# Coal Mine Methane Project in China
(Japanese Government Assistance)

March 20 1 0

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Resources Department
Japan Coal Energy Center (JCOAL)

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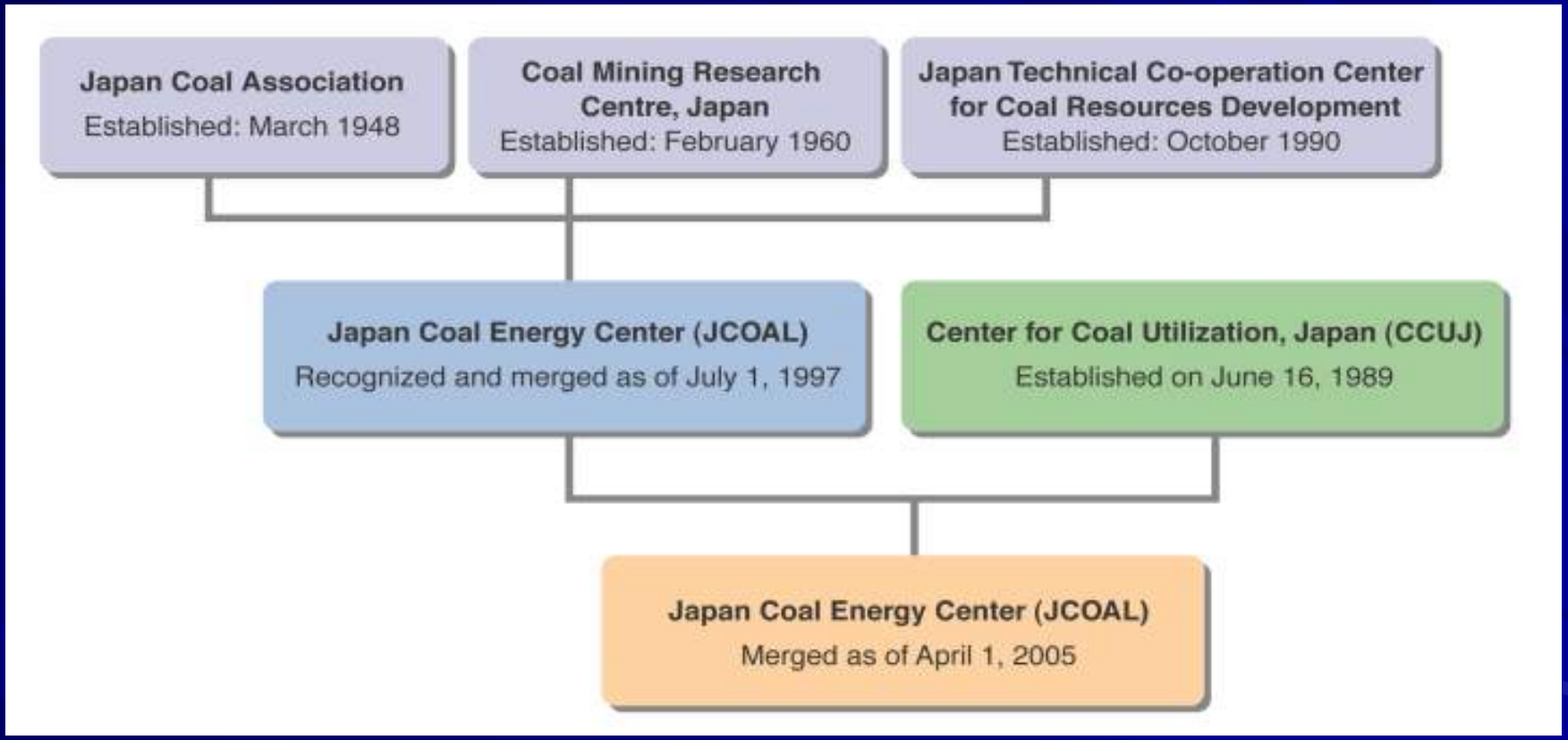
NEDO :New Energy and Industrial Technology Development Organization

# 1. Introduction of JCOAL

# Profile of JCOAL

(1) Name： Japan Coal Energy Center (JCOAL)
(2) Office： 9F, Meiji Yasuda-Seimei Mita Bldg.,
3-14-10 Mita, Minato-ku, Tokyo 108-0073 JAPAN
(3) Established： October 16, 1990
(Merged with CCUJ as of April 1, 2005)
(4) Members： 10 6 Associations
(5) Basic assets： 651 million yen
(6) E-mail ： jcoal-info@jcoal.or.jp
(7) URL： http://www.jcoal.or.jp

# History of JCOAL



# Project Scheme with China

| JAPAN | China |
| --- | --- |
| New Energy and Industrial Technology Development Organization (NEDO) | National Development & Reform Commission (NDRC) |

**MOU**

JCOAL & Private Sector ---------- Coal Mine

**Implementation Agreement**

# Project Task Share with China

JAPAN

- Site Selection
- Feasibility Study for
- Detailed Design
- Major Equipment and Technology
- Demonstration Operation
- Training/Technology Transfer

