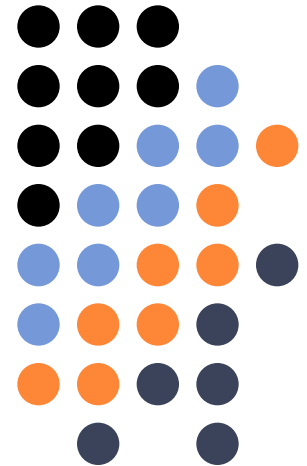# Fuel Switch & Energy Efficiency CDM Project Case Study

Prepared for Private Sector Seminar

July 21, 2011

JICA CDM Expert Team

Lecturer's Background

Hirotaka NEGISHI

General Manager, Strategic Investment Dep't, Japan Smart Energy Co., Ltd.

Working Experiences

Marubeni Co.

- In charge of nuclear power plant's supply materials trading.

Australian Embassy, Tokyo

- Promote FDI to Australia from Japan and East Asia. Involved plantation project in Australia to offset GHG emissions from Japanese power stations.

Pricewaterhouse Coopers, Tokyo

- Trained for DOE staff. Advisory services for major Japanese companies' of its carbon management strategies.

Academic BG & Qualification

- Graduate Keio University (LLB), Tokyo, JAPAN.
- Attended Ex-MBA course, Monash University, Melbourne, Australia.
- Hold Masters' Degree (Law and Diplomacy), Fletcher School, Boston, USA
- Qualified ISO 14001 EMS Auditor
- Trained for CDM Validator/Verifier (Completed Japanese Gov't Training course)

Contents

- What is Energy Efficiency Project?

- What kind of energy saving measures are available?

- Understand importance of MRV.

M: Measurable

R: Reportable

V: Verifiable

Unless, you can MRV, you never earn credit!

