



AMERICAN PETROLEUM INSTITUTE

Oil and Natural Gas Industry Guidelines for GHG Reduction Projects

API Side Event
CCAR Annual Meeting
1 April 2009
San Diego, California



Project Guidelines Objectives

- Identifying, assessing, and developing candidate projects that would lead to credible emission reductions
- Develop a framework for assessing emission reductions associated with specific project “families”, including references to relevant methodologies or Guidelines
- Attempt to be regime neutral



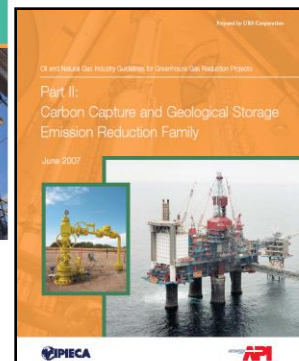
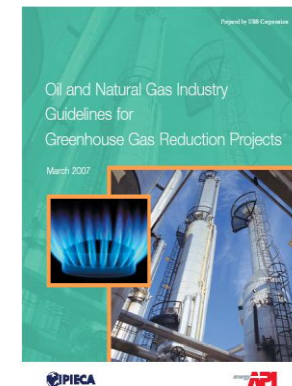
Progress To Date

➤ General Project Guidelines

- Section 1 – Introduction
- Section 2 – Overarching Principles
- Section 3 – Policy Considerations
- Section 4 – Overview of Project Families
- Section 5 – Cogeneration Project Family

➤ Section 6 – Carbon Capture and Geologic Storage

➤ Section 7 – Flare Reduction (in development)



Key Messages from General Project Guidelines

- Care must be taken in selecting the baseline scenario
 - Common practice or benchmarks can provide useful baselines but site specific issues may limit application to oil industry projects
- Policy decisions can significantly effect quantification and eligibility of reductions
- Excessive monitoring must add value for regulator and business



Steps for Project Quantification

Step 1: Define Project

- ❖ Describe the activity or set of activities that reduce GHG emissions

Step 2: Determine Baseline Scenario

- ❖ Identify baseline candidates for each project activity
- ❖ Determine baseline scenario based on sound, technical considerations and guided by common practice
- ❖ Examine the geographic area and time frame for which the baseline is applicable

Step 3: Determine Assessment Boundary

- ❖ Identify potential sources, sinks, or reservoirs controlled by, related to affected by, and relevant to the baseline scenario

Step 4: Quantify Emission Reductions

- ❖ Quantify GHG emissions for the project activity
- ❖ Estimate GHG emissions associated with the baseline scenario
- ❖ Quantify emission reductions

Emission Reductions = Baseline emissions – Project emissions

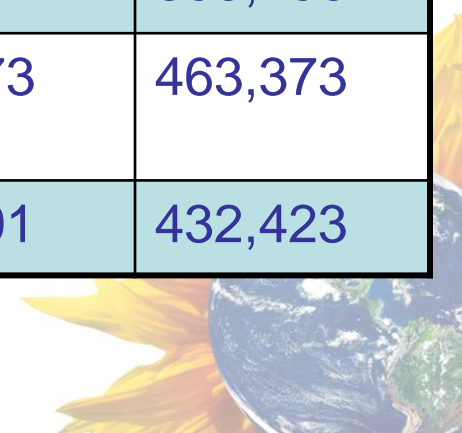


Cogeneration Case Studies

Project Parameter	Case 1	Case 2	Case 3
Turbines: Nat. gas consumption	14,760,000 MMBtu/yr	8,131,500 MMBtu/yr	8,131,500 MMBtu/yr
Project Electricity Production	1,523,000 MW-hr	1,100,600 MW-hr	1,100,600 MW-hr
Facility Usage <i>Electricity baseline</i> <i>After project</i>	250,000 MW-hr Same as above	198,000 MW-hr 275,000 MW-hr	206,000 MW-hr 275,000 MW-hr
Electricity Sold to Grid	1,234,500 MW-hr	768,100 MW-hr	768,100 MW-hr
Onsite Steam Generation			
<i>Baseline</i>	None	2,710,000 MMBtu/yr	2,710,000 MMBtu/yr
<i>After Project</i>	1,250,000 MMBtu/yr	3,614,000 MMBtu/yr	3,614,000 MMBtu/yr
Device/Fuel Replaced	Offsite coal-fired boilers	On-site diesel-fired boiler	On-site diesel-fired boiler at capacity