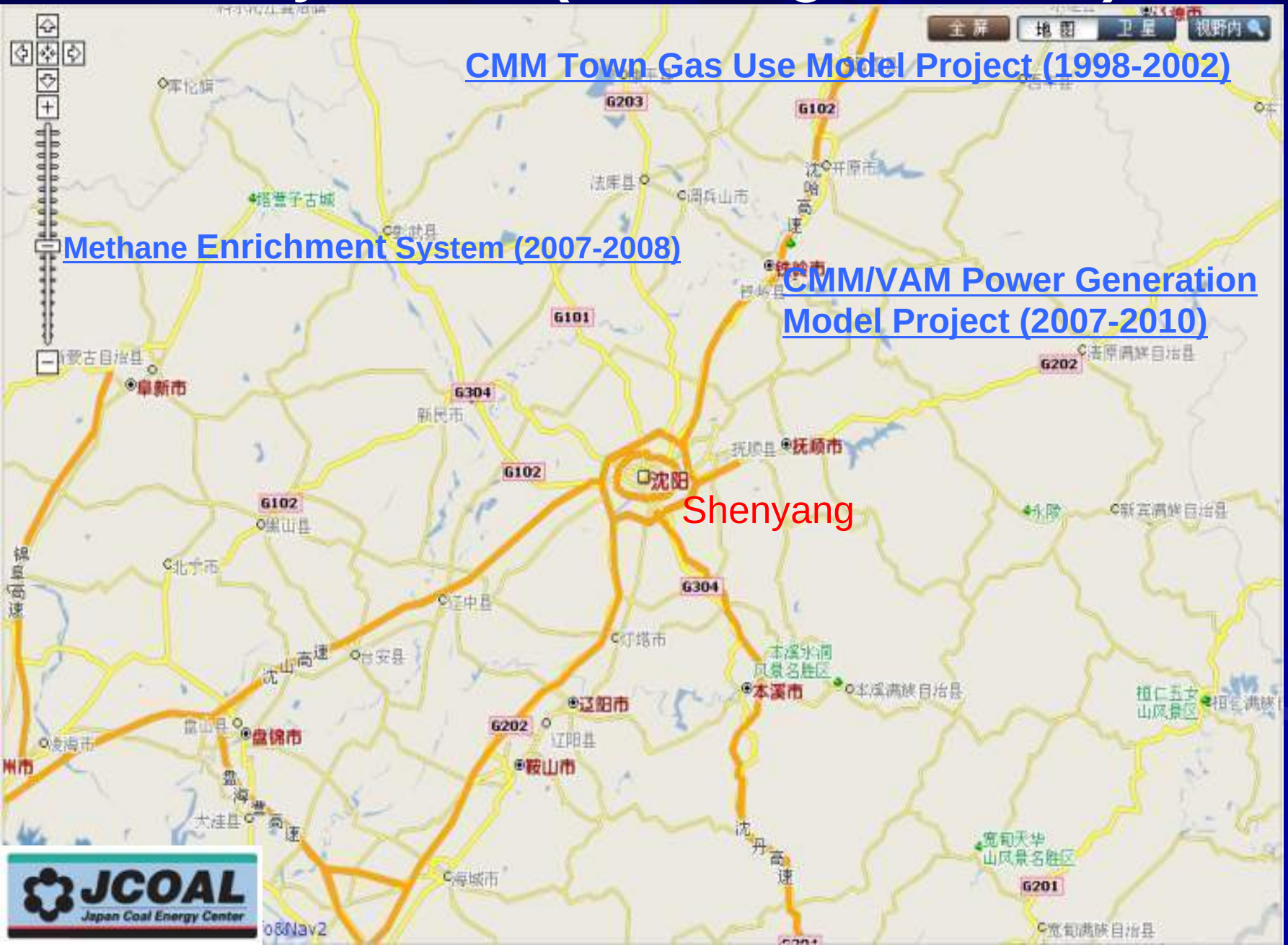
Utility Supply

China

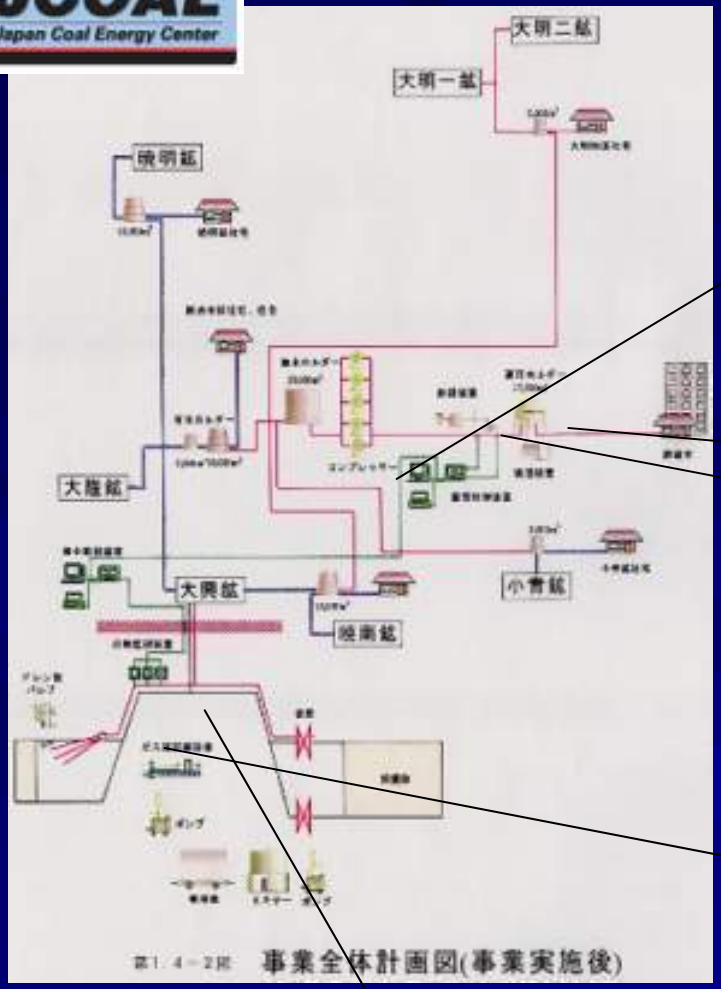
- Provide Data and Information
- Application for Government
- Auxiliary Equipment
- Inland Transportation
- Civil Works/Building
- Construction Work

# 2. NEDO CMM Town Gas Model Project at Tiefa, China

# Project Site (Liaoning Province)




JCOAL Japan Coal Energy Center



第1.4-2図 事業全体計画図(事業実施後)

# CMM Town Gas Use Model Project at Tiefa

MITSUBISHI HEAVY INDUSTRIES, LTD.

JCOAL Japan Coal Energy Center

# 3. NEDO CMM/VAM Power Generation Model Project at Fushun, China

# Liaoning　Fushun Mining / Laohutai



## Project Overview

Number of Unit　1 Unit

Type　12MACH-30G
(4 cycle, V-type, micro pilot)　Power Generation Efficiency 45%

Output　3,500kW (at generator terminal)

Fuel gas　CMM(30%<) and VAM

MITSUBISHI HEAVY INDUSTRIES, LTD.

JCOAL Japan Coal Energy Center

# GHG reduction by CMM gas engine

## The case of NEDO model plant

CMM gas consumption : 2,925Nm$^3$/h
Methane concentration : 30%
(4 ~ 5% in engine cylinder)
Amount of methane extraction : 878Nm$^3$/h
(Operation 8,000hr./year)

Green house effect coefficient of extracted methane is 21 times of $CO_2$ .

Amount of green house gas reduction by one CMM MACH gas engine is 91,000ton/year. ($CO_2$ conversion)

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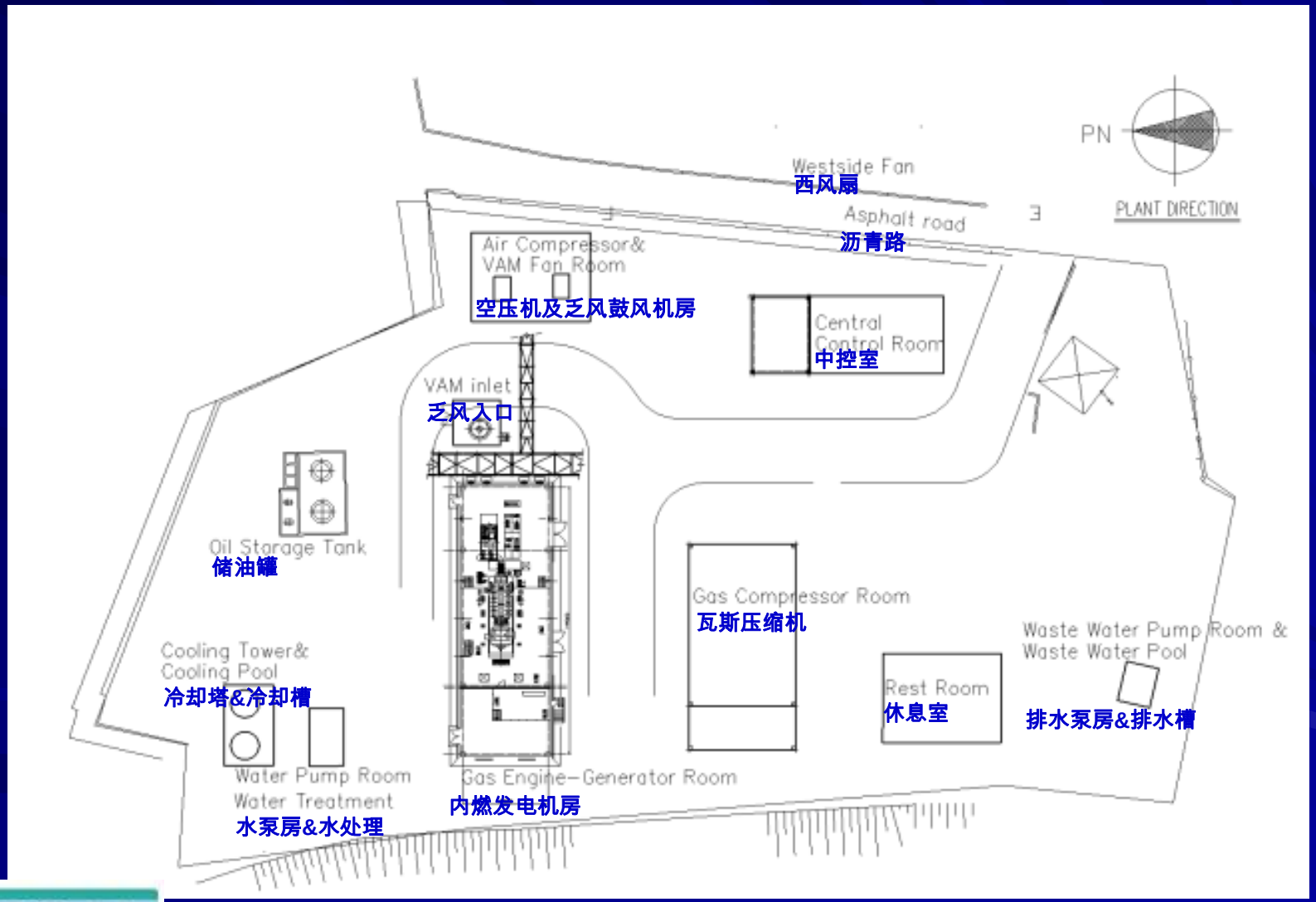
# General arrangement （KEY PLAN）