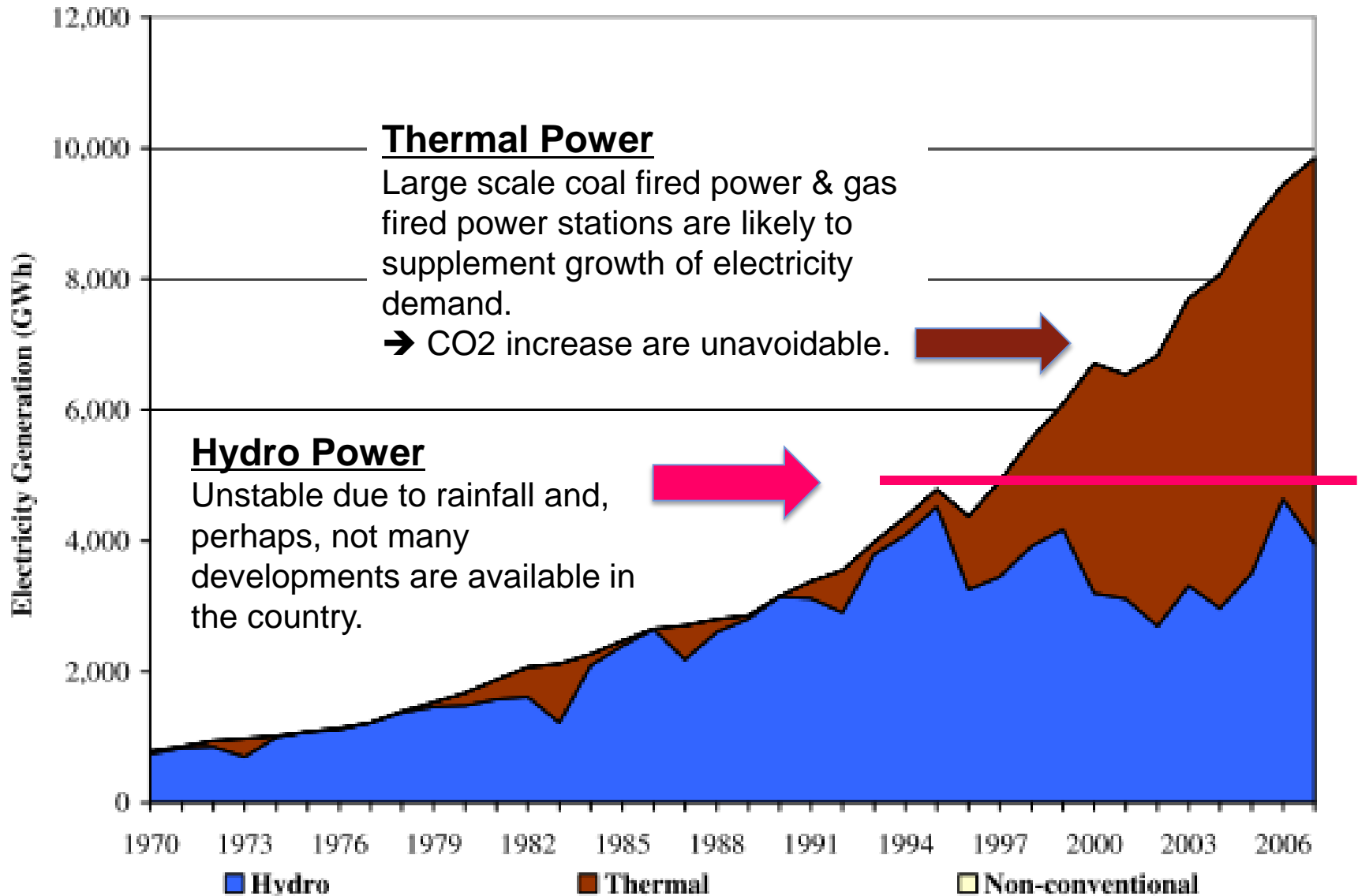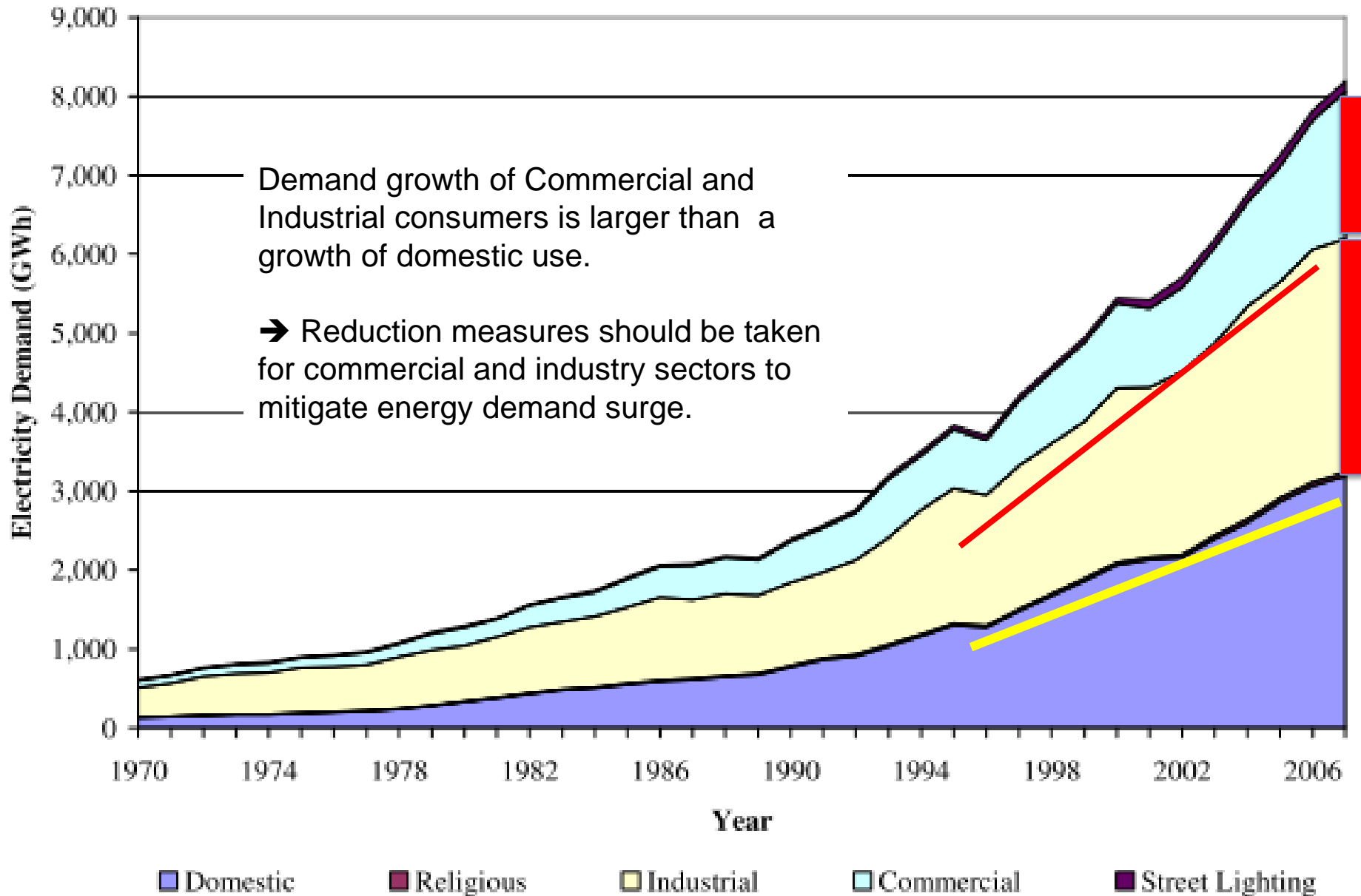# Figure 3.8- Hydro/Thermal/Non-conventional Energy Share in the National Grid

Thermal Power
Large scale coal fired power & gas fired power stations are likely to supplement growth of electricity demand.
→ CO2 increase are unavoidable.

Hydro Power
Unstable due to rainfall and, perhaps, not many developments are available in the country.

Figure 5.4 – Electricity Demand by Consumer Category

Demand growth of Commercial and Industrial consumers is larger than a growth of domestic use.

➔ Reduction measures should be taken for commercial and industry sectors to mitigate energy demand surge.

Legend: □ Domestic ■ Religious □ Industrial □ Commercial ■ Street Lighting

Y-axis: Electricity Demand (GWh)
X-axis: Year

Principles

Output (O) = Input (I) x time (t) x efficiency (η)

Output (O) = Product (P) + Emissions (e)

P + e = I x t x η

Project Goal: Reduce "e" without damaging Output!

<u>Fuel Change</u>
Alternate Input to less carbon intensive fuels to reduce emissions.

