Regulation and Incentives for Investment in the Colombian Gas Transport Network: Conclusions

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Terms of Reference

Market Analysis Ltd & Brattle Group commissioned by the CREG to conduct a economic study to:

1. Analyze the gas transport market and the regulatory framework in Colombia.
2. Take international experience, industry and government views into account.

Specifically to consider:

1. The price incentives needed to ensure that investments in gas transport infrastructure are made in a timely and efficient manner;
2. The appropriateness of adopting measures to reduce the risk of stranded assets; and
3. The appropriateness of revising the current controls on vertical integration in the gas industry.

Upstream Gas Supply

90% of Colombia's gas supply comes from two main fields:

- Guajira has about ½ of Colombia's reserves, and 58.6% of production
- jointly operated by Ecopetrol and Chevron Texaco
- average production in 2009 was 640 GBTUD
- sold at a regulated price of $2.76 per MBTU (US) and shipped to interior, Atlantic/Caribbean coast, and to Venezuela
- Cusiana has about ½ of Colombian reserves and 28.4% of production
- operated by Ecopetrol, BP, and Total and produces approx. 220 GBTUD
- other minor fields produce around 80 GBTUDs
- gas from other fields is unregulated
- auctions for 32,821 MBTUD of long-term, firm contracts held in December 2009 for Cusiana field, resulting in a price of $6.14 (US) per MBTU

Upstream Gas Supply ...

Upstream gas production is thus highly concentrated:

- Herfindahl-Hirschman Index (HHI) for gas supply is 4357 (above 1,800 considered “highly concentrated” by US DOJ)
- concentration will increase when Ecopetrol acquires complete control over the Cusiana field in 2016.

Table 1. Gas supply by company in January 2008

Company	GBTUD	Share
Ecopetrol	518	62%
Chevron	185	22%
BP	53	6%
Total	33	4%
Pacific Rubiales	27	3%
Others	25	3%
TOTAL	841	100%

The Gas Transport Network

Two large Transportation System Operators (TSOs) in Colombia:

- Promigas on the Atlantic/Caribbean coast (590 kms) with capacity of 540 GBTUD
- TGI in the inland part of the country with two interconnected pipelines systems
- Ballena - Barrancabermeja pipeline (580 kms) with capacity of 190 GBTUD
- Cusiana - Bogotá – Vasconia - Cali - Neiva pipeline (1700 kms) with capacity of 220 GBTUD
- Smaller TSOs deliver gas from the TGI system to local markets (e.g. Medellín and Bucaramanga)
- TGI purchased its pipeline network from EcoGas in an auction in 2007 for $1.4 billion (US)
- The other pipeline networks have been developed under private ownership.

