

**CEEM Conference:
Issues in the Regulatory
Reform of Oil and Gas
Development**

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- In today's talk, I will describe briefly the technical and economic environment of oil and gas development
- the economic problems inherent in using historical cost to regulate pipeline prices
- proposed auction market models for transferring shares and pricing access in the joint ownership and operation of the various technological modules in the supply chain

I. Characteristics features of Oil and Gas Development

- Resource development follows a timeline of exploration, discovery, pipeline and process facilities construction
- Inherent geological, technological and market uncertainty over long time horizons
- The sequential form of that supply chain development creates potential “knots in the hose” in providing access to pipeline and processing capacity and operations

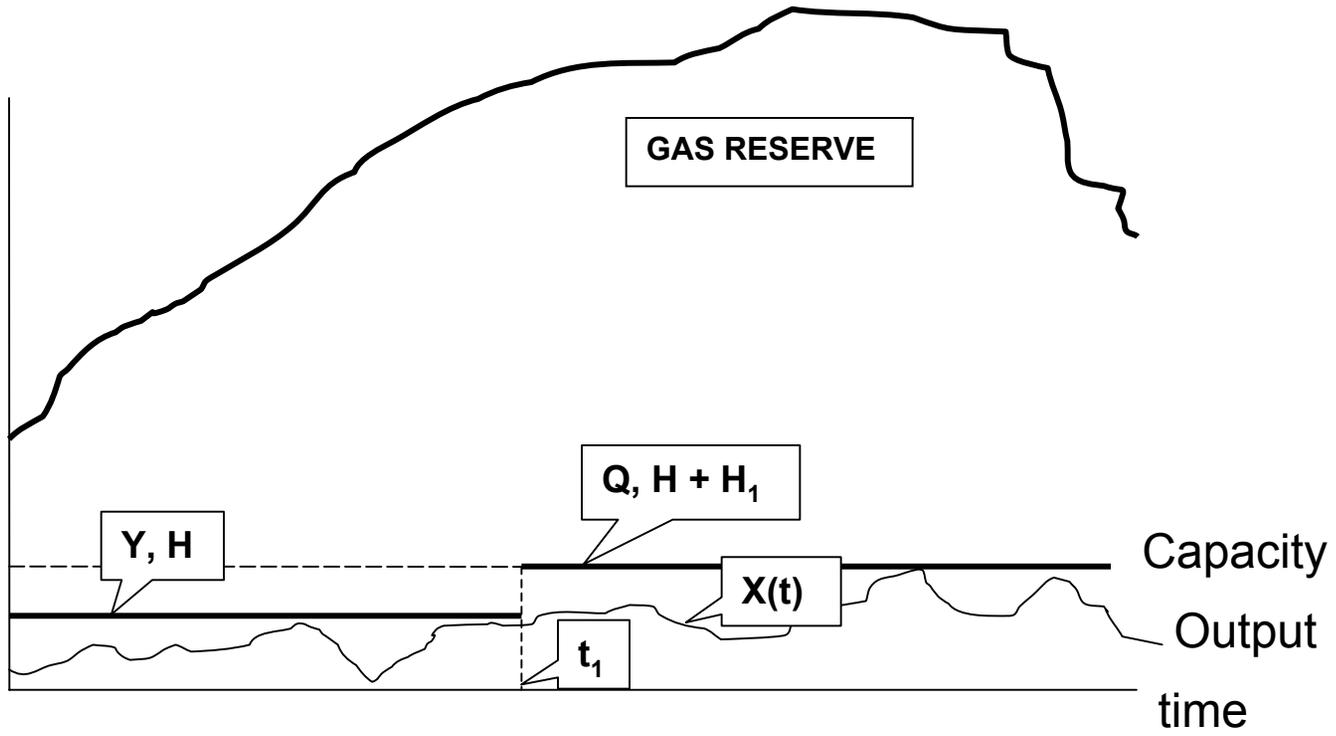
- The interests, fortunes and composition of the prime movers in the enterprise are subject to constant change:

As older fields mature and new fields are discovered it alters the facility and pipeline needs of new and original owners

In petroleum reservoirs, processing needs are for oil, gas and water; in gas reservoirs, gas, water and CO₂ must be separated; any component may be capacity constrained in a given process facility; similarly for pipeline access.

