Development of Markets

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Overview of associated gas flaring and venting

Associated gas monetization options

Market development requirements

Case studies
  • West African Gas Pipeline for power generation
  • CNG for urban clean fuels
  • Gas to chemicals

Investment climate

Conclusions
Associated gas – an energy source that is too valuable to be wasted

Large supply of low-cost natural gas gives the Middle East a substantial competitive advantage
Significant improvement has been achieved over the past 20 years

Potential opportunities for adding value to associated gas in order to develop its markets

This presentation will focus on gas-to-power, CNG as urban fuel and gas-to-chemical markets
Associated Gas

Monetization Options
Pipelines are the most mature and developed form of gas transportation.

Gas pipeline projects are highly capital intensive.

Generally pipelines are more economic than LNG below 2000 km.

Significant fixed cost component.

Economics are highly volume dependent (economies of scale).

Successful pipeline development requires:
- Sustainable market size
- Competitive pricing of gas
CNG - compressed natural gas

- Compressed gas – 100 to 170 bar & -17 to 5 deg C
- Being used as bus/taxi fuel in major cities but uses existing gas supplies
- Particularly attractive concept as gas can be loaded onto a vessel directly from the field or processing plant and delivered to off grid power plants and industrial users
- Low infrastructure costs - no need for specialized liquefaction or regasification terminals
- Logistics flexibility – can use barges, vessels or trucks
- More cost effective than LNG or pipelines for modest gas volumes (3 to 15 million Nm³/d)
- Would enable monetization of small stranded reserves (< 60 bcm)
- Scalability good – just add more vessels
Gas consumption for electricity generation is continuing to increase steadily.

- Combined Cycle Gas Turbines are increasingly the technology of choice for electricity generation.
- Capital and operating costs are lower than alternative fuels.
- Development flexibility.
- Environmentally friendly.
Market Development Requirements
Issues to be addressed in order to develop gas markets and promote their growth

- Economic incentives to support the investments needed in producing, capturing, transporting, and utilizing methane
- Policy, legal and regulatory framework
  - Property rights of methane
  - Tariffs
  - Multi-country collaboration and regional integration, if cross border
- Access to pipeline transportation
- Access to power grid
- Access to distribution channel of product value chain
Case Studies
WAGP – Associated Gas to Power
WAGP – a cross-border pipeline that transports associated gas from Nigeria to its three neighboring countries for power generation

The pipeline will be operational shortly
Gas-to-power chain involves government, international agencies, financial institutes, oil companies and power distributors, etc.

The complexity of the gas-to-power chain, and multiple cross-border agreements, required extensive negotiations.
WAGP’s tariff structure was tailored to ensure project success

- Sponsors early on tabled a scheme to:
  - Take market growth risk
  - But with a floor rate of return
  - All stakeholders benefit as pipeline fills
  - Foundation customers compensated for risk
  - Special tariff for industry

- Economic efficiency requirement added to judge Pipeline Development Plan options – Weighted Average Tariff

- Excess profits limited by tariff formula and pipeline capacity
Lessons learned from WAGP for gas-to-power market development

- Major success
  - USAID-funded technical assistance to the governments of Ghana, Benin, Togo and Nigeria resulted in over $600 million of private sector investment
  - The pipeline will take formerly flared or vented gas from Nigeria and transport it to Benin, Togo and Ghana for power generation, replacing heavy fuel oil
  - The use of flared/vented gas significantly reduces greenhouse gas emissions
  - The WAGP is expected to result in a reduction of greenhouse gas emissions of 100 million tons (CO₂ equivalent) over twenty years
  - Novel tariff model creates win-win environment for economic efficiency
  - Strong political support and regional integration
  - Strong vote of confidence by project sponsors, participants and World Bank
  - Will add stability to country power grids, supporting creation of a regional power market structure

*West Africa Gas Pipeline*
– delivering reliable energy supplies to West Africa
CNG for Urban Clean Fuels
Natural gas, including associated gas, was pipelined to Mumbai and New Delhi for use as CNG for transport and city gas.

Key Market Drivers

- Environmental
- Fuel substitution
- Energy security
- Energy conservation
- Job creation
Lessons learned from Mumbai and New Delhi market development for urban clean fuel

- Combination of judicial intervention, incentives and pricing is critical
- Advanced planning and co-ordination between various agencies is essential
- A firm plan for introduction of clean fuel should be laid down explicitly specifying the vehicle categories to be targeted
- Infrastructure at the gas supply level and vehicles and equipment should be in place
  - Adequate number of CNG stations should be in place ensuring proper spread and taking into account the vehicle mix and needs
  - Conversion kits, equipment, spares, etc. should be available
- Safety norms should be in place
- Strong inspection and maintenance regime should be in place
- Vehicle conversions should be undertaken by trained/approved workshops
- Availability of adequate CNG vehicles and CNG refuelling stations must be in place
Gas to Chemicals
Ammonia and other commodity chemicals are ideal for converting associated gas to high value market products.

- Final product is easier to transport to market
- Projected growth higher in Asia though still below GDP
- Large market size means around 4 new plants required per year
- 41 million tons per year of new capacity is expected to be required by 2020
- Indian production facilities have historically been based on naphtha as a feedstock but some are switching to gas
- Middle East investments will leverage low natural gas costs, integrated ammonia units and low delivered costs to Asia

**PROJECTED GLOBAL PRODUCTION BY REGION**
(2010, percent)

- Asia-Pacific: 45%
- Other: 30%
- Middle East: 9%
- W. Europe: 7%
- N. America: 9%
Urea made from ammonia can be easily shipped to consumer markets.

- Middle East and other gas rich regions in Latin America, Russia/Eastern Europe and Caribbean will provide surplus urea as exports to large Asian and North American deficits
  - China will continue as the world’s largest producing country though India is projected to be in deficit
  - Middle Eastern trade flows will target large volumes into India and smaller volumes into Pakistan and smaller South Asian markets
  - Latin American and Caribbean exports will go to North America
- Middle East will become the world’s urea supplier
Investment Climate
Good investment climate is essential in order to attract investors and to pay back infrastructure development cost for utilizing wasted gas.

- **Advantages of private sector participation**
  - Less capital constrained
  - Have right level of skills and experiences
  - More efficient and can implement projects faster

- **Regulatory framework for private sector participation**
  - Rules and regulations pertaining to safety, environment, land use, etc. must be in place
  - Fiscal incentives to reduce upfront cost
    - Tax concessions
    - Depreciation allowances
    - Advantageous pricing structure
    - Subsidized loans and/or other financing opportunities
  - Regulatory stability and sustainability
Potential private sector participation options

- BOTs (Build, Operate and Transfer)
- BOOTs (Build, Operate, Own and Transfer)
- Annuity scheme
- Special purpose vehicles
- Management contracts
Conclusions
There are multiple options for developing associating gas for local and world markets

Projects tend to be large and high capital, although some smaller options have been successful

Policy and regulatory framework are critical for successful market development

Economic incentives are often needed initially, but projects need to be economically viable to be sustainable

Government has to help create right investment climate to attract private sector participation