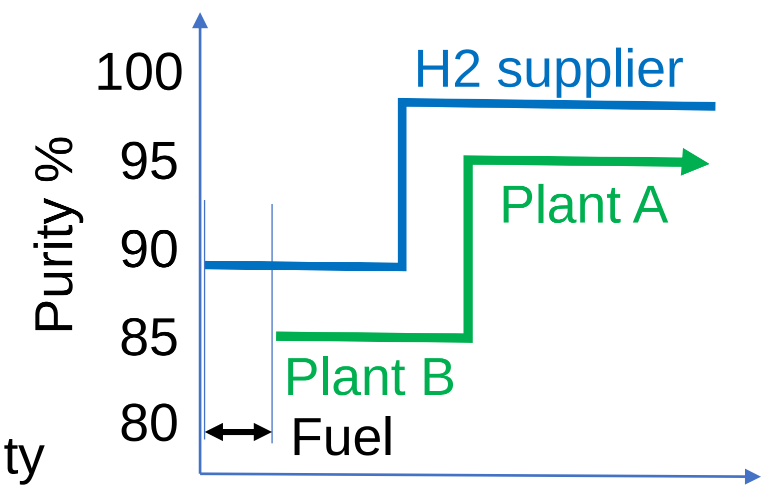
<Principles>

Right people, Right place

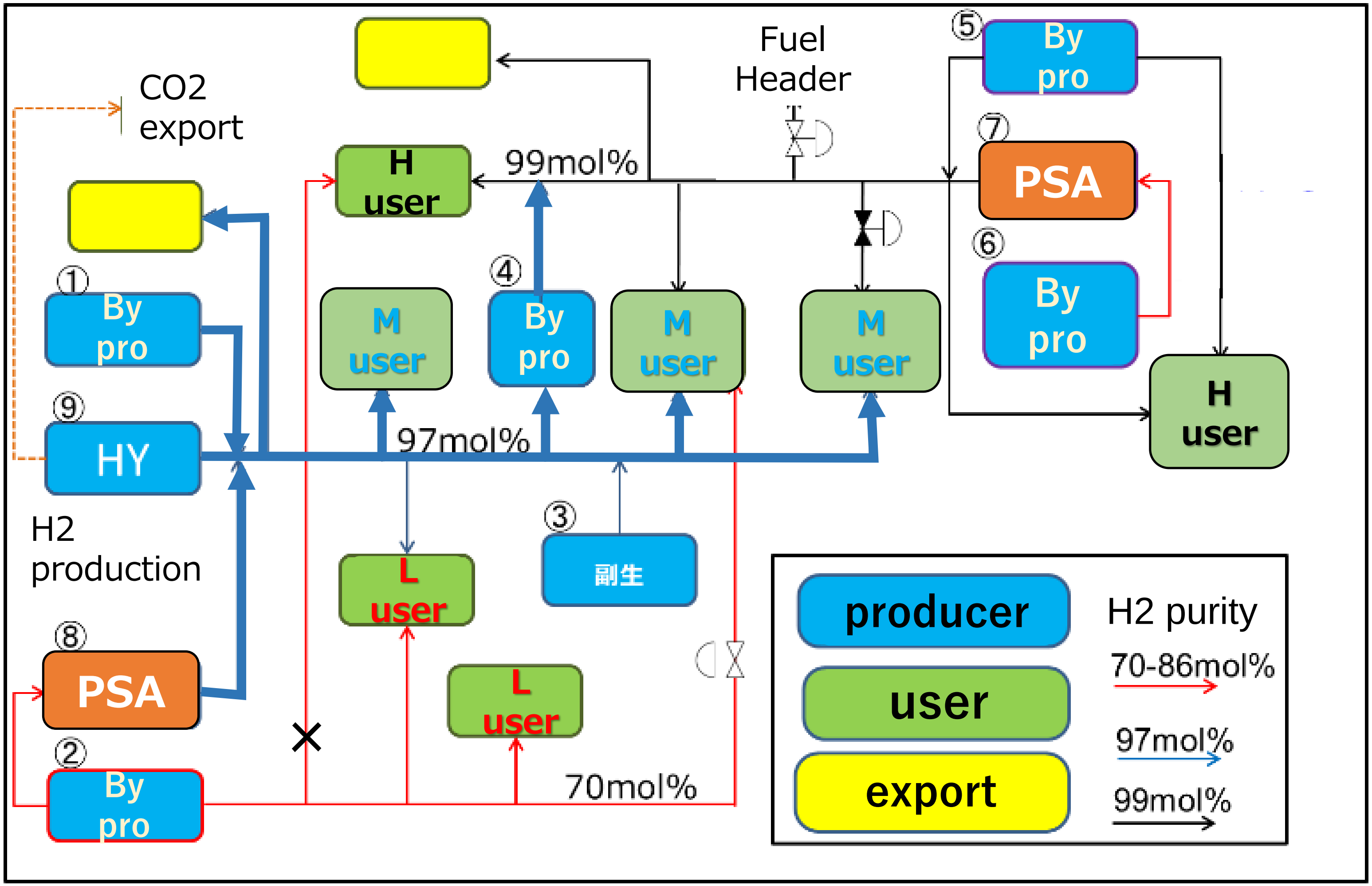
Right purity, Right user







NO.5 Energy Conservation of Hydrogen Plant by Utilization of Petrochemical by-product Hydrogen



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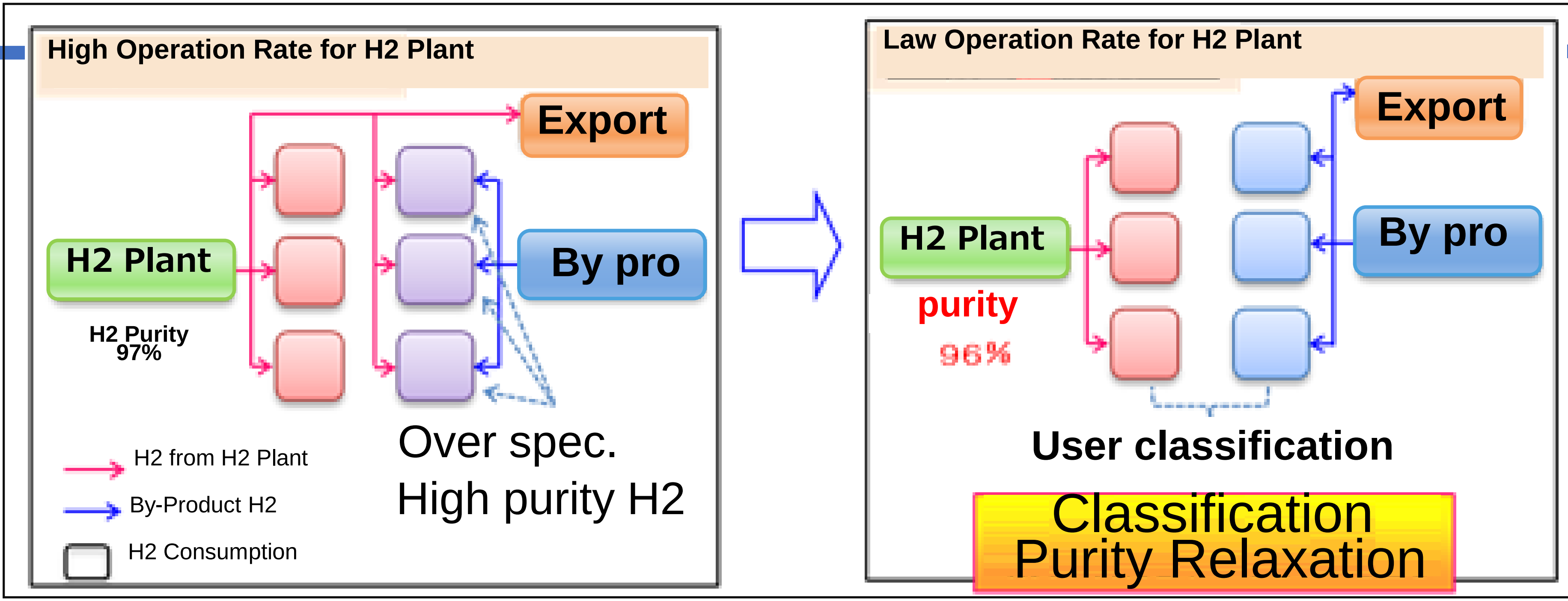