Cogeneration Case Study Results

		Tonnes CO2 Equivalent (Annual)		
		Case 1	Case 2	Case 3
Baseline Scenario	Electricity Emissions	162,315	161,959	161,959
	Electricity Grid Displacement	801,496	406,103	406,103
	Steam Emissions	153,678	353,802	265,582
	Steam incremental capacity	NA	NA	62,151
Total Baseline Emissions		1,117,489	921,864	895,796
Project Scenario	Total Direct Emissions	840,773	463,373	463,373
Annual Net GHG Reduction		276,716	458,491	432,423



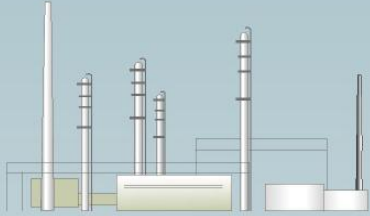


AMERICAN PETROLEUM INSTITUTE

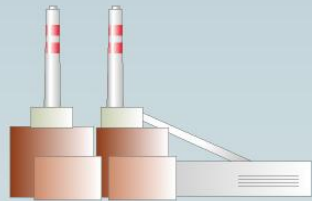
Carbon Capture and Storage



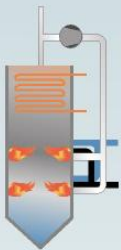
Capture Sources



Separation of Industrial Process Gas Streams



Flue Gas Separation



Oxy-Fuel Combustion

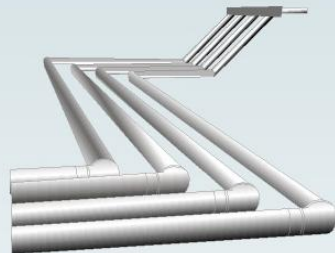


Gasification or Partial Oxidation

Transport

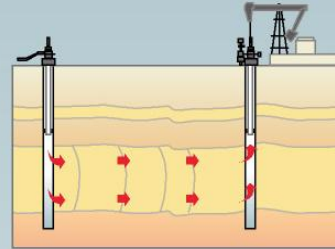


Ships

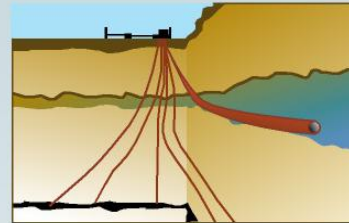


Pipelines

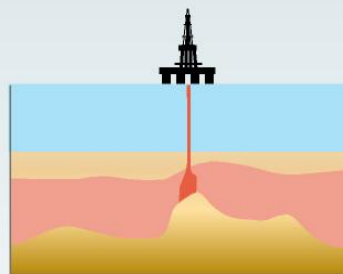
Storage



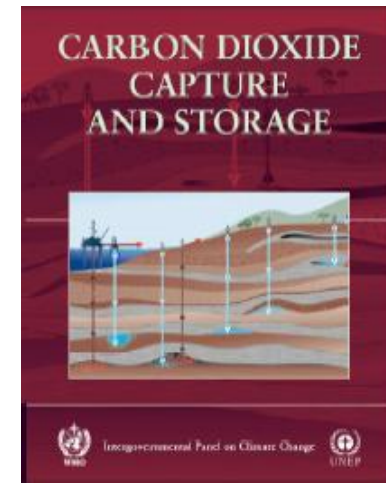
Enhanced Oil Recovery



Storage in Saline Formations



Depleted Reservoir

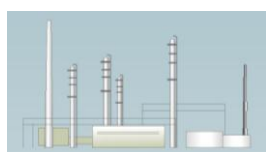


Project Definition

Explicitly excludes ocean storage

Baseline Scenario Determination

Example Project Types



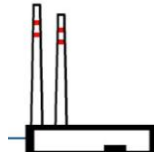
Separation of CO₂ from industrial process gas streams with storage



