



Fondazione
Eni
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CDM opportunities for the Oil&Gas Industry

SPE Workshop

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The Kyoto Protocol

- ✓ ... represents a milestone in international climate policy;
- ✓ ... should rather be considered as a first step in climate-change control.
KP as the necessary global framework for a credible GHG market
... but we need to look beyond Kyoto!

The main outcomes:

- ✓ Establishment of binding emission reduction targets for industrialised countries (Annex I Countries);
- ✓ Objective of a 5.2% overall reduction of GHG emissions by the industrialised countries and economies in transition compared to their 1990 levels between 2008-2012;
- ✓ No emission reduction requirements for developing countries.

Status of Kyoto Protocol

- Kyoto Protocol not yet into force - must be ratified by 55 countries + represent 55% total global greenhouse emissions
- To date, 117 countries have ratified representing 44.2% of emissions
 - If Russia ratifies the Kyoto Protocol, it will reach 55% and enter into force
 - Russia is holding out for 'better deal' and studying the impacts of signing the protocol
 - USA and Australia withdrew from the Protocol - reduces size of carbon market

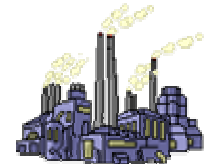
How does Kyoto Work?

✓ Two broad strategies: Mitigation & Adaptation

In order to achieve the targets:

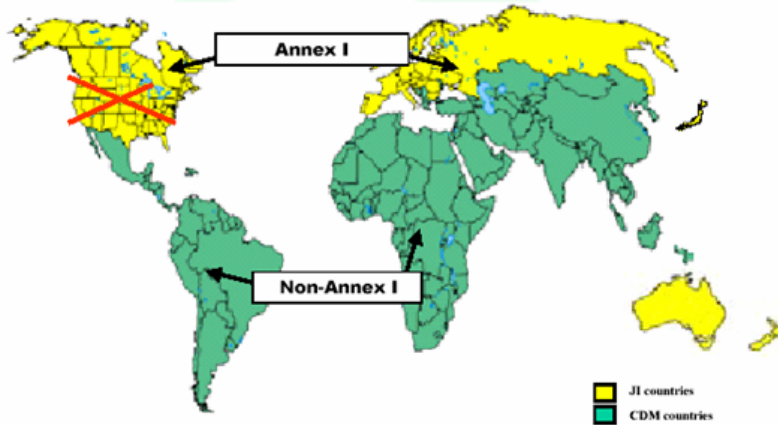
- variety of policies and measures:
 - *improving energy efficiency,*
 - *promoting renewable energy,*
 - *limiting carbon emissions from sources – Fuel Switching,*
 - *protecting forests and other carbon sinks.*

- market-based Flexible Mechanisms to increase cost-effectiveness of climate policies by reducing countries' abatement costs:
 - ***International Emission Trading (IET) – Art. 17***
 - ***Clean Development Mechanism (CDM) – Art. 12***
 - ***Joint Implementation (JI) – Art. 6***



Interaction of the Kyoto Mechanisms and Units

Trading Regimes – Kyoto Protocol



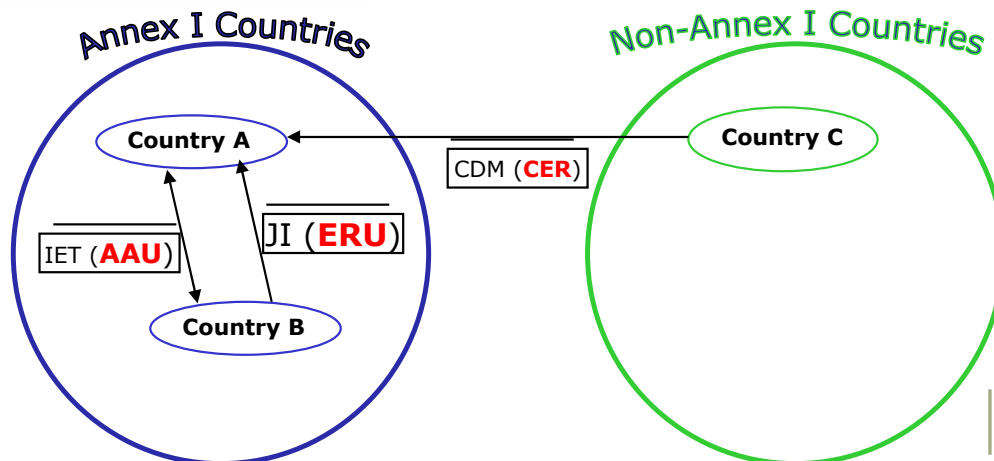
AAUs, ERUs and CERs are fully fungible within a commitment period and are treated as equal units.

Kyoto Mechanisms

Clean Development Mechanism
Projects in developing countries
- Sustainable Development Objective

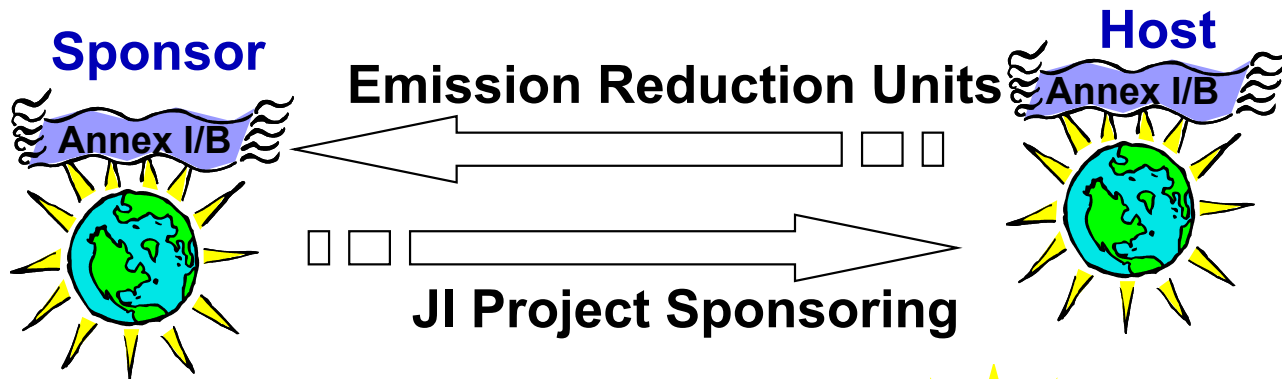
Joint Implementation
Projects between countries with targets
(Annex 1 countries)