H2 Supply from Hydrogen Plant

	H2 Generation in H2 Plant KNm3/d	Fuel Consumption in H2 Plant COE-KL/d
①Before	720	112.1
②After	580	91.7
②- ①	-140	-20.4

① Average from 1st April to 6th July 2014
② Average from 1st December to 6th March 2015

Energy Conservation Effect
Reduction of Energy, Coe : 6,732 KL Reduction
Reduction CO2 Emission

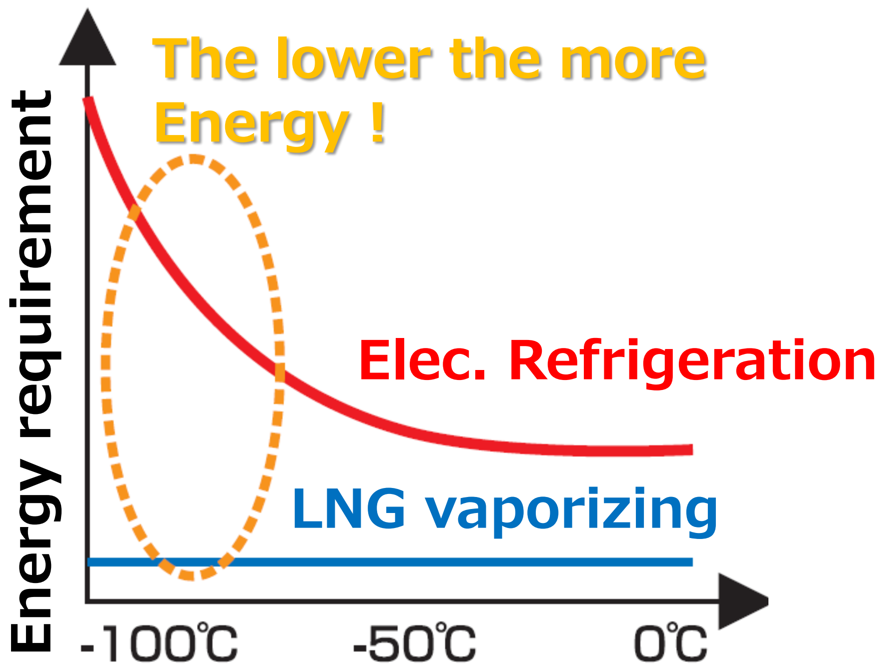
Savings
= 791,000 coe-kl/y

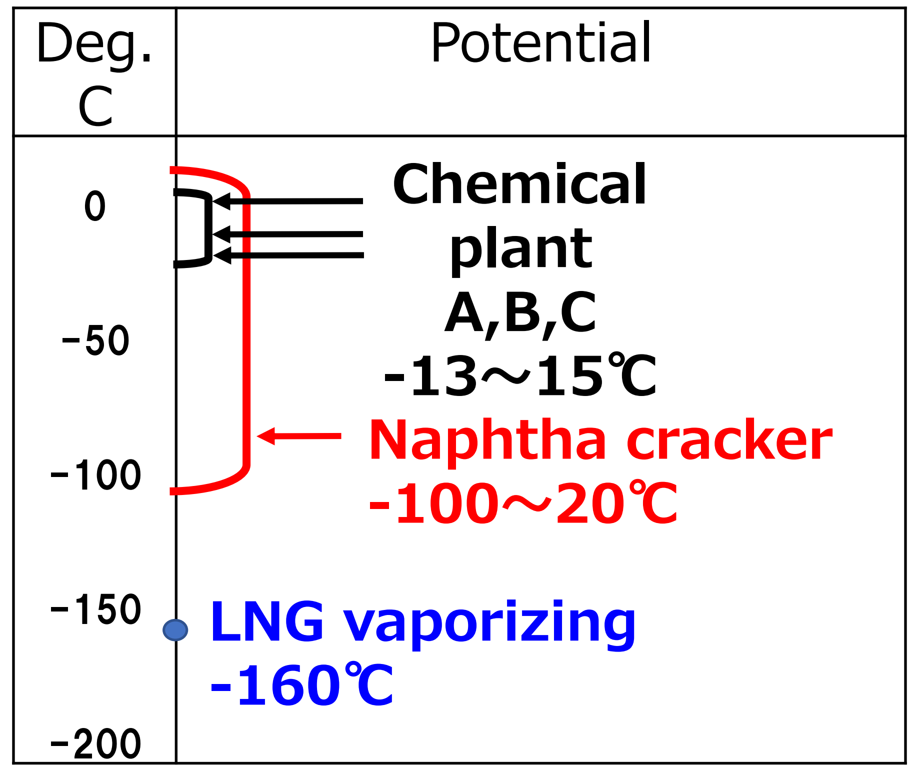
Refinery Energy Saving Rate: 0.85%

a) Integration

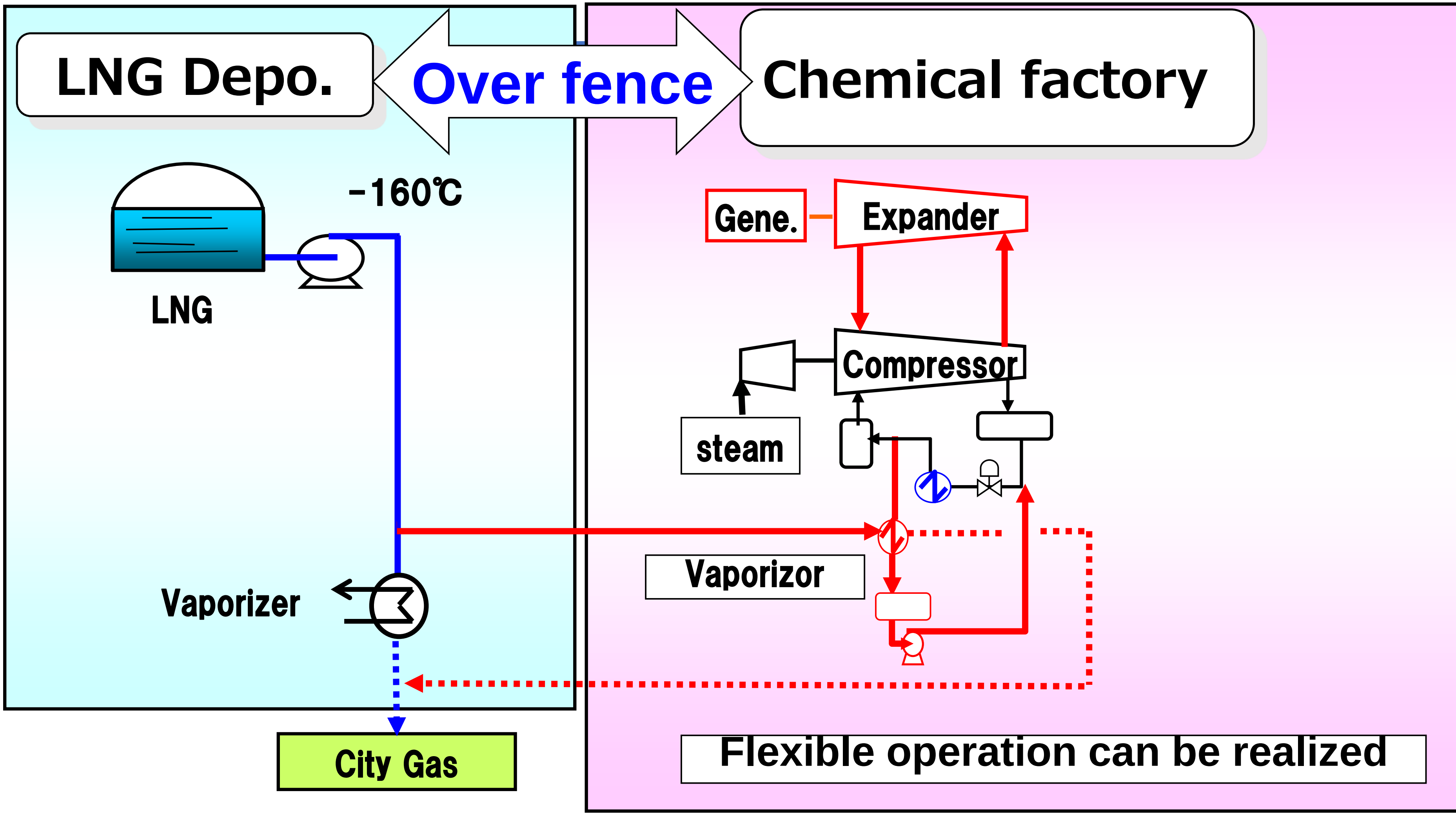
iv) Over fence

Extra low-level heat can be utilized for specific plants.



