Climate Change- Opportunities and Challenges for Oil & Gas Sector

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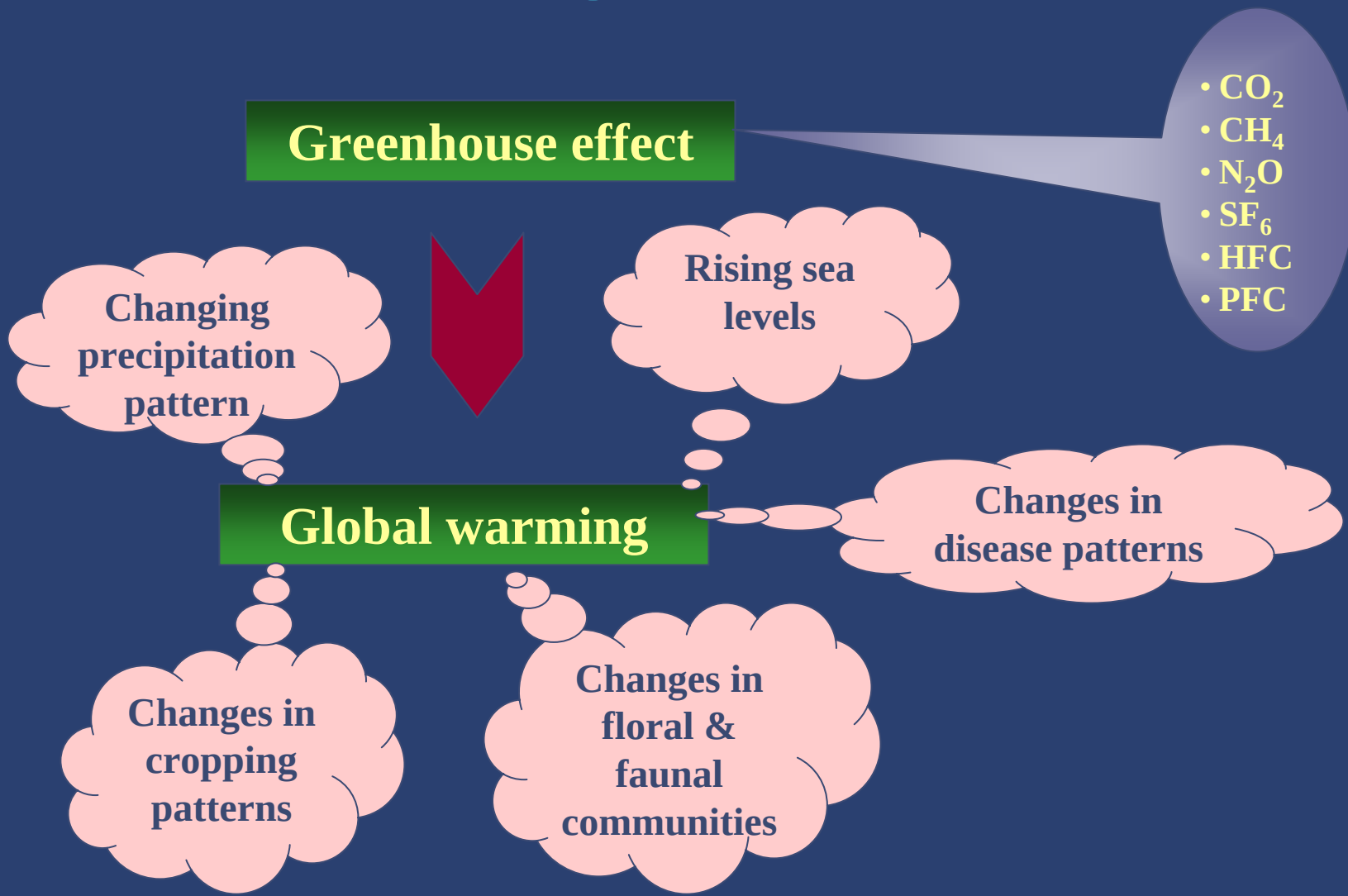
Climate Change

History of Kyoto Protocol

!! Climate Change !!



Pre – Kyoto Activities

- Montreal Protocol on “Substances that deplete the ozone layer” was adopted in Montreal in 1987.
- United Nations climate change convention (1992) articulated need to act for stabilizing GHGs in the atmosphere at levels that will not dangerously upset the global climate system.
- Most of the world’s GHGs have come and continue to come from developed countries, and as such emission reduction targets have been set for such countries.
- The Kyoto Protocol (1997) aims to reduce emissions of carbon dioxide and other GHGs from developed countries to 1990 levels.

Global Agenda for controlling GHGs

The long-term objectives of global action are to:

- de-couple emissions growth from economic growth, and
- de-carbonise the economy (reducing emissions by >50%).