Gas Transport Network

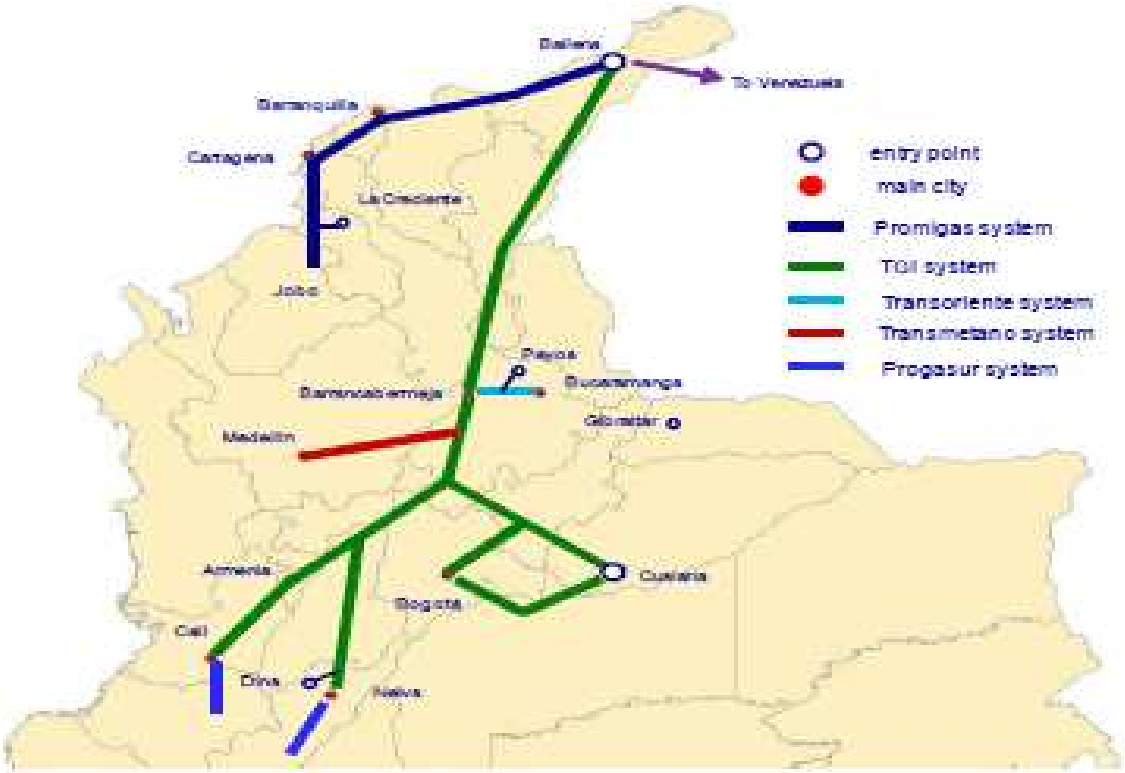

Figure 1: Colombian pipeline system

Regulatory Background

- CREG applies five-year price-caps to gas transport pipelines in Colombia
- Calculates average-cost based capacity and commodity charges for pipeline segments from investment costs, using WACCs and 20 year demand forecasts
- Split between capacity and commodity charges is negotiated between TSOs and pipeline users, and subject to arbitration
- Fixed charges to remunerate AOM costs are applied
- Regulated charges are reviewed at five-year intervals, and are for firm capacity only; prices for interruptible contracts are unregulated
- A utilisation factor (UF) is applied to determine if a pipeline segment is “used and useful”
- If expected 20-year utilization falls below 50%, the TSO's regulated charges are based on the costs of a pipeline with a 50% utilization factor
- The UFadjustment has rarely been applied since 2000

Regulatory Background ...

New investments in the network are made by private companies, with no direct CREG oversight:

Remuneration of new investments occurs either:

i. Via inclusion in the “New Investments Program” - the CREG reviews the investment to establish the “Baseline Investment”; or

ii. The TSO may choose to:

- apply the current regulated charges for the system in which the investment is made, where the incremental average cost of the investment is less than or equal to the average approved cost for the corresponding pipeline system; or
- request independent regulated charges to remunerate the investment, in cases where incremental average cost is higher than the regulated/approved cost for the corresponding stretch of pipeline.

Vertical Integration Rules

(1) Gas producers may not own more than 25% of gas transport or distribution companies.

(2) Gas transporters (TSOs) may not own more than 25% of gas production companies or distribution companies.

(3) Gas distributors may not own more than 25% of gas transport companies.

(4) Gas distributors and retailers *must* be integrated the for purposes of selling to the regulated market (below 0.1 GBTUD).

- Companies created prior to 1994 are exempt from these vertical integration rules. Particularly effects the activities of Promigas and Progasur.
- Distributors must provide third-party access for shippers selling to non-regulated market.

The Recent El Niño Controversies

Controversy concerns TGI system only. Promigas and Progasur systems have not been affected. Current capacity on the TGI system is 450 GBTUDs:

Ballena – Barrancabermeja	190 GBTUD
Cusiana – Bogota – Neiva	220 GBTUD
Other	40 GBTUD
Total	**450 GBTUD**

- Demand in normal times is 363 GBTUDs, so there is spare capacity of 87 GBTUDs
- During El Niños, gas-fired power plants demand an extra 177 GBTUDs, so there is excess demand of 90 GBTUDs
- Gas-fired power plants demand up to 93% of the Ballena – Barrancabermeja pipeline, and 45% of system capacity
- They sign firm contracts to reserve this capacity and re-sell in the interruptible market
- During El Niño periods supply is interrupted for a proportion of demand

Current Problems

I. Gas-fired power plants contracted for 182 GBTUDs of gas via Ecopetrol which contracted for only 145 GBTUDs of transport capacity. This reduced demand for TGI's capacity below what it would otherwise have been.