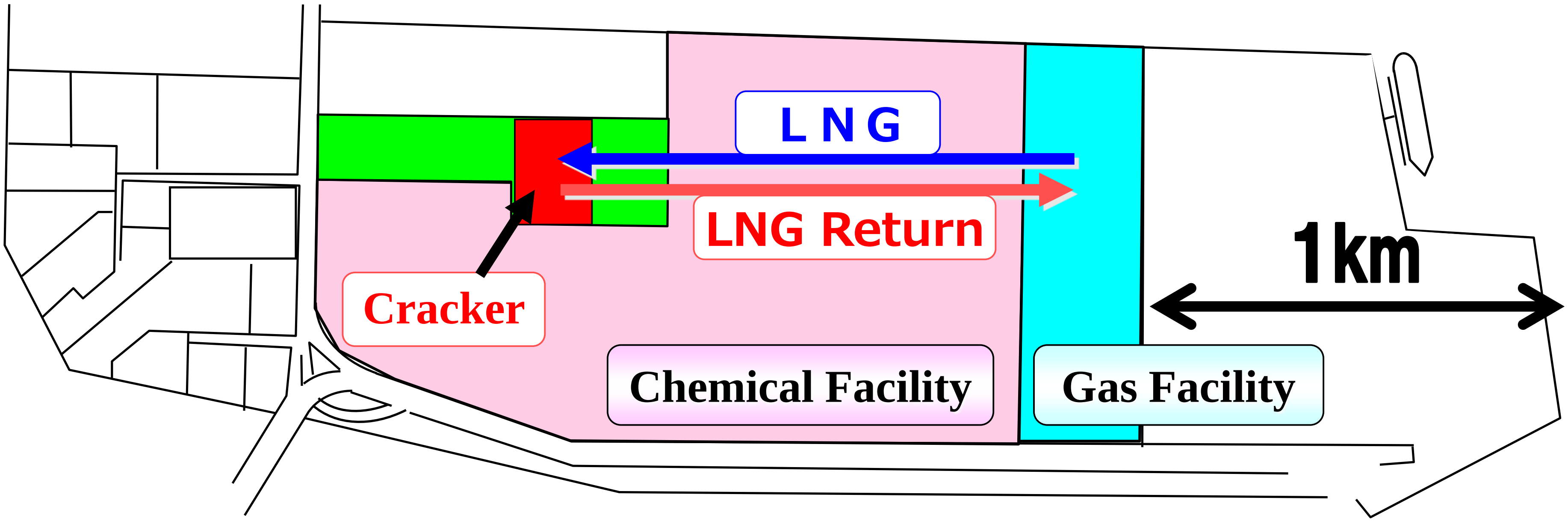


NO.2 Energy Saving by utilization of LNG Cold Energy

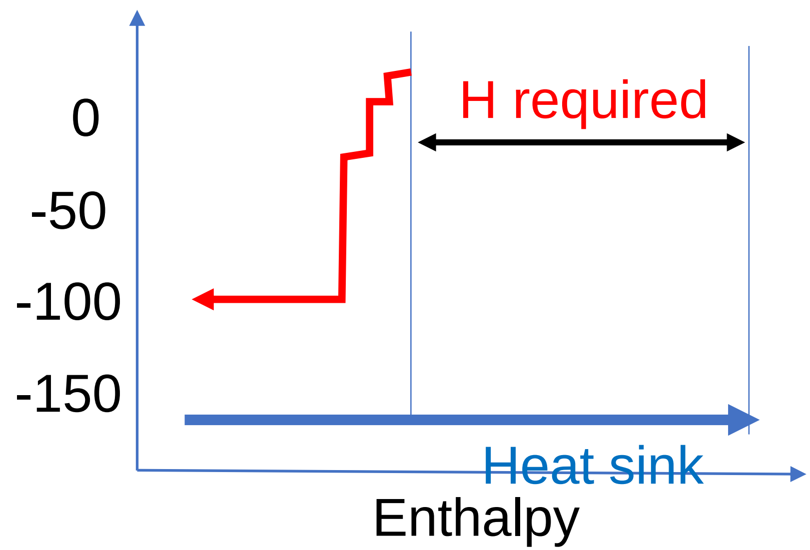


Direct use of process stream

NO.2 Energy Saving by utilization of LNG Cold Energy



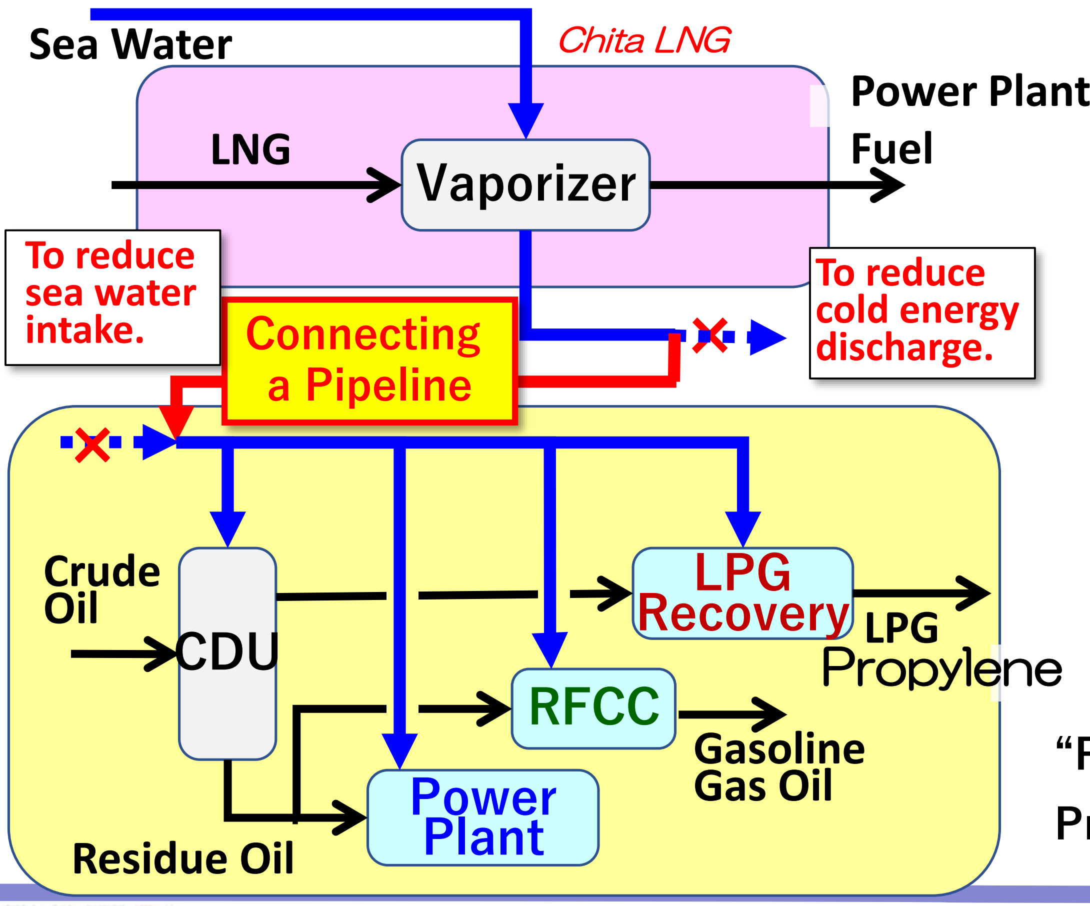
- 13,000coe-kl/y savings
- Governmental subsidy was required



For Panel Discussion

More versatile system

Sea water cooling down



Reduced 40,000Kl of crude oil throughput.

- Increase Recovery Ratio of LPG and Propylene
- Increase Crackability
- Energy Conservation

"Projects for Stable Supply of Petroleum Products" by RING

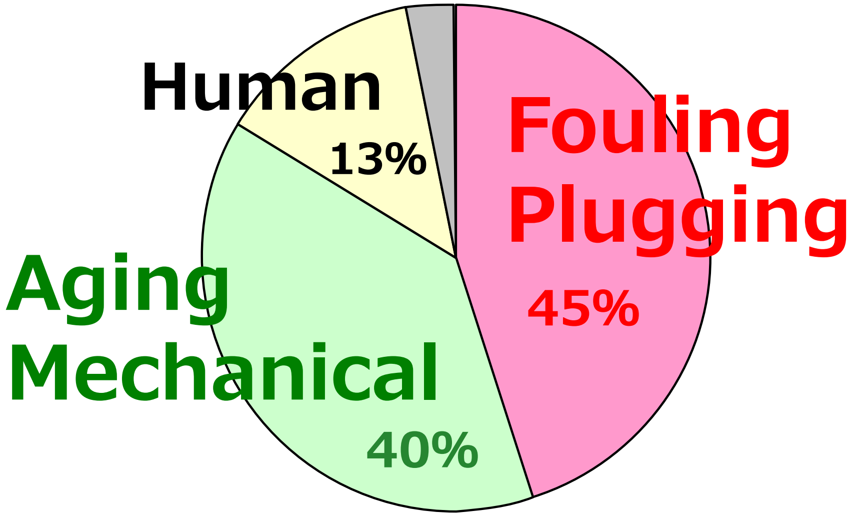
b) Asset Integrity