These will result in a additional shift from:

- energy profligacy to energy efficiency in supply and use,
- coal to oil to gas to renewable in power generation,
- petroleum to hybrids to hydrogen in transport,
- waste as a by-product to waste as a value-stream,
- free emissions to costly emissions.

!! How Potent are Greenhouse Gases (GHGs) !!

Greenhouse Gas	Chemical Symbol	Global Warming Potential (GWP)
Carbon dioxide	CO_2	1
Methane	CH_4	21
Nitrous oxide	N_2O	310
Hydrofluorocarbons	HFC-23	11,700
	HFC-125	2800
	HFC-134a	1300
	HFC-152a	140
Perfluorocarbons	CF_4 (Tetrafluromethane)	6500
	C_2F_6 (Hexafluroethane)	9200
Sulphur hexafluoride	SF_6	23,900

i.e., Reducing one ton of SF_6 emission is equivalent to reducing 23,900 tons of CO_2

Kyoto Activities

- Kyoto Protocol sets binding targets on Annex 1 (developed) countries to limit their emissions below 1990 levels by 5.4% during the accounting period 2008-2012.
- The Parties to the protocol (Annex 1 and non-Annex 1 countries) can use any of the mechanisms to meet their protocol obligations
    - Emission Trading (ET)
    - Joint Implementation (JI)
    - Clean Development Mechanism (CDM).
- Kyoto Protocol will be administered by the UNFCCC, CDM Executive Board (EB) and their panels/committees, etc.

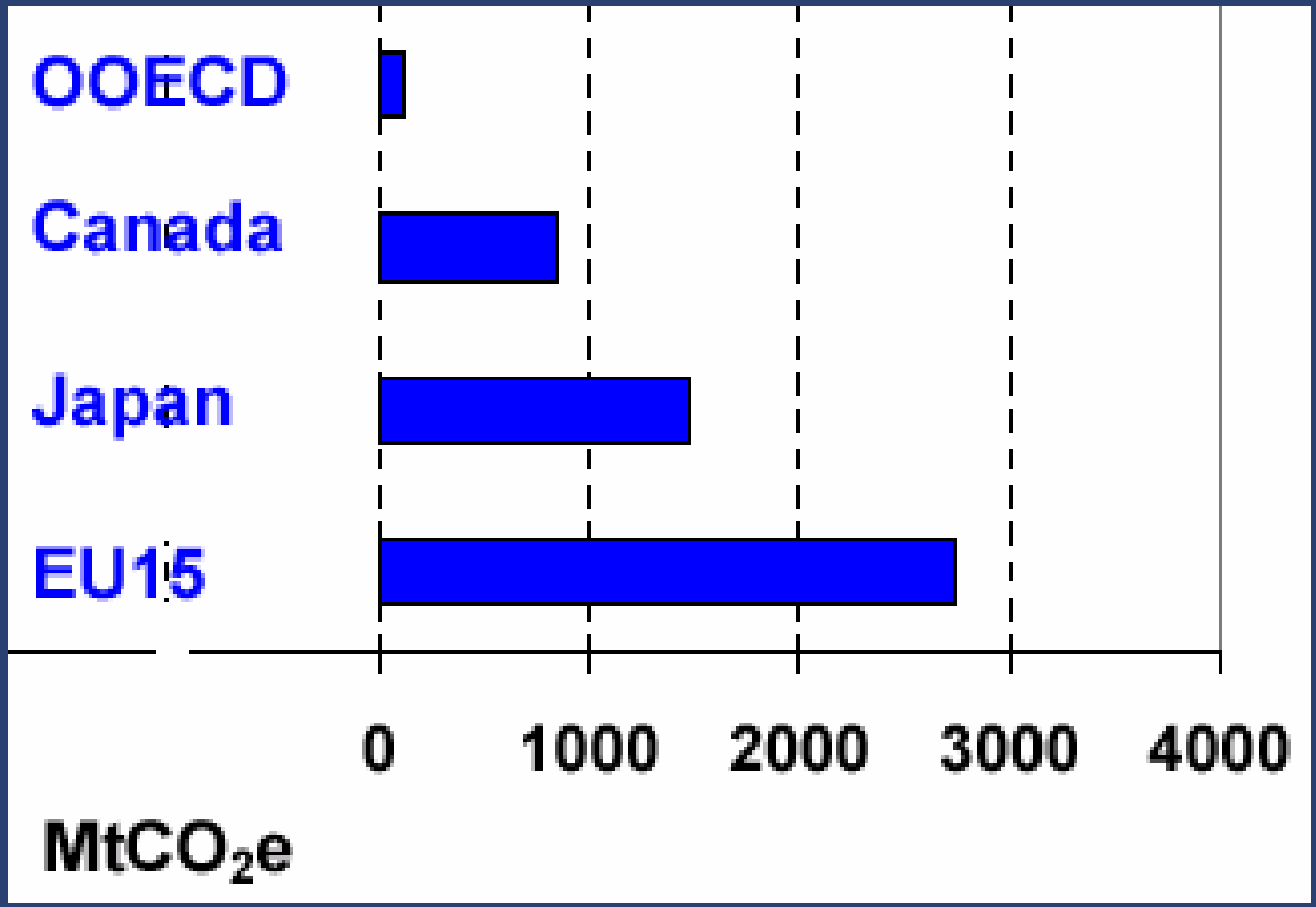
Development of CDM

Objective of CDM: According to Article 12 of the Kyoto Protocol "The purpose of the clean development mechanism shall be to assist Parties not included in Annex 1 in achieving sustainable development and in contributing to the ultimate objective of the Convention, and to assist Parties included in Annex 1 in achieving compliance with their quantified emission limitation and reduction commitments under article 3".

