

Carbon Finance in Oil & Gas sector



Opportunities and Issues

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[Outline]

- The World Bank assistance in CF
- GHG emissions in Oil & Gas sector
- Main emission reduction opportunities
- Existing CDM/JI projects in Oil & Gas sector
- Methodological challenges

World Bank Carbon Funds & Facilities

Total funds pledged: ~ US\$ 1.9 billion



- **Prototype Carbon Fund.** \$180 million (closed). Multi-shareholder. Multi-purpose.



- **Netherlands Clean Development Mechanism Facility.** \$170 million (closed). Netherlands Ministry of Environment. CDM energy, infrastructure and industry projects.



- **Community Development Carbon Fund.** \$128.6 million (closed). Multi-shareholder. Small-scale CDM energy projects.



- **BioCarbon Fund.** \$53.8 million (Tranche One closed). Multi-shareholder. CDM and JI LULUCF projects.



- **Italian Carbon Fund.** \$45 million (open to Italian participation). Multi-shareholder (from Italy only). Multipurpose.



- **Netherlands European Carbon Facility.** \$40 million managed jointly with IFC (closed). Netherlands Ministry of Economic affairs. JI projects.



- **Spanish Carbon Fund.** \$220 million (open to Spanish participation). Multi-shareholder (for from Spain only). Multipurpose.



- **Danish Carbon Fund.** \$75 million (open to Danish participation). Multi-shareholder (for from Denmark only). Multipurpose.



- **Umbrella Carbon Facility.** \$930 million (Tranche One). 2 HFC-23 projects in China.

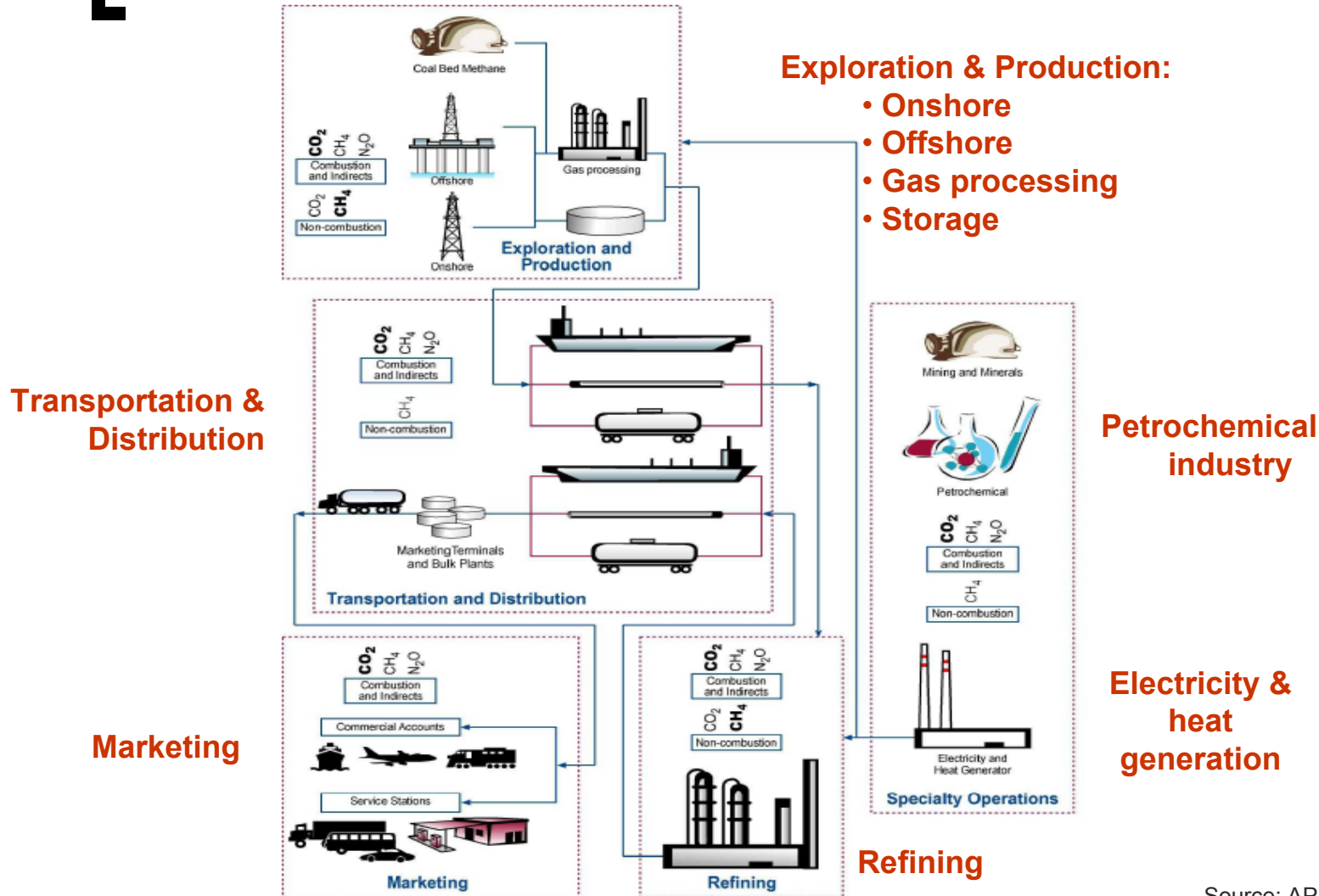
Capacity Building Grant for Carbon Finance