Three Major cause of troubles

- Fouling / Plugging
- Mechanical trouble cause of aging (Vibration/Leakage/erosion/corrosion)

Keeping performance

Should be one of the grate energy saving solution



b) Asset Integrity

CROF (CRude Oil Fouling) PJ *1)

Pre-heat train fouling is estimated to cost around $1.2 billion per annum in the US alone.

$ 6 billion/y losses in the World ! !

Cleaning

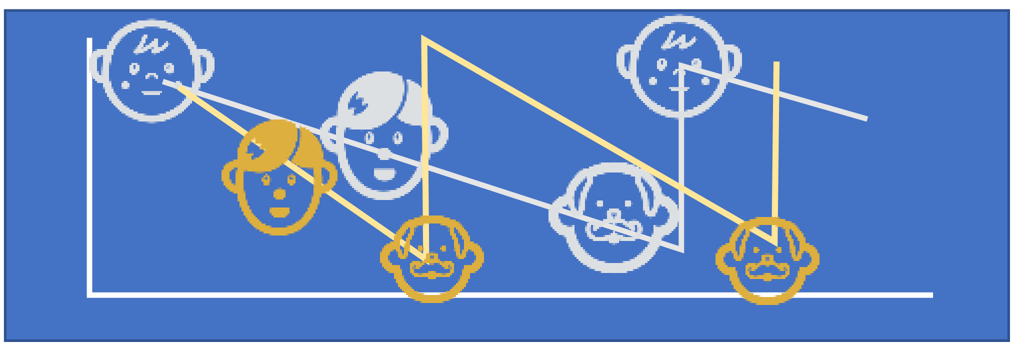
brings big energy saving
(=loss recovery)

***1) Imperial College London**

b) Asset Integrity

Recognize Specific lifespan

Each equipment have different age and MTBF.
Appropriate maintenance brings High performance continuously.

