Petroleum Industry Guidelines for Emission Reductions from Carbon Capture and Storage

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IPIECA Side Event, COP12/MOP2

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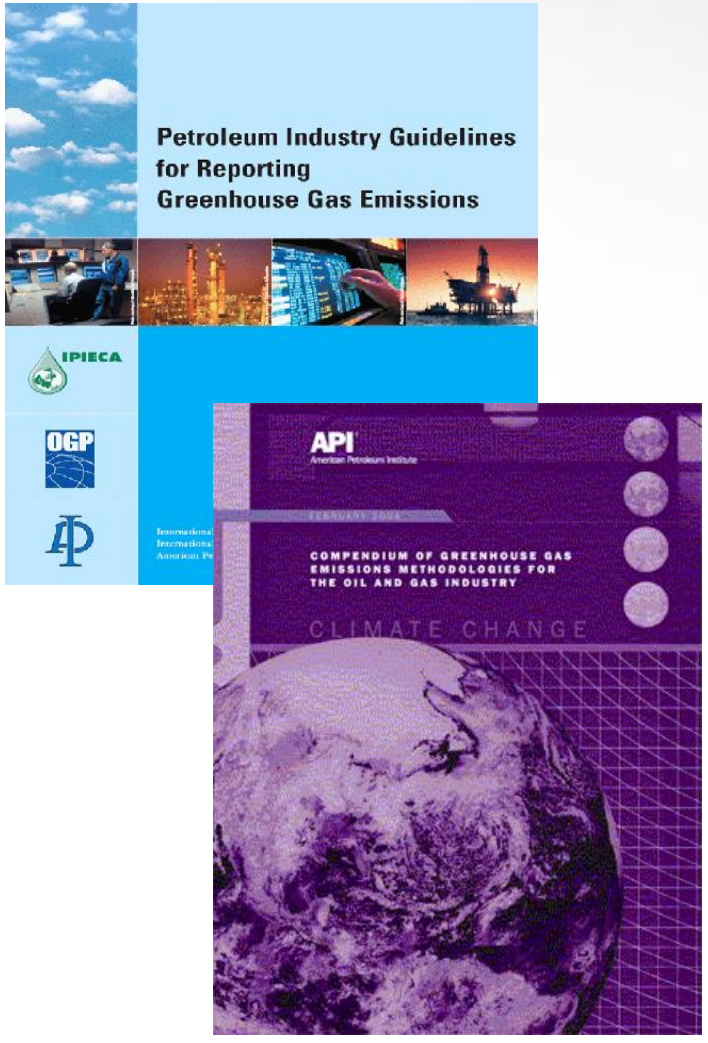
Background
Industry Guidelines on GHG Emissions



- Petroleum Industry Guidelines for Reporting GHG Emissions
- Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Gas Industry (API GHG Compendium)
- Petroleum Industry Guidelines for GHG Emission Reduction Projects

IPIECA

energy API

Project Guidelines Objectives

- Identifying, assessing, and developing candidate projects that would lead to credible confirmed 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
- **Planned Project Families:**
  - **Section 6 – Carbon Capture and Storage**
  - Section 7 – Flare Reduction
  - Section 8 – Fuel Switching
  - Section 9 – Energy Efficiency

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**
- **Monitoring should be "fit for purpose"**
  - Suitable for business and regulatory needs