II. Ecopetrol's contract contained weak incentives to avoid breach, hence the power plants did not receive all of their contracted gas supply.

III. Consumers with interruptible contracts – taxis and some industrial plant – protested to the government when their gas supplies were interrupted.

IV. The Ministry of Mines intervened in the market to rearrange who received gas supplies independently of their contractual positions.

V. Has led to claims that investment in the pipeline network has been insufficient due to the CREG regulatory regime.

VI. There have also been claims of problems obtaining firm gas supply contracts from EcoPetrol, making consumers less willing to sign firm transport contracts:

- GasNatural has signed firm capacity contracts with TGI but without any firm gas supply contracts
- Gecelca has firm contracts with Promigas until 2016 but has insufficient gas supply contracts

Has There Been Too Little Investment?

Demand for firm capacity contracts on the B-B line was less than total capacity:

- Ecopetrol contracted for 145 GBTUDs and others contracted for approx. 44 GBTUDs
- GasNatural and industrials apparently chose cheaper, interruptible contracts
- Hence the TGI did not see a demand to expand capacity in the B-B pipeline
- Should the TGI have invested despite lack of firm demand?

In 2009 the TGI began an $570 million investment program to:

- Increase capacity on the B-B line to 260 GBTUDs and capacity on the C-B line to more than 390 GBTUDs (by 35% and 75% respectively)
- GasNatural and others requested long-term firm capacity contracts with a high proportion of capacity charges
- Gas-fired power plants have reduced their firm capacity commitments from 2012 to less than 60 GBTUDs

Hence once firm demand appeared, investments were made.

Capacity Investment

Should pipeline capacity be expanded to meet peak demand?

- In UK, interruptions occur for some users in very cold weather conditions (e.g. January 2010) – not unique to Colombia
- Gas-fired power stations need to contract for a high proportion of TGI capacity, but they rarely use it - they resell the capacity on the interruptibles market
- Interruptible contracts are efficient for users with alternative sources of fuel (e.g. some UK hospitals and industrial plant; taxis in Colombia)

If pipeline capacity is expanded to meet peak demands:

- The average regulated charges to all users will increase
- There may be little or no demand for interruptible contracts
- Hence the costs of the gas-fired plant will increase, possibly dramatically
- Could make them uneconomic in the electricity reliability market

Expanding the network efficiently is a complex economic issue, and depends on preferences for firm versus interruptible contracts. Best determined by market participants' contracting behavior.

Conclusions on Current Problems

The TSOs in Colombia are making substantial investments in new capacity.

But particular issues have arisen:

- Gas-fired power plants have not contracted for the required amounts of firm transport capacity
- Companies have regretted signing cheaper, interruptible contracts and appealed for government intervention
- Gas producers may be withholding firm gas supply contracts from the market to exploit their market power in supply, making consumers unwilling to contract for firm pipeline capacity
- Taxi fares are regulated in a manner which does not allow fares to rise when taxis use more expensive fuel

Thus the issues are largely upstream and downstream, and not with transport or regulatory system.

Issues with Current Regulations

- Most market participants have not requested large-scale changes to the regulatory regime
- Some strongly oppose abrupt changes in a regime in which they are already making large, risky investments (e.g. Progasur)
- There have been proposals to adopt a “reliability charge” & “common carriage” or “centralized planning” regime for gas networks similar to the electricity system (e.g. Poyry Energy Consulting for the ANH)

Numerous proposals for more detailed changes have been made:

- Commodity/capacity charges may not remunerate TSOs' investment costs as intended, esp. for gas-fired power plant
- Utilization Factor should be changed to reduce the risk of stranded investments
- Commodity charges, average cost prices and other features of the current regime may not be providing adequate location and investment signals
- More transparent and open procedures for allocating firm pipeline contracts
- Relaxation of some vertical integration rules to streamline coordination of new gas field and pipeline developments; and to allow distribution companies to undertake secondary pipeline construction and operation

Reliability Charges

Should there be a reliability charge for gas pipelines?