International Emissions Trading
Between countries with targets
(Annex 1)

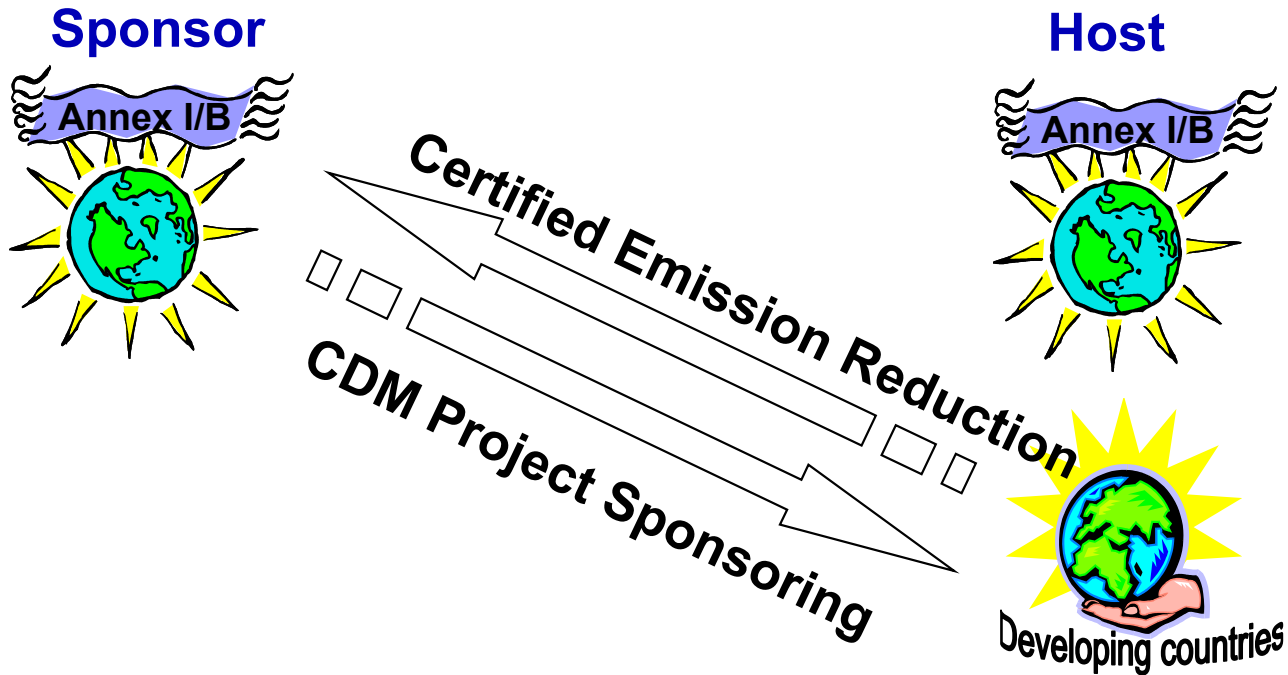


Flexible Mechanisms: Joint Implementation

- Annex I Country to invest in emission-reducing projects in another Annex I Country (to commence in 2008)
- Resulting credits are called Emission Reduction Units (ERUs)
- Projects need to follow a series of set rules
- Effectively promotes projects in less efficient locations