- The result is baffling complexity and frustration for both operators and regulators charged with the responsibility to maintain “open access” while also providing good incentives for all parties in the process of efficient economic development.

Summarizing: over time, access needs in the form of capacity rights to the pipeline, to feeder lines, to oil, water, CO₂ and gas processing capacity, will change. It changes because of a changing mix in exploration effort and success, changes in the maturity state of old versus new fields, and changes in technology. *If new wells are brought in, older less productive wells must be either “backed out,” or the constraints on separating capacity must be increased.*



**II. Historical Cost versus
Market Based Regulation:
Can co-tenancy joint venture
agreements be restructured
to promote development and
efficient pricing?**

- The idea we offer for discussion is for the state to adopt a new role: *define, and enforce pre-specified sharing rights in joint ventures that would allow markets to govern the actions of each joint venture co-tenant in the supply chain, and assist scheduling auctions as needed for transferring ownership, leased or rented capacity rights among the co-tenants and new entrants in each venture and across ventures. Access prices emerge from these auctions, not from regulation based on historical cost.*

Regulators legitimately desire to achieve “open access,” and want to avoid having any entity ensconced in a dominant bargaining position.

These objectives are highly desirable, but it is problematic to achieve them through any historical-cost based price regulation, which has offered hopes that have been hard to realize in a manner that is satisfactory to all parties.

Pitfalls of cost-based regulation

- All cost-based regulation is flawed in attempting to derive access prices from historical cost in economic environments that are highly dynamic.
- At each point in time, *efficient facility utilization and investment must always reflect current and expected future revenue and costs*, and therefore historical cost is irrelevant.

- The theory of economic regulation derives from static analysis and has no applicability to the oil and gas industry which experiences highly volatile world prices determined by changing world supplies and demand. The market is competitive, and fed by a shared supply chain.
- For incumbents it fails to recognize capital gains or losses on original investments.
- For independents it leads to high transactions and legal cost, and interminable delay in gaining access.
- For the State it reduces net revenue from royalties.

- For the original risk bearers it is heads I lose on my investment, and have no one to share the losses with; tails I win but must share the gain with latecomers.
- In that situation everyone should aspire to be a late coming free-rider and take advantage of after-the-fact knowledge of whether the investment will be a winner or a loser.

Features of Private Joint Venture Contracts

Joint venture facility sharing is commonly based on two agreement documents:

Ownership—the cotenants commonly share capacity in the same proportion that they share the capital investment by each.

Operation—by agreement the cotenants share fixed and variable operating cost depending on capacity actually used.

Three “property right” rules have emerged:

- If any co-tenant wishes to sell some part of his capacity rights, his co-tenant partners must be offered the right of first refusal.
- If any co-tenant wants to expand capacity either he must be part of a joint venture agreement, or he must obtain a release from the other co-tenants.
- The operating manager is commonly, though not always, the largest capacity rights holder.

- The question we want to pose is whether the joint venture institution can be modified so as to enable it to function as a rule-governed market institution that regulates prices and the transfer of rights.
- The standard rules operate to limit contestability, access, and the ability of facility use and expansion to accommodate perpetual dynamic change.
- Can we tweak these rules by common agreement to create a market institution for regulating the development process?

III. Property Right Rules for Competitive Joint Ventures (CJV)

Agreement means a compact in which operators abide by more open rules and the state foregoes cost-based regulation, which has imposed regulatory, legal and adversarial costs on all parties.

