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The Infrastructure Challenge

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Paris: 13 – 15 December 2006

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Outline

- A bit of history
- Top gas flaring\venting countries
- Obstacles to flaring\venting reduction
- Infrastructure requirements & investment
- Access to infrastructure
- Addressing the Challenges
- Infrastructure development & Master Planning
- Conclusions

Gas Flaring Not A New Concern

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Some examples:

- 1963 Kuwait Oil Company criticized by members of Kuwait's first parliament for its gas flaring
- 1966 Algerian Government prohibits the flaring of gas
- 1969 Nigeria's Petroleum (Drilling & Production) Regulation
- 1975 Saudi Arabia launches the Master Gas System project to recover associated gas

Gas flaring - What has changed?

Not only a waste of a valuable national resource

but an acknowledged negative impact on the environment

Top Gas Flaring\Venting Countries (2005)

Sources: Cedigaz & Others

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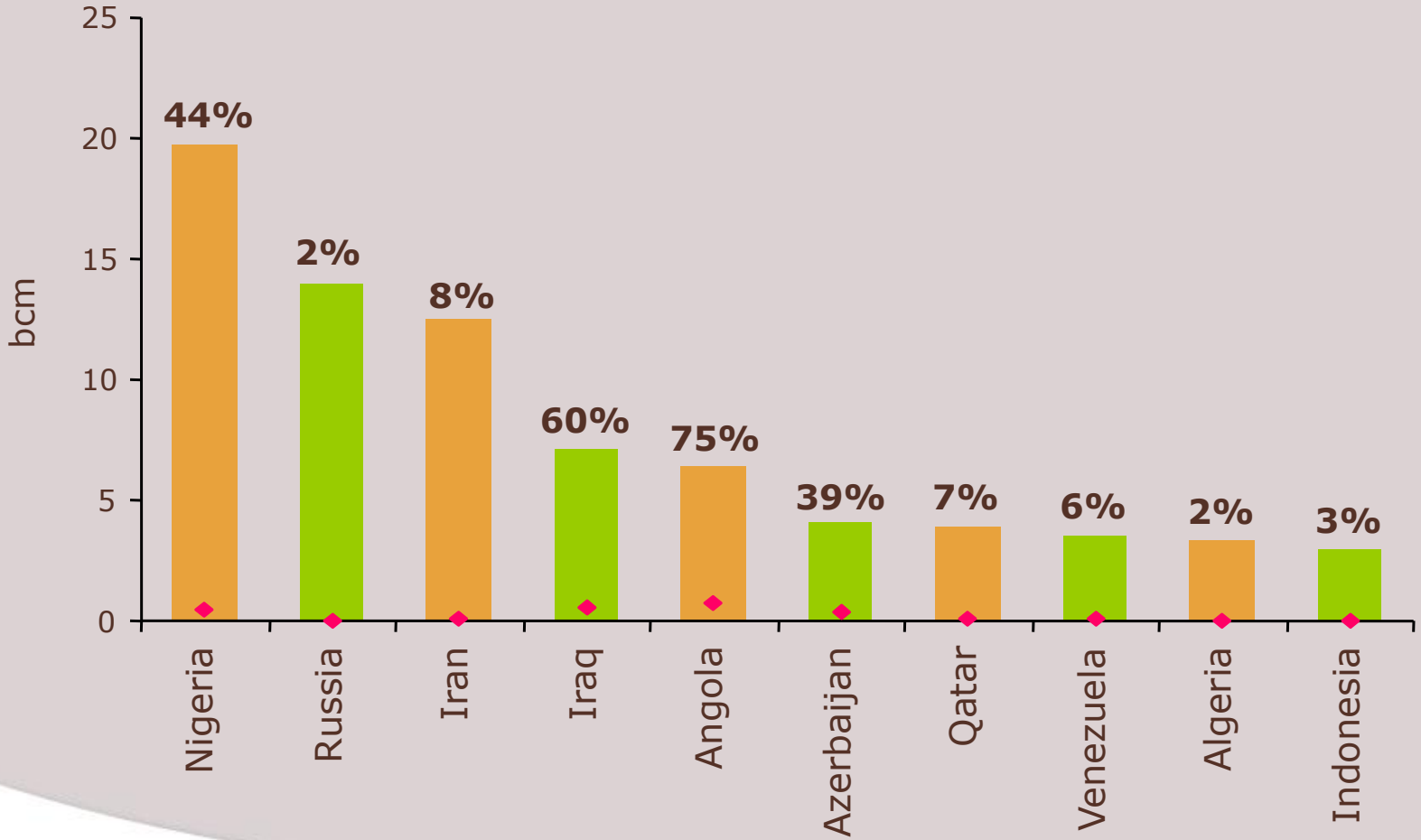
Gas Flared \ Vented in bcm & as % of Gross Gas Production