<u>Energy Efficiency</u>
Improve efficiency, while maintaining an output level.
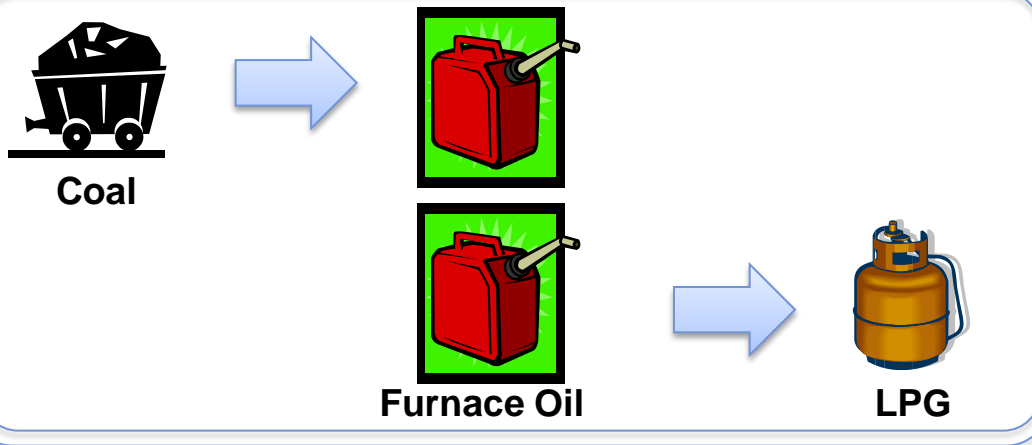Runtime, will shorten at the same time.

<u>DSM</u>
Curve out demand amount and reduce overall product of input, time and efficiency.

1. What is Fuel Switching?

Other Energy Efficiency Measures

Boiler Replacement, Efficient Motors

Coal →

Furnace Oil → **LPG**

Coal Furnace Oil →

Fuel switch measures in this category will replace carbon-intensive fossil fuel with a less-carbon-intensive fossil fuel, whereas a switch from fossil fuel to renewable biomass is categorized as "renewable energy".

Biomass Fuel

1.Emission Factors of Major Energy Sources

Fuel	Heat Value	COEF	EF	Gravity	
	TJ/MT	tCO2/TJ	tCO2/MT	t/m3:t/kl	
Furnace Oil	0.0410	77.4	3.173	0.972t/kl	$3.264tCO_2/kl$
Diesel Oil	0.0433	74.1	3.209	0.846t/kl	$3.793tCO_2/kl$
Residual Oil	0.0410	77.4	3.173	0.972t/kl	$3.264tCO_2/kl$
Coal	0.0293	101.0	2.816	$1.300t/m^3$	$3.661tCO_2/t$
LPG	0.0502	63.1	3.168		$3.168tCO_2/kg$
Natural Gas	0.0411	64.2	2.639		$2.108kgCO_2/Nm^3$
Grid Electricity					$0.686tCO_2/MWh$

Data source
1. Energy Data 2007, Sustainable Energy Authority
2. IPCC Guideline for National Greenhouse Gas Inventories, 2006, Table 1-4
3. Natural Gas's gravity data was not available and utilized Japanese data for reference purposes. Nm^3 is a unit of gas under normal state.

Biomass Fuels are regarded as "carbon neutral" & count as zero emissions by itself.

1. Fuel Change CDM Project

Number of CDM project registered and issued CER.

	On Track	Registered	Issued	CER %
Fossil Fuel Switch Total	**71**	**57**	**---**	
Coal to NG	9	5	3	65%
Coal to Oil	0	0	0	
Lignite to NG	0	0	0	
New NG plant*	30	26	14	42%
New NG plant utilize LNG	1	8	3	74%
Oil to Electricity	2	0	0	
Oil to LPG	1	0	0	
Oil to NG	28	18	13	100%
Biomass Energy Total	**395**	**358**	**151**	**85%**

*AM0029: Grid Connected electricity generation plants using natural gas is widely used in high performance combined cycle gas pwer generation projects in China and in India.