Here are property rights rules whose performance we would study using human subject experimental methods for a test bed:

- Each co-tenant is free to sell, lease or rent his capacity share to any co-tenant or external party unconstrained by a right of first refusal. Such transfers of rights among operators could occur at periodic auctions scheduled by some nomination or agreement process. All bidders, both incumbents and outsiders must meet the terms of an open auction.
- Any co-tenant or group of co-tenants, and/or any outside parties, are free to expand capacity, pay for it, and acquire rights to the new capacity. New capacity additions would be automatically triggered by the market whenever the transfer price at auction of existing capacity rises above the cost of making a capital addition.
- Operations and its management are required to be a separate entity—a cost center shared by the co-tenants in the venture; it is not a stock company, or voting collective.

Experimental Design: Initial Conditions

1. A set of incumbent members; a set of potential entrants. All agents free to bid on their initial desired throughput capacity, and reserve for future expansion of pumping capacity.
2. Processing facilities are initially balanced or proportioned to each individual's desired share of pipeline capacity.
3. A menu of alternative pipeline options, specifying initial pipeline capacity and initial installed pumping capacity, where

Pipeline Capacity = Pumping capacity – Reserve for expansion

I. **Single pipeline** Definitions:

Q = total pipeline throughput capacity (initial plus expansion capacity) of gas in MMcf/d

$Q \geq Y$ = initial (pump station) operating capacity

$Q - Y$ = expansion or reserve capacity

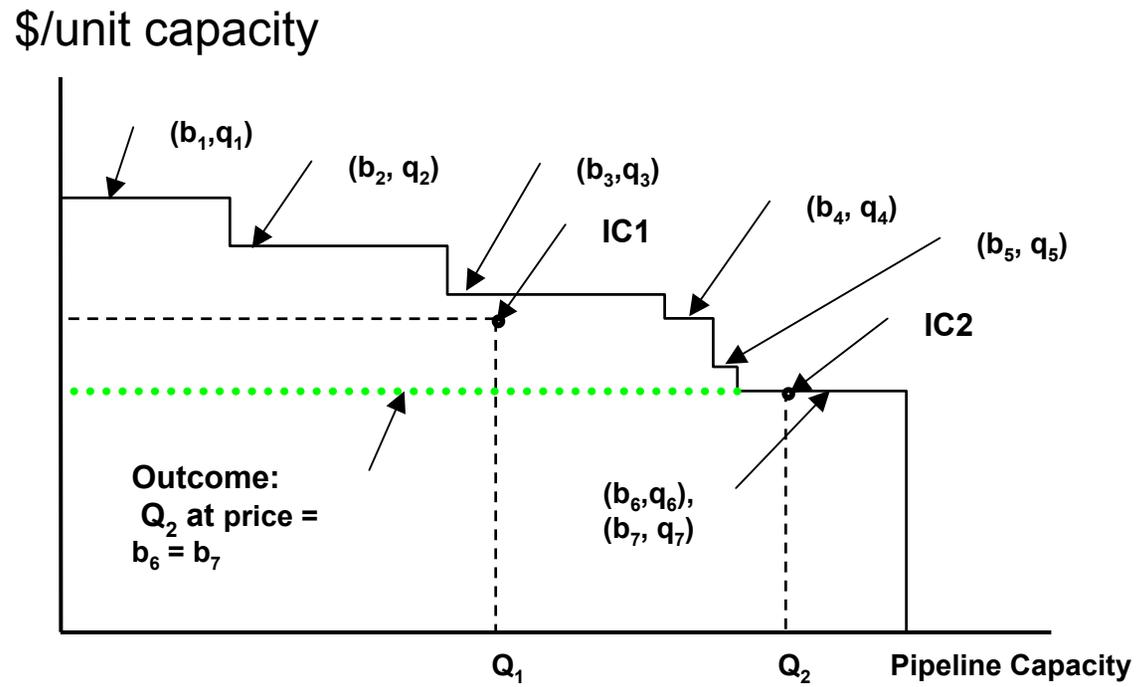
Consider two discrete alternatives:

Pipeline 1 has capacity $Q_1 = Y_1$ (0 expansion capacity); total cost is $TC_1 = K_1 + C(Q_1)$ with per unit (average) investment cost IC_1 .