- Idea is to ensure that even rarely used pipelines are fully remunerated by regulated charges
- Requires the regulator to establish the level of “reliability” needed, i.e. the overall level of investment in pipeline capacity

But:

- The pipeline networks already receive reliability charges indirectly via the gas-fired generators
- In TGI system this pays for up for 45% of total capacity, and up to 76% of the B-B line
- No current evidence of capacity shortage in the TGI or Promigas systems
- Large investments in new capacity are under way

Hence no strong arguments for a gas pipeline reliability charge.

Common Carriage, ROR, and Centralized Planning of Investments

Proposals for "common carriage" or "total revenue" type regulation also seem to have little merit.

I. No real evidence of underinvestment under the current price cap regime.

II. Decentralized decision-making is likely preferable to centralized oversight by the CREG of pipeline investment decisions.

III. As Brattle Group report shows, European regulators increasingly rely on market mechanisms to provide signals for new infrastructure investments:

- in the UK, auctions have been used since 2002 to elicit demand for, and ensure financing of, new capacity investments
- the EC allows for "merchant investments" in new pipeline infrastructure to be exempt from regulated tariffs (e.g. Nabucco, Poseiden developments)
- "open seasons", i.e. competitive processes, increasingly being used to decide on infrastructure investments
- some examples from US infrastructure regulation also

Commodity & Capacity Charges

Issues:

- Commodity/capacity charges are calculated on basis of average load factor
- Users with higher load factors prefer capacity charges, and users with lower load factors prefer commodity charges
- Can result in under recovery of investment costs, if preferences respected
- Crucial issue for gas-fired power plant, which typically obtain a 50/50 split, hence obtain capacity contracts“cheaply”
- Users with different load factors pay different prices for exactly the same firm capacity rights

Solutions:

- Capacity charges only for firm capacity rights and use commodity charges to reflect variable costs of gas transmission
- Base commodity/capacity charge split on individual load factors
- Recommend the CREG consider a new approach to this issue

Utilization Factor I

Utilization Factor (UF) - an efficiency criterion determining the amount of capacity investment to be remunerated by the regulated charges.

- Calculated using expected demand volumes for twenty years, and re- evaluated each five years
- For pipelines with a UF above 50%, entire investment cost will be recovered in expectation
- For pipelines with lower UF's, demand forecasts are adjusted upwards
- Hence the regulated charges are set "as if" the pipeline will achieve a 50% utilization factor, and total costs not remunerated

TSOs have suggested abolishing UF, or changing how it is applied by:

  - using a measure of overall capacity, rather than volume, demand
  - applying it to new investments when they are made, and not re-evaluated at five-year intervals

Utilization Factor II

Similar efficiency criteria are used by utility and network regulators around the world:

- Mobile termination charges in Europe are set for a "*hypothetical efficient network operator".* Networks' actual historic costs are not used
- EC's regulation on access to gas transmission networks has a similar approach: tariffs should be calculated using concept of "*efficient and structurally comparable network operator"*
- In UK, Ofgem allows cost recovery on NGC's capacity investments only if 50% of NPV is "presold" in long-run capacity auctions
- Ofgem has disallowed recovery of investments (£17 million in 2007 price control) when this criterion is not met
- In USA, some regulators also apply a 50% rule, whereby the pipeline must have sold 50% of the capacity in advance before it is included in rate base
- "used-and-useful" test has long been applied in US for energy infrastructure: can prevent recoupment of the costs of assets which are no longer competitive, even if they were "prudent" when incurred

Hence UF is in mainstream of international best practice.

Utilization Factor III

Proposals from TSOs:

i. **Abolish UF?** Would transfer risk to consumers and could lead to inefficient investment. Not supported by international experience.

ii. **Use capacity demand to calculate UF?**

- using volume demand can penalize a TSO even if capacity is fully booked
- e.g a gas-fired power plant might purchase a pipeline's capacity but rarely use it, leading to a low UF – but the pipeline is efficient
- CREG should consider using a capacity demand measure

i. **Apply the test only once at beginning of asset lifetime, and do not re-evaluate?**

- this would be more like Ofgem approach to gas investments in UK
- but less like Ofcom approach to telecom's regulation
- both approaches seem reasonable
- since the UF is not applied symmetrically, i.e. does not reward pipelines with higher revenues for achieving utilization factors above 50%, CREG should consider TSOs' proposal