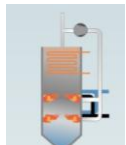
Separation of CO₂ from natural gas to sales gas specifications or for producing LNG



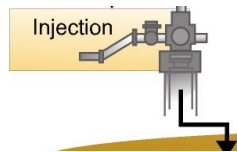
Hydrogen plant with storage



Flue gas CO₂ separation with storage



Oxy-fuel combustion with storage of CO₂



Captured CO₂ is used for EOR, EGR, or ECBM

Potential Baseline Candidate(s)

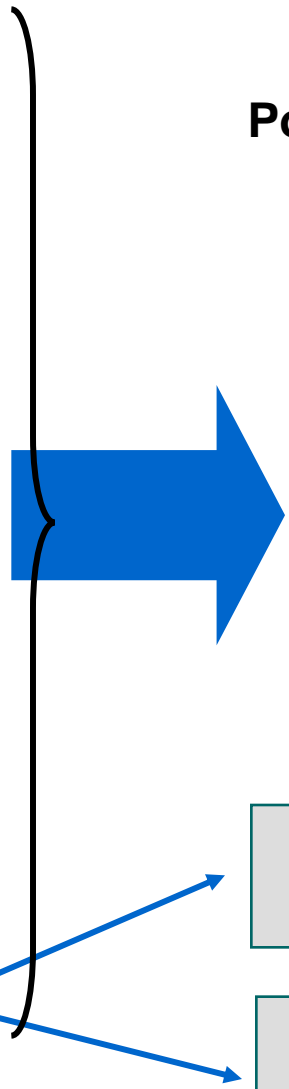
CO₂ vented to the atmosphere

Captured CO₂ captured & sold to market

CO₂ captured and stored

CO₂ purchased from a naturally-occurring underground source

EOR, EGR, or ECBM is achieved by other gases or water



CCS Emission Reductions

- Reduction = Baseline emissions – Project emissions
- Calculate the emissions that would have occurred from a reference operation (baseline scenario) without carbon capture, but with the same output, e.g.
 - Electricity generated in MW-hrs
 - Natural gas processed for CO₂ removal
- Quantify emissions along the whole CCS chain: capture, transport, injection and storage
 - Emissions from the end-use of oil or gas produced as a consequence of CO₂ storage (EOR or EGR) are outside the assessment boundary