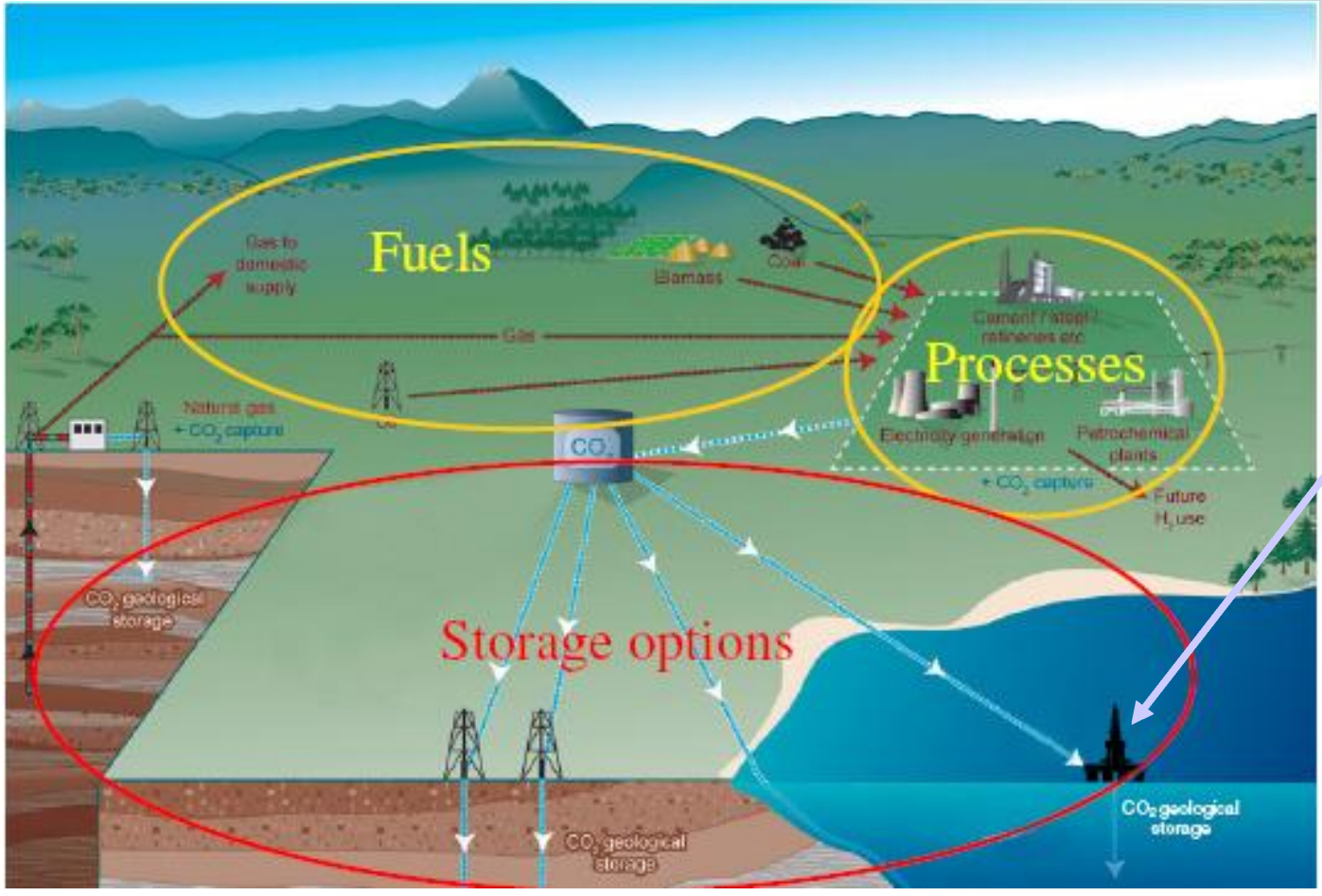
Carbon Capture and Storage

CCS Project Guidelines Experts

- **Chair**
  - Frede Cappelen, Statoil
- **CCS Experts**
  - Gemme Heddle, Chevron
  - Haroon Kheshgi, ExxonMobil
  - Theresa Hochhalter, ExxonMobil
  - Charles Christopher, BP
  - Ian Wright, BP
  - Mike McMahon, BP
  - Wishart Robson, Nexen
  - Anthony Webster, HESS
  - Brigitte Poot, Total
  - Luc de Marliave, Total
  - Tom Mikus, Shell
  - Wolfgang Heidug, Shell
  - Luke Warren, IPIECA
  - Karin Ritter, API
  - Terri Shires, URS (consultant)