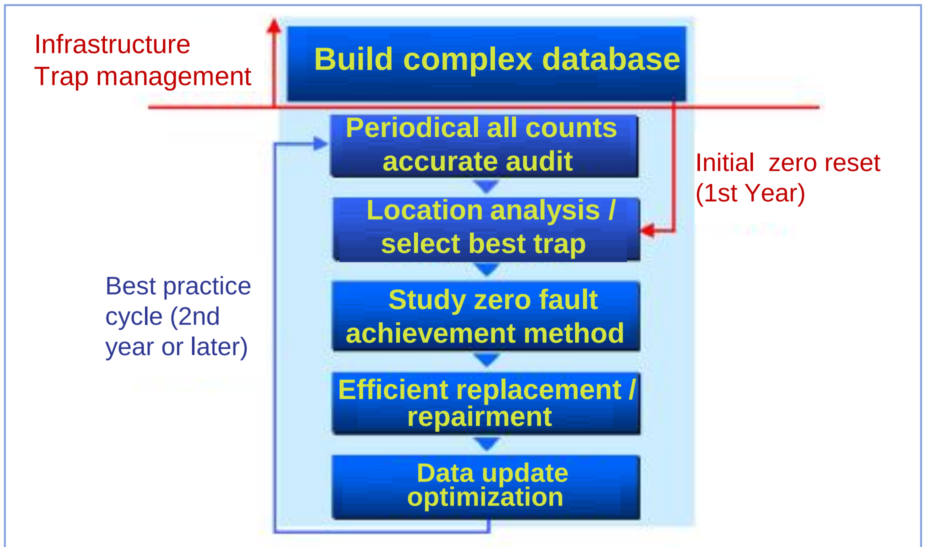


MTBF : Mean Time Between Failure

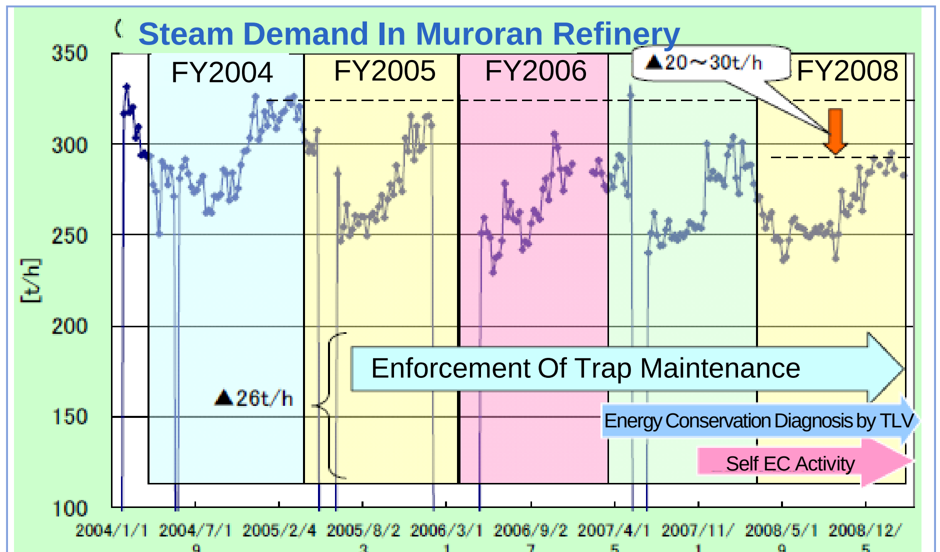
NO.3 Reduction of Steam Leakage from 100,000 Steam Traps

- Managed 100,000 traps
- 18,000coe-kl/y savings
- 46,000 t/y CO2 reduction

Reduction of Steam Leakage from 100,000 Steam Traps



BPSTM（Best Practice of Steam Trap Management



Translation of Boiler Evaporation

c) Digitalization

What does Digitalization mean?

- Monitoring
- Computer control / Modeling
- Optimization

  One plant / multi plants / Whole complex

- Big Data, AI

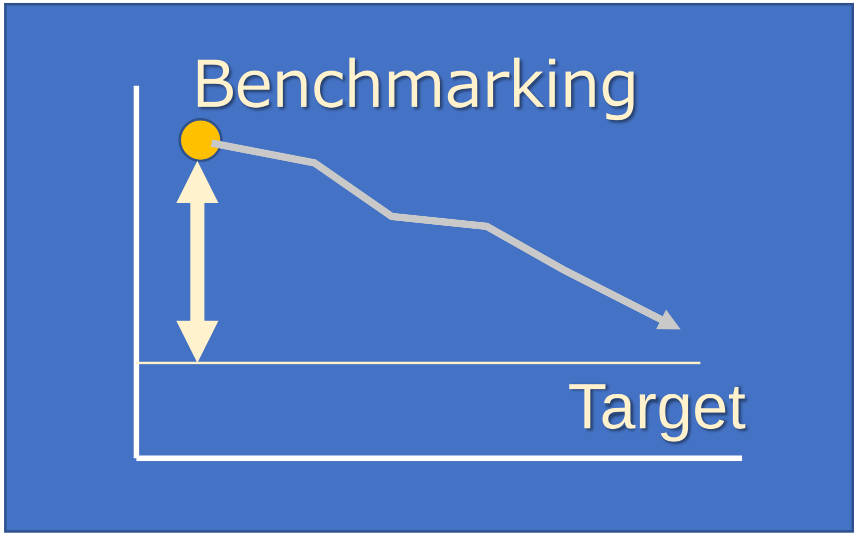
In Japan, Artificial Intelligence has been delayed in practical use.

c) Digitalization

Monitoring / Visualization

Improvement should start with awareness.

Recognize a gap !



