Developing Sour Gas Resources with Controlled Freeze Zone™ Technology

Dr. Charles (Chuck) Mart
Research Manager – Gas Technology
ExxonMobil Upstream Research Company
Houston, Texas, USA
Global Perspectives:
Outlook for Natural Gas Supply/Demand

- Natural gas expected to be the fastest growing fuel source for the next 20 years
- Demand growth expected in power generation sector because of lower emissions and greater efficiency with natural gas fired units
- Domestic and imported supplies will be needed to meet regional gas demands via pipeline and LNG deliveries
Global Perspectives:

**Challenges with Sour Natural Gas Resources**

- Provide clean-burning natural gas from increasingly sour gas resources
  - As much as 1/3 of global conventional resources have significant amounts of CO$_2$ and H$_2$S
  - Fields with CO$_2$ contents greater than 30% and H$_2$S content greater than 10% are encountered more frequently

- Management of contaminants
  - Increased focus on CO$_2$ removal and disposition
  - Alternatives to sulfur production
  - Geosequestration of CO$_2$

- Challenging economics for developing sour gas reserves
  - Smaller amounts of valuable hydrocarbon
  - Remote gas developments
**Controlled Freeze Zone™**

**Controlled Freeze Zone™ process**

- **Production wells**
- **Inlet dehydration and refrigeration**
  - Refrigerant lowers temperature to about -50°F
- **Feed gas**
- **CFZ section**
  - Conventional distillation
- **Injection wells**
  - Liquid CO₂ and H₂S
  - CO₂ and other gases sequestered and injected into dedicated wells

Gas from fields:
- Methane / CO₂ / H₂S

Methane to sales
Controlled Freeze Zone™: Technology Uses a Different Approach

Rather than avoiding solidification of CO₂, control it and confine it to specially designed section in distillation column.
CFZ™ Advantages: Capital Costs and Energy Efficiency

**Overall Costs**
- 10 - 27% lower overall capital costs
- 12 - 37% cost savings for treating

**Sales Revenue**
- 5 - 16% more energy efficient
- 4 - 8% greater sales

---

**Less Equipment**
**Lower Costs**

---

**Lower Emissions**
**More Gas Supply**
Controlled Freeze Zone™:
**History of Technology Development**

- Invented at Exxon Production Research Co. in 1983
  - Original patent granted in 1985
- Pilot plant operated in 1986
  - Proved CFZ™ concept for CO$_2$ removal
- Engineering studies and process improvements 1987+
  - Six additional patents
  - Nine pending patent applications
- Commercial Demonstration Plant operation to begin in 2010
  - Test wide range of compositions, with CO$_2$ and H$_2$S
  - Integrate with acid gas injection
  - Provide design basis for world-scale plant
Case Study: **Summary of CFZ™ Incentives**

- **Significant capital and operating expense savings**
  - Fewer processing steps and less equipment for all applications
  - Reduction or elimination of solvents and additives
  - Lower acid gas injection costs
    + High pressure separation
    + Liquid acid gas stream can be pumped for reinjection vs. costly compression
  - Provides alternative for sulfur plants
- **Higher efficiency provides more clean gas supply**
- **Environmental benefits**
  - Allows economic CO₂ injection for geosequestration or EOR