MITR PHOL
Bio Power

# Case Study: Bagasse Cogeneration Development in Thailand's Sugar Industry

For How2Guide for Bioenergy

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# Business Units of MITR PHOL GROUP

Mitr Phol has 7 business units, including Thai Sugar Business, China Sugar Business, ASEAN Business, Energy Business, Particle Board Business, Logistic Business and Australia Business.

#1
- 6 Thai Sugar mills
- Crushing Capacity: 175 k TCD
-Refinery Capacity: 7.72 k Ton/Day
-Liquid sugar 400 Ton/Day

Thai Sugar Business

- Particle board: 400 k $m^3$
- MDF: 300 k $m^3$

Wood Substitute Material Business

#1
- 6 Power Plants: 410 MW
- 4 Ethanol Plants: 1,160 k Liter/day

Energy Business

#2
- 7 China Sugar Mills
- 1 Pulp & Paper Factory
- 1 Power Plant : 32 MW
- Crushing Capacity: 87.5 k TCD
- Refinery Capacity: 2.6 k Ton/Day
- Pulp & Paper: 60 k Ton/Day

China Business

#1
- Lao Sugar mill: Crushing 5 k TCD
- Lao Power Plant: 9 MW

ASEAN Business

UST: Port and warehouse service provider

Logistics Business

#3
- 4 Sugar mills