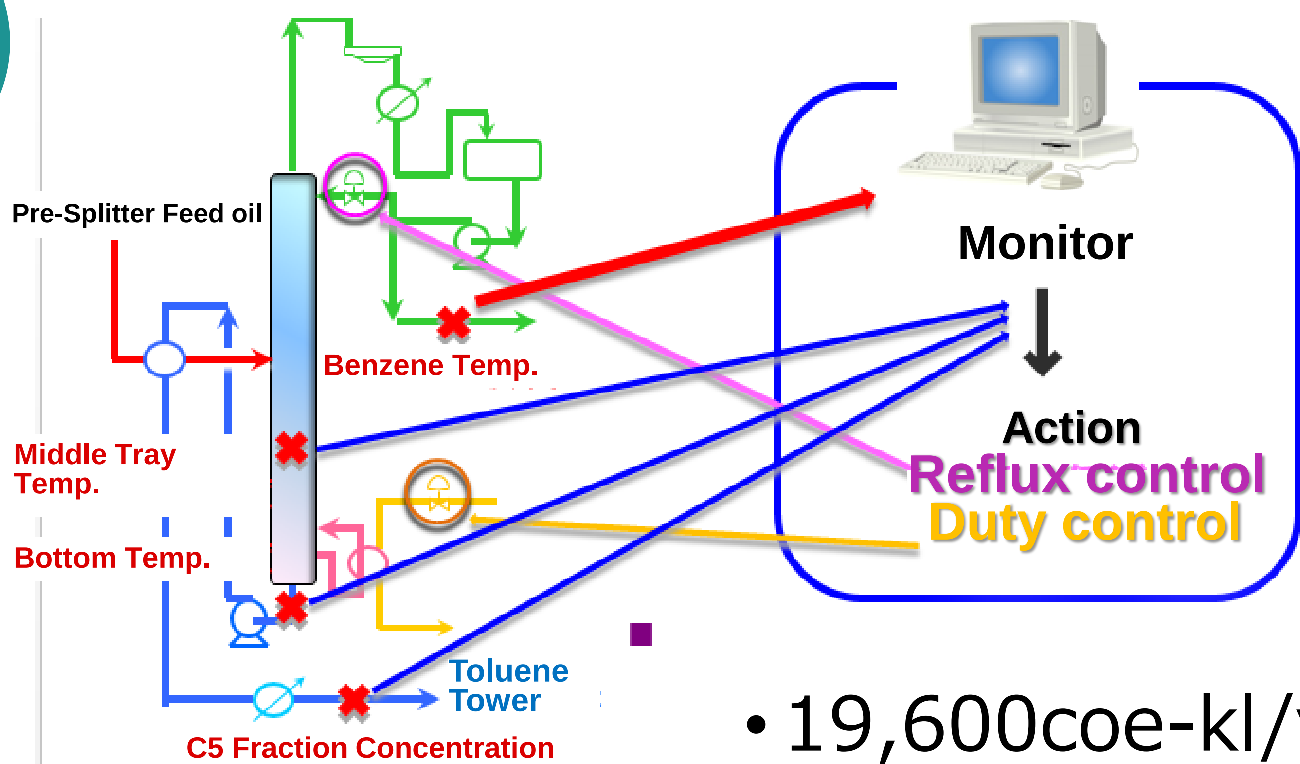
c) Digitalization

Computer control

The bigger facility control brings the bigger fruit.

NO.8 Aromatic Plant Energy Conservation by Operating Supporting System

For Single unit

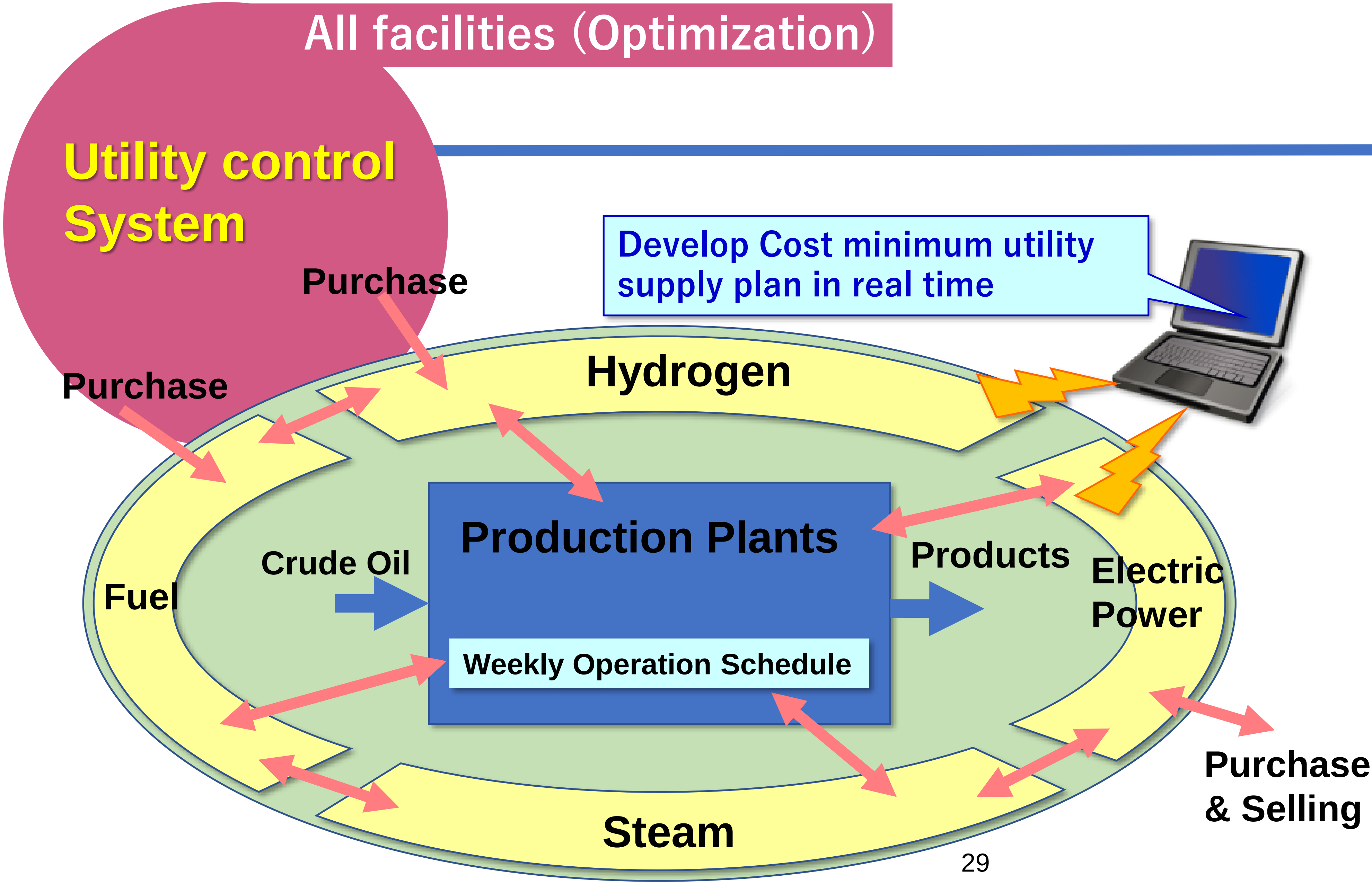


- 19,600coe-kl/y savings

Results: Energy Conservation Achievement by Introduction of Operation System and Reduction of Steam Ratio

a) Optimization of Pre-Splitter Operation
b) Reduction of Load for Panel Operator

All facilities (Optimization)