Top Gas Flaring\Venting Countries (2005)

Sources: Cedigaz & Others

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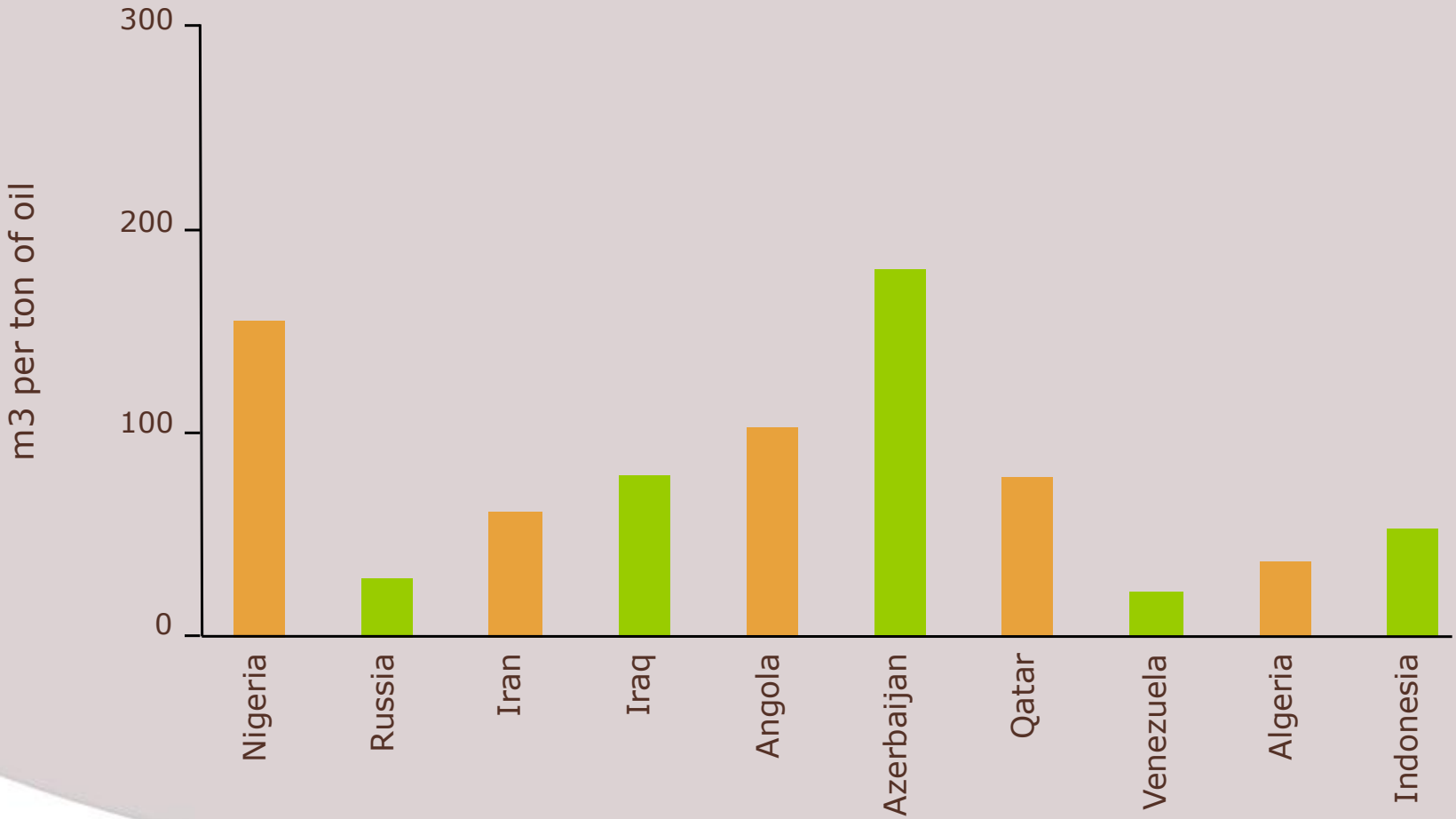
Cubic Meters of Gas Flared \ Vented per Ton of Oil Produced