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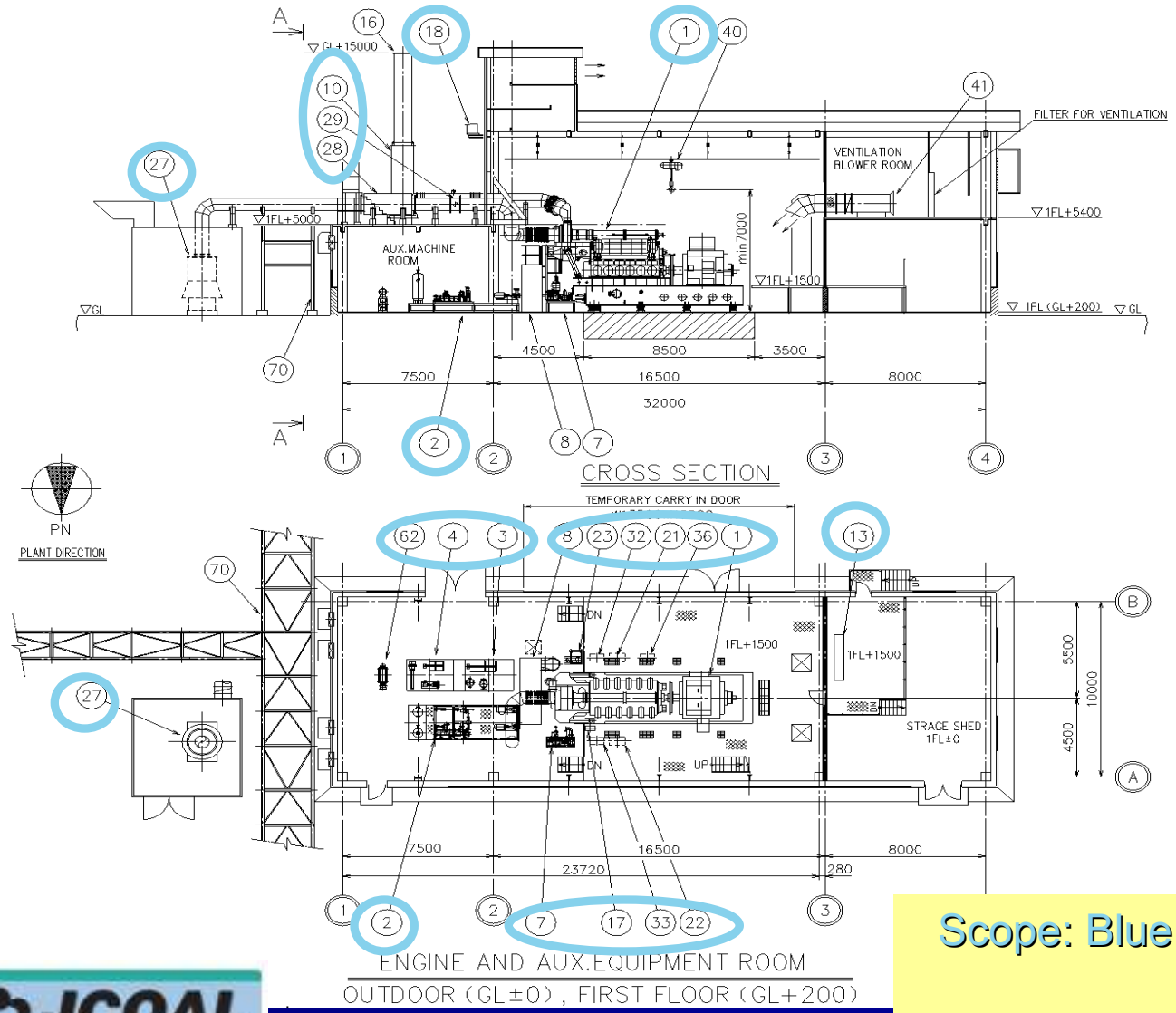
# General arrangement

## ( Cross section, First floor )




| No. | NAME | Q'ty | REMARKS |
|---|---|---|---|
| 73 | Fuel gas mixer valve unit | 1 set | HOLD | |
| 70 | Piping rack | 1 lot | – | |
| 62 | Secondary cooling water heater | 1 set | HOLD | |
| 41 | Ventilation blower & duct | 1 lot | – | |
| 40 | Overhead crane | 1 set | – | 2.8 ton |
| 36 | Lube oil filtering pump | 1 set | 1.0 | |
| 33 | Waste oil drain pump | 1 set | 1.0 | |
| 32 | Fuel oil circulating pump | 1 set | 1.0 | |
| 29 | Fuel gas mixer | 1 set | – | |
| 28 | Intake air silencer | 1 set | 20 | |
| 27 | Intake air filter | 1 set | HOLD | |
| 26 | Intake air duct | 1 set | – | 700A |
| 25 | Lube oil centrifugal filter | 1 set | 3.0 | |
| 22 | Waste oil drain tank | 1 set | 3.0 | 100 L |
| 21 | Fuel oil service tank | 1 set | 4.0 | 195 L |
| 20 | Primary cooling water tank & support | 1 set | – | 300 L |
| 18 | Oil mist box | 1 set | – | |
| 17 | Oil mist detector | 1 set | 1.0 | |
| 16 | Tailpipe | 1 set | – | |
| 14 | Exhaust gas duct | 1 set | – | 750A |
| 13 | Engine side panel | 1 set | 14 | |
| 10 | Exhaust gas silencer | 1 set | 30 | |
| 8 | Piping block | 1 set | 35 | |
| 7 | Fuel gas filter unit | 1 set | 5.0 | |
| 4 | Cooling water and heating unit | 1 set | 37 | |
| 3 | Lube oil supply unit | 1 set | 45 | |
| 2 | Fuel gas supply and pump unit | 1 set | 72 | |
| 1 | Gas engine and generator | 1 set | HOLD | |

