Gas Markets Reform: A Global Perspective

Larry E. Ruff
Market Reform

Gas Industry Company Conference:
“Optimizing the Contribution of Gas to New Zealand”
Wellington

24 August 2011
My Focus and Approach Today

Gas markets are our focus today, but it is useful to consider gas as a ‘network commodity’ like electricity

• The differences are historical/operational, not fundamental
• Lessons from one can be useful for the other

The long run is our ultimate concern, but the problem of managing and pricing short run network operations:

• Has been/is the biggest obstacle to efficient competition
• Must be solved to assure rational capacity expansion

Thus, I will discuss today the history and logic of short-run operations in both gas and electricity markets, and some implications for “Optimising the Contribution of Gas to New Zealand”
Agenda

- Competitive Gas Markets and Contract Carriage
- Competitive Electricity Markets and Network Markets
- Applying Network Market Concepts to Gas
- Some Implications for New Zealand
The Evolution of Gas Markets

The modern gas industry began in the US, with:
• Long pipelines financed with long-term gas sales contracts
• Some competition *among*, but not *on*, pipelines

In stages beginning ~ 1980, pipelines were required to:
• Stop selling gas and become gas transporters
• Convert their gas sales contracts to capacity contracts
• Make capacity tradeable and offer ‘contract carriage’

Contract carriage requires a complex, decentralised system for trading of capacity (and gas), which:
• Evolved organically in the US over the 1980s/90s
• Was copied in Europe and elsewhere
Contract Carriage Evolved Organically – Until ...


'Quality' of the Market

Transactional Efficiency

Economic Efficiency

NGPA (new-gas price deregulation)

Australia (VIC) 'market carriage'

Gas marketers

Contract carriage with decentralised trading of capacity and gas

FERC 436 (TPA, voluntary unbundling)

FERC 636 (mandatory unbundling, 'contract carriage', capacity release, bulletin boards, no-notice service, ...)

NGWDA (wellhead price deregulation)

NYMEX futures market

Transport/Sales Monopolies (wellhead gas regulated at 'cost')

Gas marketers

Contract carriage with decentralised trading of capacity and gas

Australia (STTM)

Europe

New Zealand

US

AUSTRALIA (VIC) 'market carriage'
What Is Contract Carriage? The Problem

**The Simplest Network**

The simplest network is shown as a line with arrows from A to B. The flow rate is denoted as $F_{A-B}$.

**The Operational Problem: Security**

Keep $F_{A-B} \leq K_{A-B}$ = maximum 'safe' flow rate (in, e.g., TJ/day).

**The Economic/Commercial Problem: Efficiency**

Assure that the limited capacity is used each 'day' by those with the most valuable uses for it that 'day', when:

- Market conditions can change from 'day' to 'day'
- The value of capacity depends on the value of the commodity at A and at B.
The Contract Carriage Solution – in Concept

The concept is neat and logical; the reality can be (much) less so
Simultaneous clearing of commodity and capacity in decentralised markets is complex/inefficient
... and more so as network complexity increases

A real network has no single ‘capacity’, but dozens/hundreds (thousands?) of ‘capacities’

Decentralised markets can handle (inefficiently) only a few, approximate market capacities

For security, market capacities should (and typically do) understate real capacities
A More Realistic Picture of Contract Carriage

Network Ops

Non-market actions to keep flows below real capacities
Sell/Allocate Approx. Market Capacity
Scheduled flows that approx. use market capacity efficiently and real capacities even less so

Shippers

Users

Bids & offers for commodity & market capacities
Settlement $

Approx-market-clearing Qs & Ps for commodity & market capacities

Complex, Inefficient Markets

Less Accurate Market Capacities
Easier trading, but less secure/efficient market outcomes, more intervention in the market, less effective capacity

More Accurate Market Capacities
More secure/efficient market outcomes, more effective capacity, but more complex market trading

The high costs and inefficiencies may be acceptable on a large system ... but for (e.g.) New Zealand??
Why Not Just Add More Capacity?

Network capacity could ‘simply’ be expanded until Users can ignore the network in commercial trading, because:

- Congestion almost never arises; and
- When it does, it can be managed easily in non-market ways, e.g., with proportional curtailments

This is essentially *common carriage* – which:

- Can ‘work’ where capacity is cheap and operational management is difficult (e.g., on a distribution system); but
- Will be inefficient/risky where capacity is costly and future demand for it is uncertain

*The Logical Solution:* Manage congestion efficiently, and then add capacity only when/if it is expected to reduce congestion costs enough to pay for itself
Agenda

Competitive Gas Markets and Contract Carriage

Competitive Electricity Markets and Network Markets

Applying Network Market Concepts to Gas

Some Implications for New Zealand
Regional power grids developed in the US:
• Not for long-distance transport, but to ‘pool’ generation
• With great success; prices fell steadily from 1890 to 1970

In the 1980s, pressure for competition grew, but:
• Operations are more complex/critical for power than for gas
• A ‘contract path’ model was tried but did/does not work well

When Margaret Thatcher set out to privatise the UK power sector, she did not know it was impossible, so:
• She insisted on a competitive industry based on commercial contracts
• Nobody knew how to do it, but at the last minute ...