- Crushing Capacity: 33.5 k TCD
- Power Capacity 44 MW

Australia Sugar Business

Note : Plant capacity based on 2012/13

# Biomass in Thailand

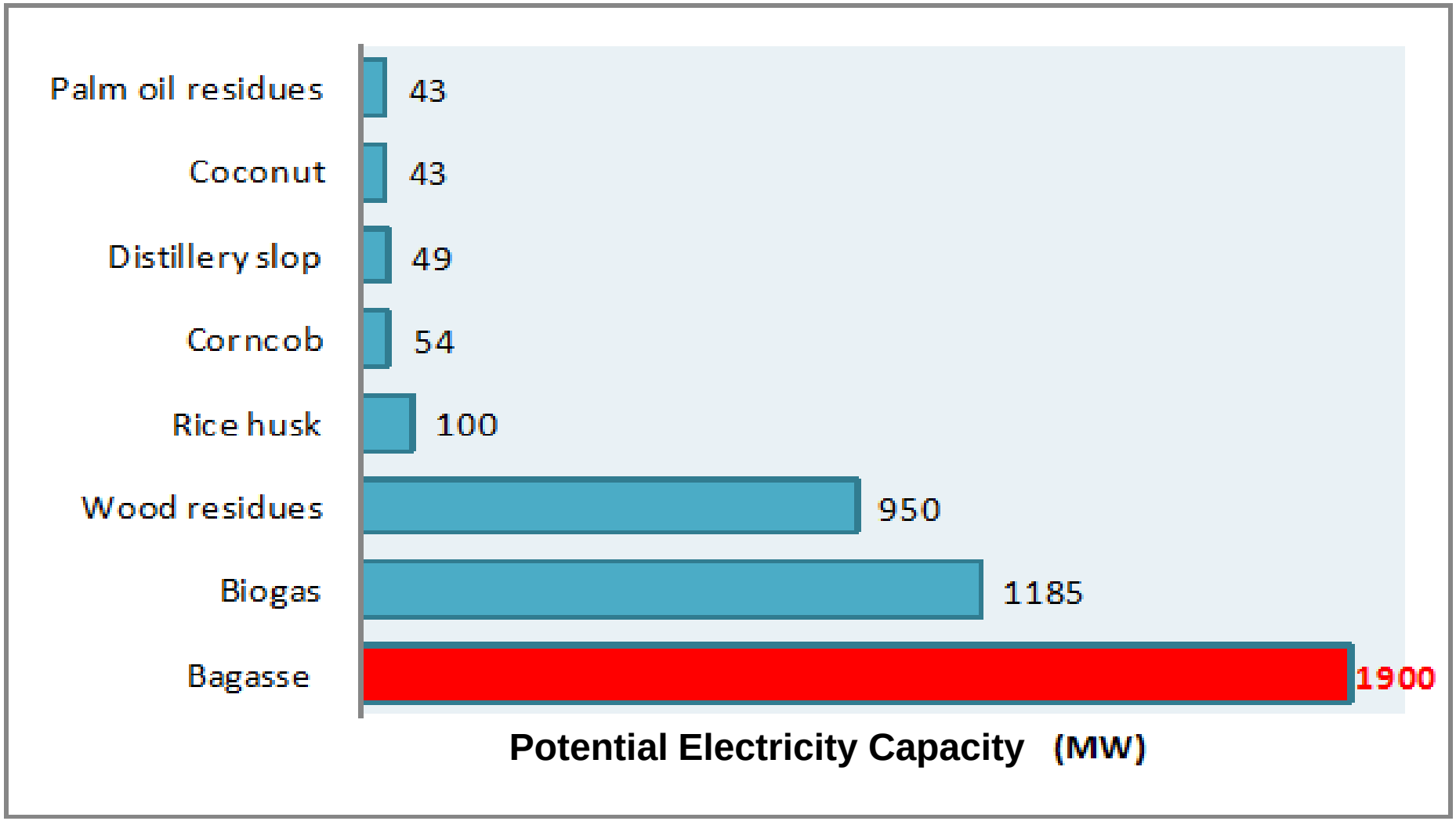








# Thailand Biomass-Based Power Generation Potential




*Source : Black and Veatch (2000). Final Report*

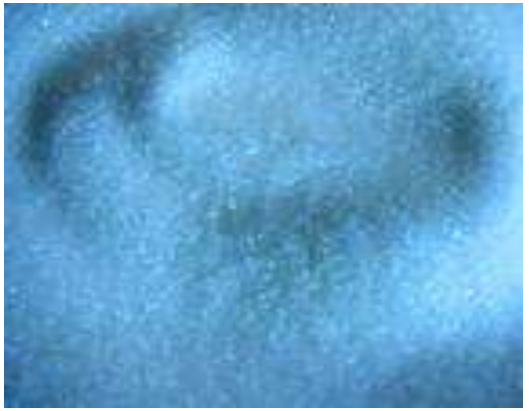
# Power Cogeneration in Sugar Mills

Sugar Cane

Sugar Mill

Juice
73%

Sugar



Bagasse 27%

Power and Steam

Fuel

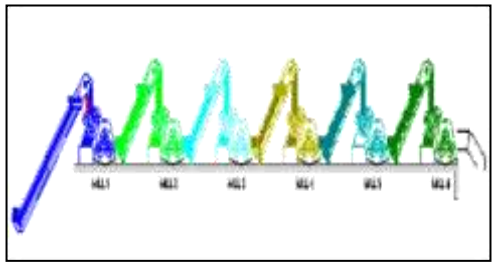
Excess
Power