Countries which are eligible: Non-Annex 1 (developing) countries like India, Mexico, Brazil etc., are countries which are eligible for CDM benefits, as mentioned in the objective above.

Baseline emission reduction: The baseline for a CDM project activity is the scenario that reasonably represents the anthropogenic emissions by sources of GHG that would occur in the absence of the proposed project activity. A baseline shall cover emissions from all gases, sectors and source categories listed in Annex A (of the Kyoto Protocol) within the project boundary. A baseline shall be deemed to reasonably represent the anthropogenic emissions by sources that would occur in the absence of the proposed project activity if it is derived using a baseline methodology referred to in paragraphs 37 and 38 of the CDM modalities and procedures.

Global Demand for CERs



Involvement from EU-ETS

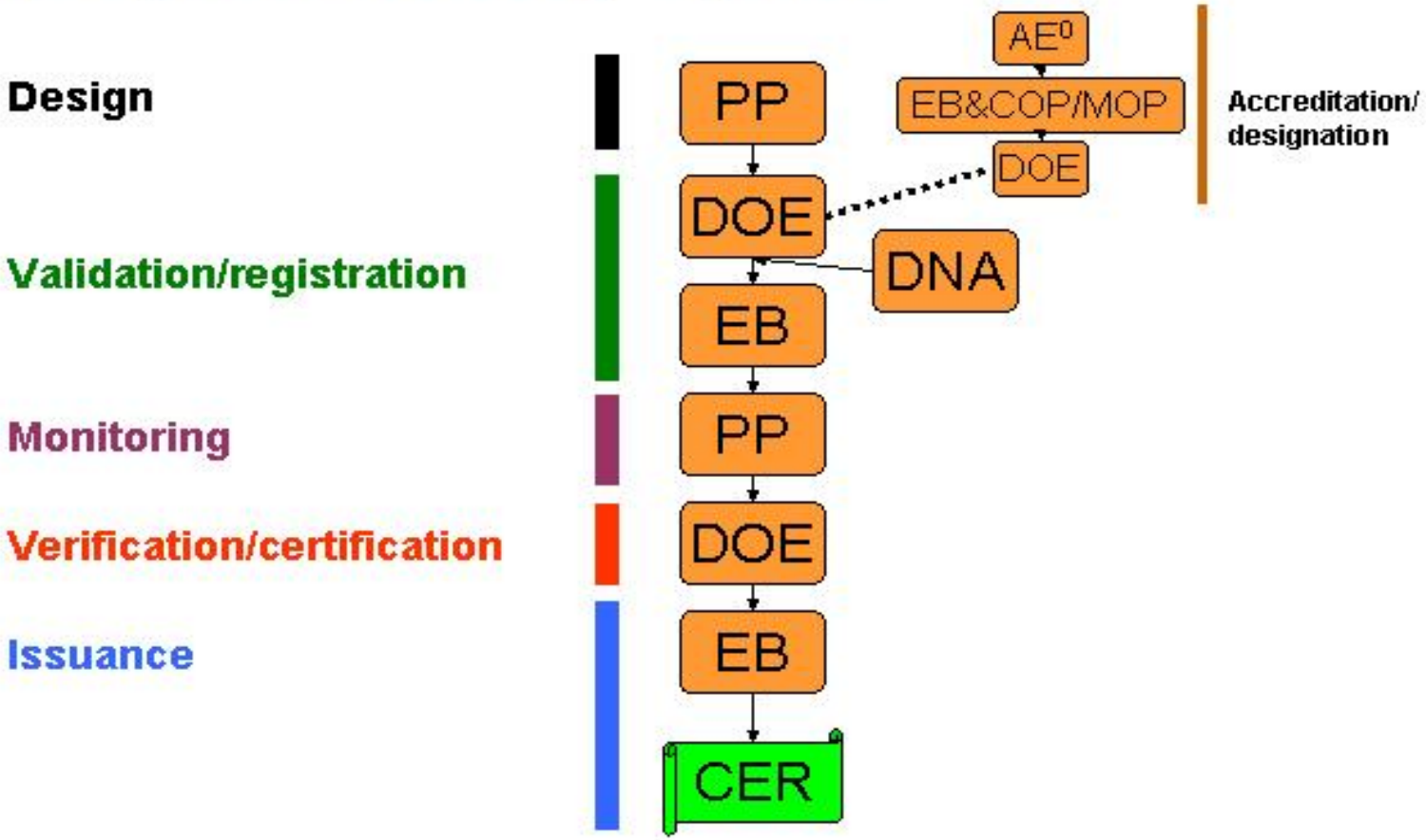
- EU countries have enacted binding regulations for compliance with Kyoto Community.
- As a test, EU countries will have a commitment/accounting period for 2005-2007.
- During this accounting period also CER's allowed upto 6%.