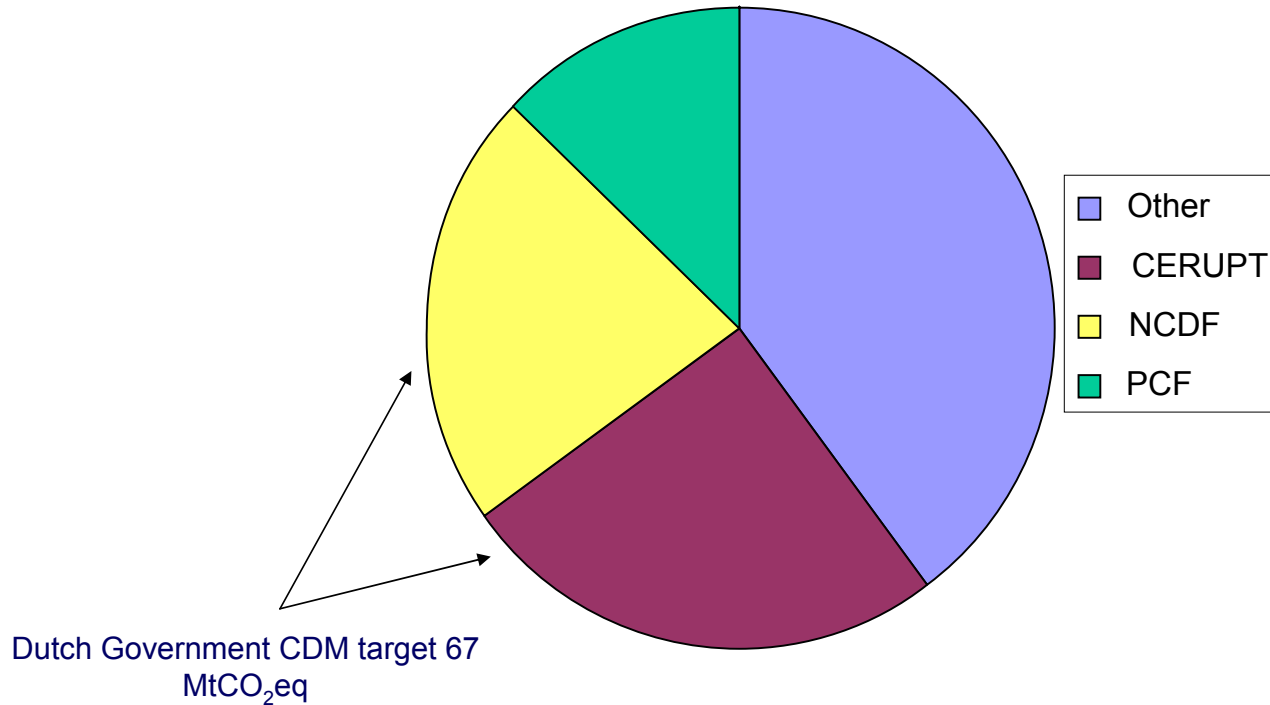
Flexible Mechanisms: CDM



Size of CDM Market

- Worldwide demand for emission reduction 700-800 MtCO₂eq/yr
 - Withdrawal of US at 25% emissions limited market size
- Estimate 100-300 MTCO₂/yr for CDM
 - Equates to 750,000 10MW hydro projects
- CDM forestry activities limited to 1% of developed countries total reductions
 - Limits size of CDM forestry market

Main CDM CER buyers to date

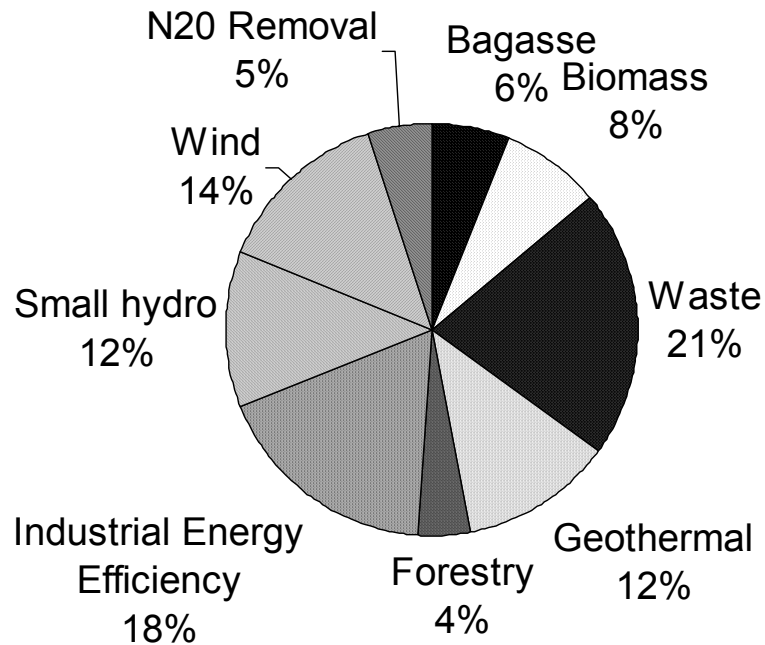


Who are the CDM buyers?

- Multilateral Funds - pool \$ from different carbon buyers
 - Prototype Carbon Fund - WB fund (6 governments; 17 companies) \$180m
 - CDCF - Community Development Carbon Fund. WB fund- target \$100m. Focus on small scale projects. target for LDC
 - BioCarbon Fund - target \$100m; approved last month, calling for subscription.
 - Netherlands CDM Facility - \$35m managed by WB
- spread risk over projects + countries
- Dutch Government
 - Tender process - called CERUPT - 18 projects selected (75% renewables)
 - Allocate funds to other multilateral and private banks
 - International Finance Corporation
 - Latin American Bank CAF
 - Rabo Bank
 - WB CDCF, PCF
- Bilateral projects, private companies

PCF Project Categories

PROTOTYPE
CARBON
FUND



Status of CDM Projects

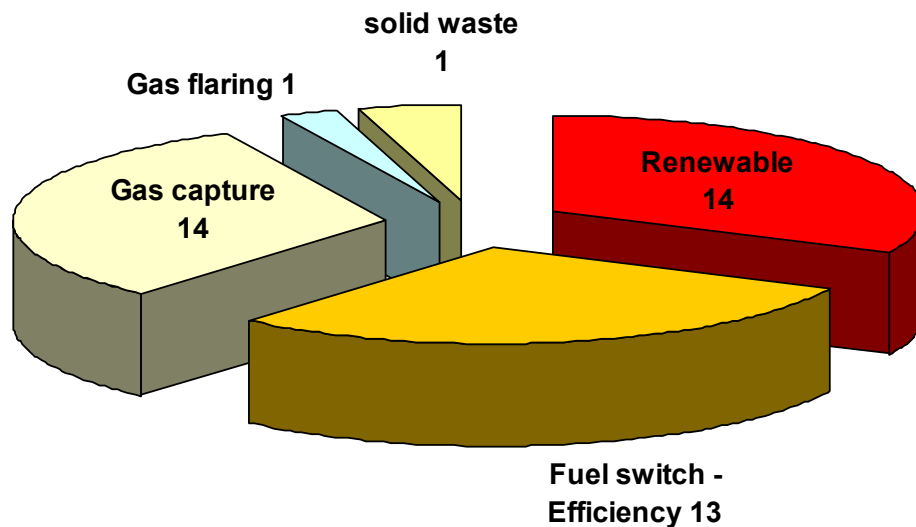
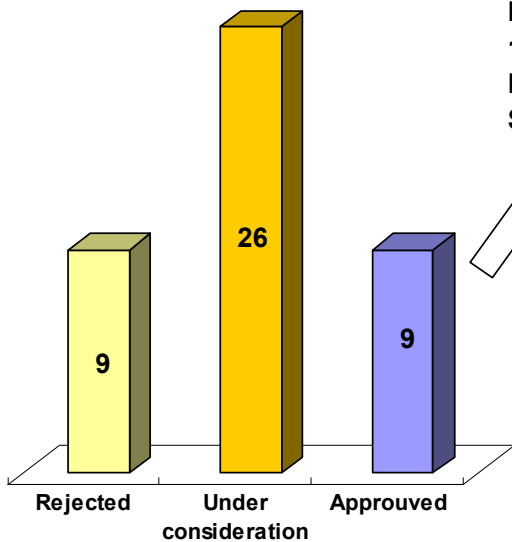
- Currently 36 projects already contracted, in process of CDM Exec Board approval
- many projects in finalization stage
 - Rough estimate of 600 projects at pre-PDD stage
 - 30 Project Idea Notes submitted to CDCF
 - 40 Project Idea Notes submitted to BioCarbon Fund
 - 360 Project Idea Notes for PCF (only 5-10% are signed)
- Not all these will make it through