Bagasse Storage

New Power House

National Grid

# How does a High Pressure System Work?



Low Pressure Boiler and TG

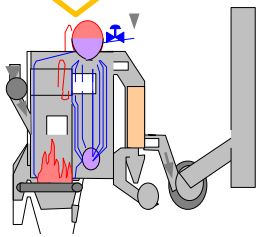
1 ton Cane

280 kg. Bagasse

35 kWH

0.45 ton steam @1.2 bar

Sugar Mill

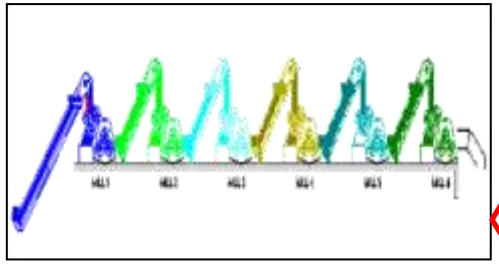


0.56 ton steam @ 16 bar

~

12 kWH

16 bar 360° C



High Pressure Boiler and TG

1 ton Cane

280 kg. Bagasse

35 kWH

0.45 ton steam @1.2 bar

Sugar Mill

0.65 ton steam @ 100 bar

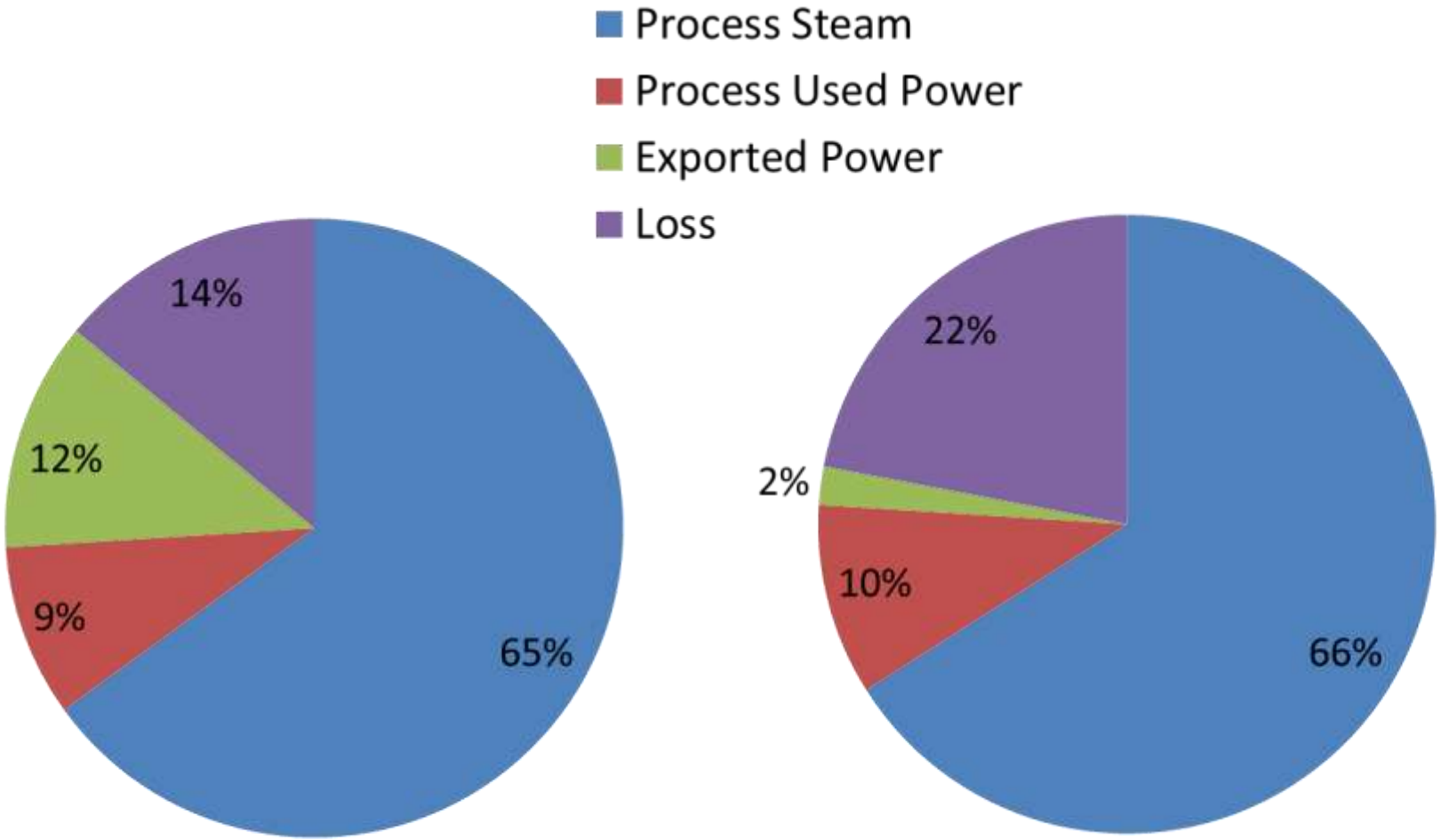
100 kWH

100 bar 510° C