Annex I Parties' total planned CER purchase in 1st Kyoto commitment period (2008 – 12)

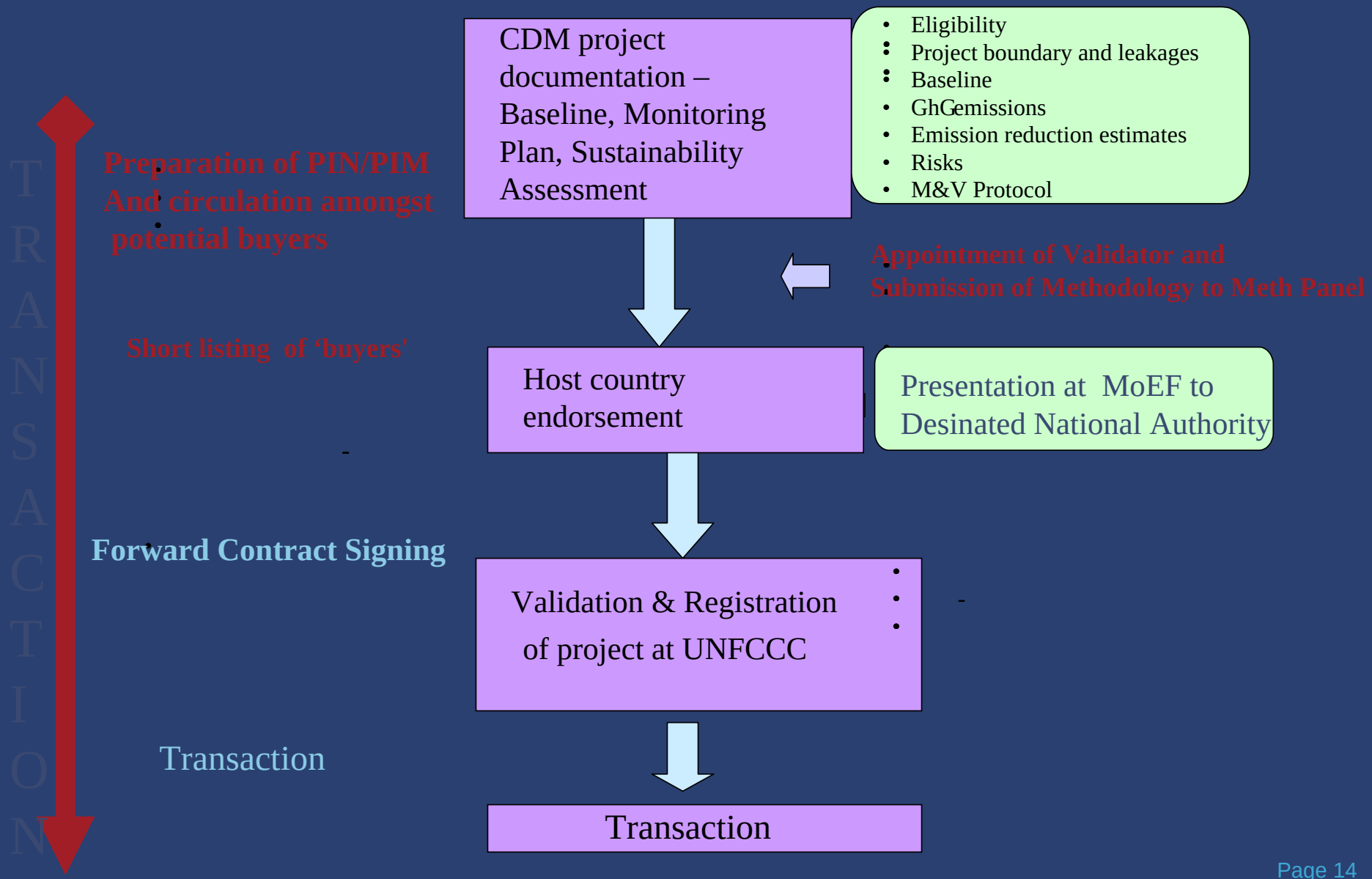
Annex I Party	Total planned CER purchase, 1st Kyoto commitment period (2008-12)
Austria	20-30 $MtCO_2e$ (JI&CDM)
Canada	50 $MtCO_2e$ (CDM, JI and ET)
Denmark	6,25$MtCO_2e$, but ≈ € 120 million to be invested in JI/CDM -2007
EU	Unclear (depends on linking proposal and possible procurement initiative)
Finland	Will be clear after revised Climate Strategy in late 2004
France	Nil (as of present), but encourages companies to invest
Germany	Nil (as of present), but encourages companies to invest
Italy	At least 60$MtCO_2e$ (JI&CDM)
Japan	At least 95$MtCO_2e$ (JI&CDM)
Netherlands	67$MtCO_2e$
New Zealand	Nil (as of present), but encourages companies to invest
Norway	0-13 $MtCO_2e$
Sweden	Will be clear after revised Climate Strategy in late 2004
Switzerland	About 5 $MtCO_2e$ (JI&CDM)
UK	Nil (as of present), but encourages companies to invest