2. What is Energy Efficiency project?
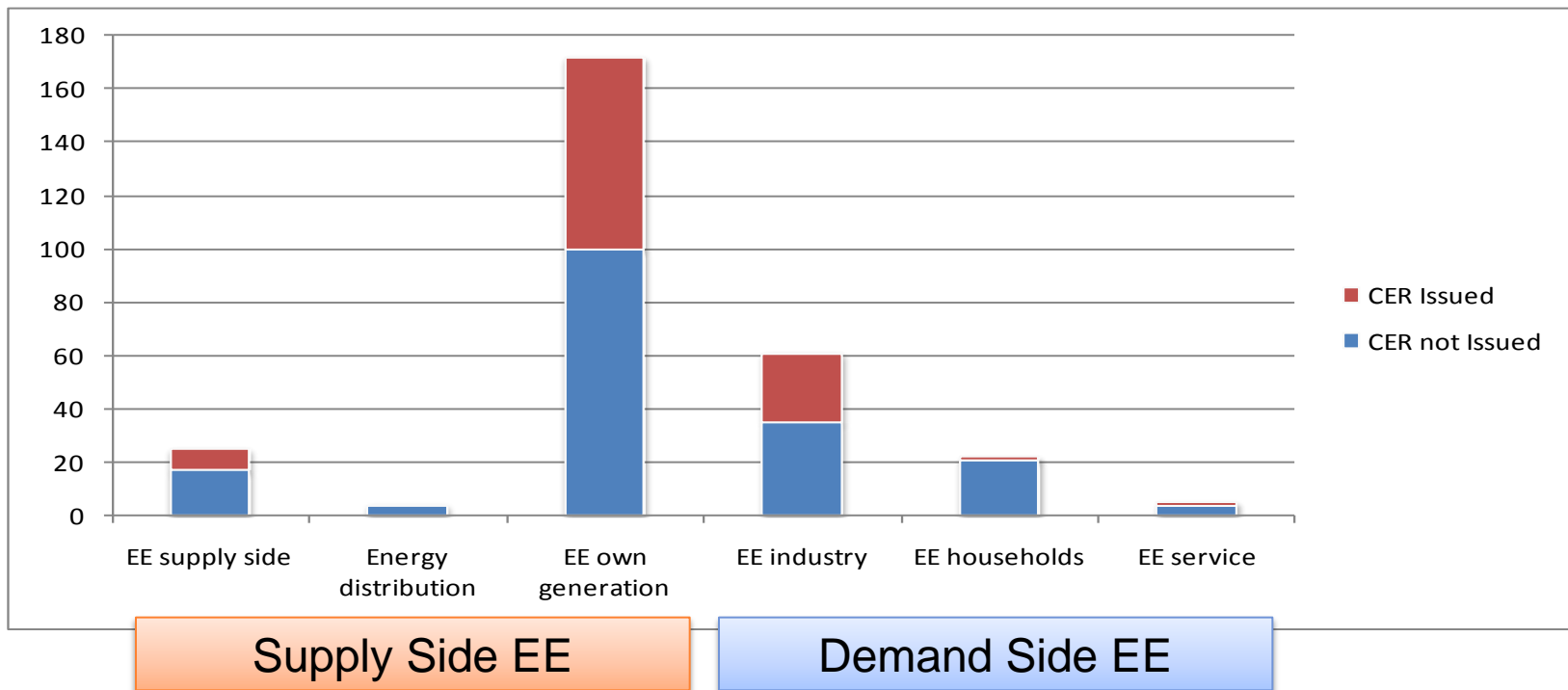
Energy Efficiency Project

The category energy efficiency includes all measures aiming to enhance the energy efficiency improvement. Due to the project activity, a specific output or service requires less energy consumption. Waste energy recovery is also included in this category.


Supply Side Energy Efficiency
Power supplier and distributer implement energy efficiency measures, inc. auxiary power –gen.
Heat recovery   Combined cycle
•Rehabilitation of power station   Smart grid

Demand Side Energy Efficiency
 the adoption of energy-efficient equipment, lamps, ballasts, refrigerators, motors, fans, air conditioners, appliances in many sites. inc. BEMS(building Energy management System).

発電出力: 312kW ～ 2,700kW

2. Energy Efficiency Statistics

- As of May 2011, there are 289 registered Energy Efficiency CDM projects.
- Of which 88 projects are demand side energy efficiency projects and the rest are supply side (including transmission) energy efficiency projects.
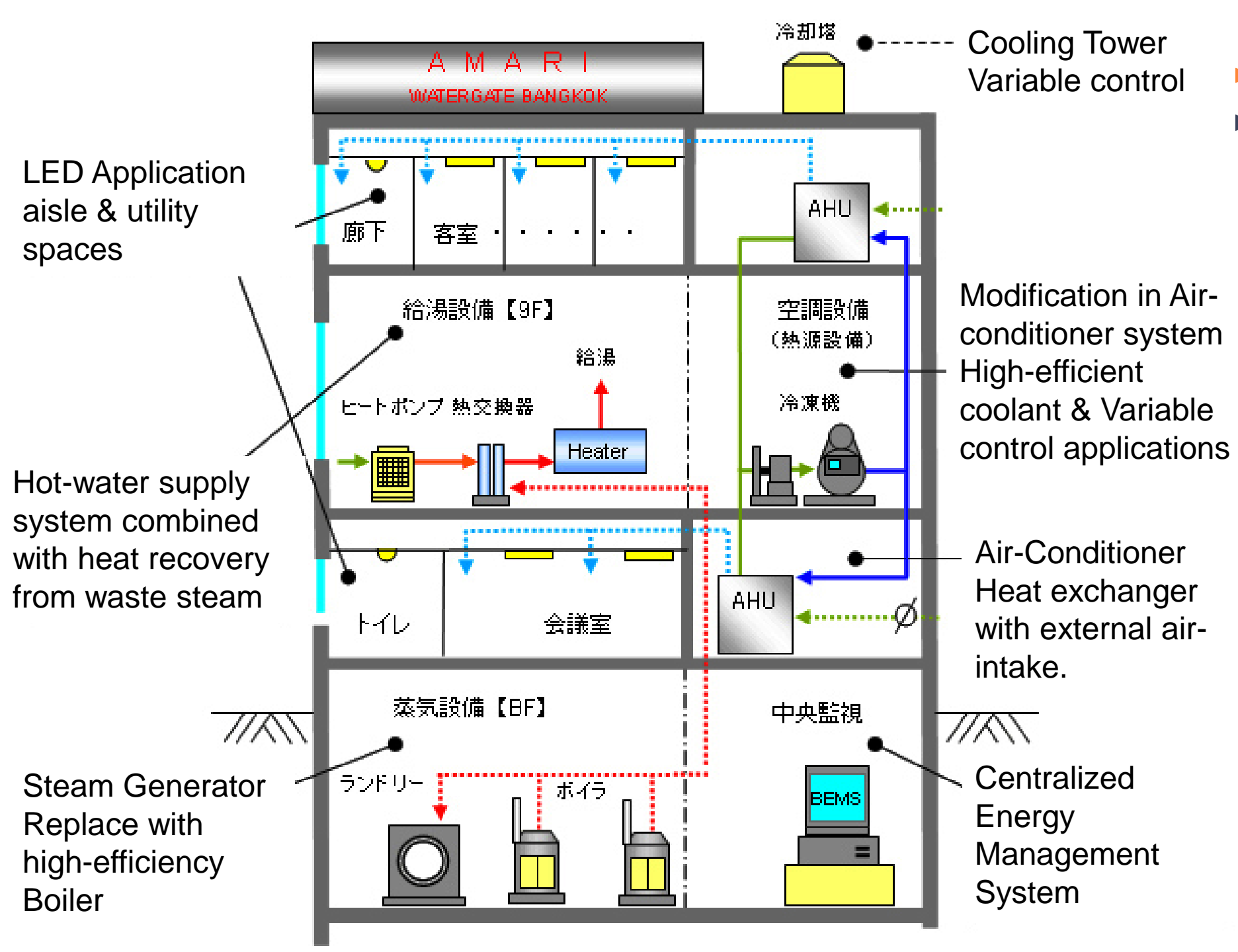- Of all the registered energy efficiency CDM,108 projects have issued CER.