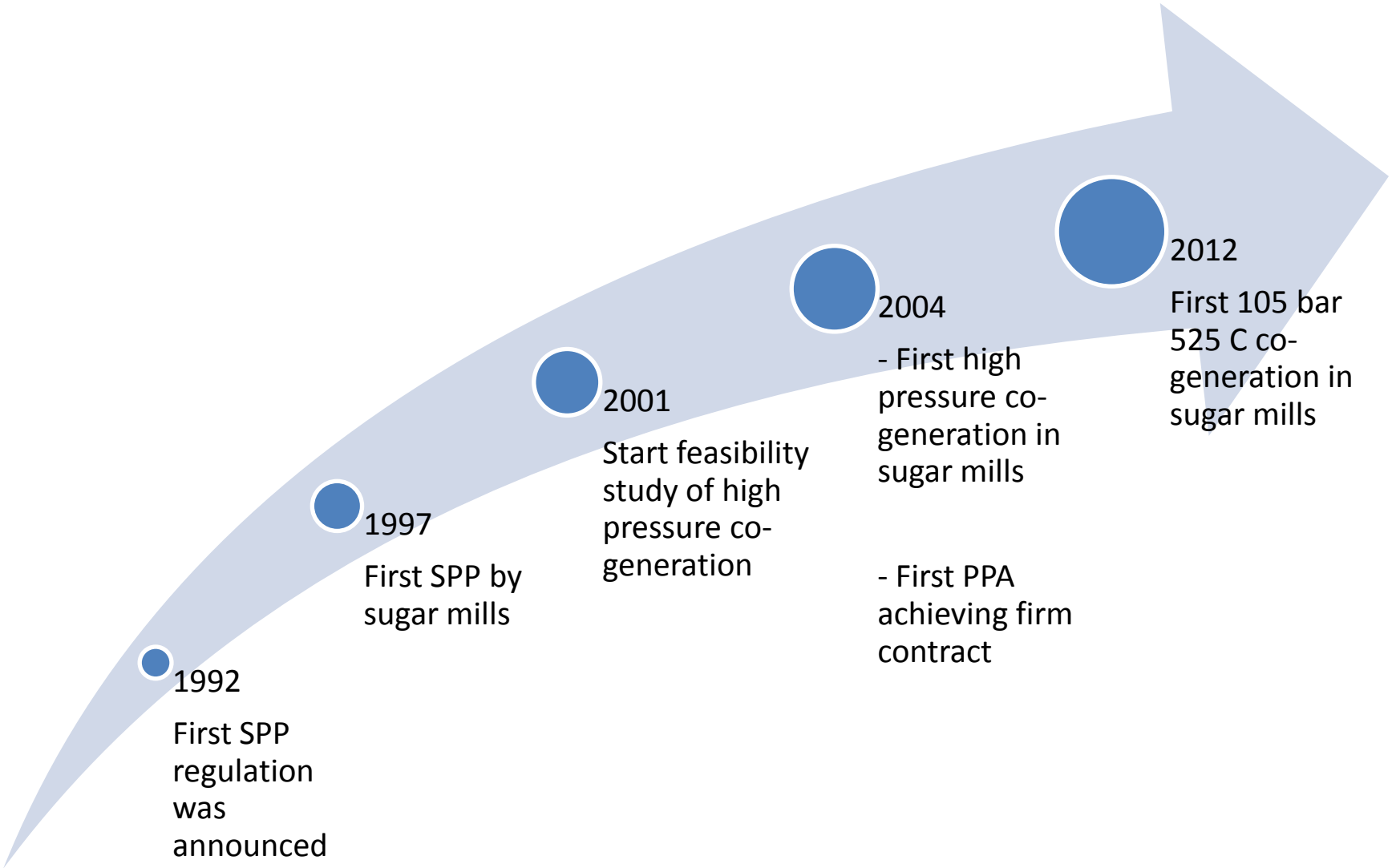
# Energy Balance Comparison

High Pressure Boiler and TG

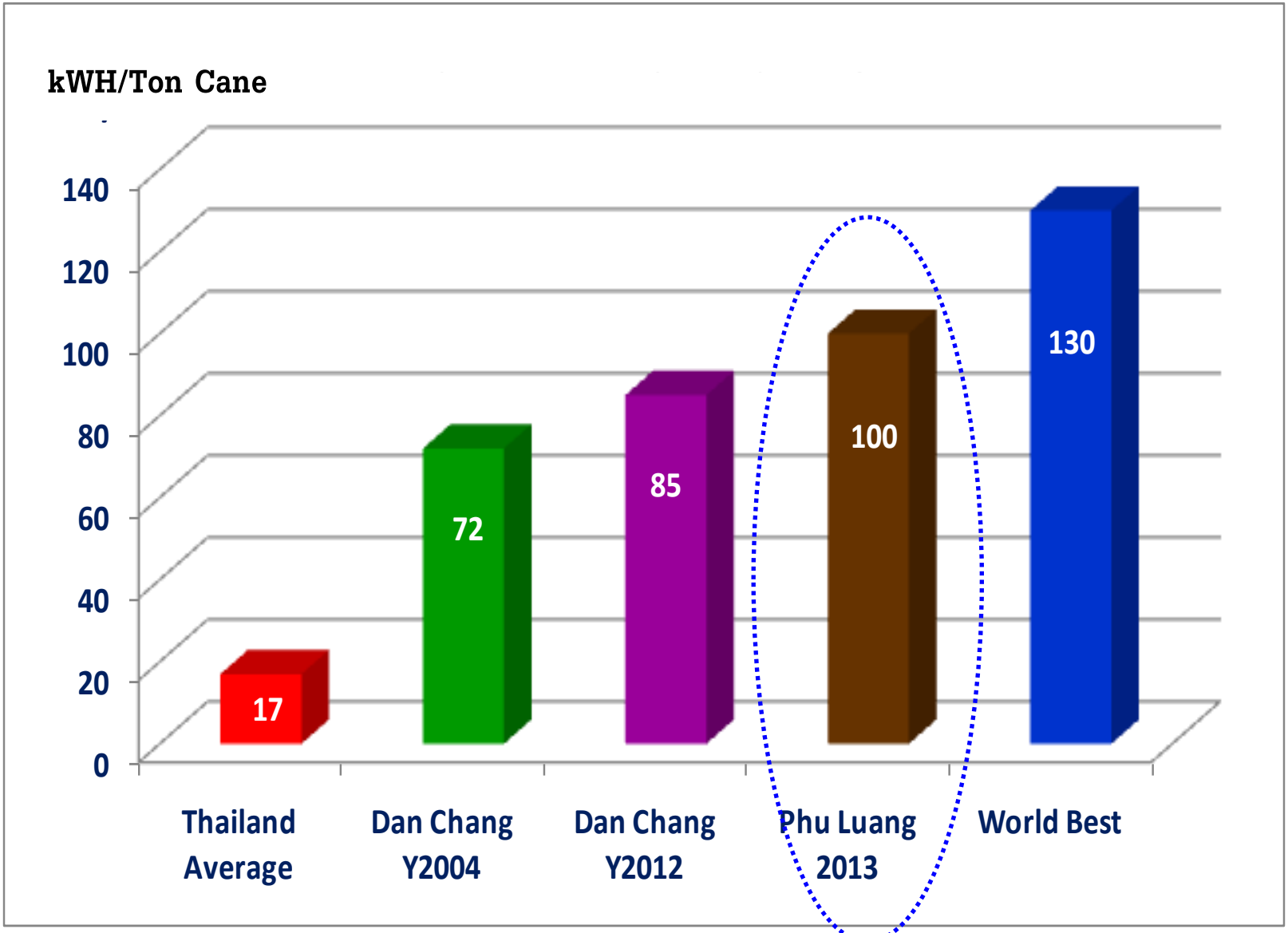
Low Pressure Boiler and TG



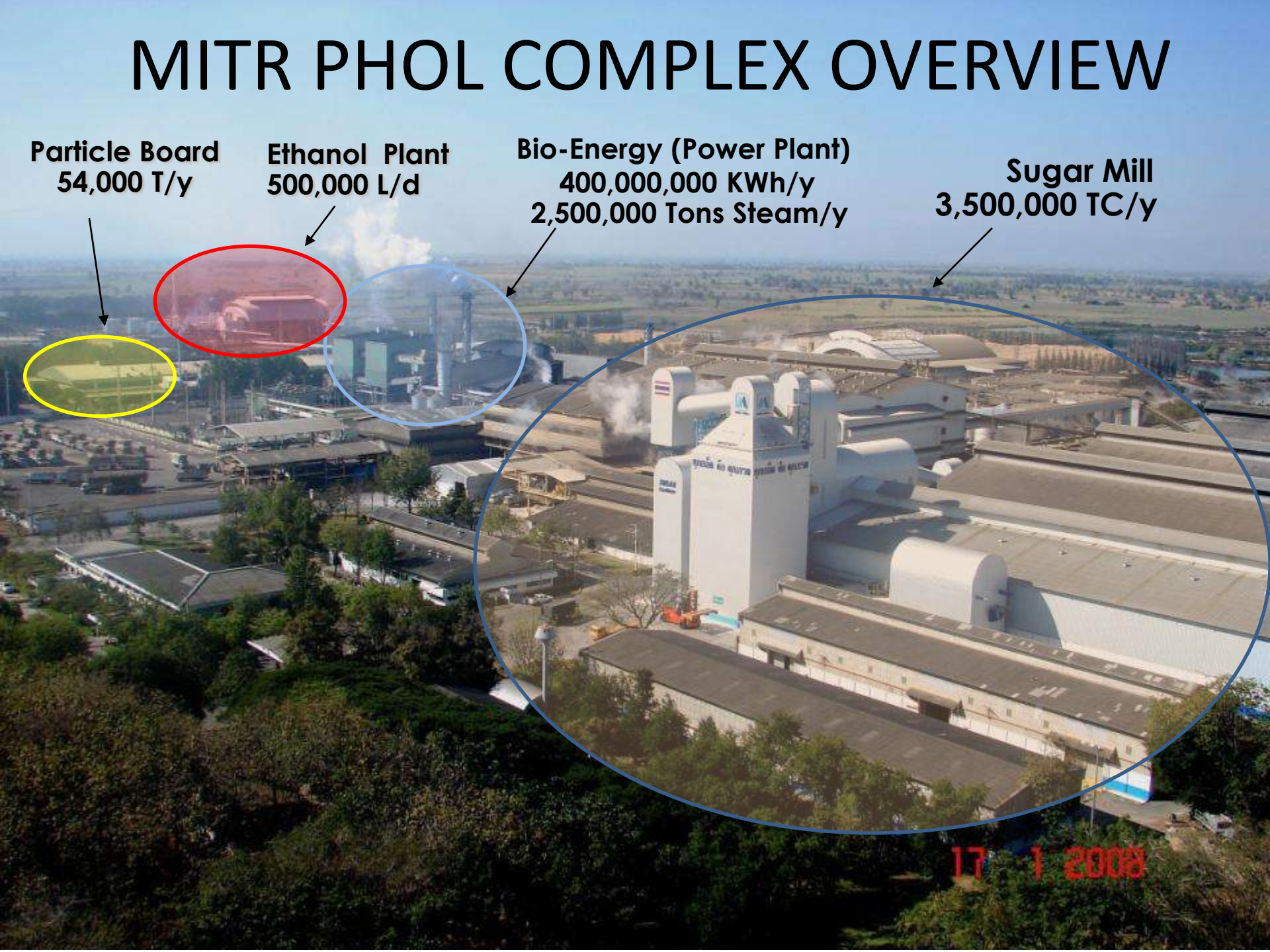
# Development of Co-Generation in Thailand's Sugar Industry



# Comparison of Electricity Output from different sugar mills



# MITR PHOL COMPLEX OVERVIEW



# Major Technical Attractions

- First high-pressure boiler turbo-generator in ASEAN sugar industry
- Boiler efficiency over 90 % (LHV basis)
- Cogeneration thermal efficiency over 70 %
- High flexibility in operation
- High electricity export to the grid: 6 times more
- Multi-fuel firing capability
- Water-cooled vibrating grate furnace
- Modern monitoring & control system (DCS)

# Favorable Environmental Impacts

## Stack emission: Cleaner air

| | | (COAL) |
|---|---|---|
| • Particulate | 20 - 50 ppm | (120) |
| • NOx | 120 - 160 ppm | (350) |
| • SOx | 0 - 8 ppm | (320) |

## Solid waste: Recycle back to farm

ashes from boiler can be used as soil improvement substance.