CDM Project Development Mechanisms

CDM project activity cycle



CDM PROJECT CYCLE



CDM Eligibility Criteria

- Project construction activity started after 1 January 2000, and for retroactive credits between 1 January 2000 and 18 November 2005.
- Project sponsor has seriously considered CDM revenue as funding option for project activity.
- Project activity meets the Sustainable Development criteria of India (as per the MoEF guidelines).
- Project activity has crossed at least one of the barriers in: technology, investment, and prevalent practice in the sector of operation.
- A buyer of CERs have been identified as participant in the project *(optional)*.
- Project does not involve funding from any Overseas Development Assistance (ODA).
- Project is “Additional to any Business As Usual (BAU) Scenario”.

Mechanism and Processes

- Project documentation
  - Background and information
  - Project boundary
  - GHG sources and sinks (direct/indirect, onsite/offsite)
  - Baseline methodology selection and justification
  - Estimates of project emission using selected baseline(s)
  - Crediting period
  - Monitoring and Verification Protocol

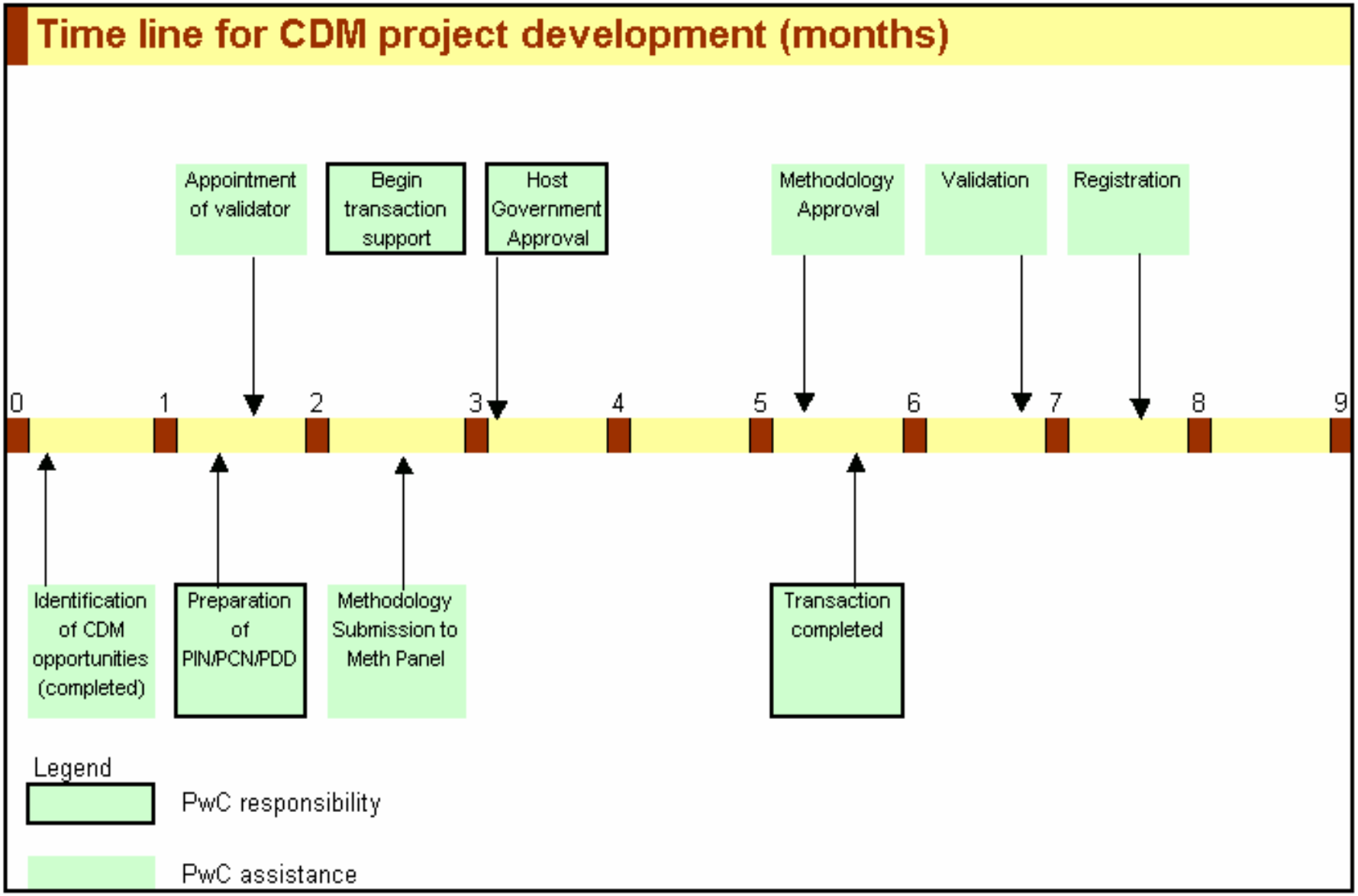