- \$570K grant awarded from a Japanese Trust Fund managed by the World Bank (PHRD) to the Ministry of Environment
- Component A: institutional framework and enabling environment
- Component B: Supporting upstream project preparation and development, including Project Idea Notes and Project Design Documents
- Expected Outcome: Increased number of carbon contracts during the grant, better participation of Pakistan in the carbon market

Why Work with World Bank Carbon Funds?

- **World Bank pays market prices corrected for risk**
- **Purchase either VERs or CERs**
 - **VER assume Kyoto risks (payment does not require that methodology gets approved by CDM/EB; nor does it require registration of project)**
 - **VER purchases can extend until 2015**
- **Always contribute beyond the purchase of the CDM emission reduction while building capacity of clients through support and training**
- **Give full information – transparency and integrity**
- **Bring the full instruments of the World Bank Group to support clients**

Oil & Gas sub-sectors



GHG emissions in Oil & Gas sector (1): Main emission sources

Category	Principal sources
Combustion emissions CO ₂	<ul style="list-style-type: none"> ■ stationary devices (boilers, furnaces, turbines, flares, etc) ■ mobile sources (transport) ■ indirect emissions (Off-site generation of electricity and heat)
Vented sources CH ₄	<ul style="list-style-type: none"> ■ process vents (glycol dehydrators, refineries) ■ other venting (storage tanks, pneumatic devices, pumps, drilling, etc) ■ maintenance (compressor off-line, pipelines blowdowns, tank cleaning, etc) ■ accidents
Fugitive sources CH ₄	<ul style="list-style-type: none"> ■ fugitive emissions (valves, flanges, connectors, pumps, compressor seal leaks) ■ other (ex. Waste water treatment)

Source: API, 2004

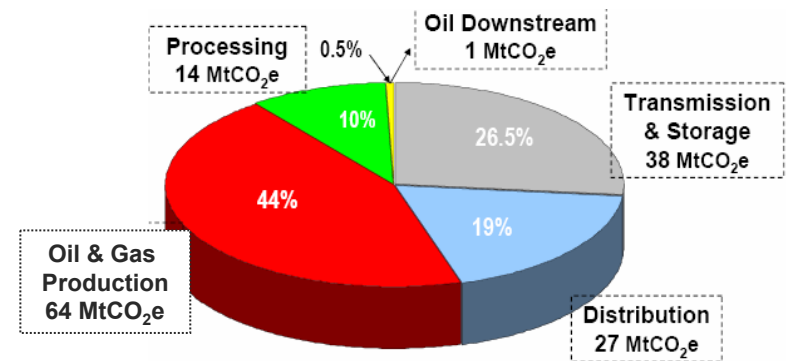
GHG emissions in Oil & Gas sector (3): Methane emissions in Oil & Gas sector

CH₄ emissions from Natural Gas & Oil infrastructure
(18% of worldwide CH₄ emissions)