## Global Warming: Reduce green house gas

- Grid emission factor : 500 kg $CO_2$/ 1 MWH

# Socio-Economic Benefits


**Increased business activities in the local community**


**More jobs have been created**

**Created value added to many agricultural waste**

**New technology transfer to the industry**


**Reduction of the nation's import of fossil fuel for power generation**

# Challenges

Technical Challenges

Operation Challenges

Financial Challenges

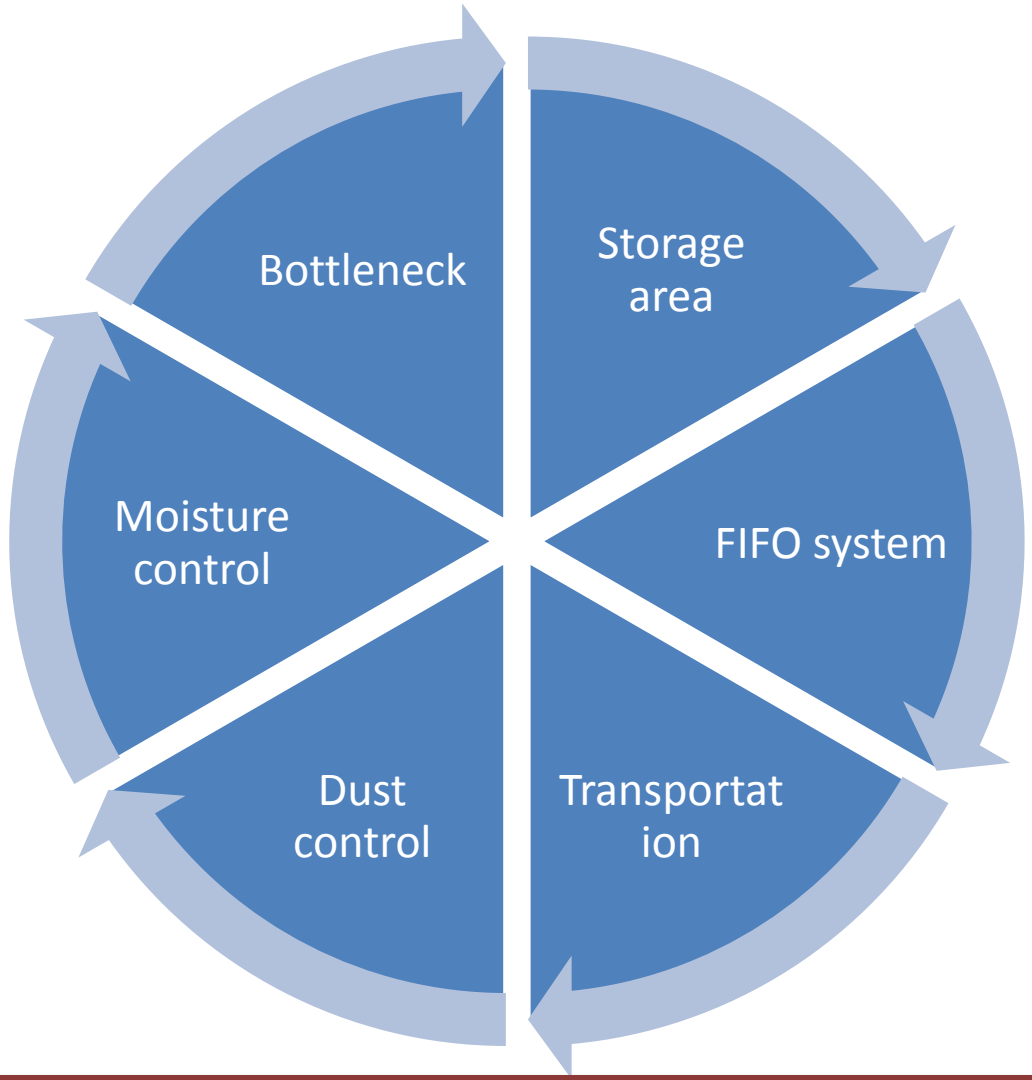
Management Challenges

# Technical Challenges: Seasoning Operation

| | Crushing | Remelting |
|---|---|---|
| Steam Consumption, ton/hr | 550 | 160 |
| Power Consumption, MW | 18 | 6 |
| Bagasse Production, ton/day | 8700 | 0 |
| Operation Period, months | 4 (Dec-Mar) | 8 (Apr-Nov) |

What capacity should the biomass power plant be ?

# Operation Challenges: Fuel Handling System




How to handle thousands ton of biomass storage?

# Financial Challenges

## Security arrangements:

- Mortgage of all land, building and equipment to the bank
- Assignment of PPA (DCB vs. EGAT) 21 yrs firm contract
- Assignment of Utilities Supply Agreement (DCB vs. Mitr Phol)
- Corporate guarantee of the loan
- All risk insurance for equipment & all assets in the name of the creditors

## Exchange Rate Risk

- All foreign contracts had been converted to local currency loan.

## Project Implementation Risk

- Fix price lump sump
- Fix time turnkey

## Income

- Energy payment, indexed to natural gas price
- Capacity charge, indexed to Dollar exchange rate
- Carbon credit from CDM project

# Management Challenges

| | Current | New Scheme |
|---|---|---|
| Main Concern | Internal production | External customer |
| Efficiency | Less priority | Major concern |
| Engineering | In-house | Out-source |
| Investment | Low | High |
| People<br>• Recruitment<br>• Compensations | Sugar industry | Power plant |
| Communication | Informal | Formal |

Need a new management concept !

# Key Success Factors Implementing Large Scale Biomass Power Plant

Questions
&
Comments