Mechanism and Processes….*(contd.)*

- Host country endorsement
  - Sustainability review: Social, Economic, Environmental
- Validation
  - Selection of DOE
  - Validation of baselines, emission estimates, M&VP
  - Validation of additionality
- Registration
  - Register project activity as CDM with CDM-EB

Mechanism and Processes….*(contd.)*

- Monitoring
  - Self or third party
- Verification and certification
  - Selection of DOE
  - Verification of performance against baseline
  - Certification
  - Request for issuance of CERs from CDM-EB
- Crediting of Emissions reductions with CDM-EB registry

Time line for CDM project development (months)



CDM Opportunities

Petroleum Sector

Oil Companies Operations

Upstream Operations

- Exploration development and production of oil and gas

Downstream Operation

- Refining , Processing , distribution and marketing of product derived from oil and gas including service station

Chemicals

- Manufacture, distribution and marketing of chemicals products derived from oil and gas

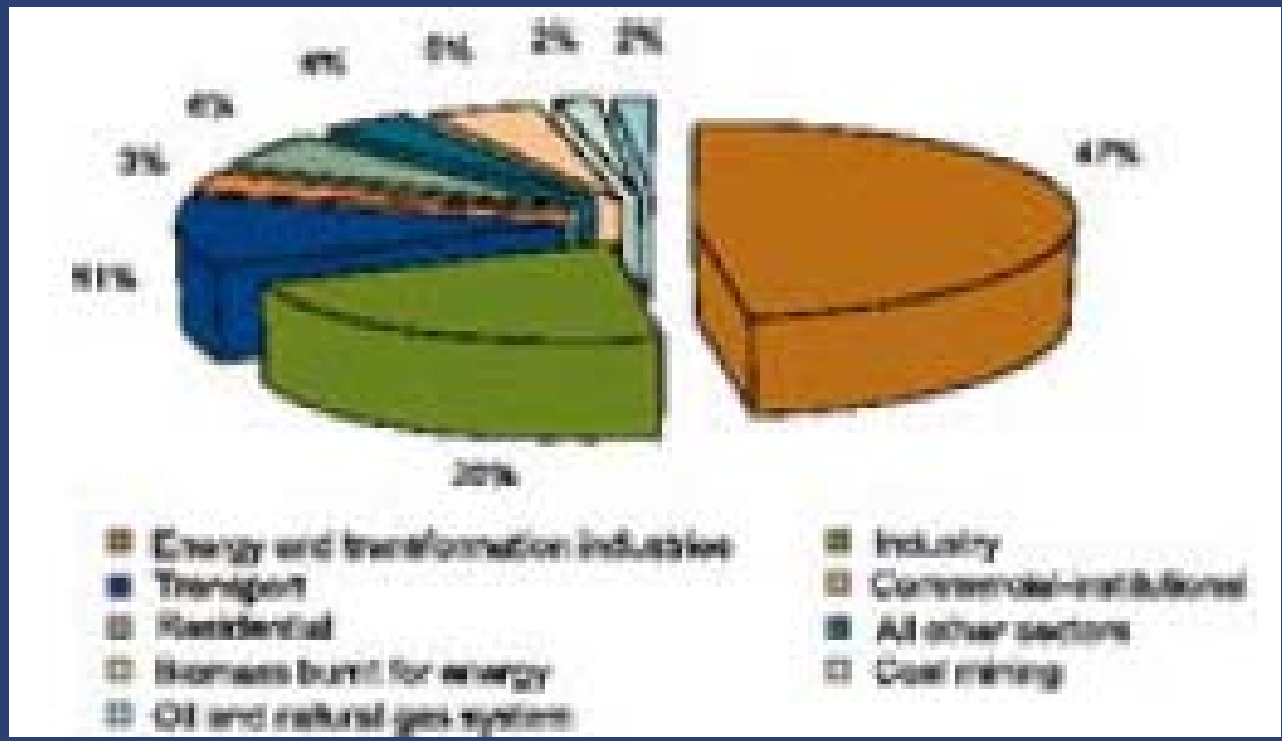
Petroleum Industry Greenhouse Gases

- CO_2
- CH_4
- N_2O (amount is quite small compared to CO_2 & CH_4)