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Obstacles to gas flaring reduction and elimination vary

- Operational
- Hydrocarbon monetization priorities
- Commercial viability
  - production profile & volumes of gas flared
  - contractual & regulatory framework
  - infrastructure constraints
  - absence of viable markets

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But real obstacle

When associated gas flaring/recovery is not addressed at right level

- A lack of medium to long-term policy / strategy to recover & monetize associated gas and NGLs
- In some cases volumes of associated gas flared not properly estimated
- Correct composition of flared gas not always known
- No coordinated efforts among different stakeholders
- Associated gas recovery efforts → Just a series of ad hoc measures
- Penalizing measures – Is it really the best way to address the problem?

Infrastructure Requirements

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Pipeline systems
Processing
NGL recovery
Compression

Transmission

Downstream Infrastructure

Infrastructure Investment (cont'd)

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Infrastructure development constraints vary
Rich producers with developed industry and dominating NOCs → better position to address the constraints and have done so
Small or moderate hydrocarbon producers in low income and under-developed regions of the world → find it more difficult to address the challenges
Some oil & gas producers with established large NOCs or state-controlled hydrocarbon companies → continue to face constraints, but on-going efforts to introduce changes

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Viability of infrastructure investment

- Less challenging if associated gas can be re-injected
- Otherwise, will depend on:
  - Location
  - Size
  - Markets

However, even if on paper investment shown to yield high return

Does not necessarily mean that infrastructure will be built

Flaring continues!

Infrastructure Investment (cont'd)

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Who is supposed to invest?

NOC, IOCs or both

Investment drivers/constraints

- National strategy for associated gas recovery and utilization
- Corporate strategy & objectives
- Contractual framework for the use of the recovered gas
- Access to existing infrastructure & regulatory issues

Access to Infrastructure

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Ownership
NOC
IOC
JV

Capacity
Reflecting "narrowly" defined objectives
Excess capacity not available when needed if access allowed

Access mechanism
No access or poorly defined mechanism
Technical constraints (e.g. gas quality)
Commercial constraints (3rd party access conditions, tariff, fee)

Addressing the Challenges

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Removal of barriers is fundamental

- Access to existing and expanded infrastructure
- Development of new infrastructure (beyond project focus)
- Capturing aggregation benefit
- Identifying mutual benefits (NOC & IOCs)

Do not underestimate barriers!

Addressing the Challenges (cont'd)

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Gas flaring issue must be acknowledged at highest level of policy decision making process

- Consultations with all stakeholders
- Favorable regulatory & fiscal framework: incentives & penalties
- Enforcement of regulations \ policies ("empowerment" & champions)
- Contracts reflecting policy objectives

Infrastructure Development & Master Planning

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Need to design or adjust national gas strategy

- Consistent with overall energy & environmental strategies
- Master Plan for utilization of non associated & associated gas
- Should avoid unrealistic theoretical planning exercises
- Should be based on an integrated approach
- Design of Gas Master Plan (GMP) should involve all relevant stakeholders (state, private, local & foreign)

Infrastructure Development & Master Planning (cont'd)

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Focus on gas flaring & infrastructure parts of GMP

- Conduct gas flaring inventory – develop a database
- Carefully assess options to monetize associated gas
- Carefully assess need for additional/new infrastructure
- Adopt concept of centralized infrastructure where applicable ("Sharing" concept)
- Define guidelines for funding infrastructure development ("Who pays for what")
- Outline guidelines for infrastructure access

Key building block of Integrated GMP

Conclusions

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- Infrastructure development challenges vary
- Absence of adequate policy/strategy to address issue of associated gas flaring & recovery
- Assessment of viability of infrastructure investment can't be limited to project – but must benefit all parties
- Removal of barriers extremely important, but should be focused and adequately sequenced
- Infrastructure development & use must reflect an integrated planning approach (Gas Master Plan) covering both non-associated and associated gas