NO.3 Reduction of Steam Leakage from 100,000 Steam Traps

Beneficial SSOP (Steam System Optimization Program)

TLV

CES Survey

■ Optimization of Energy Balance
- Steam Balance
- Heat And Electricity Balance

■ Optimization of SA (Steam Application)
- Importance of Quality & Productivity
- Recovery & Reuse of Drain & Waste Heat

Optimization of Steam System

BPSTM (Best Practice of Steam Trap Management)

■ Optimization of Drain Disposal Place
- Reduction of Drain Obstacle
- Reduction of Steam Loss

Fundamental Infrastructure for Steam System Optimization

c) Digitalization

Big Data / AI

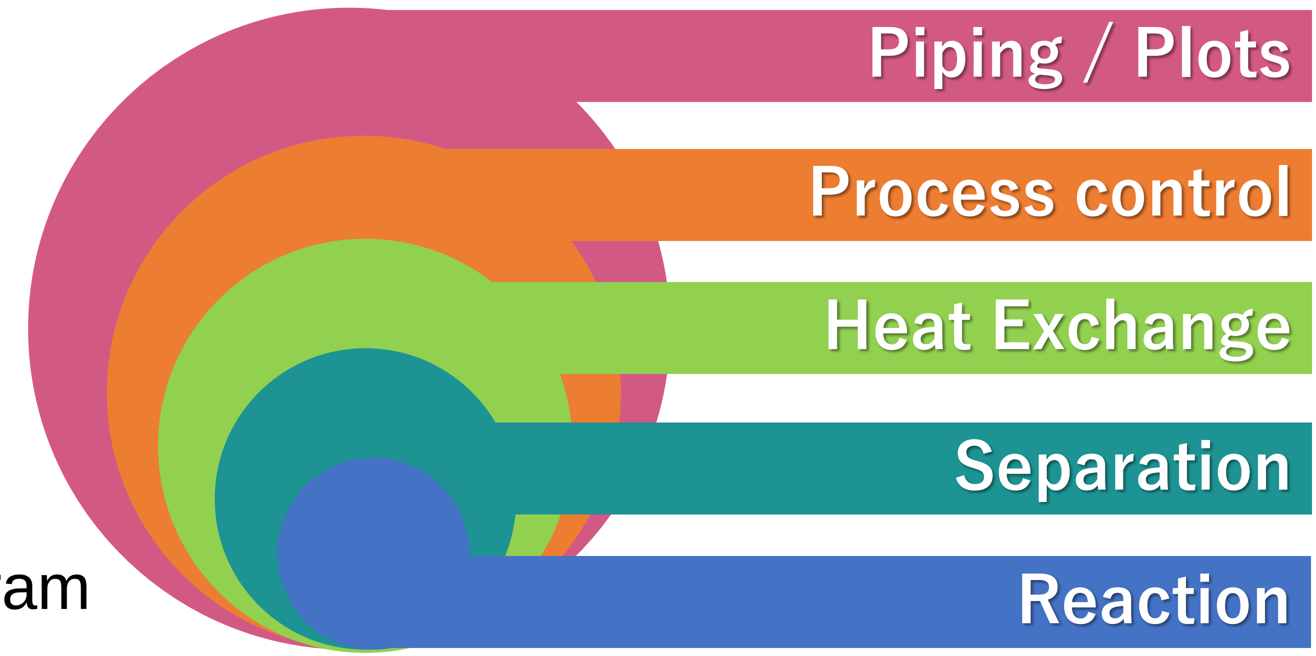
No best practice is observed.

d) Reaction

Process design procedure

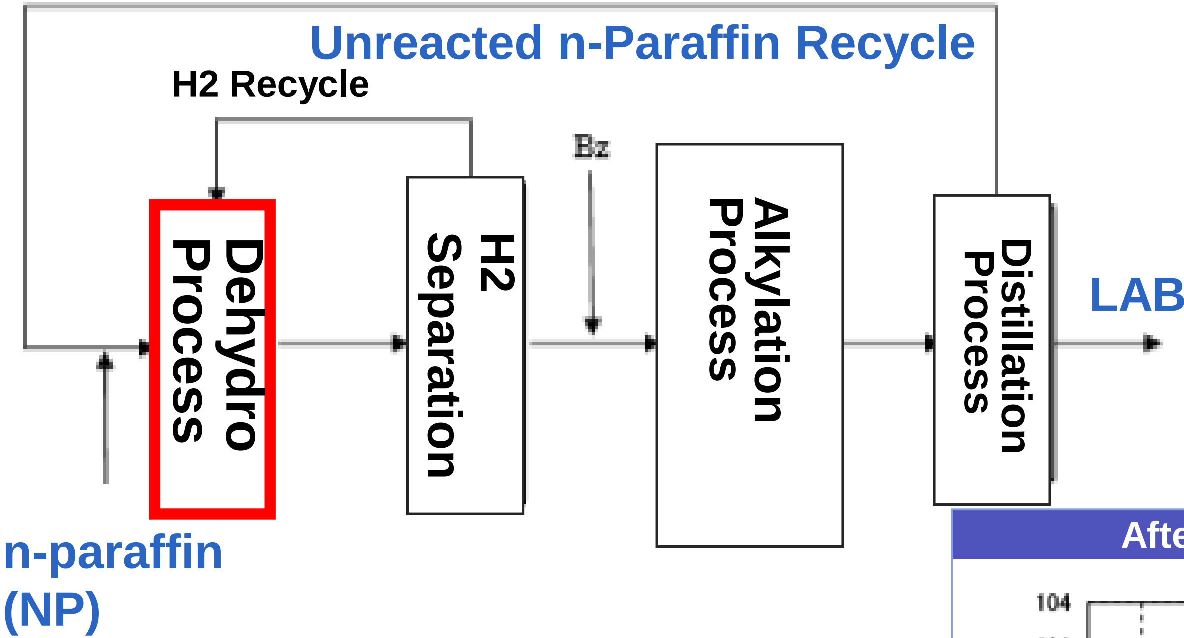
Procedure starts from a reaction.

It dominates the process.



