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Carbon Capture and Storage for Enhanced Oil Recovery in The UAE

by

**Sam Nader, Tarik Afachtal, (Masdar, Abu Dhabi),
Brian Fraser, Doug Macdonald (SNC-Lavalin Inc., Calgary, Canada)**

Project Mandate

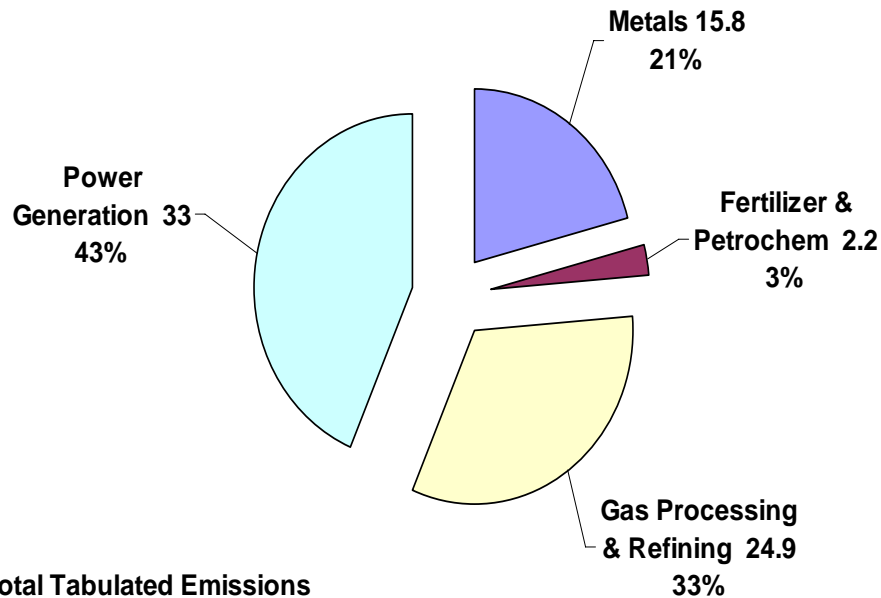
1. Emissions Data Collection and Review
2. CO2 Capture Technology Review
3. Project Technical Definitions and Cost Estimates
4. Short List of Projects
5. Economic Evaluations
6. CO2 Transportation
7. Project Selection and Ranking
8. Path Forward

Project Schedule

- Kickoff June 2007
- Interim project review 2007
- Final Report End January 2008

CO2 Inventory Results

Abu Dhabi and Nearby CO₂ Sources by Industrial Sector



**Total Tabulated Emissions
75.9 Million Tonnes perYear**

- 21 sites
- 240 point sources
- 76 MMT/A CO₂ Emissions, Present and Planned
- Mainly Flue Gas

Review of CO2 Capture Technologies

- Flue Gas Based (Most of Abu Dhabi Sources)
- Non Flue gas Based (gas processing, Steel industry gases)
 - Licensor information received
 - Fluor (Flue gas)
 - MHI (Flue Gas)
 - ABB (Flue Gas)
 - BASF (Gas Processing)
 - ExxonMobil (Gas Processing)
- Emerging Technology Licensors

Technical Definitions and Cost Estimates

- Assumptions
 - All Base Load
 - Mostly Flue gas Sources = Amine Capture
 - Mostly Retrofit into existing facilities
 - Nominal Size ~ 2 million Tonnes per year
- Project Definition
- Equipment Layouts
- Feedback from Emitters
- Conceptual Process Design
- Equipment Sizing
- Cost Estimating
- Ranking Using Approximate Unit Cost