Approval status of CDM projects

- 36 projects have been submitted baselines approved
 - Sept Round - 14 projects
 - Colombia Wind 19.5MW
 - Oil Field Gas Recovery and Utilization
 - 2xSugar waste co-generation
 - Municipal Solid Waste to Energy India

Status of Approval of Methodologies by the EB

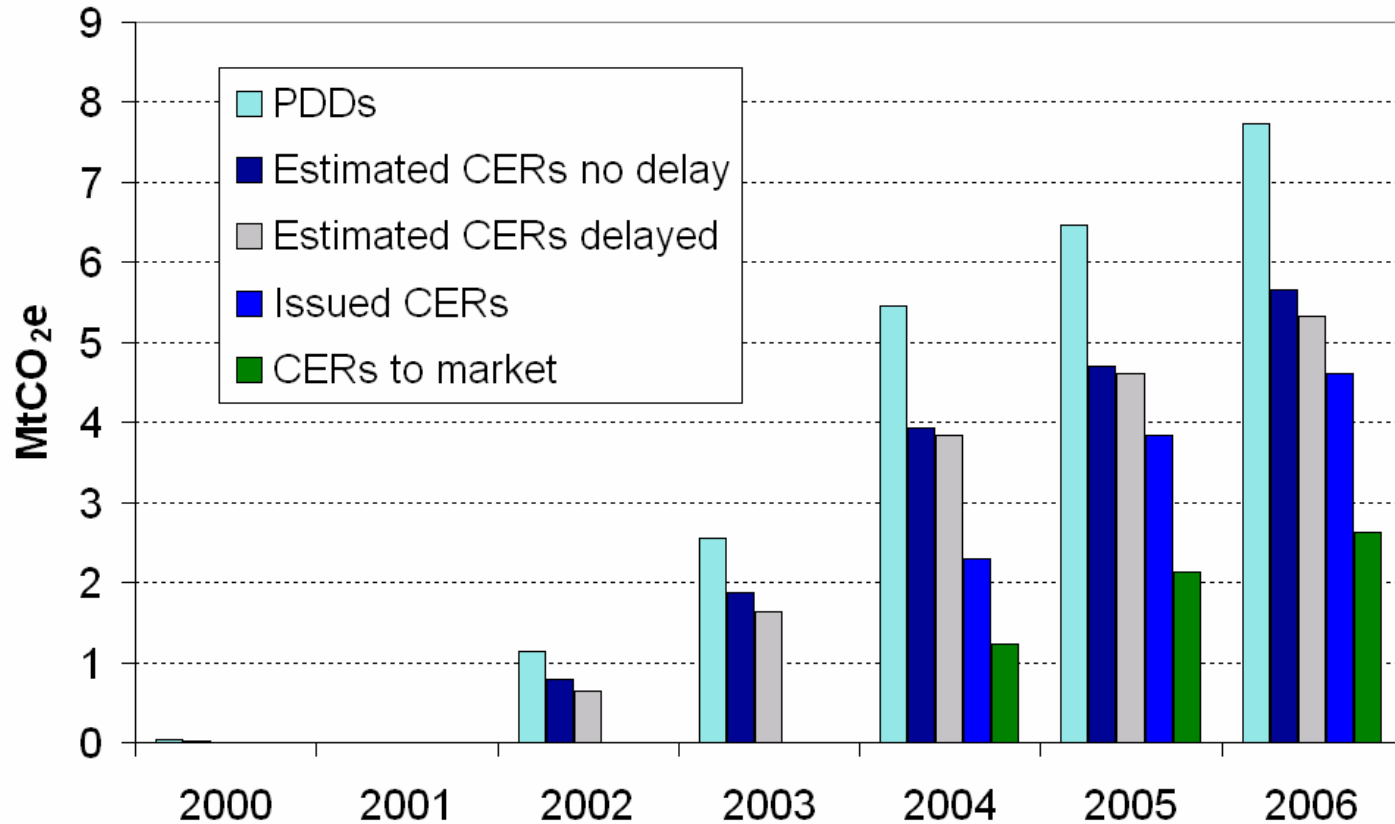
Of the 9 approved methodologies, 3 are located in Brazil and 1 respectively in Chile, Korea, Mexico, Thailand, South Africa.