India’s Petroleum Sector emissions for the base year 1994

Total emissions	CH4 (t)	CO2 e emissions (t)
Oil and natural gas system	601	12621
Coal mining	650	13650

Relative GHG emissions from energy sector activities in 1994



GHGs Emissions Upstream Petroleum Operation

Source Category	GHG	Estimation
Combustion sources	CO_2	Fuel Consumption
Flaring	CO_2,CH_4	Quantity of Gas flared
Associated Gas Venting	CO_2,CH_4	Quantity of Gas Vented
Acid Gas Removal	CO_2	Emission based on quantity of gas produced and assumed residual CO_2 content
Glycol Dehydration		
Tank Flashing		
Other Process Sources		
Non Routine Sources		
Process Fugitives		
Non Operational Facilities		

GHG Emission from Petroleum Refining and Petrochemicals

Source Category	GHG	Estimation
Combustion sources	CO_2	Fuel Inputs
Flaring	CO_2, CH_4	Quantity of Gas flared
FCC Coke Burn	CO_2,	Fuel Inputs
Hydrogen Plant	CO_2	
Other process sources		
Non Routine Sources		
Process Fugitive		
Non Operated Refineries and Petrochemicals Plants	CO_2,CH_4	

GHG Emissions Mitigation Measures

There are tremendous opportunities in the petroleum refining industry to reduce GHG emissions, including

(1) energy efficiency measures, such as optimization of process energy input, recovery of waste heat, cogeneration of heat and power, and use of refinery gases,

(2) process improvements to increase process efficiency and optimize production processes,

(3) better management practices, and

(4) reducing fugitive methane emissions.

Energy Efficiency

- Energy use optimization and cogeneration
- Heat exchange optimization and heat recovery: The greatest single energy loss in a refinery occurs during the final cooling of process streams. Recovery of low-level heat to other process streams could optimize heat use and reduce the energy needs for cooling.
- Utilization of process by-products: By-products of one process could be used as fuel input in another process
- Improving combustion processes: A refinery can have from four to 40 combustion sources. Adoption of advanced combustion technologies can induce significant potential in energy savings.

Process Improvements/Modifications

- Separation process: one of the most energy-intensive and energy consuming processes in refineries. State-of-the art technologies for the separation process, such as reflux-overhead vapor recompression, staged crude preheating, air pre-heater and intermediate re-boilers and condensers, can significantly reduce energy consumption in the process.
- New catalysts: Adopting new catalysts can greatly decrease the energy requirement of processing fuels.
- Increased use of polymerization.

Better Management Practices

- mechanical integrity of equipment such as pressure vessels, piping, and furnace and boiler tubes can reduce heat loss and associated CO2 emissions.

Reducing Fugitive Methane Emissions

- Leakage detection equipment and preventive measures.
- Installing vapor recovery. Fugitive and vapor emissions are a major emission source for many facilities.

Approved Methodology
CDM Executive Board

AM0008:Industrial fuel switching from coal and petroleum fuels to natural gas without extension of capacity and lifetime of the facility
&
ACM0009:Consolidated methodology for industrial fuel switching from coal or petroleum fuels to natural gas

Baseline → Coal and Petroleum fuels used

Exa:United Phosphorus Limited Project

AM0009: Recovery and utilisation of gas from oil wells that would otherwise be flared

Baseline → Flaring

Exa: The Ovade Ogharefe Gas Capture and Processing Project , Nigeria

AM0014:Natural gas-based package cogeneration

Baseline → Without cogeneration

The Project activity is applicable to a third party cogeneration

AM0017:Steam system efficiency improvements by replacing steam traps and returning condensate --- Version2

Baseline → Old system

Emission reductions occur as a result of steam savings by improving the functioning of steam traps and collection and reutilization of condensate

AM0018: Steam optimisation systems

Baseline → the continuation of production using current processes and efficiencies

Exa: Energy Efficiency through Alteration of fuel oil atomizing media in coal-fired thermal power plant. CESC limited, India

AM0023: Leak reduction from natural gas pipeline compressor or gate stations

Baseline → no current systems in place to systematically identify and repair leaks

ACM0007: Methodology for conversion from single cycle to combined cycle power generation

Baseline → Single cycle

ACM0008: Consolidated methodology for coal bed methane and coal mine methane capture and use for power (electrical or motive) and heat and/or destruction by flaring