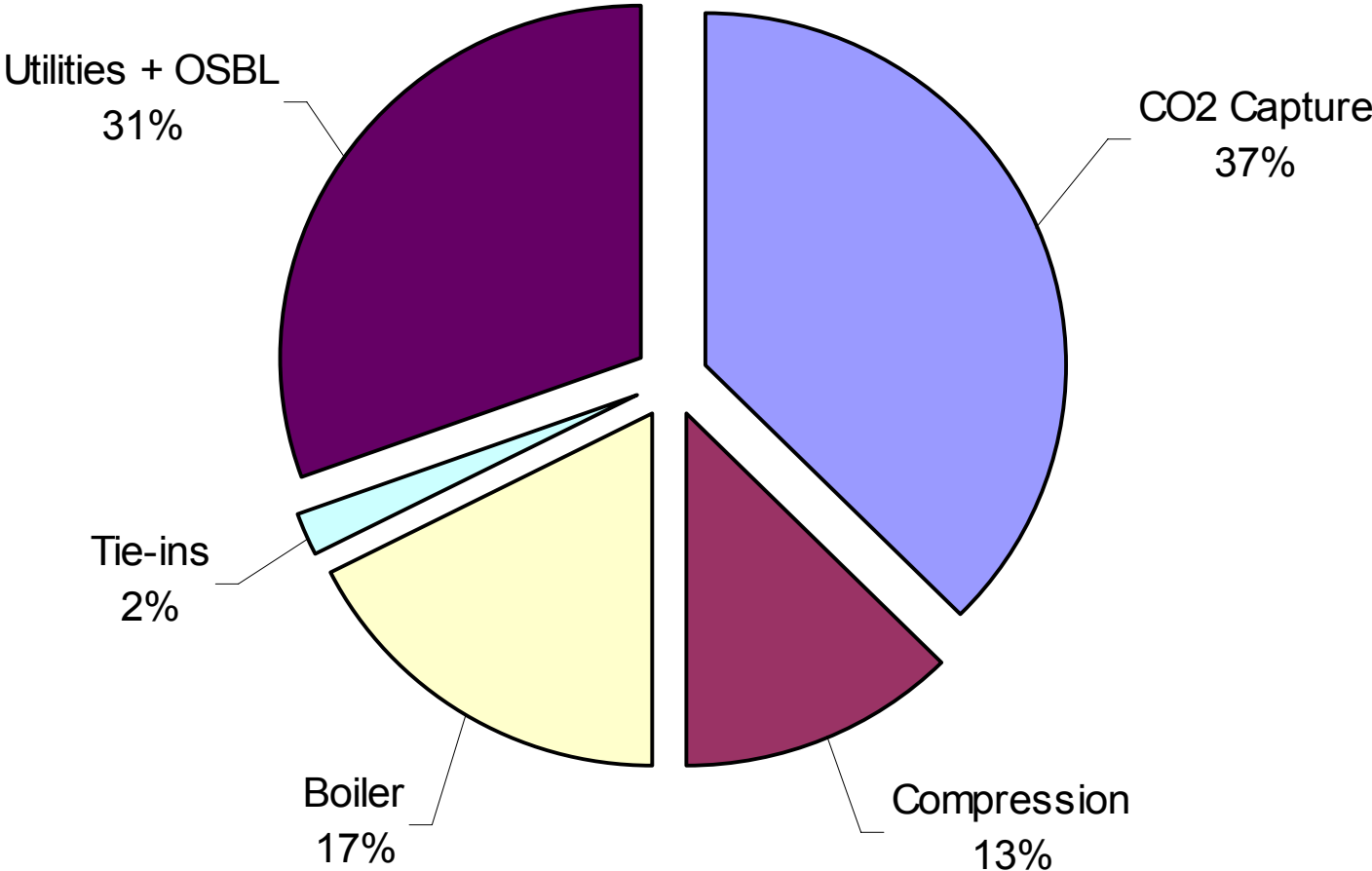
CO2 Transportation

- Overall Pipeline Network
- Design Basis
 - Single sink
 - Supercritical (Dense Phase) = 100 bar minimum
 - Dry!
 - 60°C max = Buried
 - Prebuild mainline pipe segments for second project

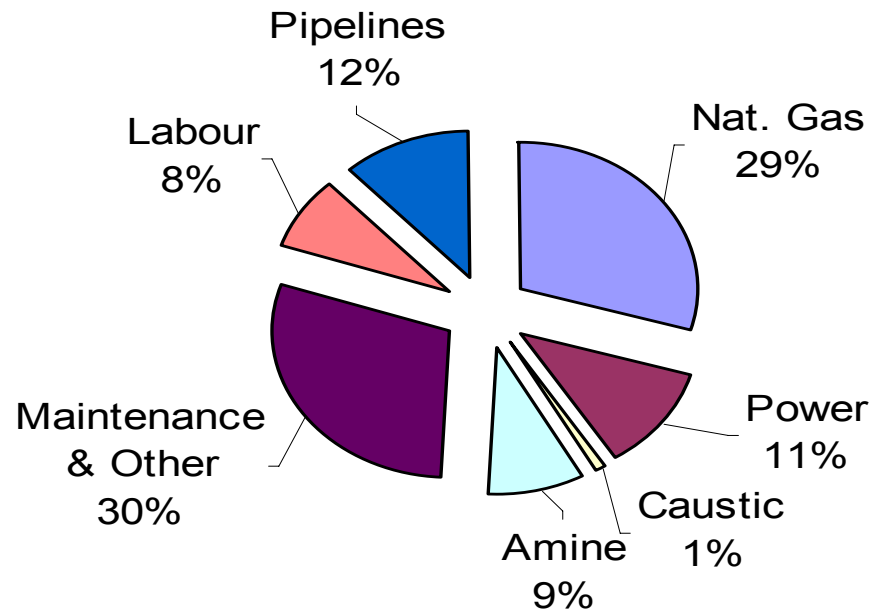
Desirable Characteristics of CO2 Sources

- High CO2 concentration
 - Favours
 - Non-Combustion Sources, Reformers, Boilers
 - Modern Gas Turbines with fired HRSG
 - Downgrades
 - Older or non – HRSG Gas turbines
- Cooling Water Availability
 - Hot Flue Gas Requires Quench
- Size of Point Sources
 - Economies of scale
 - Minimizes equipment duplication