CCS Projects

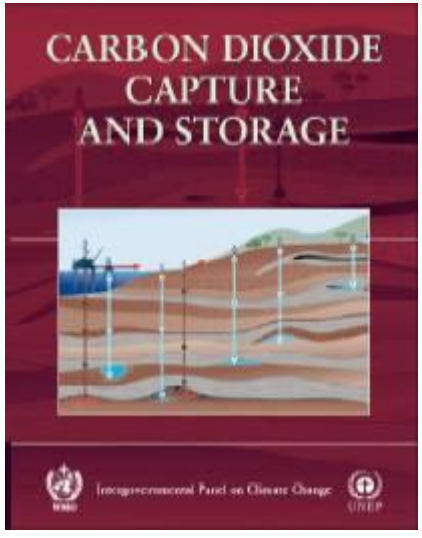
Carbon

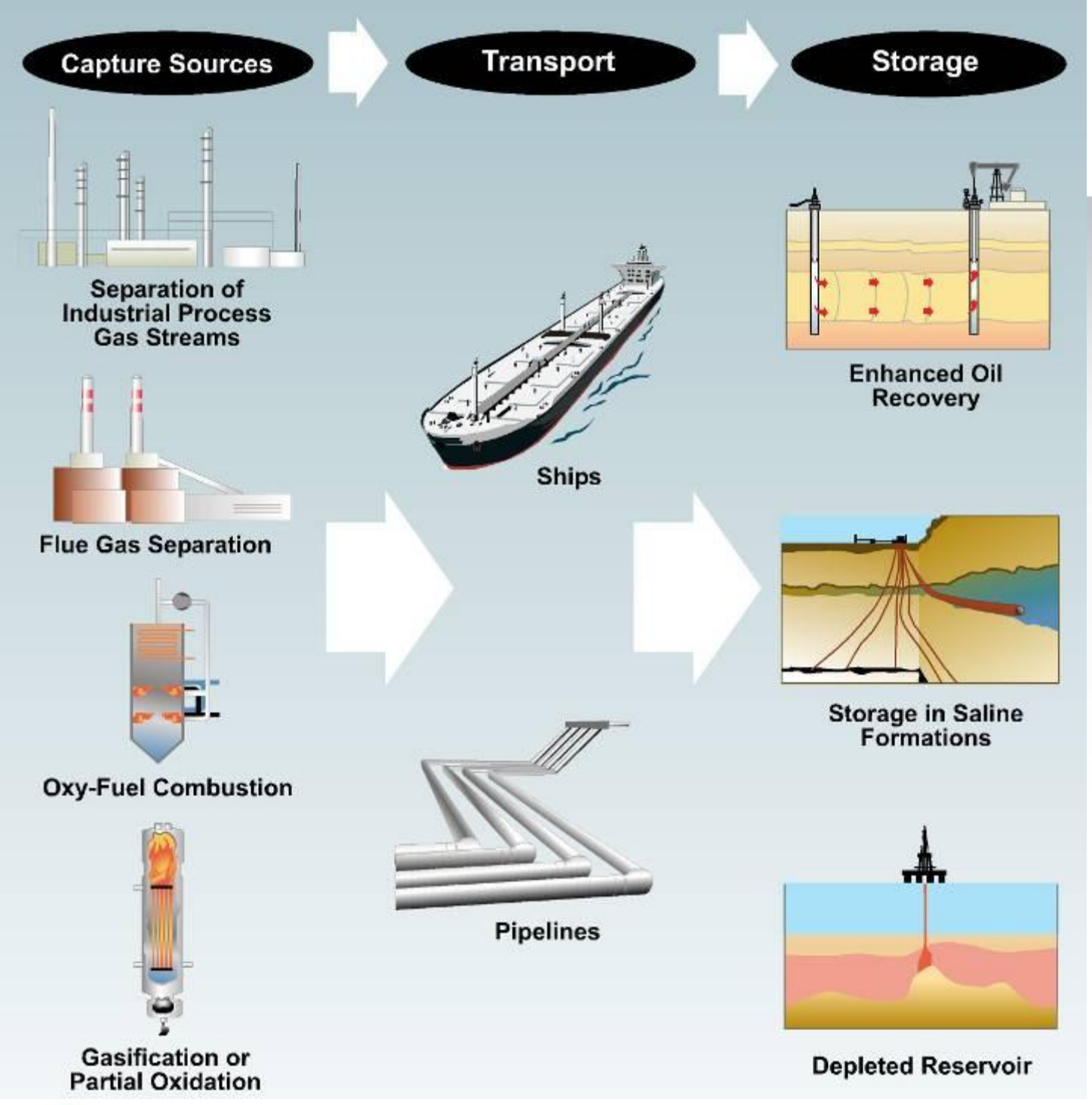


Capture

and secure Storage in a geological formation

Ocean storage is not covered by the guidelin



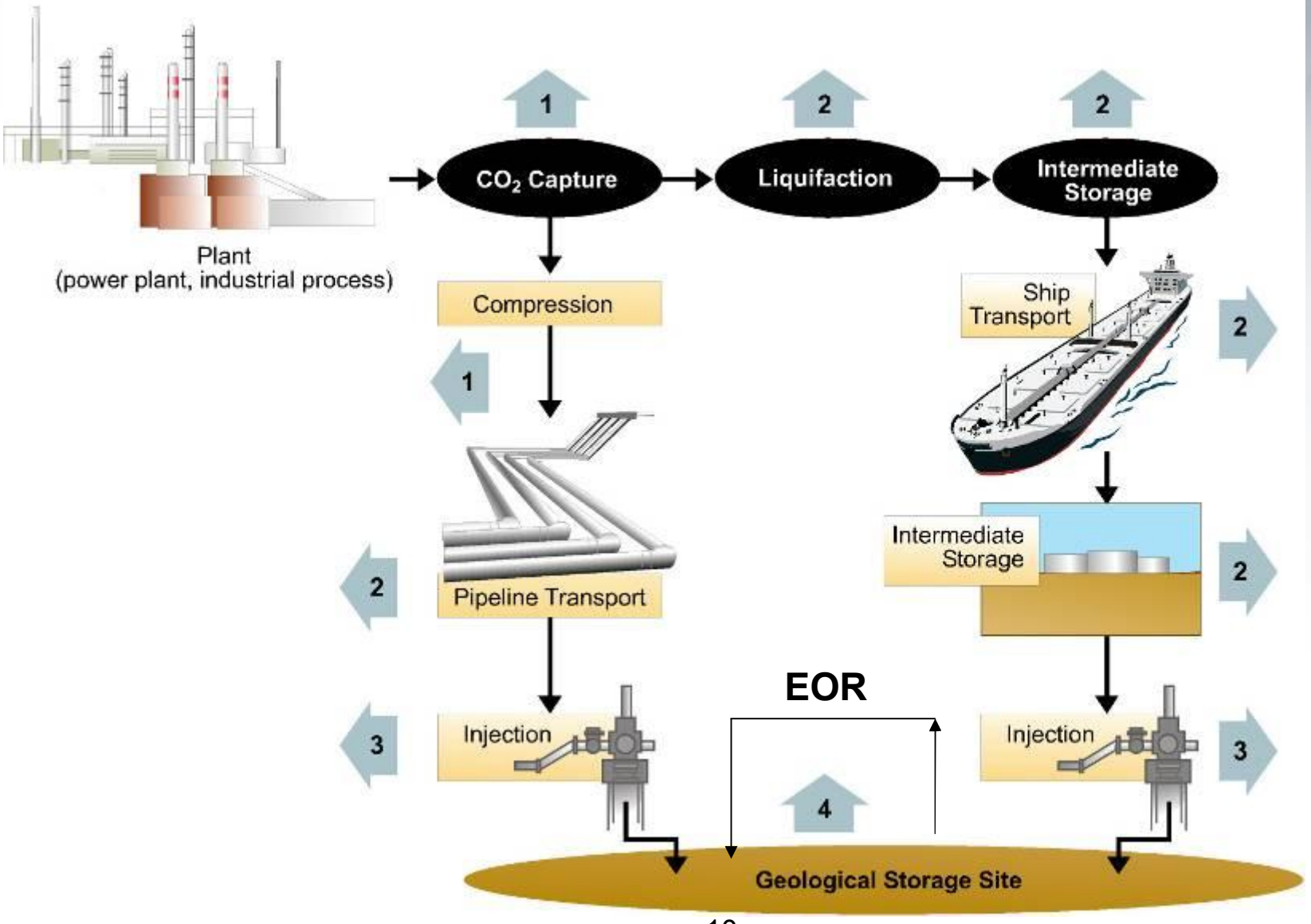


CCS Project Family Basis

Explicitly excludes ocean storage

Monitoring emission

Sources at the whole CCS chain



CCS Emission Reductions

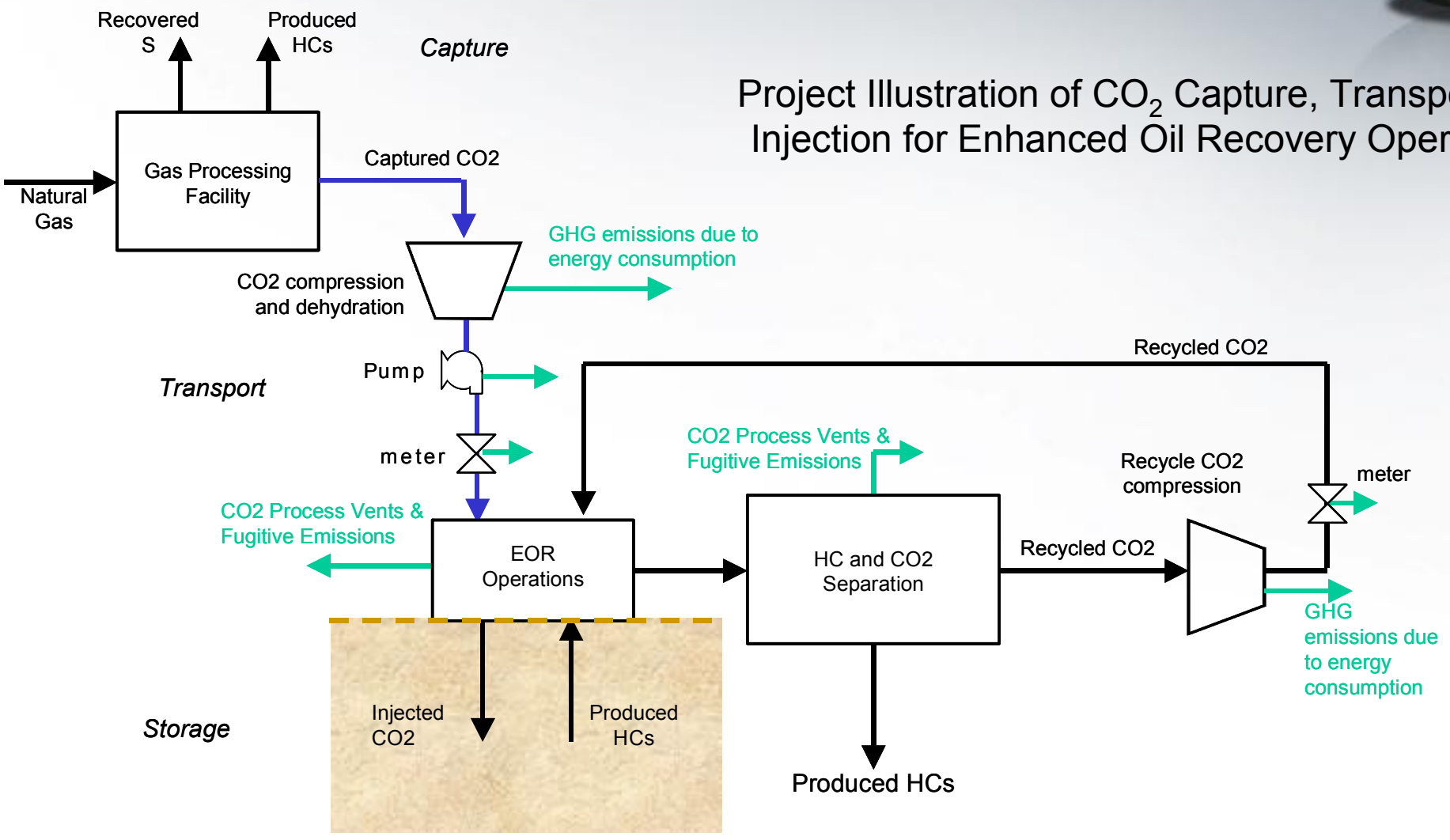
- **Monitor emissions sources along the whole CCS chain: capture, transport, injection and storage, site operations, seepage, and any CO_2 recycle operations when used for enhance oil recovery (EOR)**
  - Emissions from the end-use of oil or gas produced as a consequence of CO_2 storage (EOR or EGR) are not addressed
- **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 CO_2 removal
- **Reduction = Baseline emissions – Project emissions**

Determine Benchmarks (1)

Example Project Types	Potential Baseline Candidate(s)
Separation of CO_2 from natural gas to sales gas specifications or for producing LNG	• Vented to the atmosphere • *CO_2 captured and stored* or sold to the market
Separation of CO_2 from industrial process gas streams with storage	
Flue gas CO_2 separation with storage	• CO_2 from an existing flue gas stream (e.g., power plant exhaust gas) is vented to the atmosphere. • *CO_2 captured and stored* or sold to the market
Oxy-fuel combustion with storage of CO_2	
Hydrogen plant with storage	
Captured CO_2 is used for EOR, EGR or ECBM	• CO_2 is purchased from a naturally-occurring underground source • CO_2 uptake from EOR production wells vented to the atmosphere • EOR or EGR is achieved by injection of other gases or water.
Acid gas injection – CO_2 and H_2S are injected into the production reservoir and stored	• CO_2 is vented from AGR unit • *CO_2 captured and stored* or sold to the market