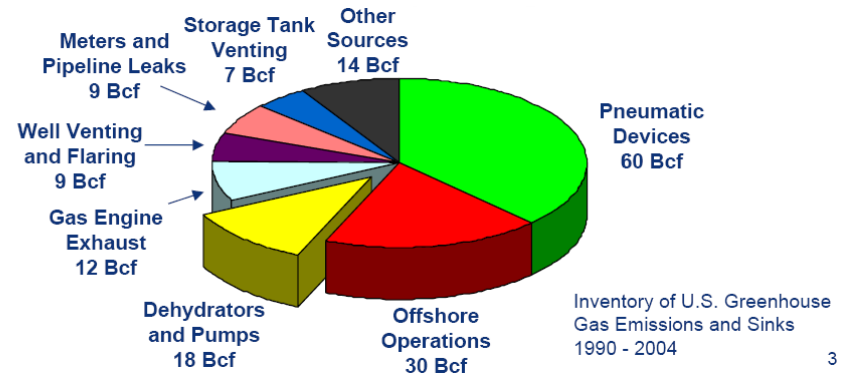
Country	Emissions, MtCO ₂ e
Russia	253.4
Unites States	138.6
Ukraine	60.1
Venezuela	52.4
Uzbekistan	33.7
India	24.3
Canada	23.5
Mexico	15.4
Argentina	13.6
Thailand	8.4
China	1.5

Source: Methane to Market, 2006

CH₄ emission by sub-sectors in U.S. (145 MtCO₂e)



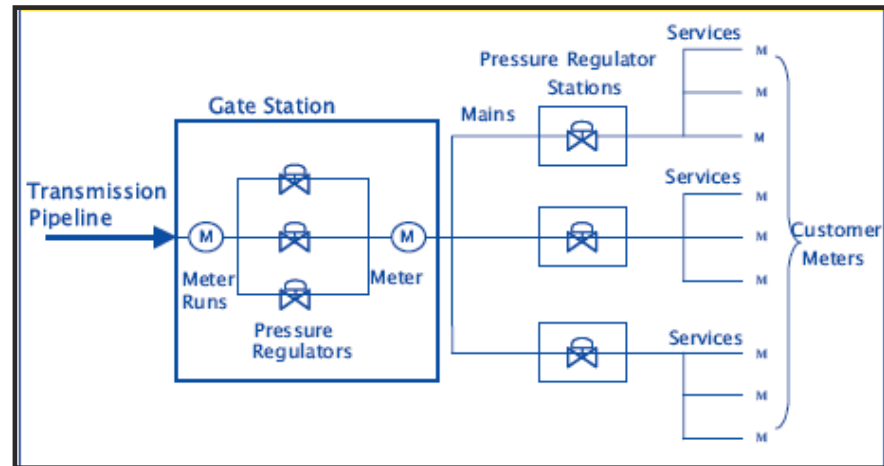
CH₄ emission by source in U.S.



Methane emissions in Gas distribution sub-sector

General schematics of Natural gas distribution networks

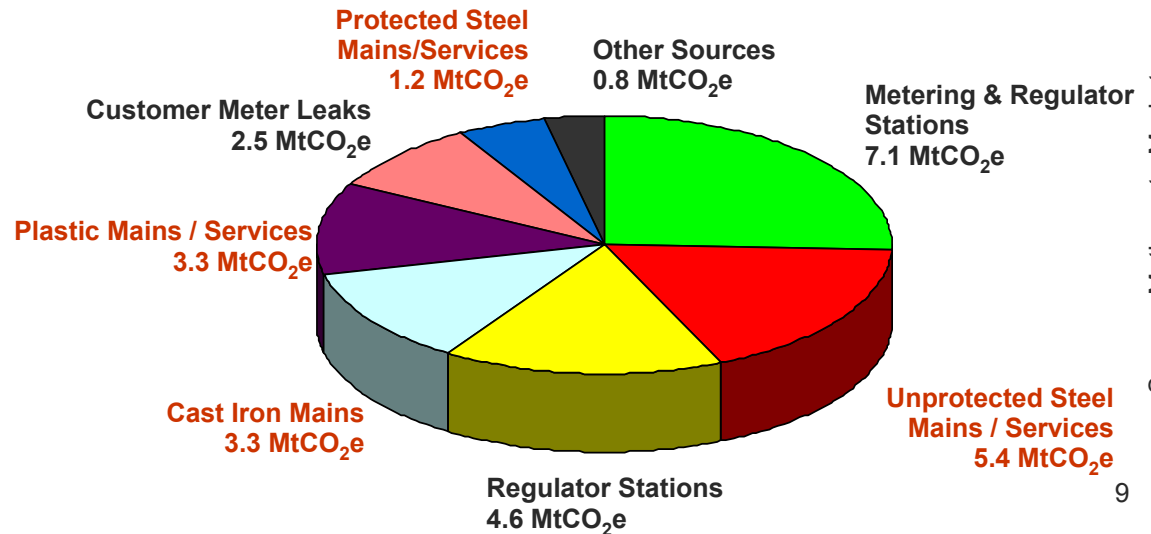
- progressive decrease of pressure from 75-55 atm to 3-0.05 atm
- extensive system of pressure regulator and meters