Supply Side EE   Demand Side EE

2. Key Insight of Energy Efficiency Project

In project, the output has to be maintained before and after the energy efficiency project

Energy

1,000 units/h

A   900 units/h

B   800 units/h
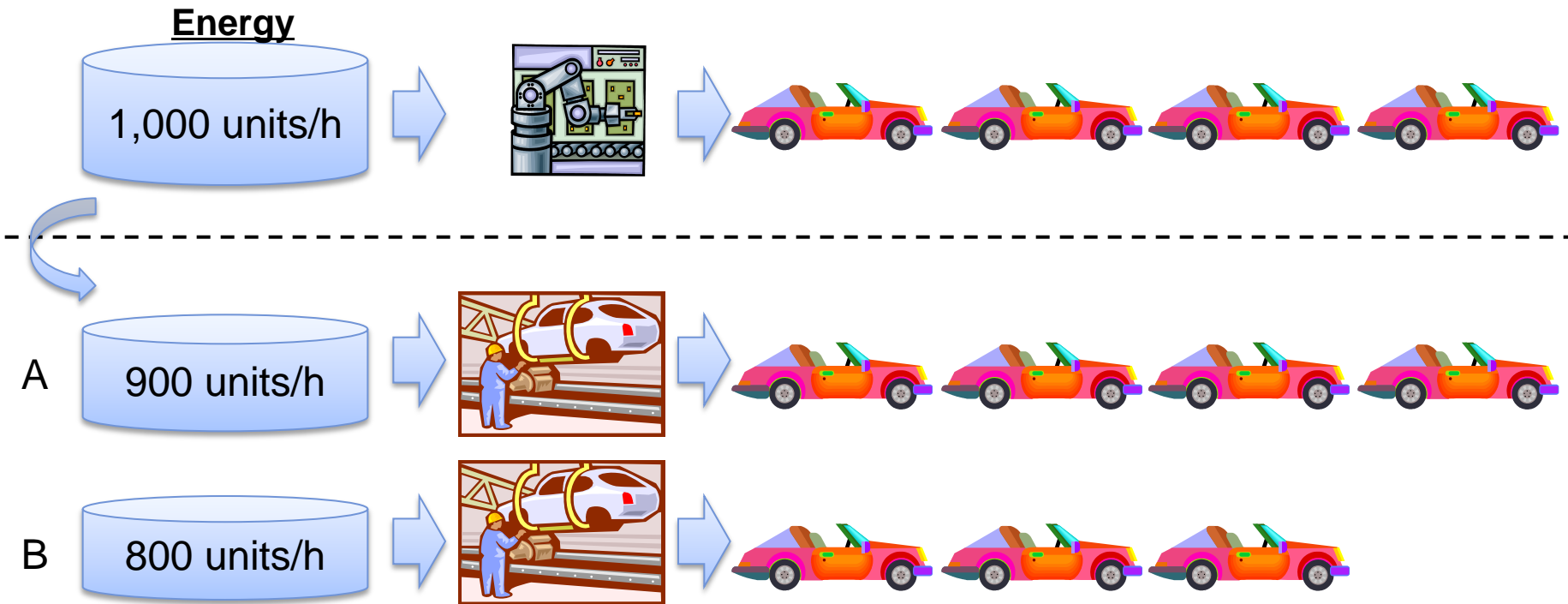
Which is "energy efficient"??

3. Technology: Boiler Replacement

- Boiler Replacement aimed to improve efficiency of boiler.
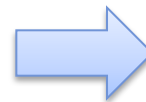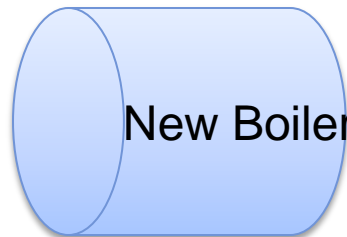- Project also changes its fuel to low-emission fuel.