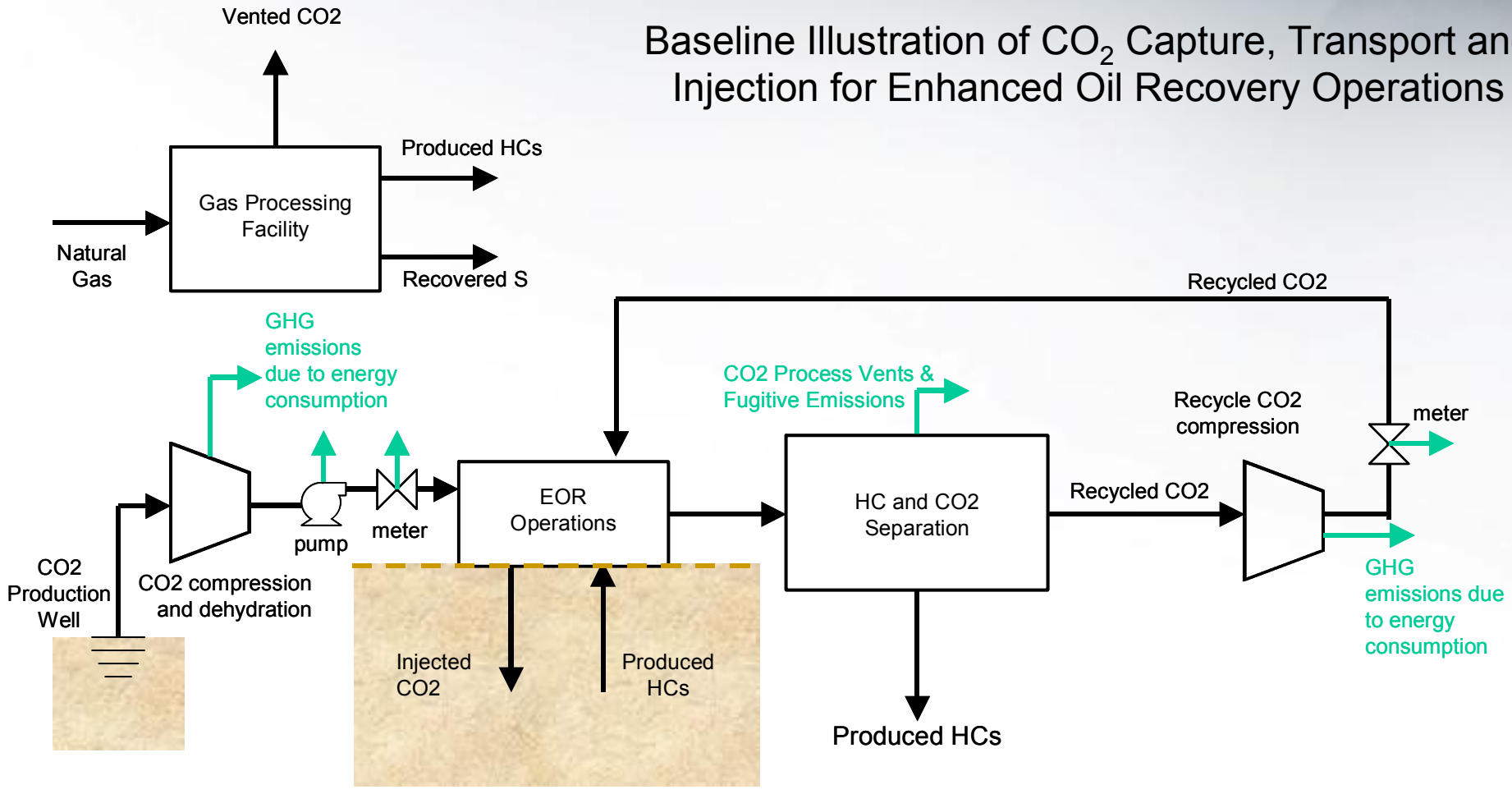
Example – CCS for Enhanced Oil Recovery

Project Illustration of CO_2 Capture, Transport and Injection for Enhanced Oil Recovery Operations