Source: Natural Gas STAR

Methane losses from distribution networks (U.S. example)

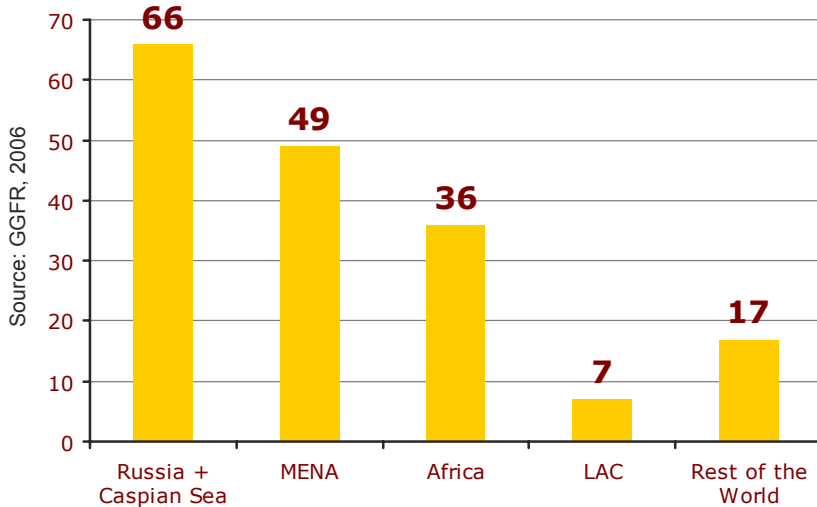
- Nearly all distribution sector methane losses are unintended fugitive leaks
- Pipelines – about 50%
- Pressure regulating & metering equipment – about 50%



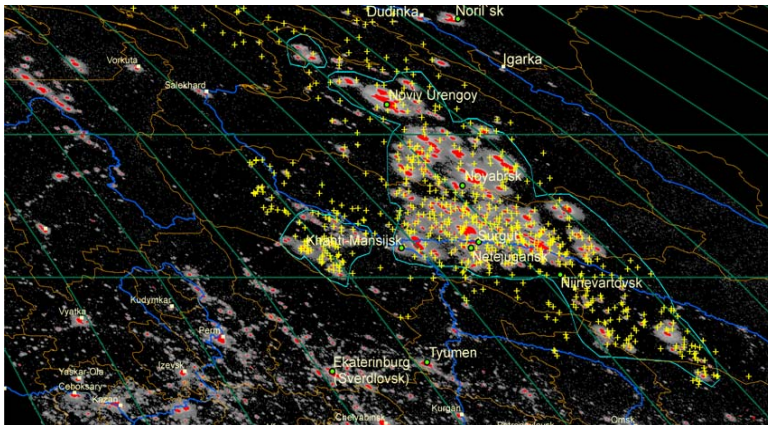
Source: Methane to Market

Associated petroleum gas flaring

Flares as seen from the Satellites (Bcm of gas)