Fuel Change

Old Boiler

Improve an efficiency

New Boiler
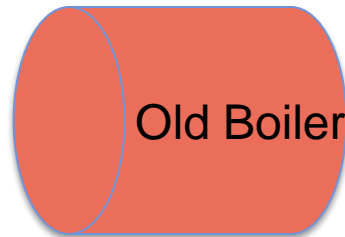
Project can be identified in facilities with high demand for heat & steam.
- ◆Hotel & Dormitory
- ◆Factory (food, textile etc.)
- ◆Laundry

For the sake of MRV, the reduction need to be clearly attributed to each of measures taken in the projects.
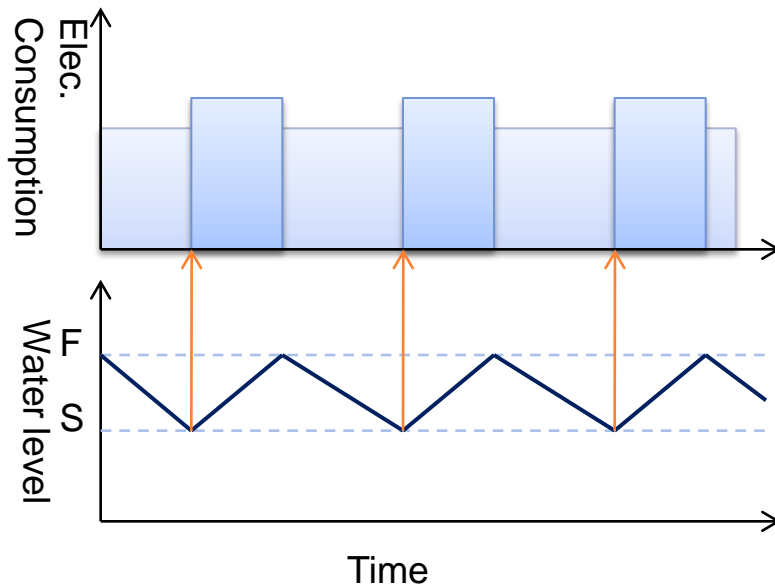
3. Technology: Inverter & Load Variable

Boiler water pump continuously pumping water, regardless water amount in the boiler tank.
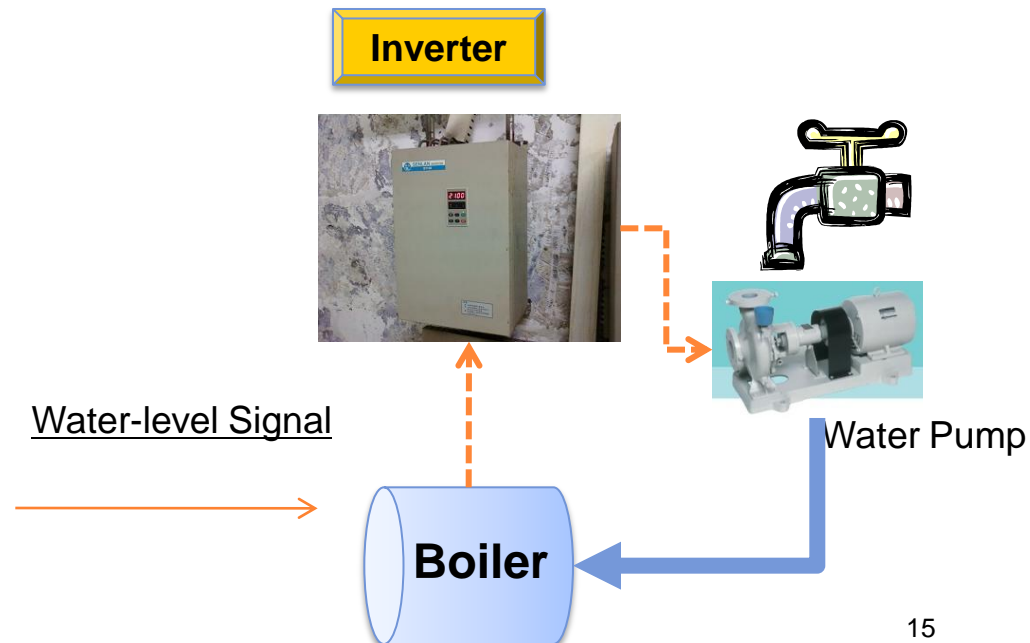
Inverter technology on/off the pump be referring water level of the tank.
By reducing idle time of the pump, it reduces an electricity consumption.

Monitoring
◆Power consumption of the system (kWh)
◆Number of operational hours (hrs)
◆Emission factor of the electricity (tCO$_2$e/kWh)

Inverter

Water-level Signal

Water Pump

Boiler

Elec. Consumption

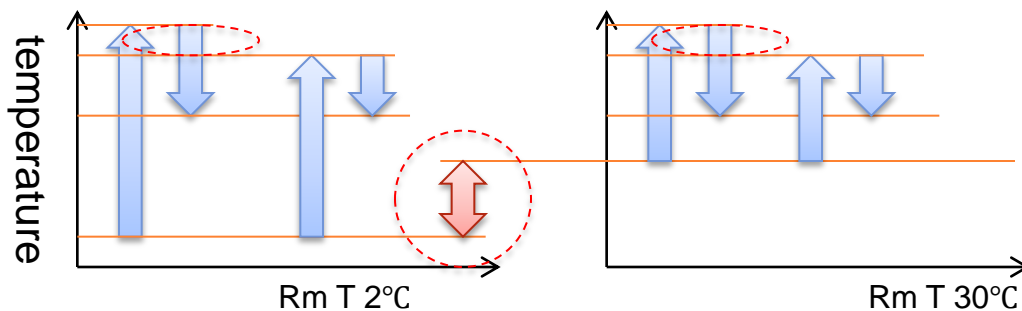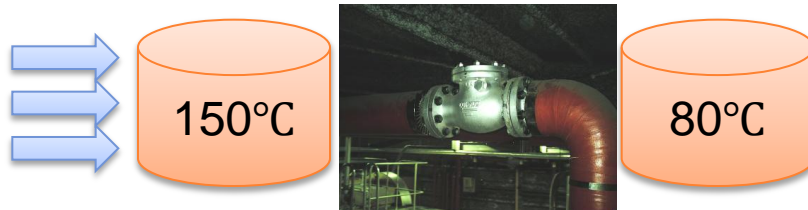Water level

F

S

Time

15

Inverter Project is difficult to draw Baseline due to on/off.