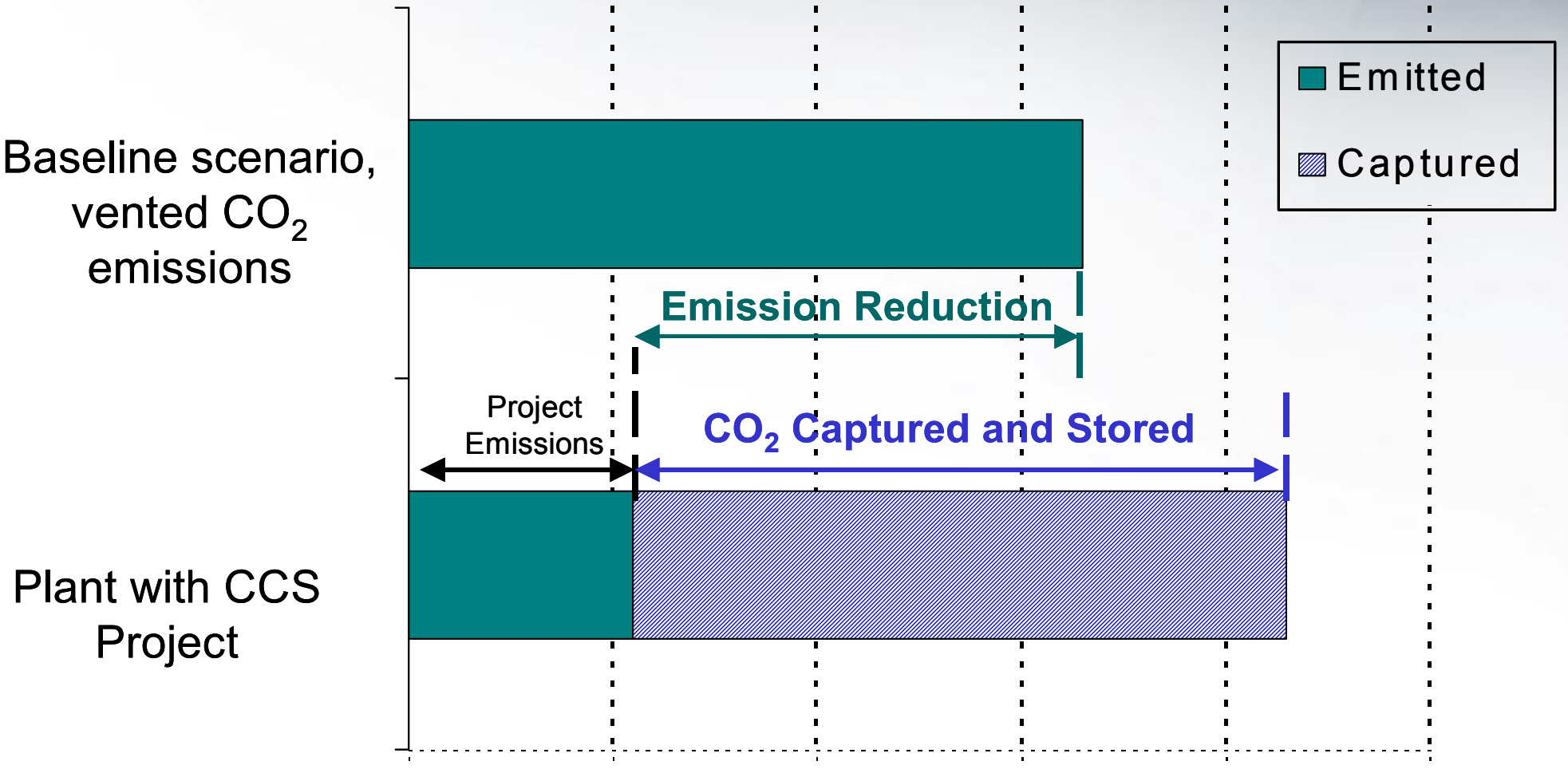


CCS for Enhanced Oil Recovery – baseline

Baseline Illustration of CO_2 Capture, Transport and Injection for Enhanced Oil Recovery Operations