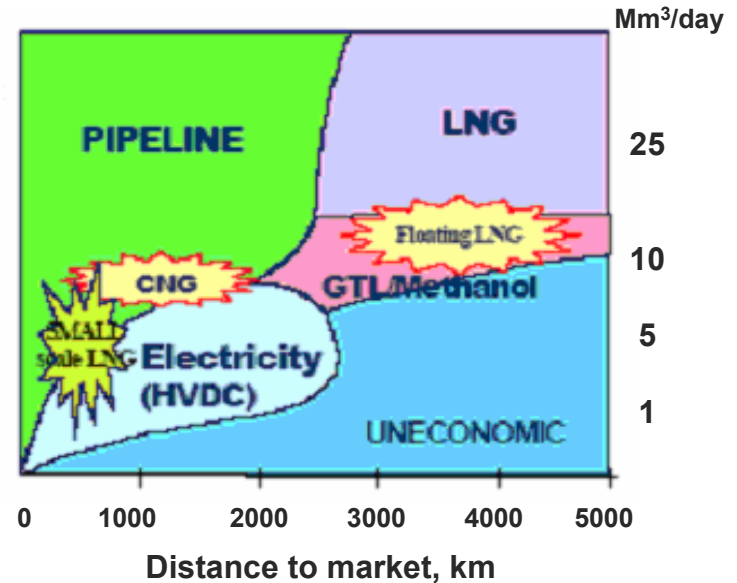
Flares in Western Siberia, Russia



Economics of APG use

Applicability of Gas pipeline/ LNG projects

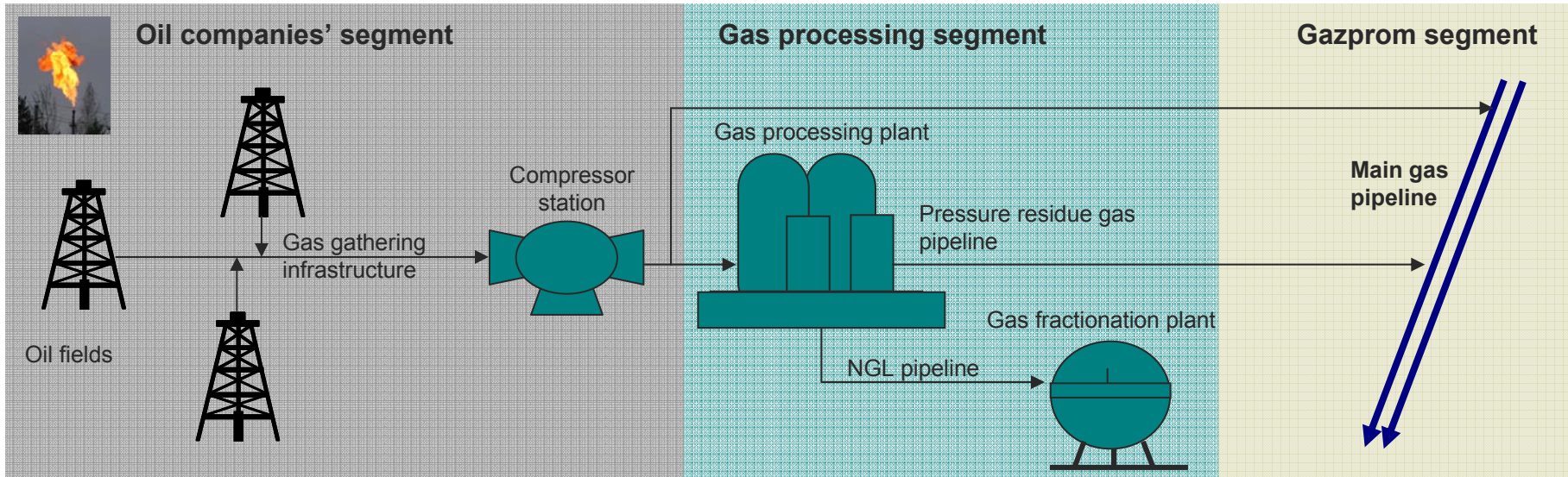
Where new technologies are targeted



- LNG: liquefied natural gas
- GTL: gas-to-liquids
- CNG: compressed natural gas
- HVDC: high-voltage direct current

Source: SINTEF

Economics of gas flaring: Russian example



Available amounts and composition of APG
 Insufficient local demand
 Cost of infrastructure
 Distance to the market / gas processing

Project-level barriers

Low regulated price of APG
 High fraction of liquids
 Stable supply

Sector and macro-economic barriers

Low intake price of APG
 Lack of spare capacity

Main emission reduction opportunities in Oil & Gas sector under CDM/JI

- 5 project families:
 - Gas flaring reduction
 - Fugitive emissions reductions
 - Energy efficiency
 - Carbon Capture and Storage
 - Cogeneration
- Gas flaring reduction CDM/JI projects are currently by far the most successful
 - 16 CDM projects using AM0009
 - 1 CDM project using AM0037
 - 3 JI gas flaring reduction projects



Main emission reduction opportunities: gas flaring reduction methodologies

Project family	Activity	CDM methodology	Status
Gas flaring reduction	Utilization of tail gas from oil or natural gas processing plants	AM0037: Flare reduction and gas utilization at oil and gas processing facilities	Approved
	Recovery of gas at oil wells	AM0009: Recovery and utilization of gas from oil wells that would otherwise be flared	Approved