3. Technology: Pipe Blanket

Pipe Blanket is a method to cover pipe
and high temperature parts by glass wool.

150℃   80℃

130℃   80℃

temperature

Rm T 2℃   Rm T 30℃

Monitoring
◆Temperature of in/outflow (℃)
◆External temperature (℃)
◆Flow rate (m³/sec)
◆Consumption of fuel/electricity to generate
  steam(L of fuel or kWh of electricity)
◆Emission factors

**Blanketing pipe is a handy
project due to easy installation
and cost-effectiveness.
The project is difficult to factorize
the energy reduction causality to
pipe blanket, fluid's temperature
or an ambient temperature drops.**

16

3.Technology: Lighting Modification

- ## LED Application

  Replace inefficient lighting to efficient lightings.

- ## Application of Automatic Controller/sensor

The project needs to monitor electricity consumption of modified section to avoid disturbances.
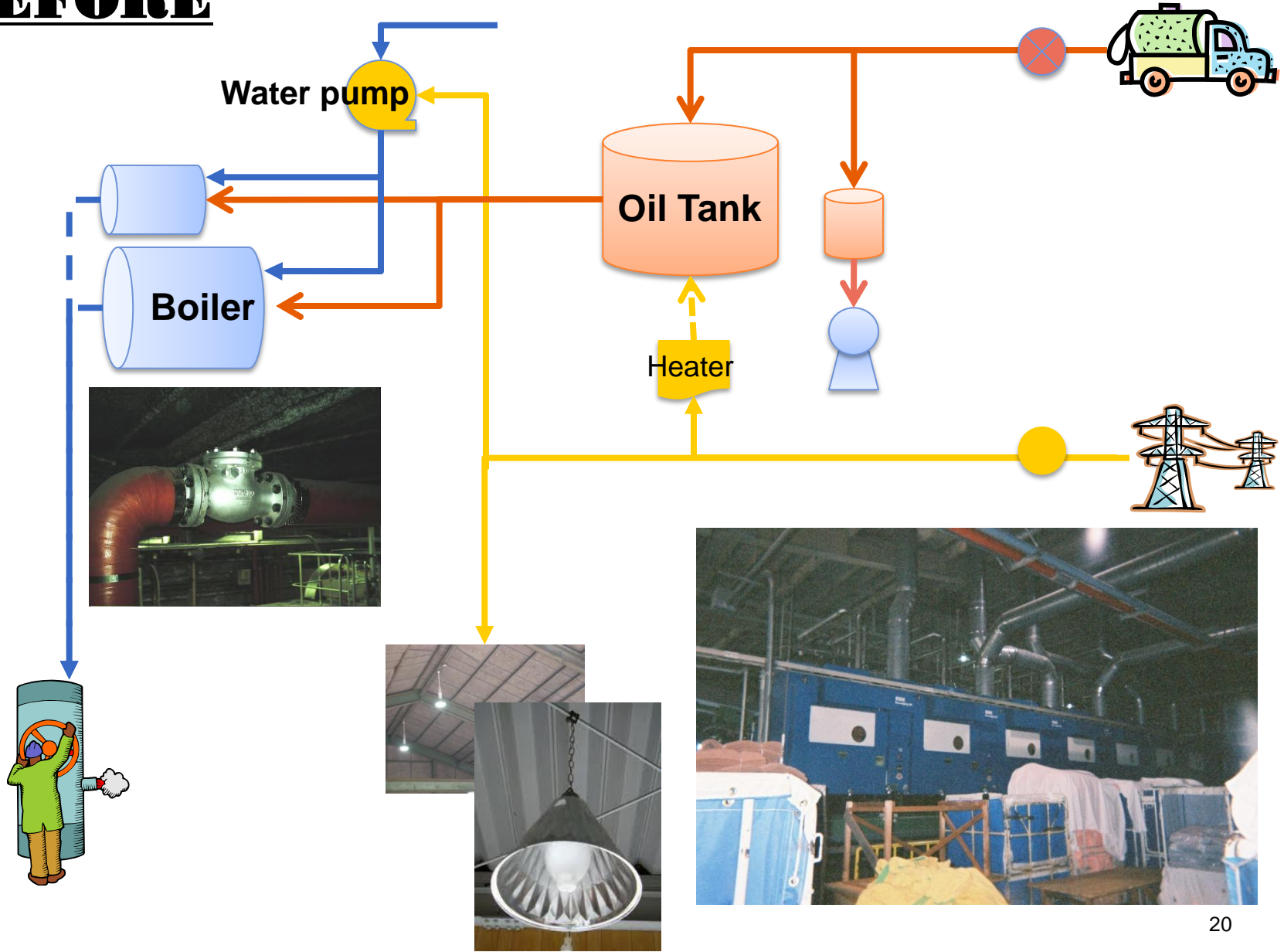
2. Case: Project in Laundromat Services (Cont'd)