CO_2 captured or injected vs. avoided or reduced



Potential Emission Sources

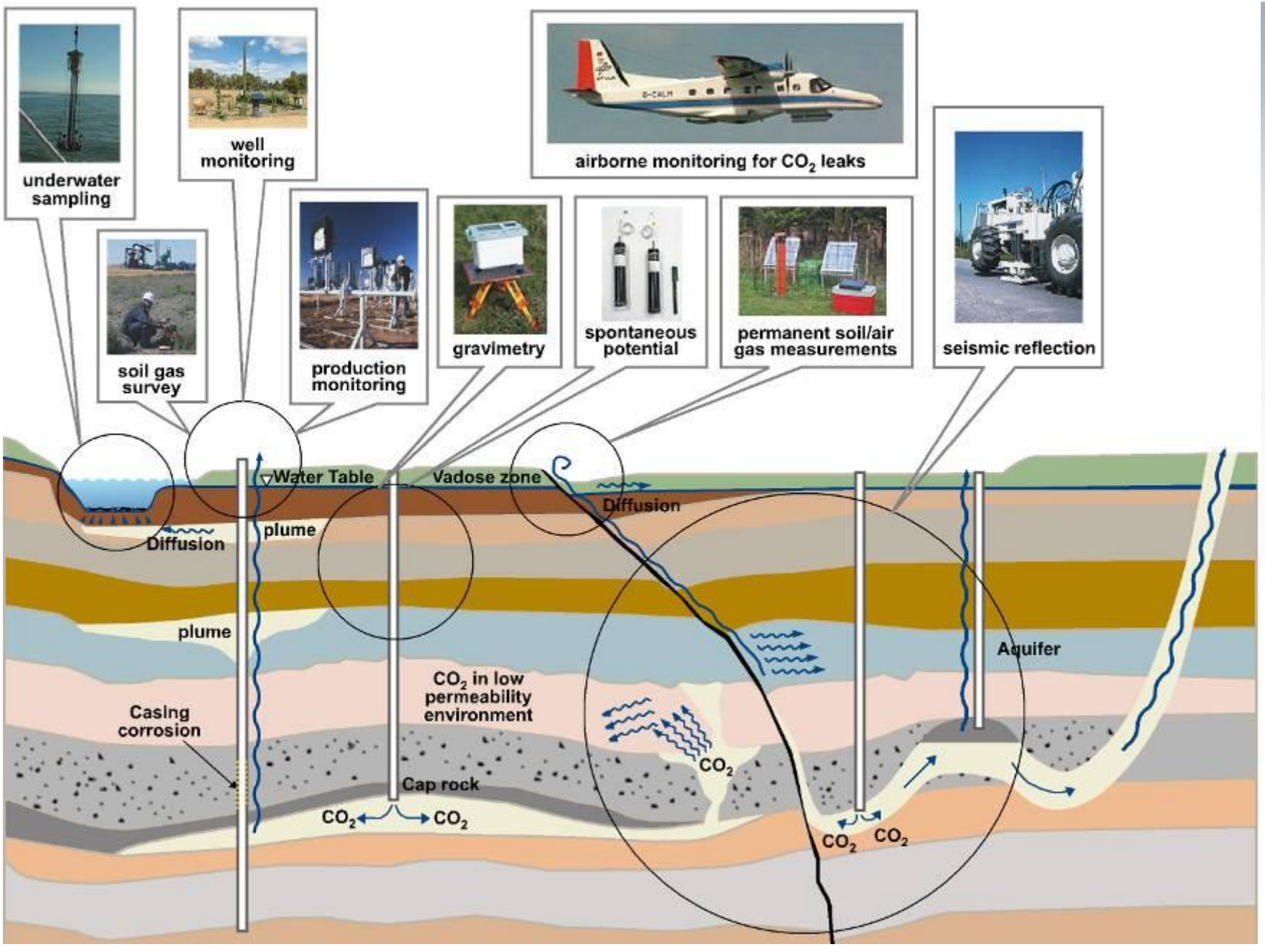
*Capture	Gas processing
	Fuel combustion
	Purchased electricity
	Fraction of CO2 (or CH4) not captured
	Use and disposal of CO2 removal agent
*Transport	Gas-fired compressor engines
	Purchased electricity
	Mobile source combustion
	Pressurized CO2 equipment leaks
	Maintenance or emergency releases
	Intermediate storage
	Loading/unloading
	Losses in transport

*Injection	Gas-fired compressor engines
	Purchased electricity
	Pressurized CO2 injection equipment
	Dehydration and other gas treatment equipment for recycled gas
	Production and injection wells
	Maintenance or emergency releases
Storage	Seepage from geological formations
	CO2 leakage from wells
	Uncaptured CO2 co-produced with oil or gas

•With appropriate site selection and good operational practice, emissions from storage sites are likely to be very small, and require site-specific monitoring systems to provide assurance of secure storage.

*Emissions from these sources can be estimated using methods from the API Compendium of GHG Emission Estimation Methodologies for the Oil and Gas Industry

Monitoring Techniques



Monitoring Considerations

- **Variety of methods available**
  - Many well established in the oil and gas sector
- **Must be tailored to site specific characteristics**
- **Monitoring should evolve with improving technologies and risk management**
- **Pre-operational evaluation is key to site selection**
  - Size and properties of the reservoir needed for initial risk assessment, monitoring plan, and risk management plan
  - Understanding of background emissions
- **Operational monitoring provides information for:**
  - Emission estimation
  - Modeling update, providing basis for confidence in longer-term predictions
  - Risk management

CCS Guidelines - Key Messages

- **Assessment of project emission reductions from a baseline should include the whole CCS chain**
  - Capture, transport, injection and storage
- **Reservoir monitoring is required to confirm secure storage**
- **Monitoring should be "fit for purpose"**
  - Based on site specific risk assessment
- **Existing oil industry experience and expertise provides basis and confidence in CCS**

Path Forward

- Continue CCS project family guidelines development parallel to finalizing general project guidelines
- Peer review Januar 2007
- Draft Final CCS Guidelines by 2Q07
- Final general project Guidelines by 1Q07