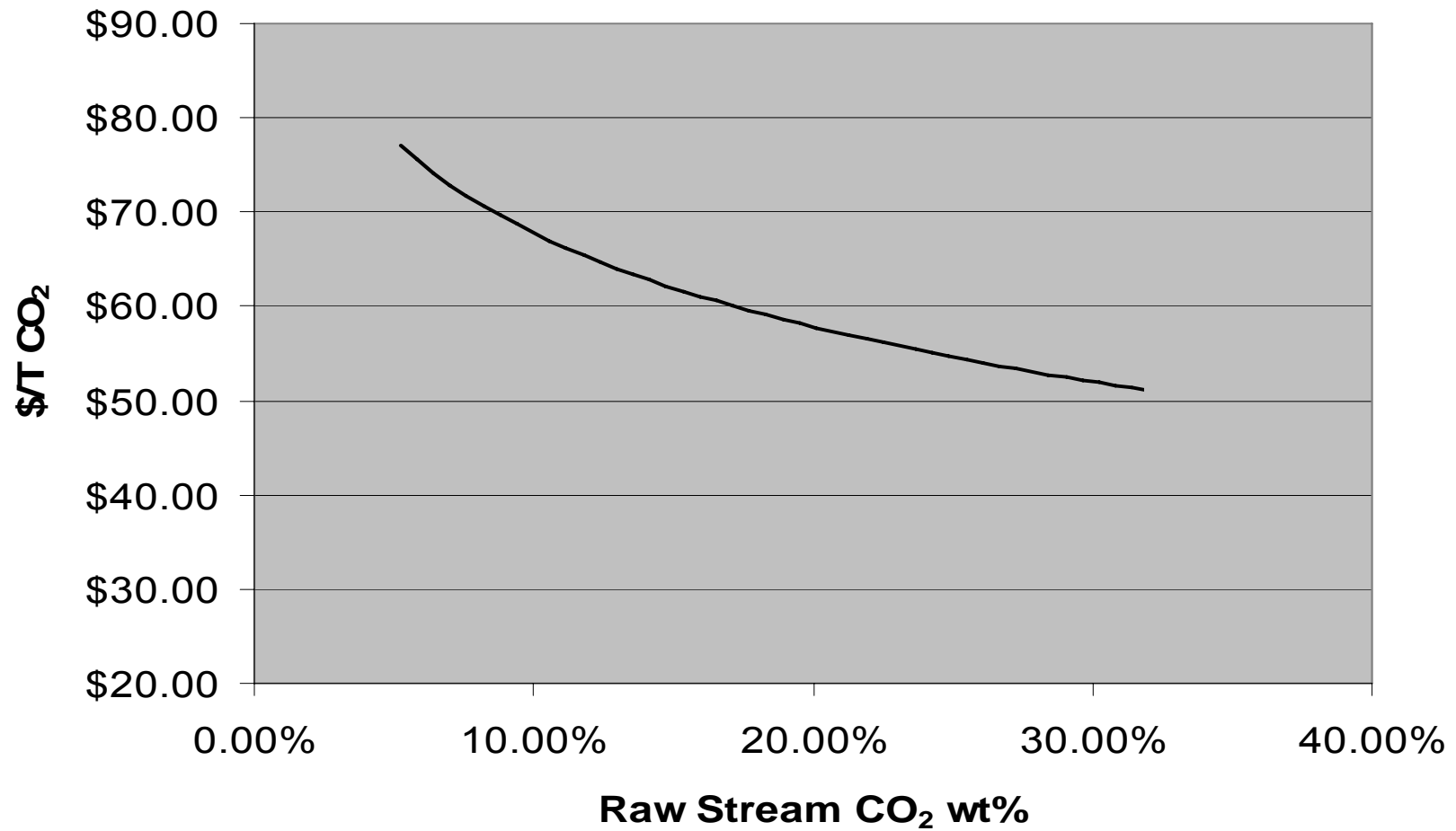
Selected Project Capital Cost Distribution



CCS Cash Operating Costs: Representative Project



Relationship of Source Stream CO₂ Concentration to Capture Cost



CCS: Abu Dhabi Vs. W. Europe / N. American Locations

- Large Oil reservoirs = Large Storage capacity
- Low Energy Costs
- Clean Sources
 - No particulates
 - No Sulphur
- Sources Close to Sinks

- Lower CO₂ Concentrations

The Future

- Research and Development for power and carbon capture technologies:
 - Existing
 - Emerging
- Operating Experience
- Design with CO₂ Capture in Mind
 - 10-20% savings in operating cost
 - Little improvement in Capital Costs

Path Forward

- 4-6 Projects in Abu Dhabi can be implemented relatively quickly
 - 6-8 million tonnes per year CO₂
 - Competitive CO₂ Costs
- Integrate CO₂ Capture in new plant design
- R&D Commitment

Thank You!