Baseline → No methane capture

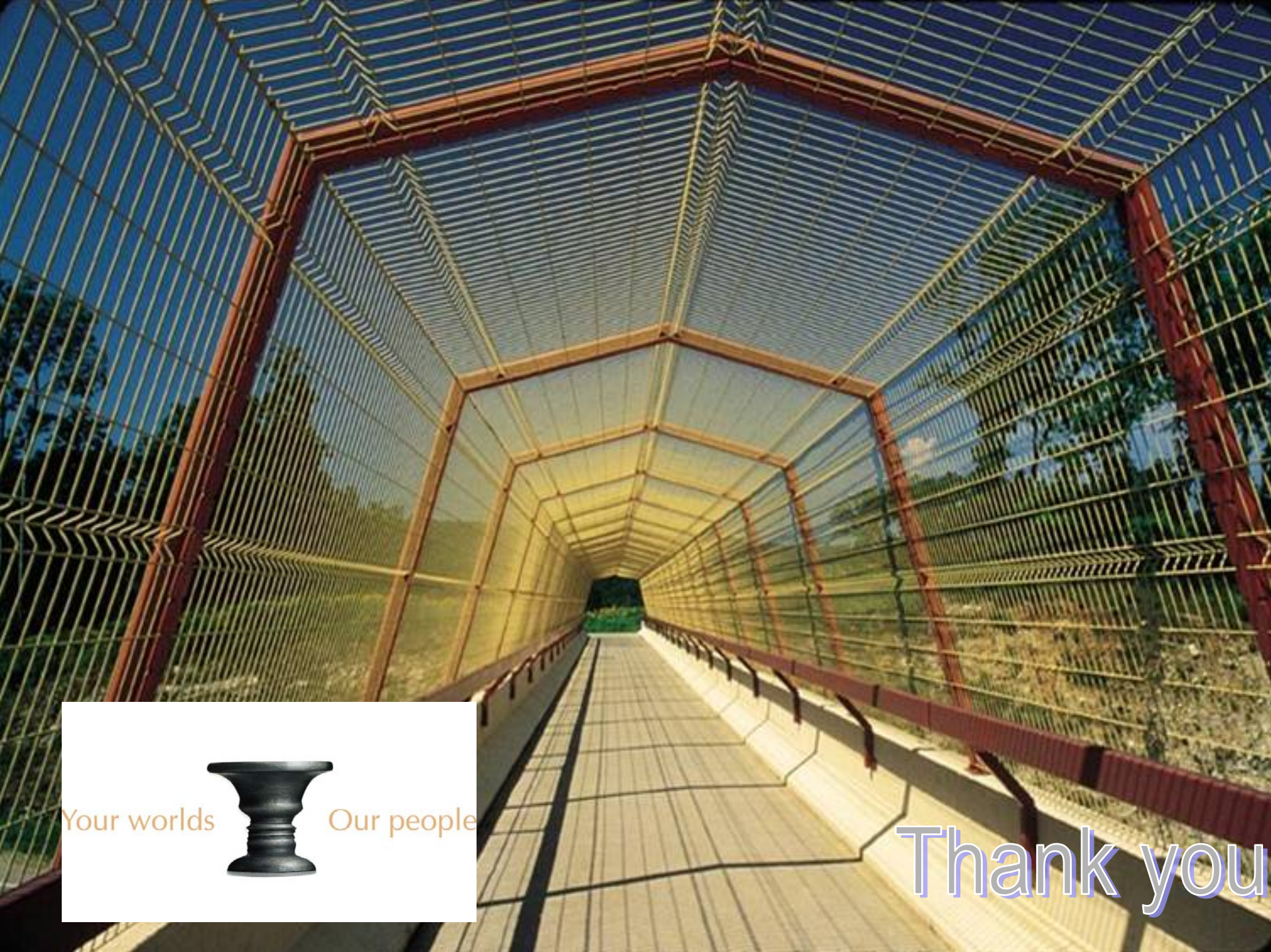
Exa:Huainan Panyi and Xieqiao Coal Mine Methane Utilization Project , China

Target CDM Projects

- **NM0142 :**
  Palm Methyl Ester - Biodiesel Fuel (PME-BDF) production and use for transportation in Thailand
- **NM0167 :**
  The White Tiger Oil Field Carbon Capture and Storage (CCS) project in Vietnam
- **NM0149 :**
  Coal to natural gas feedstock conversion for the large-scale manufacture of Pure gas at Sasol facilities, South Africa
- **NM0168 :**
  The capture of the CO2 from the Liquefied Natural Gas (LNG) complex and its geological storage in the aquifer located in Malaysia
- **NM0160 :**
  Shell Cogeneration Project
- **NM0108-rev :**
  Biodiesel production and switching fossil fuels from petro-diesel to biodiesel in transport sector - 30 TPD Biodiesel CDM Project in Andhra Pradesh, India
- **NM0145 :**
  Reduction of Flaring and Use of Recovered Gas for Methanol Production
- **NM0148 :**
  Fuel switch project for generation of cleaner power

Target CDM Projects

- Gas flaring reductions (both upstream and downstream)
- Gas re-injection and gas utilization for own consumption
- Leakage reductions from petroleum infrastructure
- Efficiency and environment improvements in refineries


Your worlds
Our people
Thank you