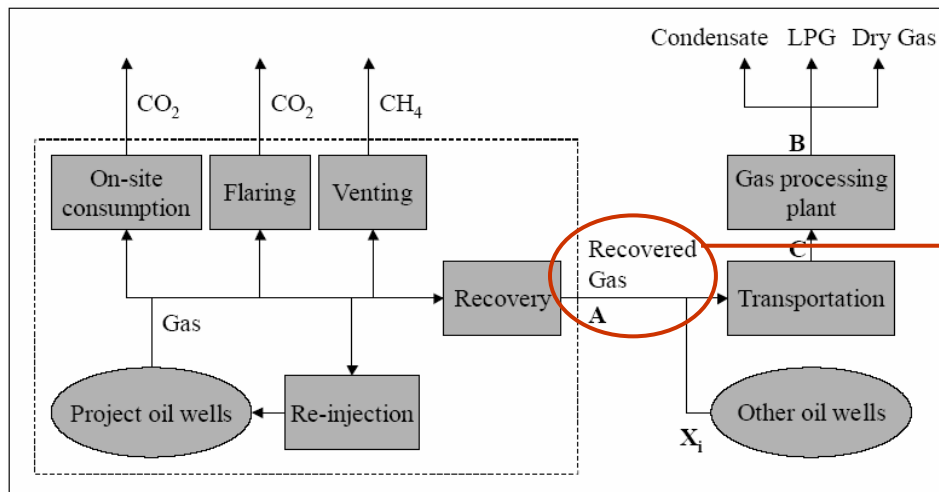
Gas flaring reduction	CER/ERU per year	Country (Project)	Project type	Methodology	
CDM projects	2,500 ktCO ₂ e (r)	Qatar (Al-Shaheen)	Gas-to-pipeline	AM0009	
	2,500 ktCO ₂ e (v)	Nigeria (Ovade)	Gas-to-pipeline	AM0009	
	2,270 ktCO ₂ e (rr)	Equatorial Guinea*	Methanol production	AM0037	
	1,500 ktCO ₂ e (r)	Nigeria (Kwale)	Gas-to-power	AM0009	
	677 ktCO ₂ e (r)	Viet Nam (Rong Dong)	Gas-to-pipeline	AM0009	
	327 ktCO ₂ e (v)	Indonesia (Tambun)	Gas-to-LPG	AM0009	
	124 ktCO ₂ e (v)	Indonesia (Medco)	Gas-to-LPG	AM0009	
	73 ktCO ₂ e (v)	India (10 projects)		AM0009	
	JI projects	30 ktCO ₂ e (d)	Lithuania (Minol)	Gas-to-power, LPG	AM0009 elements
		90 ktCO ₂ e (d)	Russia (Yukon)	Gas-to-processing	AM0009
160 ktCO ₂ e (d)		Russia (North-Danilovsk)	Gas-to-power	JI approach	

* The project in Equatorial Guinea may not be eligible – starting date before 2000

Main emission reduction opportunities: Gas flaring reduction AM0009

- Restrictive, but quite simple:
 - Emission reductions only at the APG capture point
 - NO specific treatment of subsequent APG utilization
 - NO consideration for incomplete burning of APG at flare stack
 - NO requirement for historical data availability
 - Realistic and representative alternatives

Project boundary in AM0009



Baseline emission calculation:

$$BL_y = V_{A,y} \cdot W_{carbon,A,y} \cdot \frac{44}{12} \cdot \frac{1}{1000}$$

Volume of gas recovered at point A

Carbon content of APG (molecular composition)

Expand AM0009 boundaries: Methodology submissions for gas flaring

Project family	Activity	CDM methodology	Status
Gas flaring reduction	Utilization of tail gas from oil or natural gas processing plants	AM0037: Flare reduction and gas utilization at oil and gas processing facilities	Approved
	Recovery of gas at oil wells	AM0009: Recovery and utilization of gas from oil wells that would otherwise be flared	Approved
	<i>Displacement of emission from off-grid plants in a capacity deficit grid</i>	<i>NM0208: Afam integrated gas and power project (Shell, Nigeria)</i>	<i>NBM_NMM Preliminary recommendation by Meth Panel 27</i>
	<i>Recovery of gas at oil wells and utilization for on-site power generation</i>	<i>NM0219: production gas recovery and utilization at Bloque 16 oil field, Ecuador (Repsol)</i>	<i>C (not approved)</i>
	<i>Recovery of gas at oil wells and re-injection to enhance oil recovery</i>	<i>Under development</i>	<i>-</i>