Scope: Blue marks are supplied by MHI

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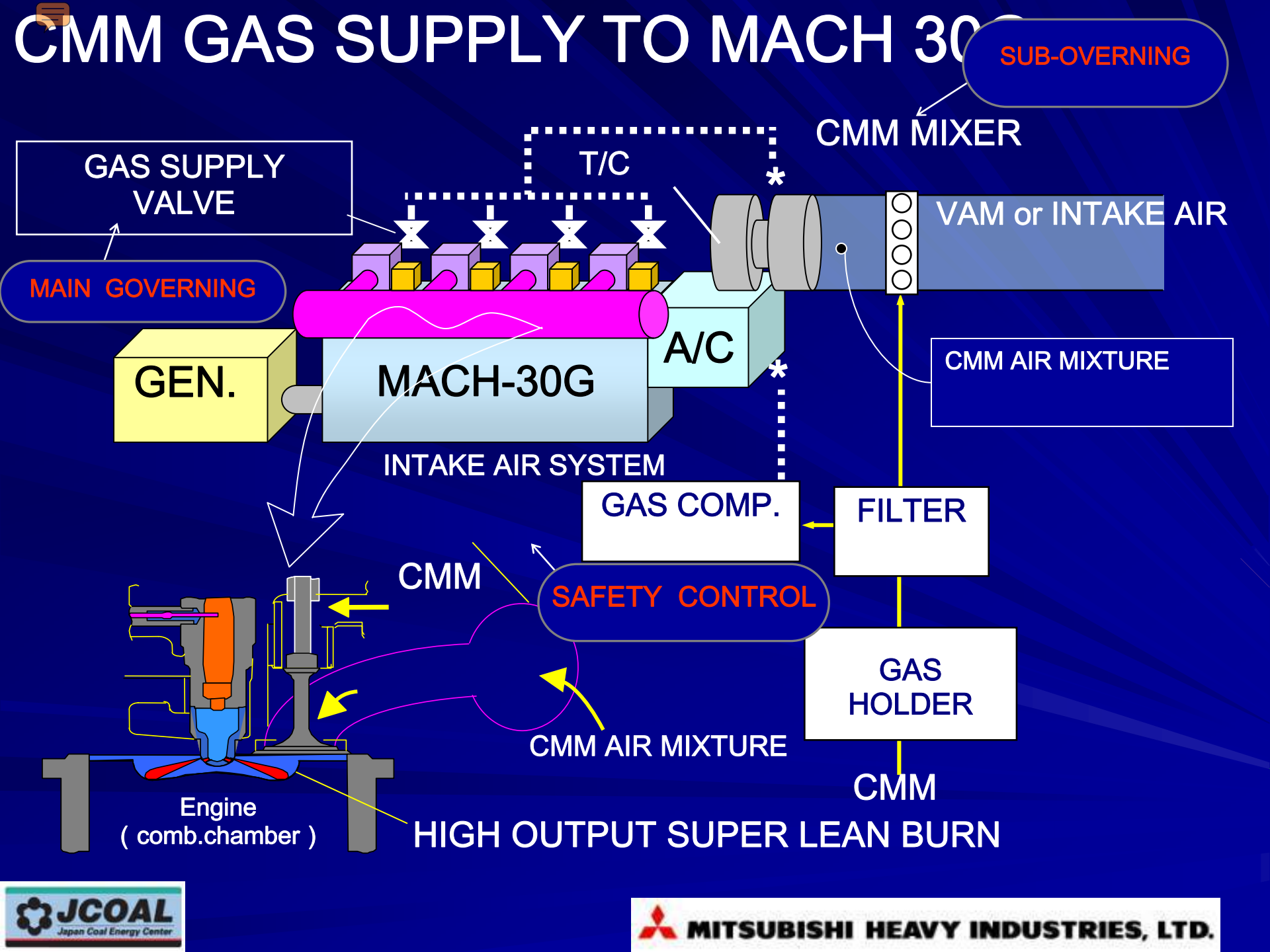
# CMM GAS SUPPLY TO MACH 30

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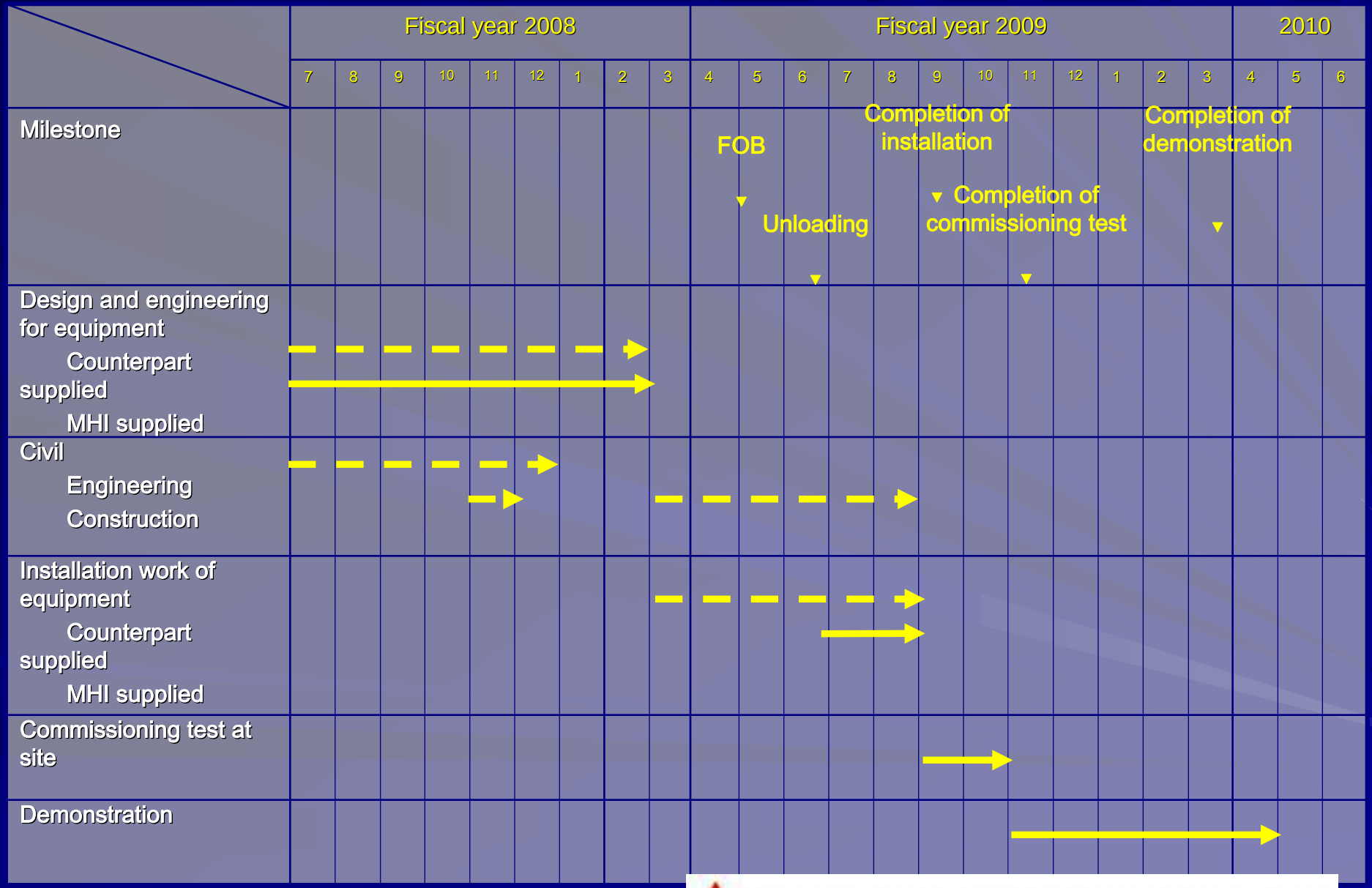
# Schedule for NEDO model plant




MITSUBISHI HEAVY INDUSTRIES, LTD.