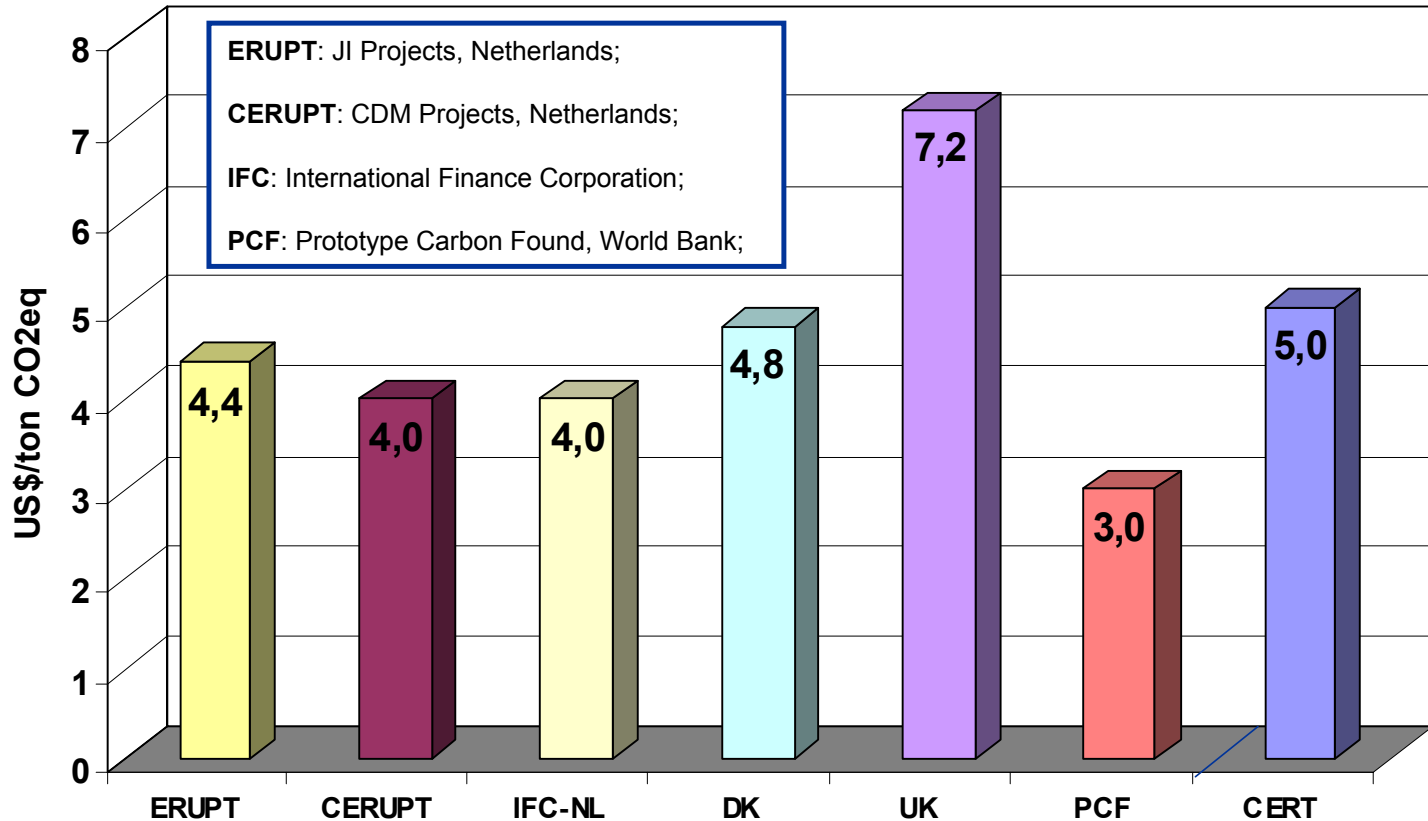
Approved Methodologies

NAME	HOST_COUNTRY	PROJECT_TYPE	Riduzioni Annuali di CO2 in Ton CO2 eq	Riduzioni Globali di CO2
Ulsan HFC 23	REPUBLIC OF KOREA	GAS CAPTURE	1.400.000	9,80 MT CO2
Salvador da Bahia landfill gas utilization	BRAZIL	GAS CAPTURE	904.942	6,33 MT CO2
NovaGerar landfill gas utilization	BRAZIL	GAS CAPTURE	509.000	3,56 MT CO2
Durban Landfill	SOUTH AFRICA	GAS CAPTURE	457.719	3,20 MT CO2
Graneros fuel switch	CHILE	FUEL SWITCH	99.946	0,70 MT CO2
VRBC Project	BRAZIL	RENEWABLE	95.663	0,67 MT CO2
AT Biopower (Full)	THAILAND	RENEWABLE	83.582	0,59 MT CO2
El Gallo Hydroelectricity project	MEXICO	RENEWABLE	70.484	0,49 MT CO2
Cerupt landfill	BRAZIL	GAS CAPTURE	69.588	0,70 MT CO2

Success rate



Real market prices [US\$/ton CO₂]



Renewable Energy: Oil Electricity Generation

Project

- 10.3MW capacity from special high-pressure boiler with steam-turbo generator
- Combustion of 220kT/yr of empty fruit bunches from processing plant
- Palm Oil mill is 1.5km from 20kV substation + close to river

Project Details	
Project Cost	US\$16.5 mil
Operating Cost	US\$1.6 mil
Financing	Debt 60%, Equity 40%
Interest Rate on Term Loan	12% pa
Plant Load Factor	82%
Annual Electricity Generation	10.285 million kWh per year
CERs generated per year	56,500 tonnes CO2
Calorific Value of Fuel	1052 kcal / kg
Fuel Cost	US\$0.027 / kg
Power Sale Price	US\$0.0625 / kWh
Project IRR <i>without</i> CDM funds	19.5%
IRR at CER price of US\$3.50	21.3%
IRR at CER price of US\$5.00	22.1%
IRR at CER price of US\$7.50	23.6%

Energy Efficiency: Brick Kilns in Bangladesh

	Baseline Case	CDM Project
Project Size	170 million bricks per year	170 million bricks per year
Capital Investment	US\$4.89 mil	US\$13.69 mil
Fuel Costs	US\$2.25 mil	US\$1.91 mil
Operations + Maintenance	20% of project cost per year	36.4% of proj cost per year
Sale price per brick	US\$0.04483	US\$0.05517
Financing Interest Rate		15%
Total emissions of CO2	86,496 tonnes per year	41,438 tonnes per year
Emissions Reduction		45,059 tonnes per year
Financial Internal Rates of Return IRR (assuming CER value of US\$10 per tonne of CO2)		
Without CDM Financing	IRR on Equity	18.9%
	IRR on Total Costs	17.3%
With up-front CDM Financing	IRR on Equity	27.4%
	IRR on Total Costs	20.6%
With Sale of CERs	IRR on Equity	24.8%
	IRR on Total Costs	20.2%

CER Value: The Economic Impact

Caribbean wind farm project:

- 20 MW electricity output
- 50,000 t CO₂ emission reductions per year (for 10 years)
- Project costs: US\$20m (+)
- Carbon value
- @\$3 US/tonne CO₂e = \$1.72m US
- @\$5 US/tonne CO₂e = \$2.87m US

Proportion of project costs:

- | | |
|-------------|----------|
| @ \$3/tonne | - 8.6% |
| @ \$5/tonne | - 14.35% |