Existing CDM/JI projects in Oil & Gas sector: GGFR demonstration projects



GGFR Supported CDM/JI “Demonstration” Flaring Reduction Projects

Country	Company	Project	Project Type	CER/ERU (ktCO ₂ e)		Status
				Per year	Up to 2012	
Algeria	Sonatrach	TFT	Gas to pipeline (AM0009)	200	1,000	In progress (PDD)
Indonesia	Medco	Kaji	Gas to LPG (AM0009)	123	1,034	In validation
Nigeria	Eni	Kwale	Gas to power (AM0009)	1,513	10,540	Registered
Nigeria	Shell	Afam	Gas to power (NM)	740	3,700	NBM_NMM
Nigeria	Eni	ObOb	Gas to re-injection (NM)	2,000	10,000	On hold
Russia (JI)	Region-energogas	North-Danilovsk	Gas to power (JI)	162	813	Under Determination

Main emission reduction opportunities & methodologies in Oil & Gas sector

Project family	Activity	CDM methodology	Status
Leak reduction from gas transmission systems	Detection and repair of leaks from natural gas pipeline compressor stations, gate stations <u>and surface facilities in gas distribution</u> by establishing advanced leak detection and repair practices	AM0023 V.2: Leak reduction from natural gas pipeline compressor and gate stations, as well as from <u>surface facilities in gas distribution systems</u> (including pressure regulation stations)	Approved
	<i>Reduction of leaks from the linear part of transmission pipelines (excl. storage & compressors)</i>	<i>NM0172-rev: Methane leak reduction from natural gas pipelines (Georgia)</i>	<i>C (not approved)</i>
Leak reduction from gas distribution systems	Replacement of cast iron pipes with polyethylene pipes	AM0043: Leak reduction from a natural gas distribution grid by replacing old cast iron pipes* with polyethylene pipes	Approved
Energy efficiency	Steam system efficiency improvement in refineries	AM0017: Steam system efficiency improvements by replacing steam traps and returning condensate	Approved
	<i>Cogeneration in a refinery/industry facility</i>	<i>NM0160-rev: Shell cogeneration project</i>	<i>C (not approved)</i>

* The revision to include old steel pipelines was not accepted, but new submissions may take place