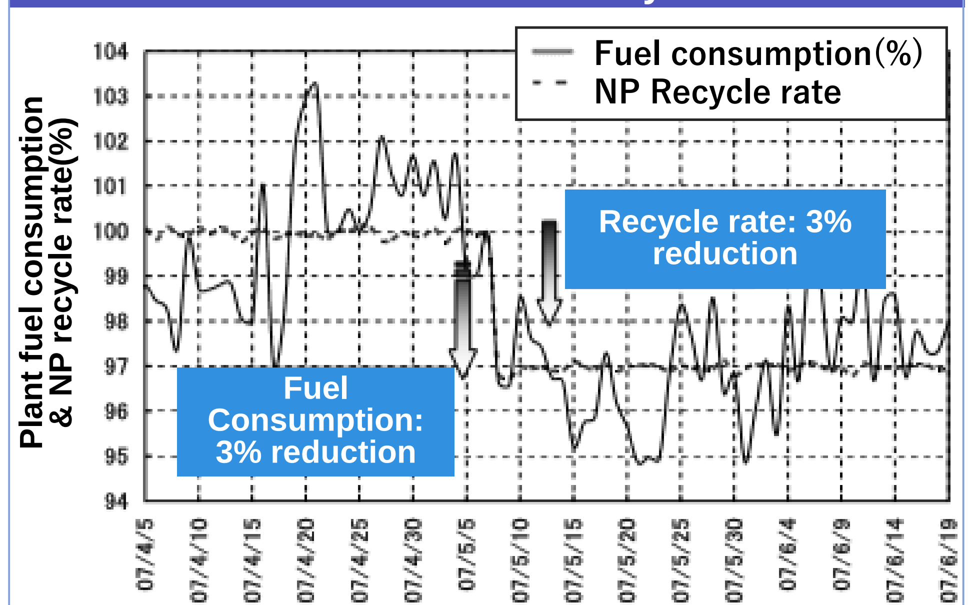
Onion Diagram

NO.7 Energy Conservation for Liner Alkyl-benzene(LAB) Plant



Process Flow

After Reduction of NP Recycle Rate



Conversion up brings

Recycle rate decreasing

Reducing distillation duty

NO.9 Energy Conservation of Hydrogen Plant by Reduction of Reformer Catalyst Deterioration

Target of Energy Conservation

	Item	Target[*1]	Coe (tl/Y)
Reduction of Catalyst Determination	Fuel gas Consumption	2%Reduction	500
S/C Reduction	Fuel gas Consumption	2%Reduction	500
	Steam Consumption (Equivalent to Fuel gas)	3%Reduction	750
	Total	7%Reduction	1, 750

Target = Ratio to overall H2 plant energy consumption

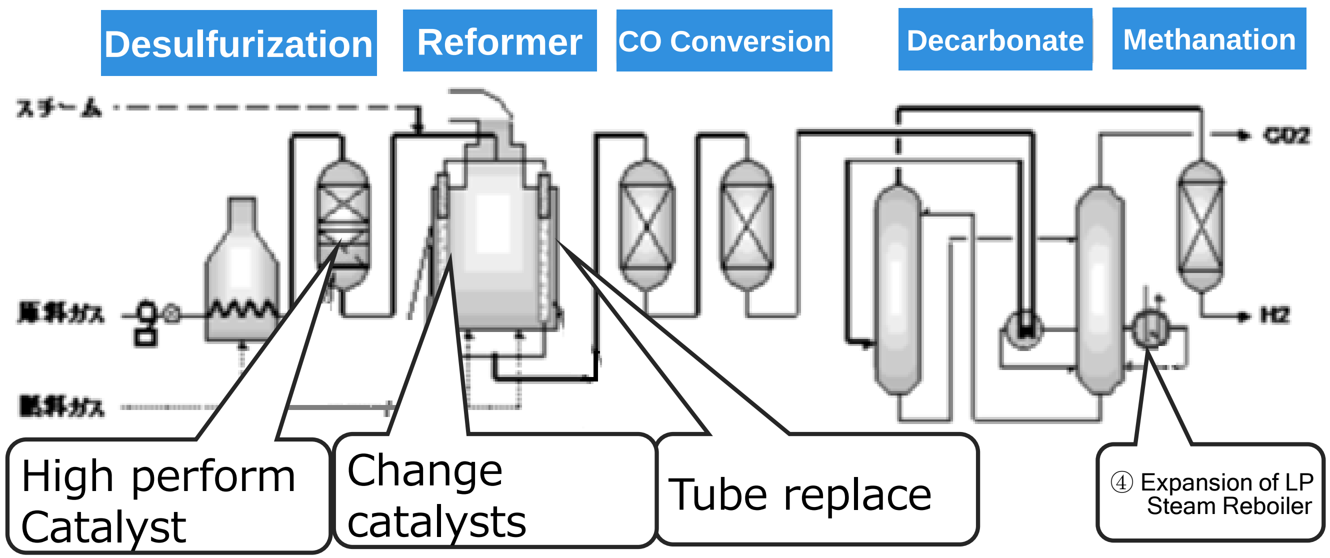
For Steam Reformer

FEED spec. relaxation

S/C ratio optimization

High performance catalyst

- 2,170coe-kl/y savings are realized



e) Subsidy

Support system in Japan

a. Green Investment tax reduction

経済産業省
Ministry of Economy, Trade and Industry

b. EMS support subsidy

一般社団法人
環境共創イニシアチブ
Sustainable open Innovation Initiative

c. EE&C Investment

NEDO New Energy and Industrial Technology Development Organization

Conclusion

New approach will be required

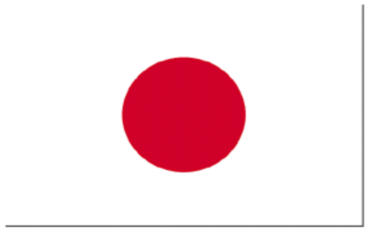
Japan has been an advanced energy-saving country so far. The importance of “Best Practices” are never change.

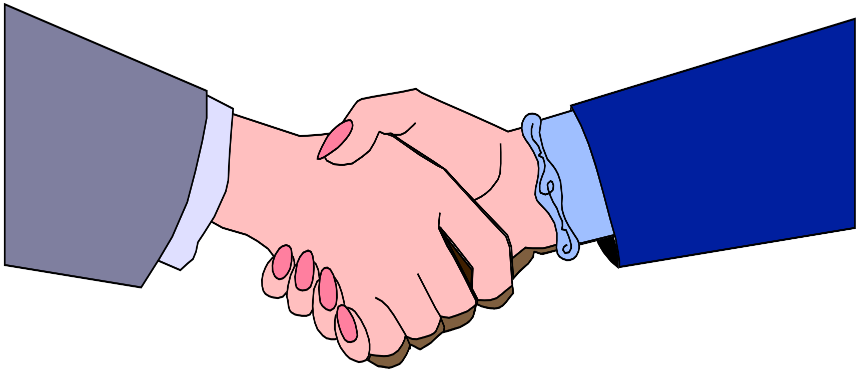
However the evolution of digitalization will bring a grate change of energy use.

To accelerate advanced approach, we need a special supports and efforts.

We are now in a same start line.

Thank You Very Much





For More Information;
The Energy Conservation Center, Japan
https://www.eccj.or.jp **<from 1996>**

Asia Energy Efficiency and Conservation Collaboration Center
(Established in April 2007)
https://www.asiaeec-col.eccj.or.jp

Japanese Business alliance for Smart Energy-Worldwide
(Established in October 2008)
https://www.jase-w.org/

The Energy Conservation Center, Japan
Since 1978

省エネのシンボルです
SMART CLOVER

The Symbol of Energy Conservation
Since 2005ECCJ has been spread the symbol mark with the visual image of a flour-leaf clover which is thought to bring happiness named as "SMART CLOVER", representing everyone's energy conservation activities.

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