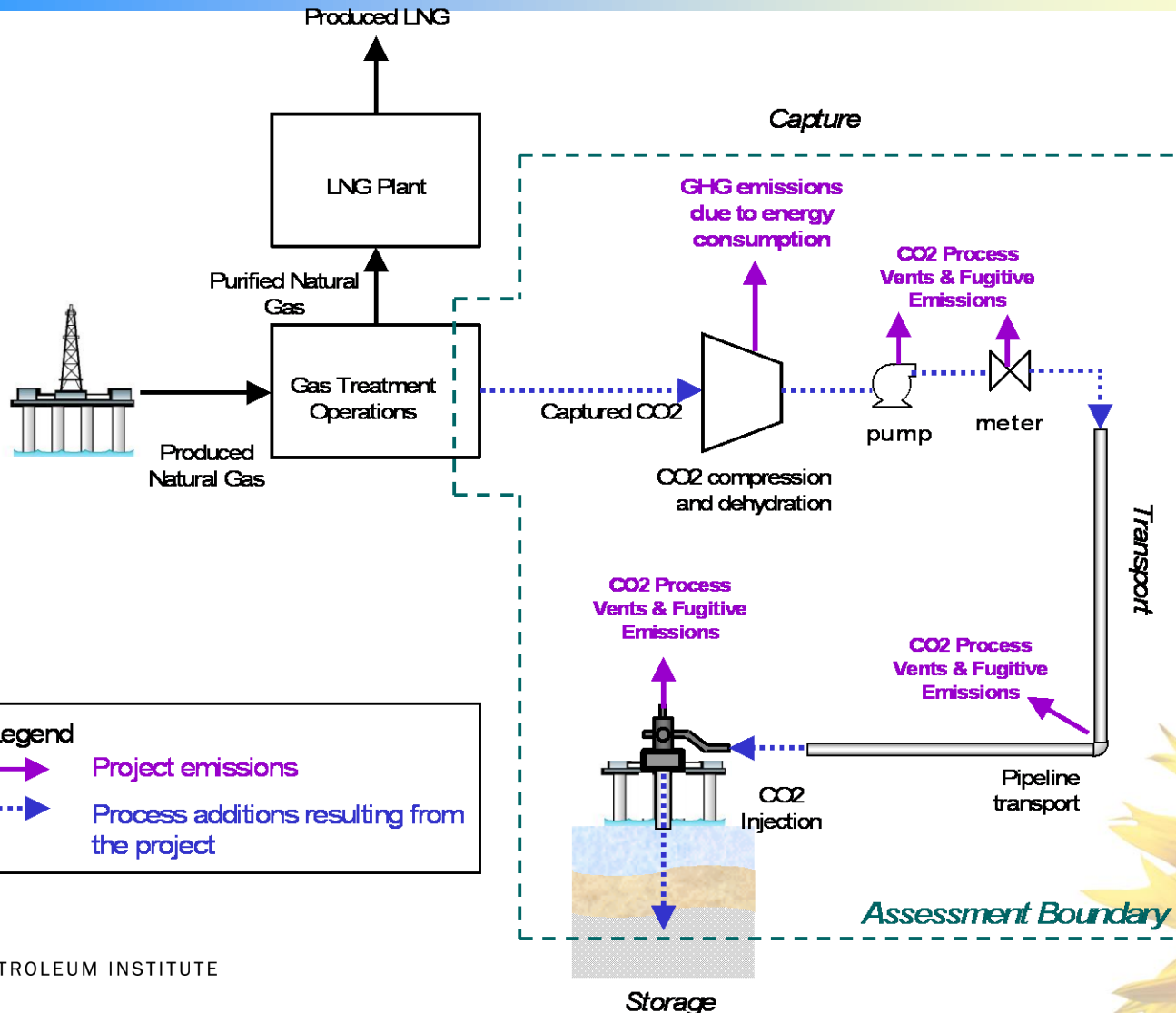


CCS in Saline Formation

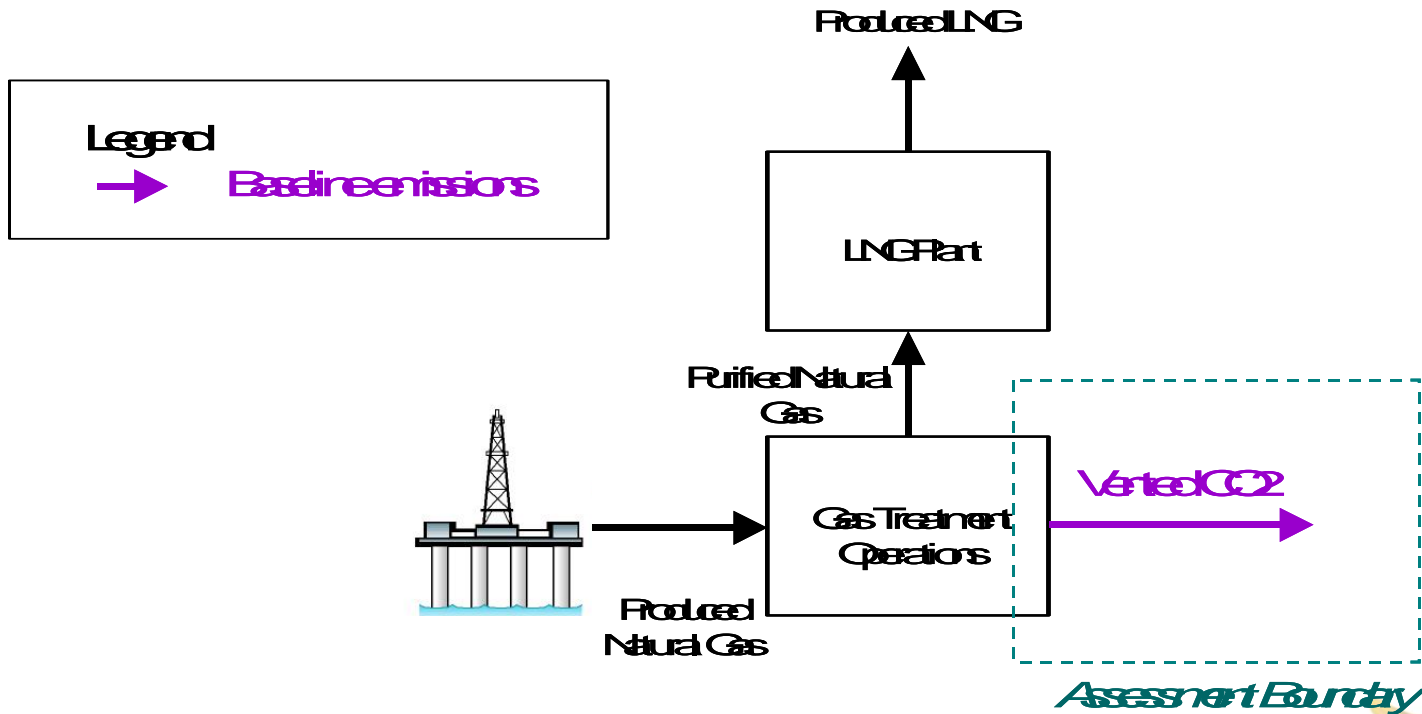
- 734×10⁶ scf/day of natural gas is produced from 9 offshore wells and is piped to an onshore LNG facility
- Produced natural gas contains 3.9 to 5.4 mol% CO₂, 0-2 mol% H₂S, and 81-83 mol% CH₄
- CO₂ is separated from the natural gas using an amine unit and amine regeneration prior to cooling the produced gas to form LNG containing 99% CH₄
- Captured CO₂ is compressed using multiple engine-driven compressors and electric-driven pumps to transport the CO₂ stream 94 miles to an offshore CO₂ injection well and inject the CO₂ into the deep saline formation
- Annual fuel consumption is 1.27×10⁹ scf of fuel gas and 3,528 MW-hr to compress 700×10³ tonnes CO₂ per year that is captured from the LNG plant
- CO₂ is injected into a deep saline formation, separated from the ocean floor by a gas bearing formation, an oil bearing formation, and a thick shale formation



Project Illustration of CCS in Saline Formation



Baseline Illustration of CCS in Saline Formation



CCS Case Study Results

Baseline		700,000 tonnes/yr CO2 vented
Project	Combustion	86,187 tonnes CO2 Eq.
	Vented	246 tonnes CO2 Eq.
	Fugitive	425 tonnes CO2 Eq.
	Indirect	3,095 tonnes CO2 Eq.
Reduction		610,047 tonnes CO2 Eq. /yr



Key Messages

- Determination of emission reductions should be based on generally accepted principles and sound technical considerations
- Reported information should provide a faithful, true, and fair account of the reductions achieved
- For existing operations, historical conditions, which are distinctly different from historical emissions, often provide the most realistic baseline scenario
- For new operations, common practice is generally an objective and credible prediction of what would have happened in the absence of the project.



Key Messages, continued

- Methodologies should be fit to purpose
- Care must be taken in selecting the baseline scenario in the petroleum industry
 - Common practice or benchmarks can provide useful baselines but site specific issues mean that they can be difficult to apply to oil industry projects
- Policy decisions can significantly effect quantification and eligibility of reductions
- Baseline scenarios based on financial analysis are not always objective
- Excessive monitoring requirements may discourage participation without adding value