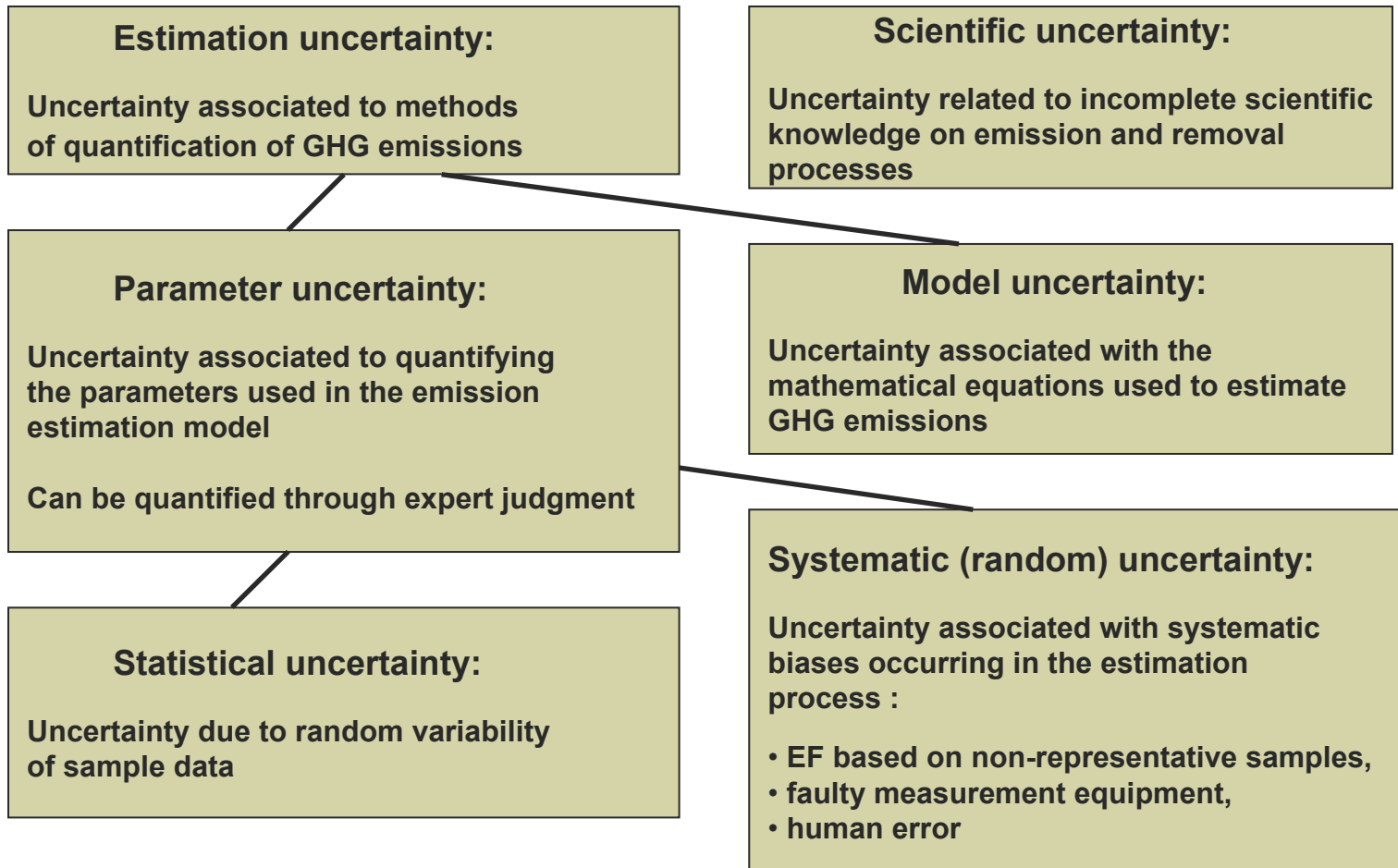
CDM/JI projects in Oil & Gas sector

Project family	CER/ERU per year	Country (Project)	Methodology
Leak reduction from gas transmission systems	On hold	Moldova	AM0023
	(3.170 ktCO ₂ e)	Georgia	<i>Methodology was not approved</i>
Leak reduction from gas distribution systems (surface facilities)	5,000 ktCO ₂ e (d)	Russia (Stavropol)	Elements AM0023
	975 ktCO ₂ e (d)	Russia (Belgorod)	Elements AM0023
	897 ktCO ₂ e (d)	Russia (Bryansk)	Elements AM0023
	790 ktCO ₂ e (d)	Russia (Tula)	Elements AM0023
	771 ktCO ₂ e (d)	Russia (Rostov)	Elements AM0023
	731 ktCO ₂ e (d)	Russia (Volgograd)	Elements AM0023
	364 ktCO ₂ e (d)	Russia (Orel)	Elements AM0023
	240 ktCO ₂ e (d)	Russia (Kursk)	Elements AM0023
	146 ktCO ₂ e (d)	Russia (Nevinnomissk)	Elements AM0023 Ver.2*
	104 ktCO ₂ e (d)	Russia (Kostroma)	Elements AM0023 Ver.2*
	64 ktCO ₂ e (d)	Russia (Vologda)	Elements AM0023 Ver.2*
	Brazil (Rio de Janeiro)	<i>AM0043-rev.(not approved)</i>	
	Mexico (Monterrey)	<i>AM0023 Ver.2*</i>	
Energy efficiency	x	China (Fushun)	AM0017
	53 ktCO ₂ e (r)	India (Mumbai)	AMS II.D (fuel switching**)

* AM0023 Ver.2 includes the surface facilities in gas distribution systems

** Waste heat recovery at gas compressor stations on offshore platform

Methodological challenges: measurements and uncertainties



Eligibility Criteria (Additionality)

- Project has to be “additional”: above and beyond business as usual or baseline > **cannot be demonstrated after the project has been implemented!**
- Good rule of thumb: **common practice test**: has technology/ type of project been implemented over past five years in that country?
- Demonstrated through:
 - **Barrier analysis**: project faces barriers that prevent its implementation: commercial finance, technological, etc.
 - **Investment analysis**: project is economically or financially less attractive than other alternatives
 - Relatively simple for project which generate no financial or economic benefit other than the sale of emission reductions

Methodological challenges: additionality demonstration

“Objective” challenges:

- Legal mandatory requirements / Enforcement
- Energy price volatility / Transition context / Economics
- Common practice and barriers: limited data is available

“Judgmental” challenges”:

- Negative perception of the Oil & Gas sector
- Publicly Acceptable / Unacceptable common practices (venting?)
- Perception of budget constraint for Oil & Gas companies