The UK Pool set the stage for a ‘Cambrian-Explosion’ in the number and diversity of markets (species)
The ‘Cambrian Explosion’ in Electricity

UK Pool (bid-based dispatch/spot pricing)

Chilean Mkt. (Settlement @ SRMC)

PURPA (QFs@Avoided Cost)

Power Pooling

Wheeling, Contract Paths

Schweppe nodal pricing

Hogan FTRs

Hogan Bid-based LMPs

FERC Standard Market Design

EU Directives (non-pool and limited effect)

NEW ZEALAND (First LMP Mkt)

Norway, Argentina, Australia, Peru, Spain, Columbia …

LMP in US: PJM, NYISO, NEPOOL

Non-LMP in Ontario, Alberta, …

LMP in MISO, Singapore, CAISO, ERCOT, …

Non-LMP in Ireland, …

ENRON Collapse

Failure of California’s No-Pool Market

‘Quality’ of the Market
Transaction Efficiency
Economic Efficiency

The fundamental conflict in a network market is that:

- Users’ need *decentralised commercial freedom*
- Operators’ need *centralised technical control*

The logical resolution of this conflict is a centralised, computerised **spot market integrated with Ops**

- Users freely bid/offer to advance commercial objectives
- The spot market includes network realities as accurately as desired and still clears quickly (in minutes) and cheaply
- Ops uses the spot market bids/offers and systems to find, implement and compensate any ‘out of market’ adjustments needed for security or efficiency
- Capacity rights become financial ‘congestion hedges’ that have no direct effect on operations or pricing
Even simple versions of these concepts and processes can be useful in gas – particularly on a small system.
Agenda

Competitive Gas Markets and Contract Carriage

Competitive Electricity Markets and Network Markets

Applying Network Market Concepts to Gas

Some Implications for New Zealand
What Is Best for a Small Gas System – e.g., NZ?

Neither contract carriage nor common carriage – or some hybrid – is likely to be cost-effective; but:

• As the Bard said: “There are more things in heaven and earth ... than are dreamt of in your [contract /common carriage] philosophy”

• Network market principles can be used to purpose-build a market-based solution for the specific situation

Australia has shown how, inventing two, very different solutions for two, very different situations

• The ‘market carriage’ system in Victoria; and

• The Short-Term Trading Market (STTM) elsewhere Victoria

_The details may not be applicable to New Zealand, but the general principles and the process are_
Example 1: ‘Market Carriage’ in Victoria

In 1997-99, Victoria had to create a market from scratch

- Neither contract nor common carriage were suitable
- So network market concepts were adapted to gas

In the unique Victorian ‘market carriage’ gas system:

- Market bids/offers are used in a central optimisation/market clearing process to find for each day
  - A daily Market Schedule and gas price that ignore the network
  - An Operational Schedule that reflects the real network
  - When these differ, the least-cost way to close the gap
- Capacity rights (Max. Daily Quantities) are purely financial

*The VIC market has worked well, and has evolved to handle (stimulate?) new supplies, storages and pipelines*
Victoria: Comparison & Growth

- **SA**
- **VIC**
- **NSW**

**EAPL System**
- **Eastern Pipeline (Alinta)**
- **UGS**
- **LNG**
- **To Yolla**
- **To Yolla (2005)**
- **Patricia Balleen (2003)**
- **Minerva (2005)**
- **Thylacine (2006)**
- **Geographe (2007)**
- **Casino (2006)**
- **Otway Basin**

**Population** | **Gas Cons.**
---|---
**VIC Then** | 4.4 Million | 200 PJ
**NZ Now**  | 4.4 Million | 170 PJ
**VIC Now**  | 5.7 Million | 280 PJ

Example 2: The Australian STTM

In 2008-10, in Australia outside Victoria:

- Gas/capacity trading on the contract carriage pipelines to metropolitan areas was limited/inefficient
- Pipelines would not change contracts or procedures, so integrating spot trading with Ops was not possible

In the Short-Term Trading Market (STTM):

- Each pipeline states its TJ/day ‘capacity’ to its hub
- A daily spot market allocates/prices this capacity and gas
- Shippers/pipelines operate under their contracts as before, with STTM incentives to deliver STTM quantities
- The STTM capacity price is paid by shippers who use capacity to shippers who have pipeline capacity contracts

The STTM is working well and is being extended
Agenda

Competitive Gas Markets and Contract Carriage

Competitive Electricity Markets and Network Markets

Applying Network Market Concepts to Gas

Some Implications for New Zealand
What Does New Zealand Have Now?

Vector uses a simple form of *contract carriage*

- A shipper cannot ship more gas than the (market) capacity it holds, and Vector limits the (market) capacity it sells
- But Vector’s market capacity is a poor approximation of real capacity that (probably) significantly understates real capacity and cannot be freely traded

In practice, this is more like *common carriage*, which:

- Only ‘works’ as long as there is excess capacity
- Creates calls for new capacity at the first sign of congestion

*This is not a criticism of Vector; they are doing the best they can with the operational system they have.*
I do not now know the best solution for New Zealand; but 25 years of thinking about/working on network markets give me a pretty good idea where New Zealand should start looking.

To increase the efficiency and effectiveness of gas competition, New Zealand has four basic options:

- **Muddle Through:** Try *ad hoc* solutions such as letting ‘capacity’ follow the customer and hope for the best.
- **Build Uneconomic Capacity:** (Try to) guarantee full cost recovery and hope more gas is discovered.
- **Create a Real Contract Carriage System:** Develop a more complex system of capacities and hope for efficient markets.
- **Create a Network Market:** Use the above concepts to purpose-build a network market for New Zealand.
And What Might New Zealand Find?

If New Zealand were to develop a more efficient network market, it would probably find that:

- Smarter operational management can increase effective capacity; congestion might become/remain a non-issue.
- Such a system is less difficult and costly than expected/feared – and certainly cheaper than adding capacity.
- Even a simple network market could improve trading efficiency and costs enough to stimulate more competition, and perhaps even more investment, in the gas sector.

Creating a real network market is certainly worth serious consideration, and may well be the best approach, for “optimising the contribution of gas to New Zealand”