# Installation of Gas Engine

# Gas Engine and Auxiliary Equipment

# Engine of Mitsubishi Heavy Industries

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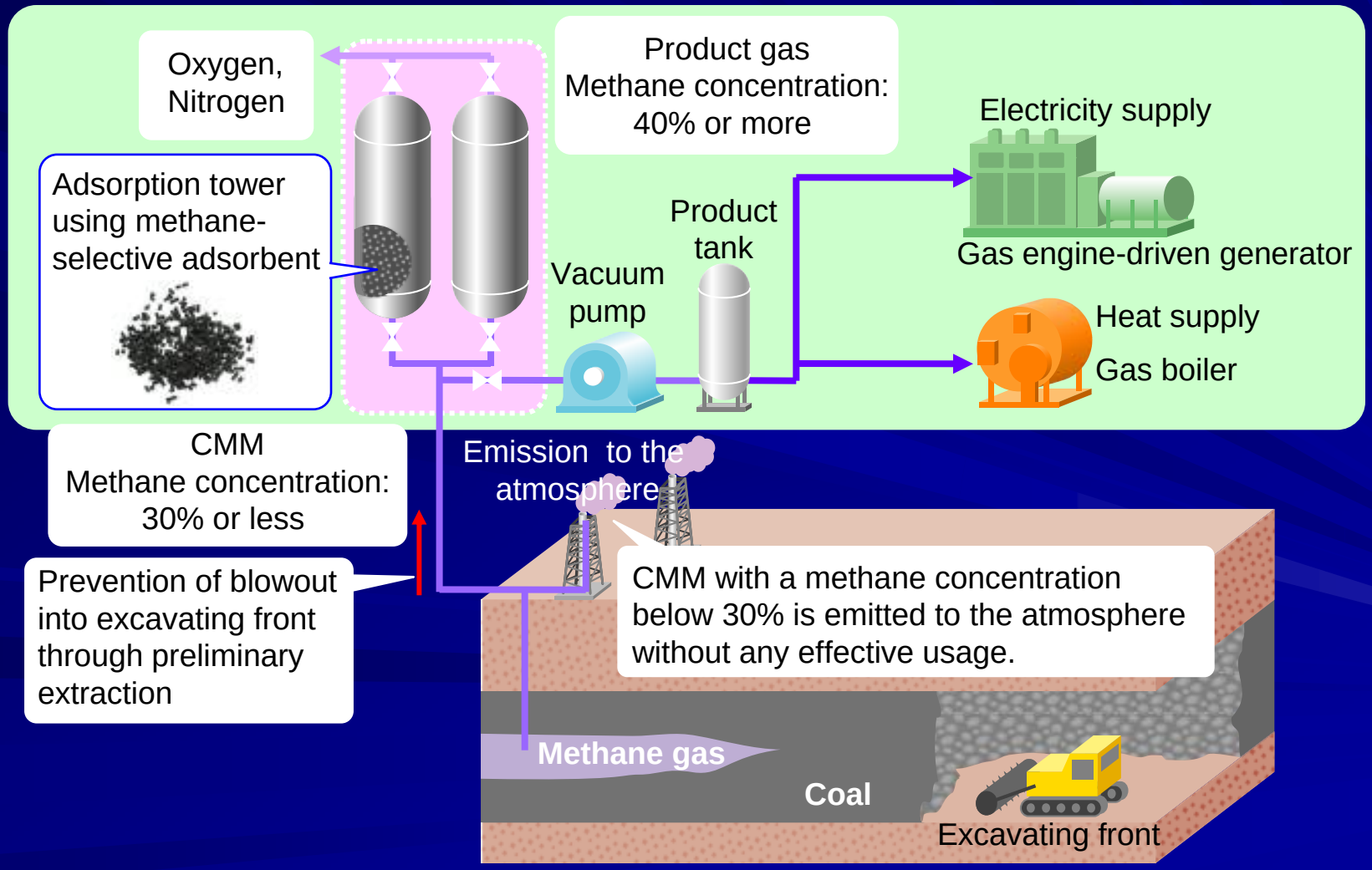
# 4. NEDO CMM Concentration Technology Development Project at Fuxin, China

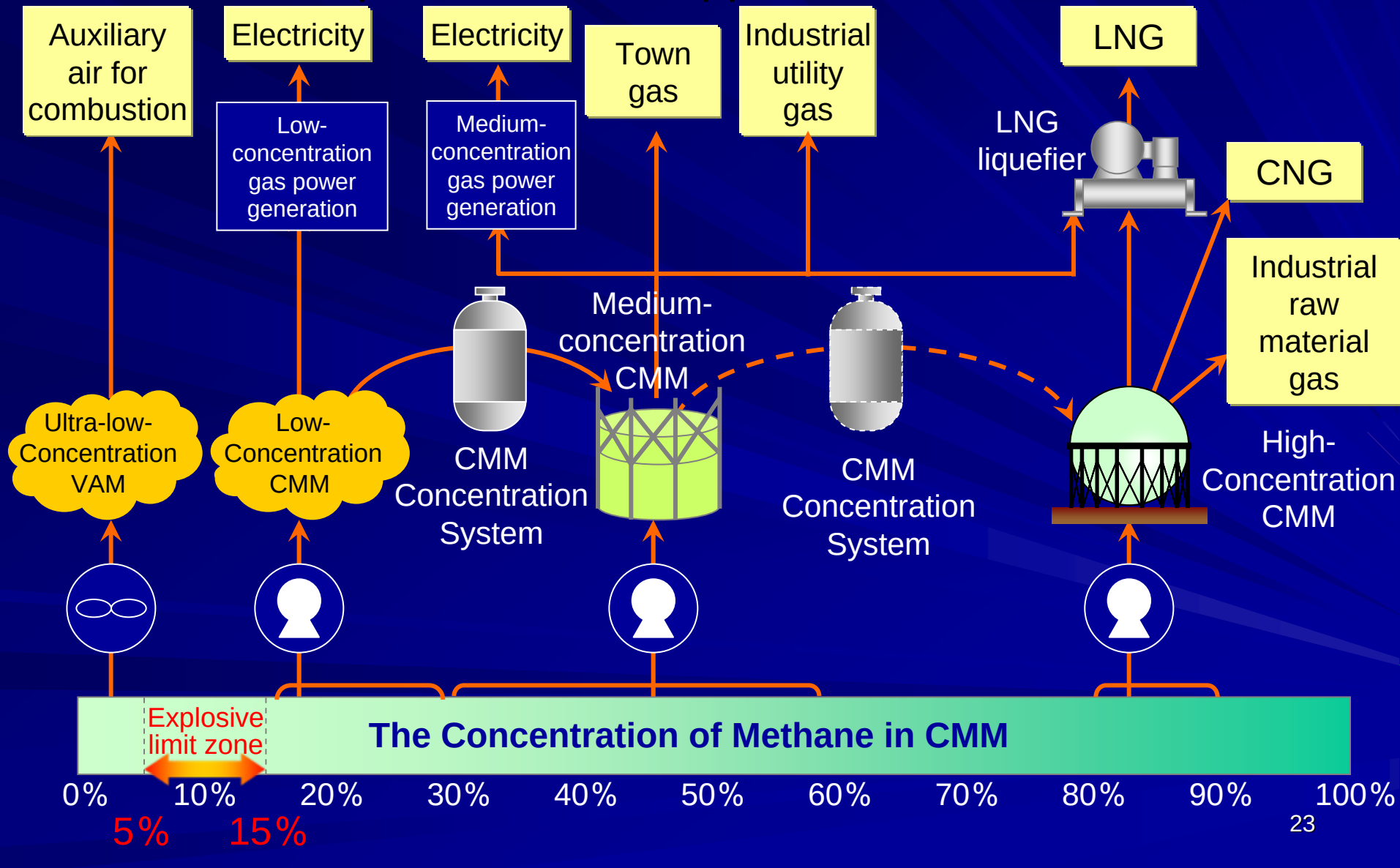
# Introduction : System concept

This system enables to concentrate CMM emitted to the atmosphere without any effective utilization.