Feature of Energy Use

◆ Requires intensive energy for pressing (steam), laundry (hot water).
◆ Heat requirements varied with peripheral temperatures but stable for year-round.
◆ Outside temperature varies from 32℃ in August to -20℃ in February.
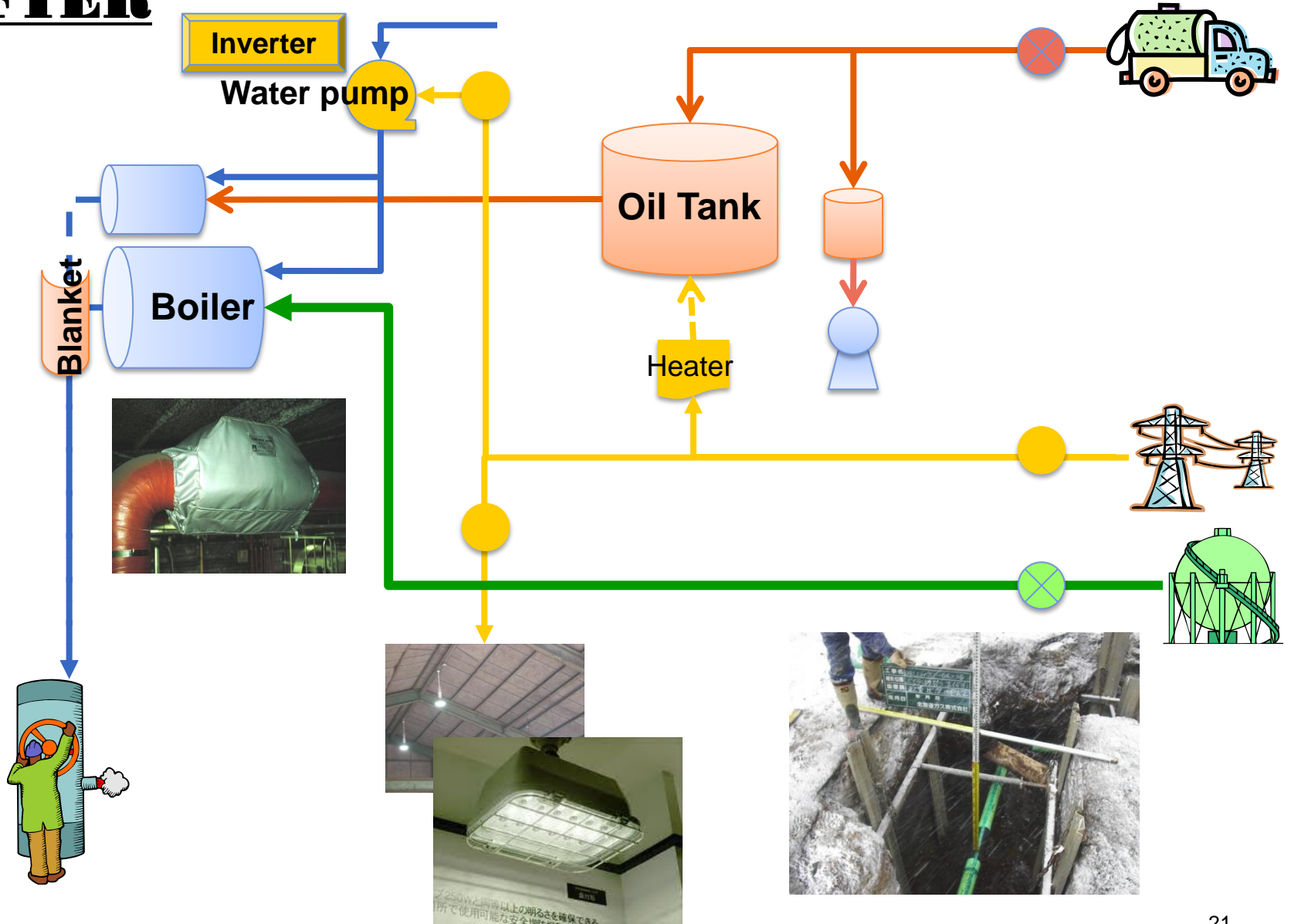◆ Energy costs, electricity and fuel, occupies 50% of expenses.

BEFORE

Water pump

Oil Tank

Heater

Boiler

AFTER

Inverter

Water pump

Blanket

Boiler

Oil Tank

Heater

4. What can be done in CDM & what not?

	Project A: Boiler Fuel Change	Project B: LED application	Project C: Inverter Application	Project D: Blanket Application
AMS Methodology	III.B	II.E	II.C	---
Baseline	Keep using furnace oil.	Keep using mercury lamp	Keep operating pump regardless load/demand	Expose valve where heat are easily leak.
Project	Replace furnace oil to natural gas.	Replace mercury lamp to LED lamp to reduce electricity consumption	Control and limit pump action depends on water level of boiler.	Cover valve to avoid heat expose to atmosphere
Monitoring	Gas consumption with gas flow meter with gas company's invoice.	Electricity Consumption with metering devices and electricity bill.	Metering devices	Continuous monitoring of temperature of fluid and exposed environment.
CDM?				

Fuel Change & Energy Efficiency Project: Summary

Fuel Change Project

a) Biomass Fuel Change Project:

- Check supply stability in terms of volume and price for project periods.

- Transportation of fuel are to be measured in the calculation, closer the source, better project performance.

b) Fossil Fuel Change Project:

- It maybe economical without carbon income.

- Performance improves by combined with energy efficiency improvements.

Energy Efficiency Project

- MRV is key factors if the project aimed to evaluate environmental performances.

- Maintain output level before and after the project to measure nominal performance improvement.

- Causality and attribution are important to claim credits.

Think Twice!!
Do you really need carbon credit to realize your project??