Usage, Location & Investment Signals I

1. The CREG repays historic investment costs over 20 years and sets later charges using forward looking costs.

- this may overcompensate investment and result in too high average charges
- European regulators' group recommends using 40-60 years for pipeline assets, and setting constant regulated charge in real terms
- in any case, the two different price caps applied by the CREG can’t *both* give correct cost and location signals to pipeline users

2. The commodity charges don't repay investments for demand with low load factors.

- gas-fired power plants may be purchasing firm capacity rights too cheaply
- different users paying the same capacity/commodity charges pay different amounts for the same firm capacity rights

Usage, Location & Investment Signals II

3. **The TGI system is valued at 70%-80% of historic costs.**

- potentially results in too low average prices, and may encourage inefficient usage and location decisions
- again, gas-fired power stations may be purchasing capacity too cheaply

4. **Average-cost charges by their nature result in lower prices for pipelines with higher utilization factors.**

- makes uncongested pipelines more expensive than congested pipelines for users
- other things equal, users will prefer to locate on more congested pipelines
- but pipeline capacity should be cheaper where it is in excess supply, and more expensive where it is not
- could lead to expansion of busy pipelines when excess capacity exists elsewhere

Price Signals: Proposed Solutions

I. Introduce Ramsey prices to replace average-cost charges:

- well-known informational & implementation difficulties if regulator to set charges
- based on elasticities of demand – wouldn't necessarily lead to better congestion and location signals
- can fall most heavily on poorer consumers with fewer alternatives available
- should be applied to all prices and system capacity, not just to regulated capacity contracts for pipeline segments
- would mean extending regulation to interruptibles and unregulated market

II. Auction pipeline capacity contracts:

- more practical and well-tested solution – similar approach followed in UK
- auctions held for long-term and short-term firm and interruptible contracts
- users pay true opportunity cost, so improves location and TSO investment signals
- should allow for more open and transparent market

Auctions for Pipeline Capacity

Auctions would largely "decouple" investment remuneration issues from prices paid for pipeline usage: auction prices wouldn't depend on regulatory value of assets.

Numerous implementation issues to be addressed:

1. Consistency with the current price cap methodology

- i.e. how to deal with excess revenues when auction prices exceed regulated maximum prices
- in UK these are rebated via reductions in other charges

2. Product definition and frequency of auctions.
3. Auction design, combinatorial issues, reserve prices.

We recommend that CREG consider introduction of auctions in medium to longer term.

Vertical Integration Issues

No demands for large-scale changes in the current rules.

Issues concerning:

- construction of pipelines to new gas fields have arisen (e.g. Gibraltar)
- length ot time for regulatory approval of new developments
- also proposals to allow distribution companies to undertake secondary pipeline construction and operation

The CREG is developing proposals to address these issues, which we have commented on.

Conclusions of Study I

I. **Recent controversies caused by supply interruptions to some consumers on interruptible contracts.**

- this can occur in all systems (e.g. UK) and is efficient
- gas-fired power stations in Colombia mean there is a large supply of interruptible capacity in some pipelines
- expanding capacity to meet peak (El Nino) demand may be very costly and potentially inefficient
- best decided by market participants via their contracting behavior
- large expansions in TGI system are underway due to demand for firm, long-term contracts
- but gov't intervention to reallocate gas supplies provides poor incentives for users to express their needs in demand for contracts
- better to let regulated market mechanisms operate

Conclusions of Study II

II. No evidence of underinvestment, or failure of regulatory system. Issues of concern have arisen only in TGI system:

- gas-fired power plants have not contracted for the capacity needed to meet their demands, reducing demand for capacity on TGI system;
- some companies have regretted signing cheaper, interruptible contracts and appealed (successfully) for government intervention;
- upstream gas producers may be withholding firm gas supply contracts, making consumers less willing to contract for firm pipeline capacity; and
- taxis appear to be regulated in a manner which does not allow their fares to rise when they are forced to switch to more expensive fuels.

The first two are historic in nature, and unrelated to the regulation of gas pipeline infrastructure. The latter two issues are upstream and downstream of the transport system, and do not relate to the regulatory system itself.

Nevertheless, they will probably need to be addressed if the gas market is to function efficiently in the future.