SE Asia waste to energy project:

- 2 MW electricity output
- 50,000 t CO₂e (+) emissions reductions (for 10 years)
- Project costs: US\$3.5m
- Carbon value
- @\$3 US/tonne CO₂e = \$1.72m US
- @\$5 US/tonne CO₂e = \$2.87m US

Proportion of project costs:

- | | |
|-------------|---------|
| @ \$3/tonne | - 49.1% |
| @ \$5/tonne | - 82.0% |

CDM OPPORTUNITIES OIL & GAS SECTOR

CDM & JI Perspective in the Upstream sector

✓ Flaring down

- Local gas market
- Gas lift and Re-injection
- Power generation Projects
- Export to International markets

✓ Fuel switch (from high carbon-content to low carbon-content fuels)

- Increasing the penetration of natural gas

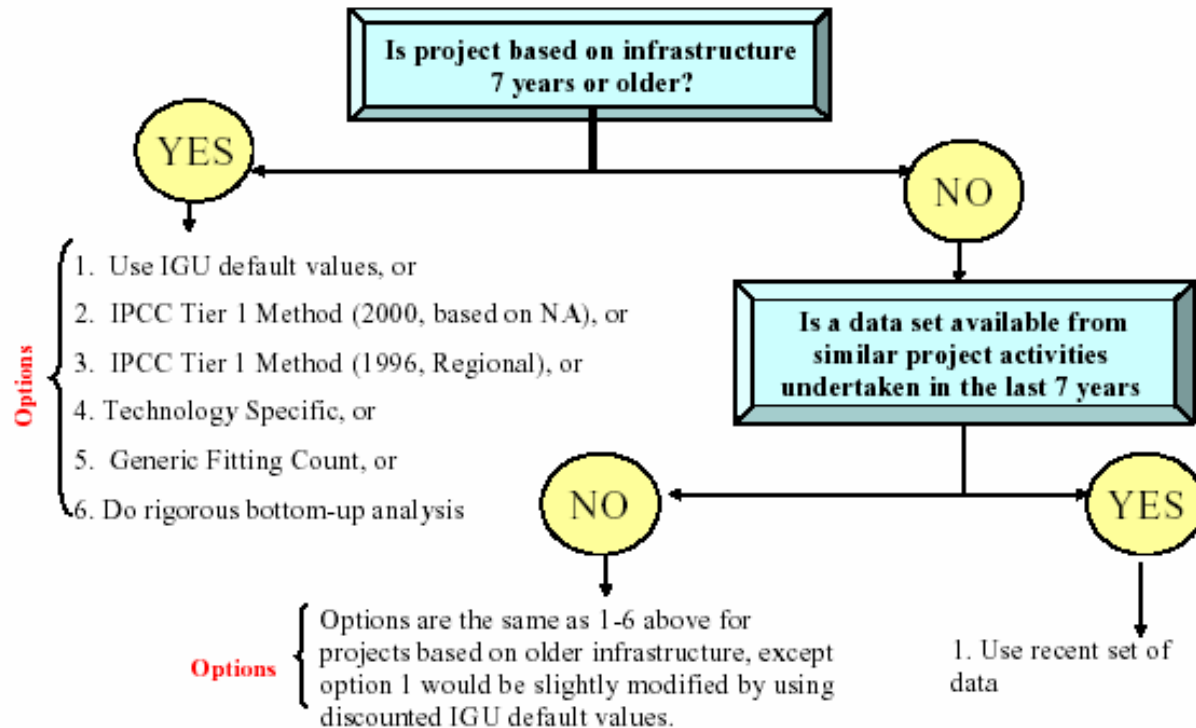
✓ Improvement in oil and gas transportation efficiency (reducing losses of pipeline systems)

CDM & JI Perspective in the Gas Sector

- Gas that was previously flared will be transported to be used in plants as power plants, LNG plants, GTL plants.
- Capturing Fugitive associated gas emissions
- Capturing Fugitive Gas Emissions from Compressor Stations
- Reduction of Leaks in Gas Pipelines
- Project focuses on minimizing or eliminating leaks from control valves.
- Increase efficiency and capacity for processing gas that would otherwise be flared.
- Pipeline system optimized to reduce fuel consumption and lower greenhouse gas emissions.
- CO2 sequestration projects
- Re-injection of associated gas that would otherwise be flared

