Sustainability and offshore oil and gas exploration and production

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Key topics

- Importance of sustainability to the oil and gas industry
- Importance of sustainability to environmental regulators
- Sustainability challenges facing the exploration and production industry
- Key responses to these challenges
- Future exploration and production sustainability challenges – methane hydrates
Sustainability

• How to produce energy so as to sustain over many generations our society, environment and the economy.

• Sustain: “to keep going”
  – Oxford English Dictionary
Sustainability Drivers

• Increased population
• Increased competition
• Civil strife
• Global climate change
• Stakeholder and shareholder expectations
Population Projections

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Importance of sustainability to the oil and gas E&P industry

• A way to live one’s values
• An approach to maximize environmental social and financial performance
• An approach to have multi-generational impact
• An approach to secure the “license to operate”
The importance of sustainability to environmental regulators

- Environmental performance has improved because responsibility and accountability is dispersed throughout the company
- The CEO, CFO, senior VP for corporate affairs, senior VP for environment health safety and sustainability all have a stake in sustainability
- Everyone in a corporation has a stake in sustainability
- Sustainability is the link between environmental and social impact: environmental justice
Challenges: exploration and production

Historic and present challenges:
• Flaring and venting
• Decommissioning of oil and gas installations
  – Brent spar oil storage tank disposal
• Management of drill cuttings
• Produced waters
• Drilling muds and fluids
• System for estimating and validating greenhouse gas emissions
• subsidence
• Spills
• Safety
• enhanced profitability
Sustainability E&P responses

- Venting and flaring: piping of gas to coastal facilities; use of gas as an on platform source of energy
- Use of solar and wind power generation on offshore production facilities
- Spill prevention
- Less harmful drilling muds and fluids
- Safety improvements
- New techniques to estimate and manage GHG emissions
Responses: the role of technology

• Identify and development discovered reserves less intrusively
• Faster elimination of non-prospective areas do more efficient basin modeling
• Better subsurface imaging and interpretation using gravity and 4-D seismic data thereby decreasing the number unsuccessful wells
• More efficient off take from smarter wells, requiring fewer wells per unit of production
• Less environmentally intrusive handling of drill cuttings
• Decreased venting and flaring

• --Dr. John H. Barwis, Shell UK exploration and production
Sustainability reporting

• Global reporting initiative
• United Nations environment programs oil sector report
• International Petroleum Industry Environmental Conservation Association and American Petroleum Institute joint corporate reporting project
performance measures

Present Measures
- Emissions to air
- Discharged water
- Waste
- Health and safety
- Social
- Resource management
- Economic
- regulatory sanctions
- Contractor performance
- Management systems – ISO 14001
performance measures

• Future measures
• Environmental impact of products
• Health impact of processes in products
• Access to sensitive areas
• Land-use and habitat restoration
• Climate change – GHG. trading
• Stakeholder consultation
• Strategic EHS risk management
Impact

• Marine Mammals
• Human Health Impact
• Climate Change
Future challenges-- methane gas hydrates
What are Gas Hydrates?

The heat from the flame melts the hydrate thus releasing more methane to fuel the flame.

Notice the water dripping from the person’s hands.
What Are Gas Hydrates?

- Crystalline Solids
- Clathrate Structure
  (gas molecules within water cages)

Photo source: http://woodshole.er.usgs.gov/project-pages/hydrates/
Pipeline Plugging

– preventing Gas Hydrate formation accounts for

  • 10-15% of the production costs
  • $1 Million per day for Methanol alone

www.spe.org/cda/images/hydrate.jpg
Examples of Natural Gas Hydrates

Blake Ridge

Hydrate Ridge

methane hydrate
bubbling from dissolving hydrate
Where Do Hydrates Form?

- In sediments below the ocean floor

Geologic Settings

Images:
Trehu et al., 2002
BSR
Seafloor
Distribution of organic carbon in Earth reservoirs (excluding dispersed carbon in rocks and sediments). Numbers in gigatons ($10^{15}$ tons) of carbon.

Data from USGS
CO2 Displaces Methane

Sketch of a Proposed Method to Sequester CO2 while Producing Methane and Possibly Electricity.
Backup Slides
An integrated approach

• Offshore oil and gas exploration production is part of an overall system:
  – E& P
  – Transportation
  – Storage
  – Refining
Challenges and responses: transportation, storage and refining

**Transportation**
- Double hulled tankers
- Movement to zinc based paints

**Storage**
- Segregation of water and ballasts of
- No discharge of ballast waters
- Minimize use of water tank cleaning

**Refining**
- Reduction of sulfur content in oil
- Use of heat exchangers to preheat feedstock in reformulation process
- Floating roof tanks to control benzene