# Introduction : Effective utilization

## Expansion of use applications of CMM



# Demonstration Test : Specifications

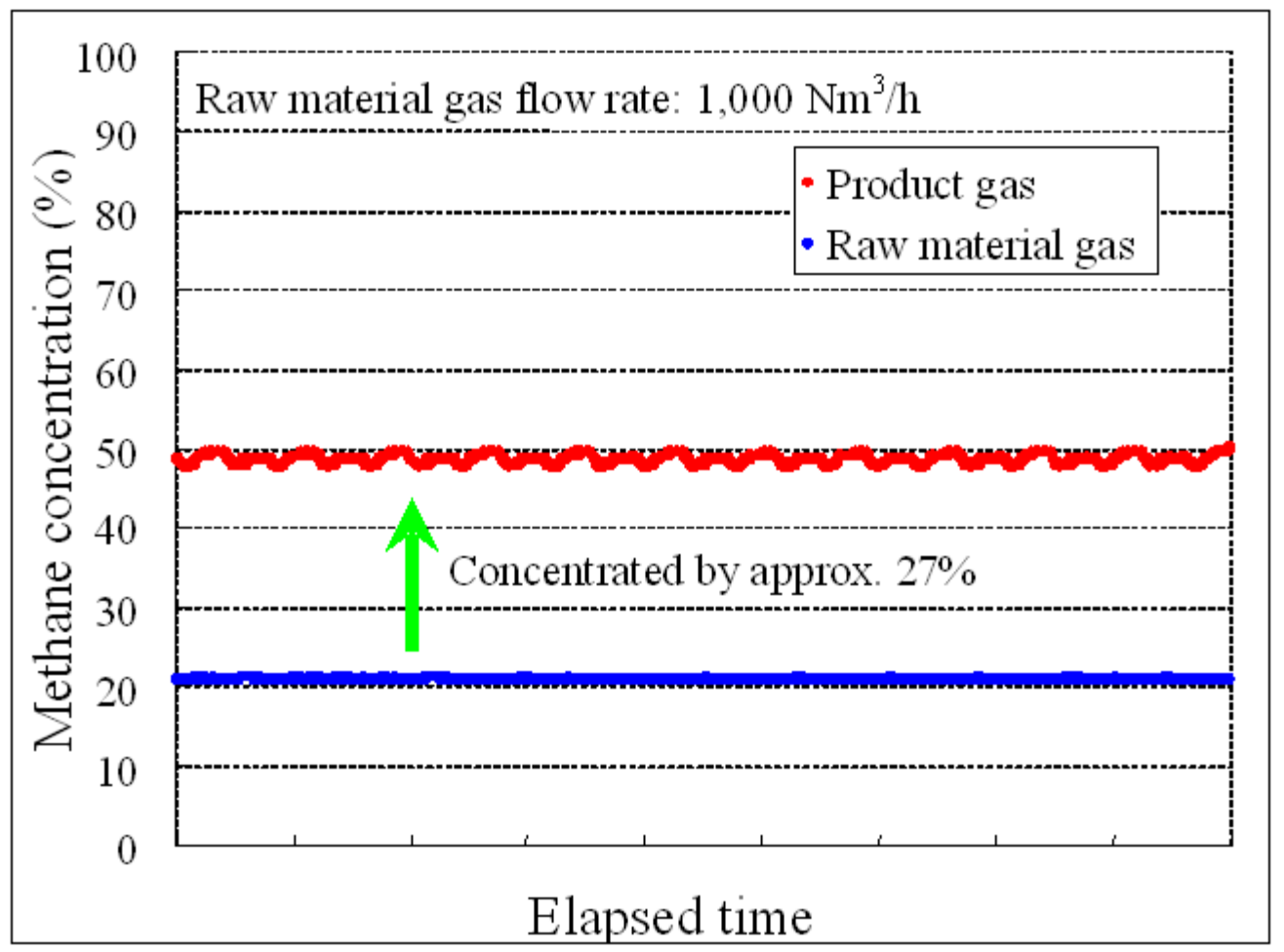
Specifications of CMM Concentration Plant
for Demonstration Test

- **Inlet CMM** $CH_4$: 20%, 1,000 $m^3/hr$
- **Product gas** $CH_4$: 45%, 400 $m^3/hr$
- **Recovery factor** 90% or higher

# Demonstration Test : Plant appearance

# Demonstration Test : Results

It was confirmed that CMM of 21% methane gas was successfully concentrated to 48%.



# 3. Demonstration Test :Results

The target performance of our system was achieved (25% concentration, 90% recovery).

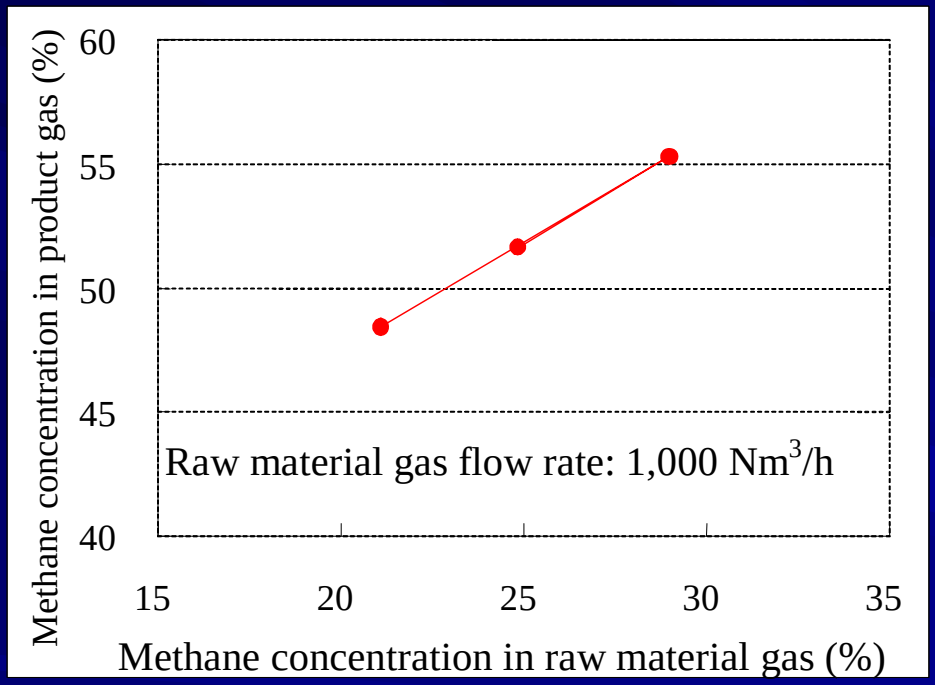



Fig.1 Dependence of the methane concentration in raw material gas against methane concentration in product gas

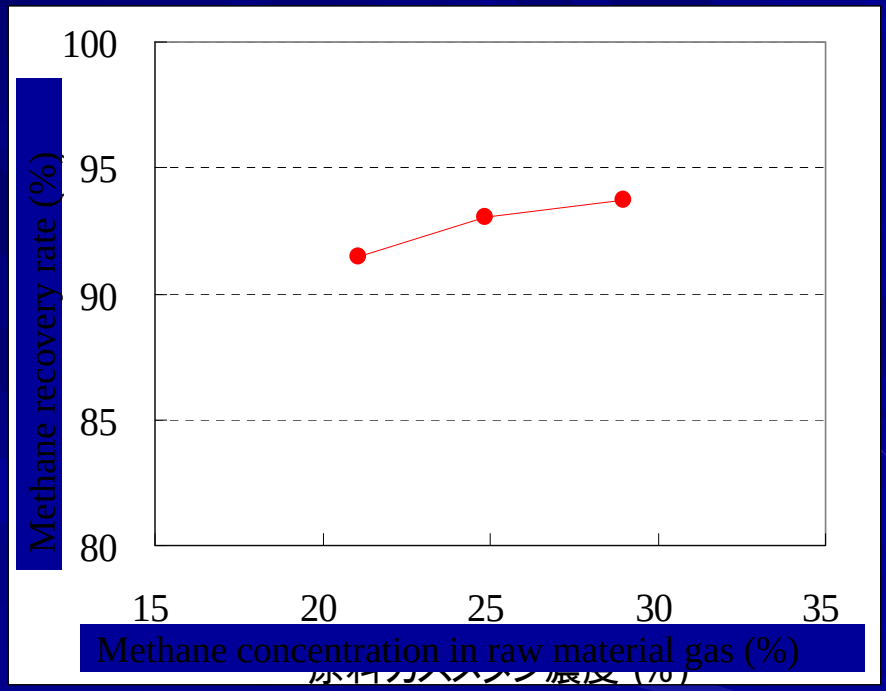



Fig.2 Dependence of the methane concentration in raw material gas against methane recovery rate