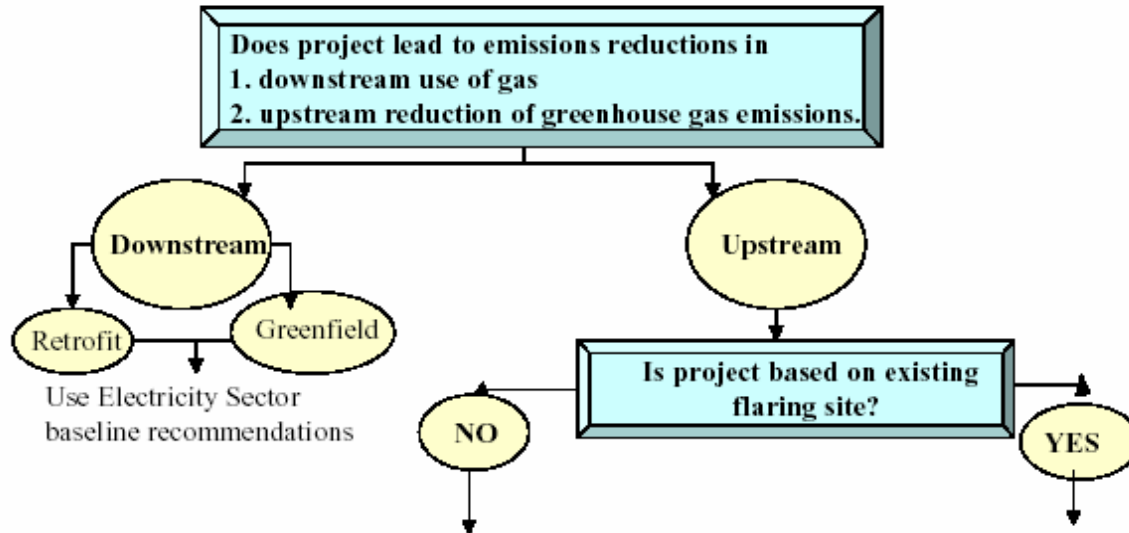
Decision Tree for Project Developers

Fugitive Emissions



Decision Tree for Project Developers

Flaring Reduction

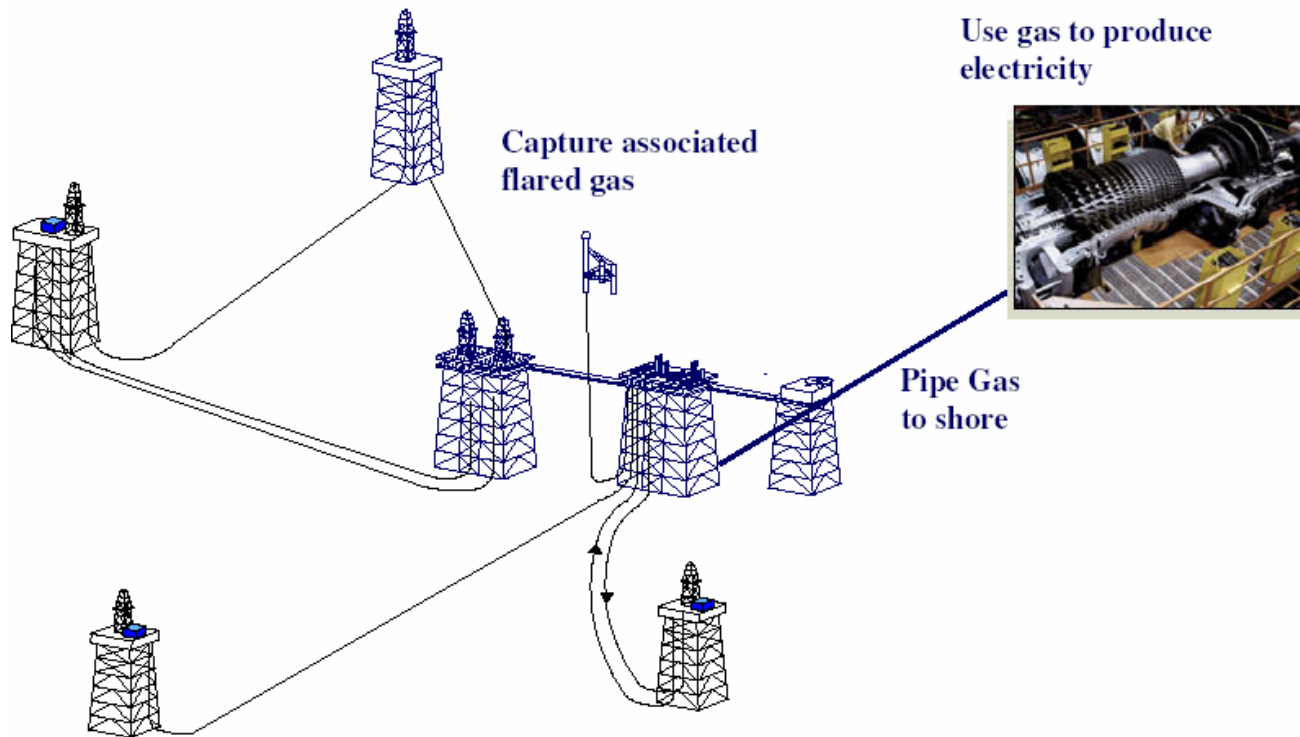


Options

1. Baselines are determined by greenhouse gas emissions from flaring as a function of total oil production and the gas to oil ratio, using appropriate data from the last 7 years.
2. Immediate qualification/disqualification of certain flaring reduction projects as credit-worthy
3. Qualitative project-specific assessment of what would have happened otherwise.

1. Determine Flow Rate, and
2. Determine Combustion Efficiency. (To accomplish, determine gas composition and a wind categorization for the site **OR** assume a 99.5 per cent combustion efficiency)

Example Gas Recovery Project – how?

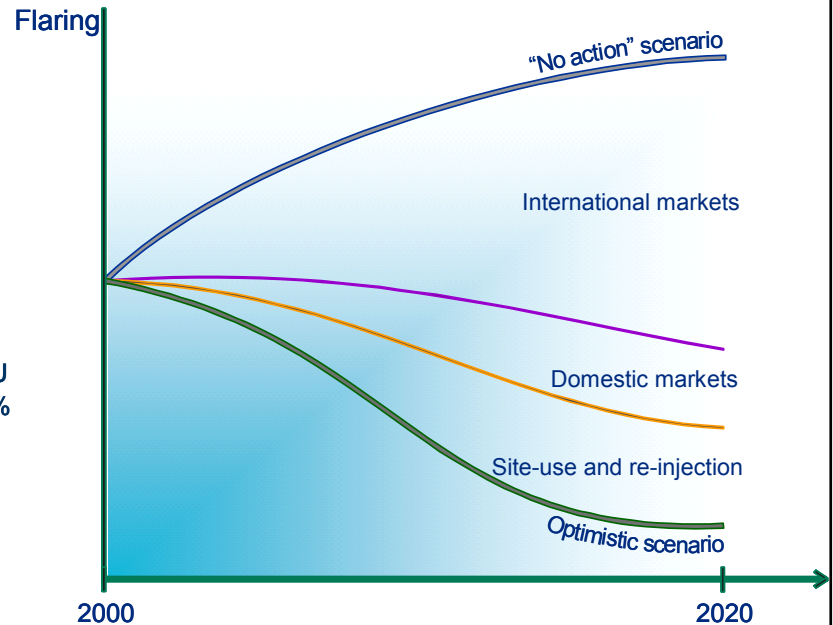
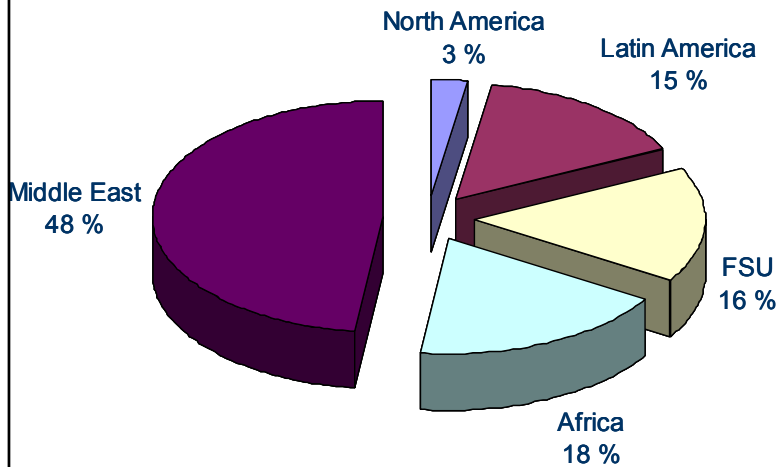