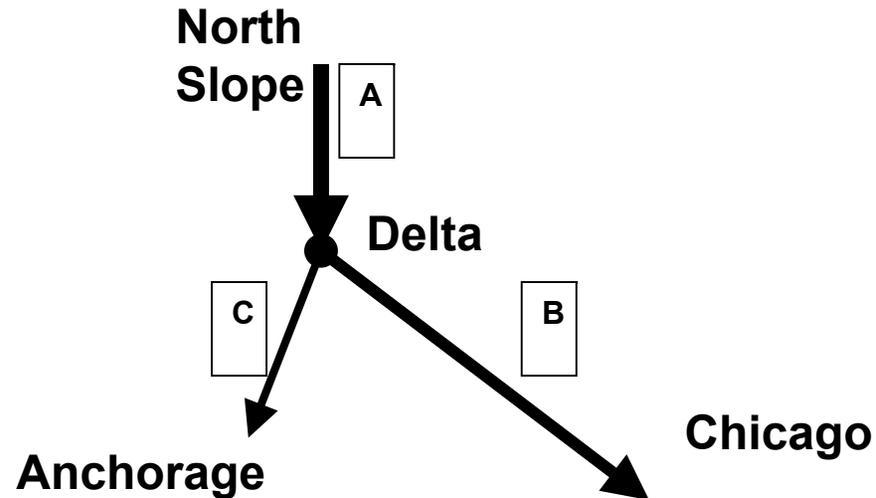
Pipeline 2 has capacity $Q_2 > Y_2 = Y_1$ (with given fixed expansion capacity); total cost is $TC_2 = K_2 + C(Q_2)$ with per unit (average) investment cost $IC_2 < IC_1$ (assumes economies of scale)

I. Single pipeline

Example of Auction Bids for Two Alternatives



II. Telescoped “Y” network; three legs A (North Slope), B (Chicago), C (Anchorage)



The discrete alternatives might assume that $QA \geq QB \geq QC$ with, for example two sizes offered on each leg, say (42" & 36") (36" & 30") (30" & 24").

Unit Capacity costs are now:

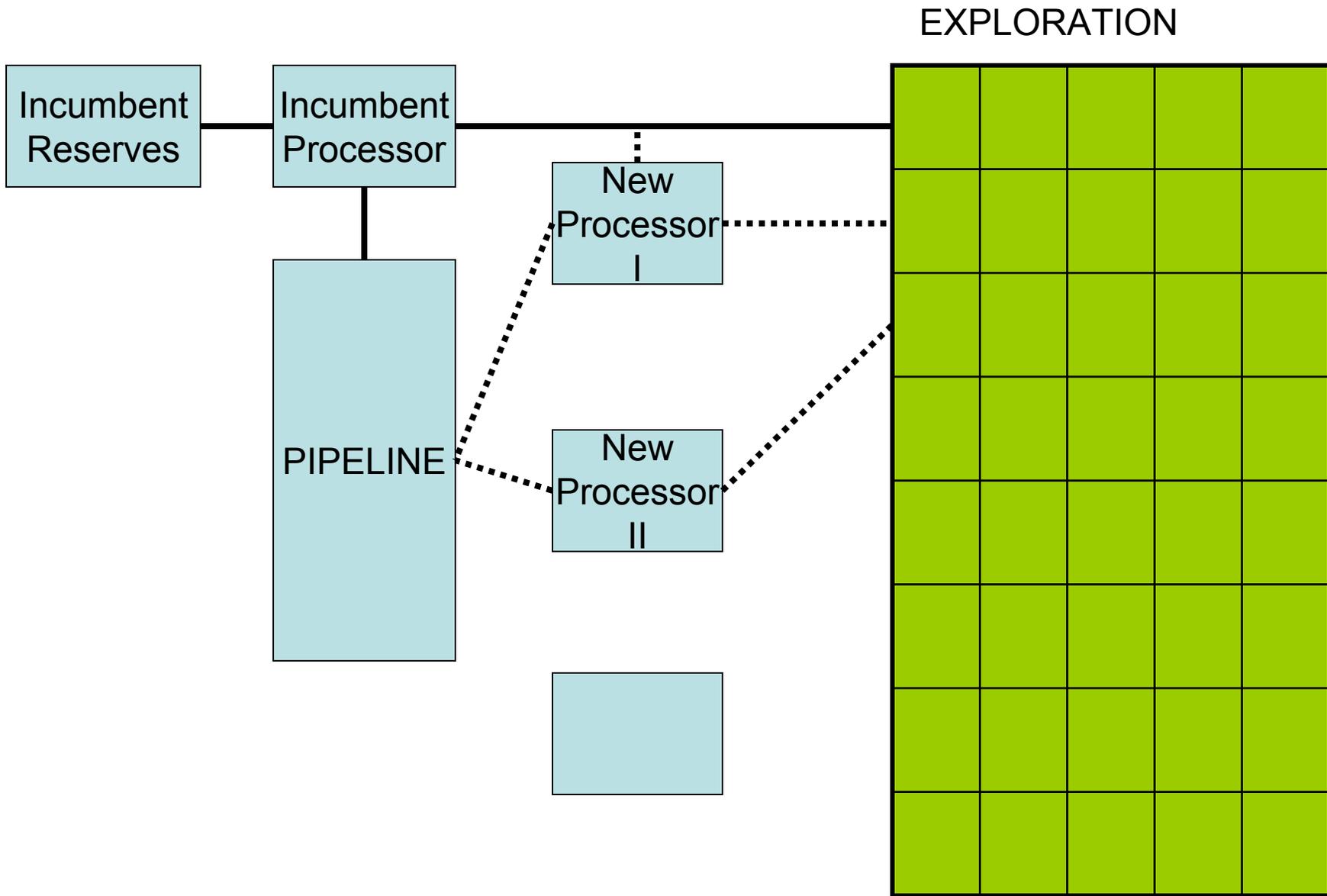
ICA1 > ICA2; QA1 < QA2

ICB1 > ICB2; QB1 < QB2

ICC1 > ICC2; QC1 < QC2

Supply Chain Evolution

- *Production and operations:* In each operating period production by each cotenant yields an allocation of operating cost from separation and pipeline services.
- *Depletion:* Production leads to reservoir depletion that is different for each cotenant since each is tapping into different, or differently shared, reservoirs. Thus each agent experiences a different pattern of output change over time.
- *Exploration:* All agents are engaged in exploration activity, with specified success probability for a strike of size R in each period.
- When an incumbent member of the CJV makes a strike the resulting output is blended into their current output stream to maintain their utilization of separation and pipeline operating capacity.



Pricing and Transferring Rights Over Time

- All auctions would be run in multiple unit, multiple resource, combinatorial form
- Thus a bid to buy or sell (**A and B**) means that the bidder desires both or neither.
- A bid (**A or B**) means either but not both.
- A budget constraint may accompany a set of bids.

- If an incumbent's strike exceeds his current capacities, and/or if any of the entrant prospectors make a strike, the entity must acquire rights to separation and pipeline operations capacity.
- Preferably, in order to enhance the value of both access rights and exploration leases, options on access could be offered by incumbents with state auction leases, the options exercisable if and when exploration was successful.

- *Triggers for capacity expansion:*

If the clearing price for any of these capital resources exceeds the unit cost of expanding its capacity, and the excess revenue bid exceeds the cost of a unit expansion, this triggers the investment, and the capacity is increased.

- *Pipeline reserve capacity rights:*

Since expanded pipeline operating capacity can only come at the expense of reserve capacity, bidders must hold equivalent rights to reserve capacity for surrender if their operations bid wins. If they do not already hold such rights they must acquire them at auction with bids of the form: **A** (capacity expansion in the amount **E**) **and B** (reserve rights in the amount **E**). Additional bids, **B**, for reserve capacity can be placed independently.

Exploration leases:

The Auction Center (experimenter) will periodically call for an auction of new exploration rights; such auctions trigger a general auction for the rights to facility capacity. In this way bidders can assure access rights at the time they acquire lease rights.

These auctions might be for options on capacity rights, callable on conditions stated in the option contract, rather than ownership rights.