# Commercial Plant : Specifications

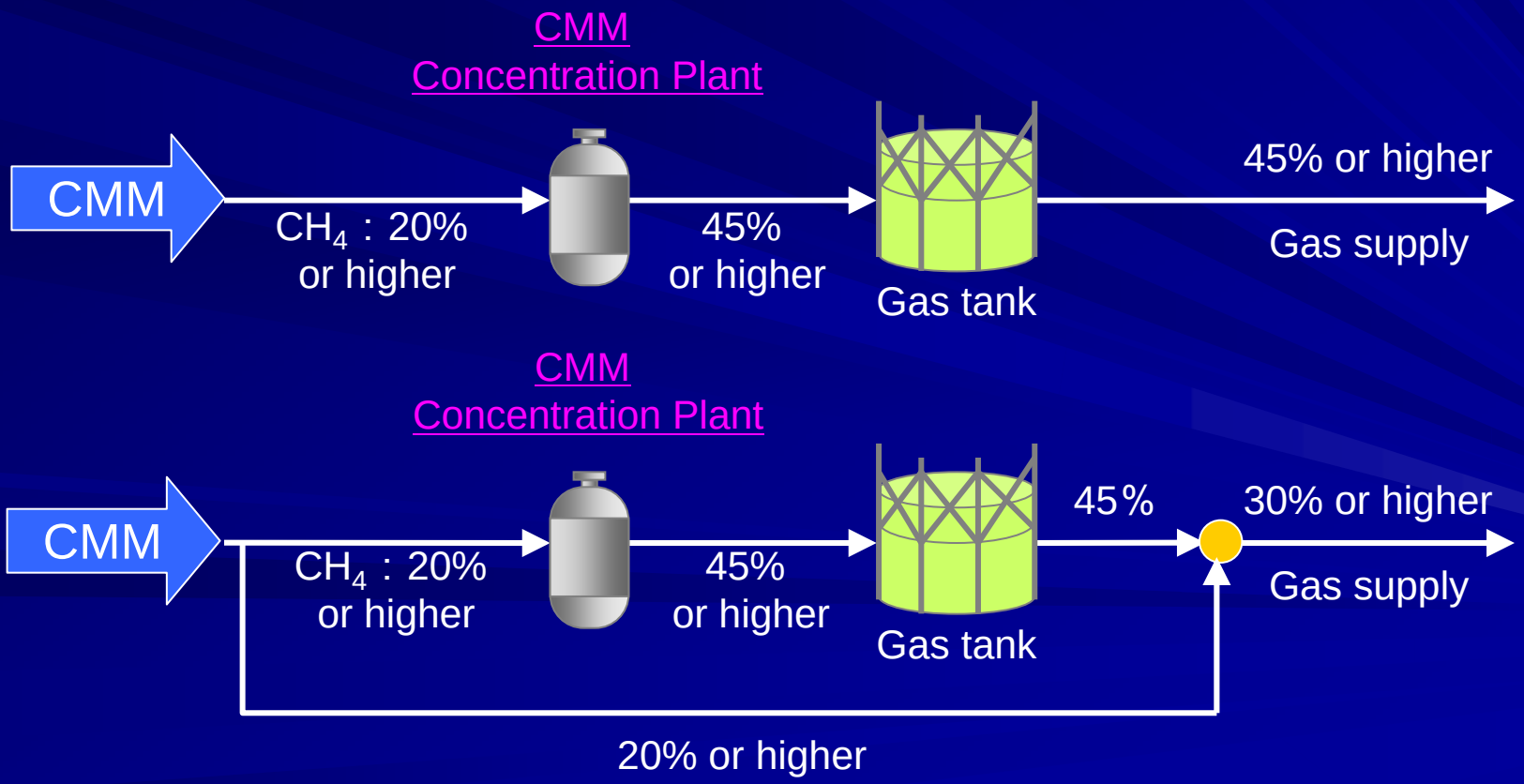
## Standard Specifications of Methane Concentrating plant

- **Inlet CMM** $CH_4$: 20%, 2,000 $m^3$/hr
- **Product gas** $CH_4$: 45%, 800 $m^3$/hr
- **Recovery factor** 90% or higher

# Commercial Plant :Basic System

## Basic System

(Methane concentration in raw material gas: 20% or higher)



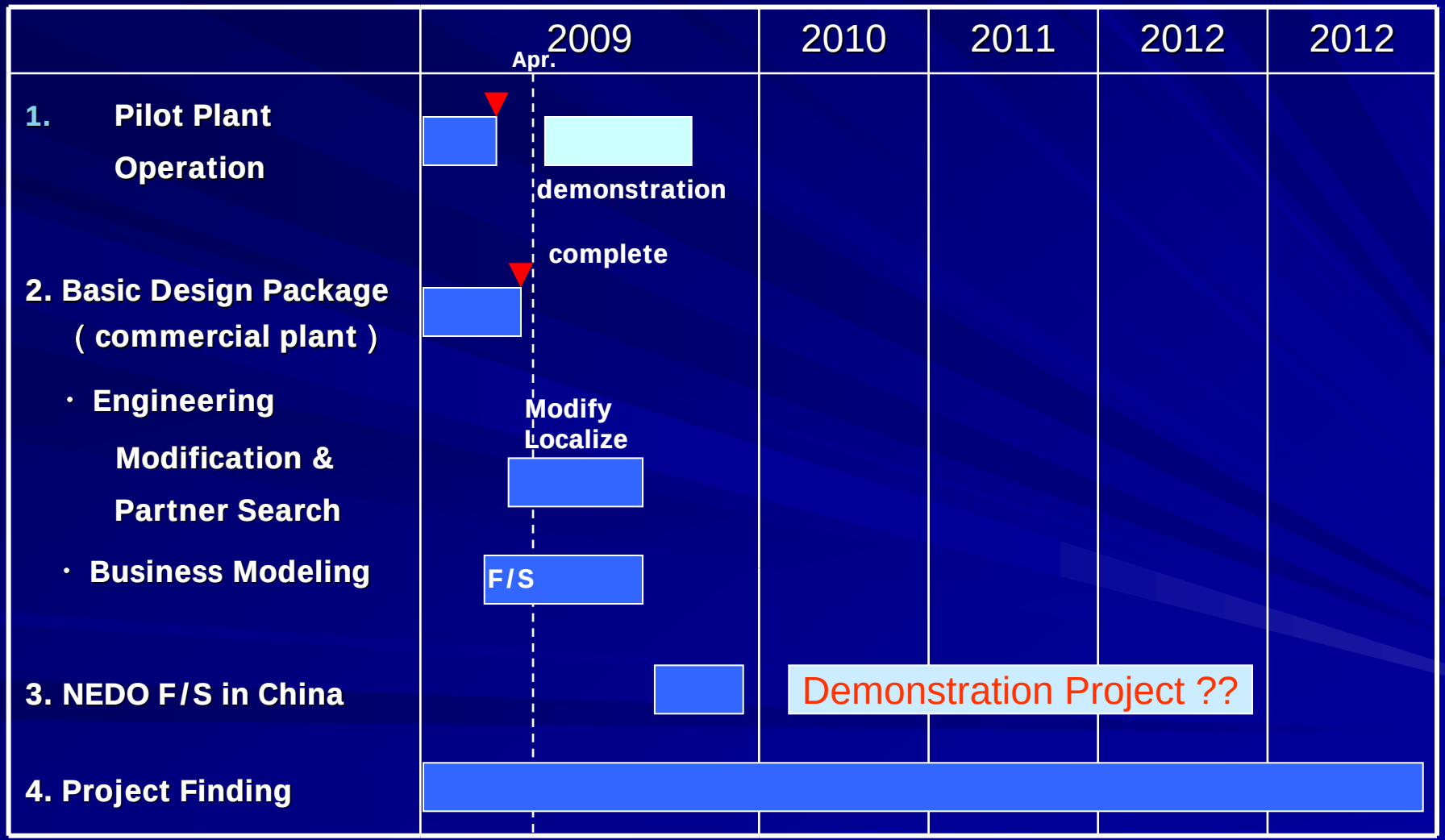
# Effects of Introduction

For example,

if the commercial plant of CMM concentration (flow rate : 2,000Nm3/h) is installed;

- Energy conservation: 2,600 kl/yr reduction (crude oil equivalent)
- Greenhouse gases: 38,000 t/yr reduction ($CO_2$ equivalent)