Example Re-injection/Condensate Recovery Project

- **Without Project - Baseline**
 - Flaring of waste gas on existing platforms (variable)
 - Development of new production facilities without flaring, per current government policy
- **With Project**
 - No routine flaring on existing or new platforms
 - Development of new production facilities without flaring
 - New condensate recovery and transport equipment, new re-injection compressors
- **Incremental Emission Reduction**
 - Estimated emissions savings on order of 20 million tons CO₂e over first 7 years of Project operations

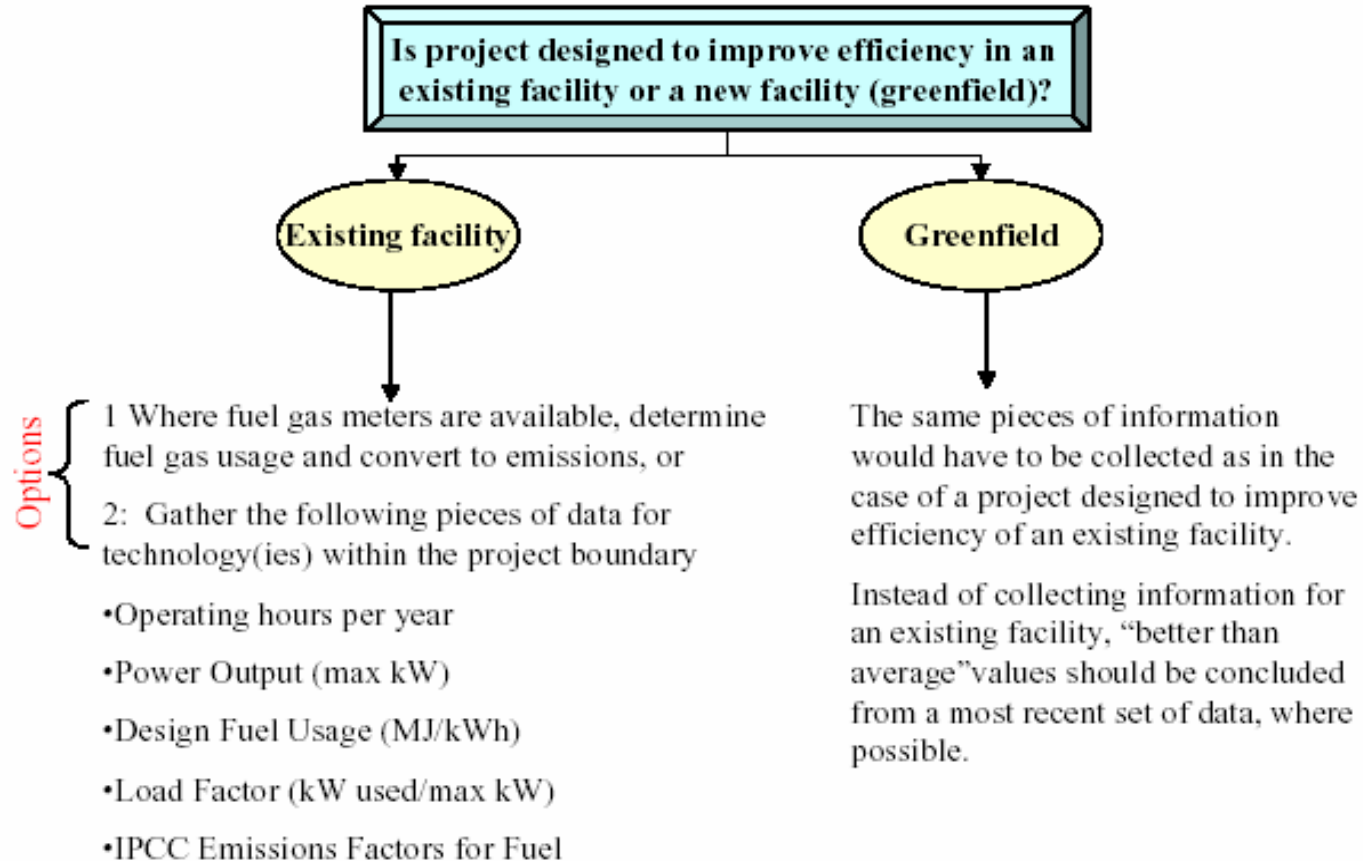
World future flaring trends

Production increment (1999-2020)



Decision Tree for Project Developers

Energy Efficiency Projects: Compressors



Some preliminary conclusions

- Compliance in the carbon constrained economy does not merely represent a cost issue. It also represents a business opportunity.
- The Clean Development Mechanism (CDM) in particular, represents an incentive both for companies and governments to invest in clean energy projects in developing countries, helping such countries to adopt a sustainable path for a lower carbon future.
- The engagement of the oil & gas sector in the Kyoto mechanisms is therefore very important and auspicious for the implementation of a successful climate change policy.
- Flaring Reduction Projects driven by CDM Flexible Mechanism could be the right path to minimize global GHG emissions from associated gas flaring.