# Business Plan



# 5. NEDO VAM Turbine Project in China

# VAM Turbine

JCOAL
Japan Coal Energy Center

## Catalytic Combustion

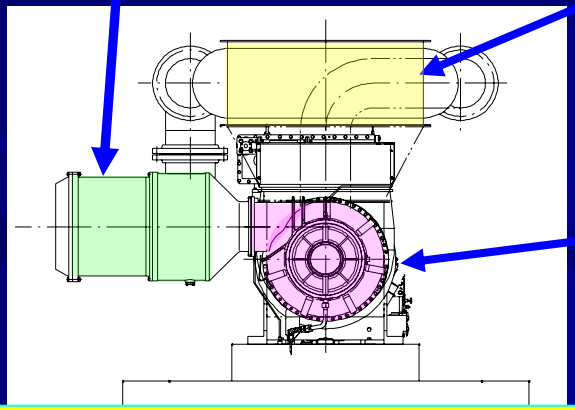
Only one practical use in the World

1,500kW Gas Turbine：M1A-13X

## Heat Exchanger

Long Time Operation Record

600kW Gas Turbine：S7A



Catalytic Combustion Gas Turbine

Many Installation

1,000kW Gas Turbine：M1A-01

Kawasaki

# Catalytic Combustion

**Features:**

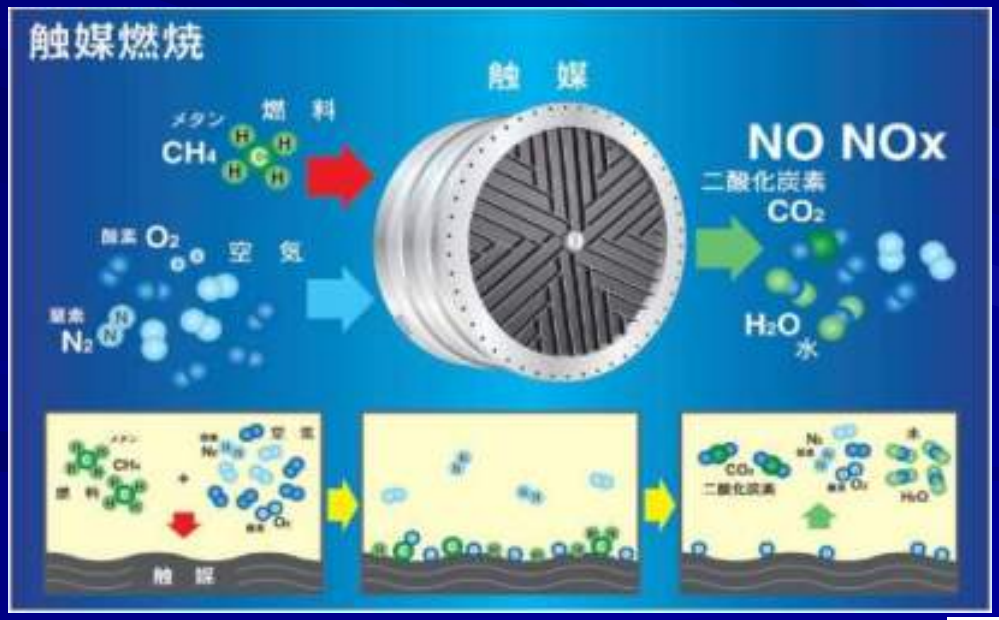
**No NOx, No flame, Low concentration methane be used ( -5% )**

- **Flame Combustion ( Ordinary Combustion )**

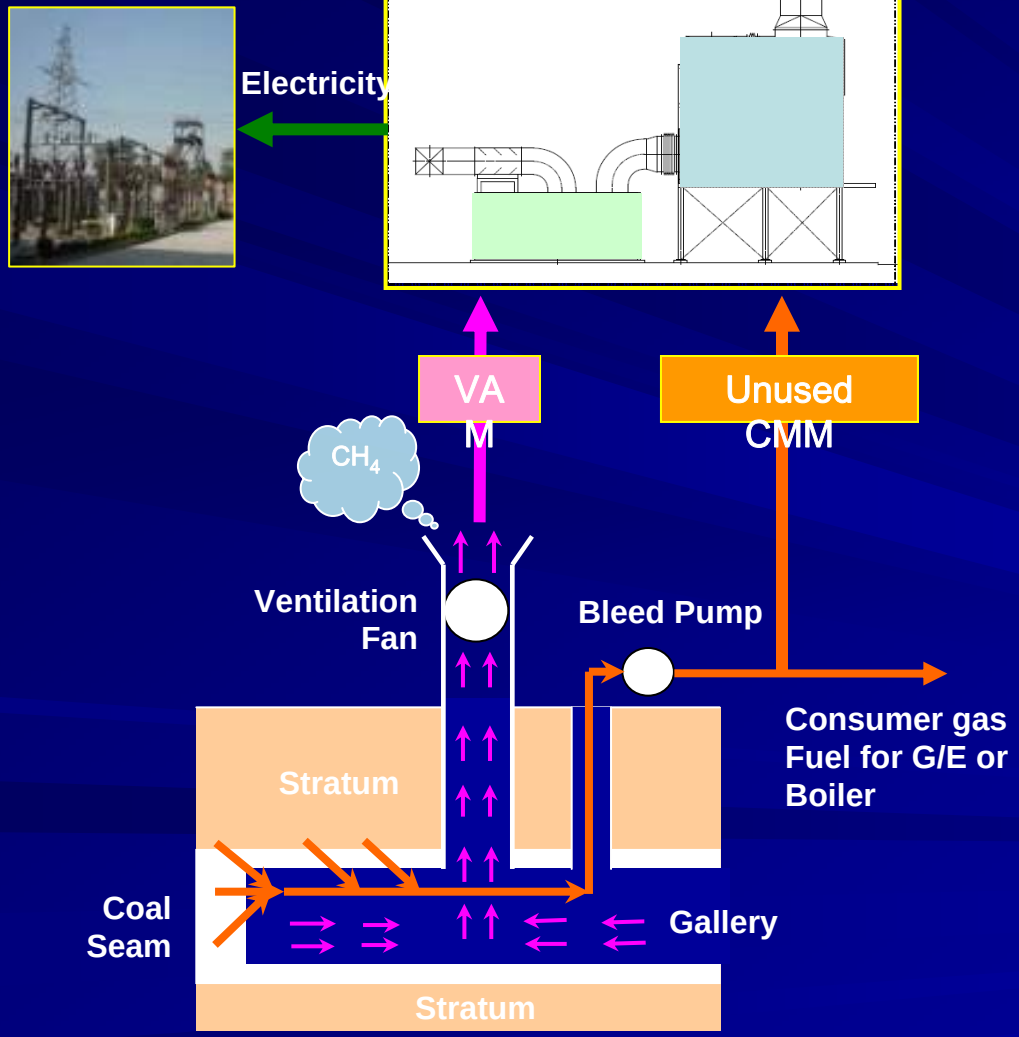
  Fuel + $O_2$ Combustion. Minimum methane concentration is +5%.

- **Catalytic Combustion ( Oxidization by catalyst )**

  Fuel oxidization at low temperature : Oxidization of $O_2$ + $CH_4$ at the surface of catalyst



# What can we do with VAM/CMM?




- Generate by utilization of VAM/CMM as fuel

**Gas Turbine Gene-set**

- Special Combustion

- Consume the mine's fugitive methane (VAM)

**VAM Treatment**

- Optional System

# Performance

**For Reference**

| | | |
|---|---|---|
| Gene-set | Output of Generator ( kWe) | 850 |
| | Utilization of VAM & CMM ($Nm^3$/hr) | 23,000 |
| | GHG Reduction (t-$CO_2$e/year) | 54,000 |
| Option | Mitigation of VAM & CMM ($Nm^3$/hr) | *** |
| | GHG Reduction (t-$CO_2$e/year) | *** |
| Reduce More Than 54,000 GHG | | |

# Features of the System

- **Excellent capability** for VAM mitigation
- **Stable Operation** on low methane concentration ($CH_4$ < 2%)
- **Safety** due to no need for flammable gas compression
- **Electricity generation** by unused VAM and CMM
- **No NOx** emissions
- **No Cooling Water** required
- **Mobile Unit** would be available
- **Low Cost** for GHG reduction

# Schedule of the Planned Project

| Fiscal Year | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|
| Practical Test Plan | | | | |
| ・FS/S (NEDO Fund) | | | | |
| ・Design of plant | | | | |
| ・Manufacturing of plant | | | | |
| ・Local foundation work | | | | |
| ・Installation & test | | | | |
| Commercial Operation | | | | |

# Thank you!

- JCOAL
  http://www.jcoal.or.jp/


- Mitsubishi Heavy Industuries (Gas Engine)
  http://www.mhi.co.jp/


- Osaka Gas  (CMM Concentration)
  http://www.osakagas.co.jp/


- Kawasaki Heavy Industries (VAM Turbine)
  http://www.khi.co.jp/