Transmission Pricing Review: High-level Options Investigation (Stage 1)

Rajat Sood

Prepared for the Market Development Programme Conference

October 2009

Frontier's involvement in the Review to date

Efficient Pricing Theory paper (1)

International Review paper (2)

Discussed at July TPTG meeting (3)

High-level Options and Filtering Criteria Report (4)

Discussed at September TPTG meeting (5)

Summary presentation of all 3 reports to the MDP Conference (6)

Efficient Pricing Theory

Encouraging efficient use of the existing network…

Nodal pricing will be sufficient if :

- Prices reflect the marginal cost (or value) of electricity:
  - Participants bid their true marginal cost
  - Prices reflect the value of unserved energy
  - Participants are fully rational and informed

Nodal pricing provides sufficient signals

Efficient Pricing Theory – continued

Encouraging efficient investment decisions…

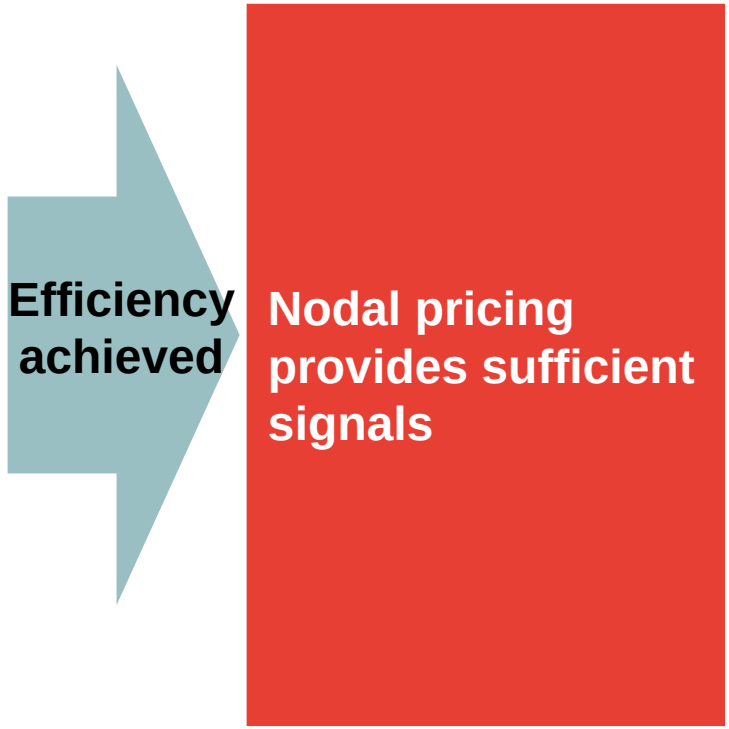
Nodal pricing will be sufficient if :

- Prices reflect marginal costs

And

- No economies of scale

- Transmission networks are 'perfectly augmented' : a perfectly **designed** and **applied** Grid Investment Test (GIT)



Efficient Pricing Theory – continued

In the 'real world' …

- Marginal prices **may not** reflect the marginal cost of electricity
- Participants **may not** bid their true marginal cost
- Participants **are not** fully rational and informed
- Economies of scale **arise** in generation or load investments
- Transmission networks **are not** 'perfectly augmented'
  - Due to economies of scale in transmission investment
  - 'Over-caution' by network planners in applying the GIT

Role of transmission pricing?

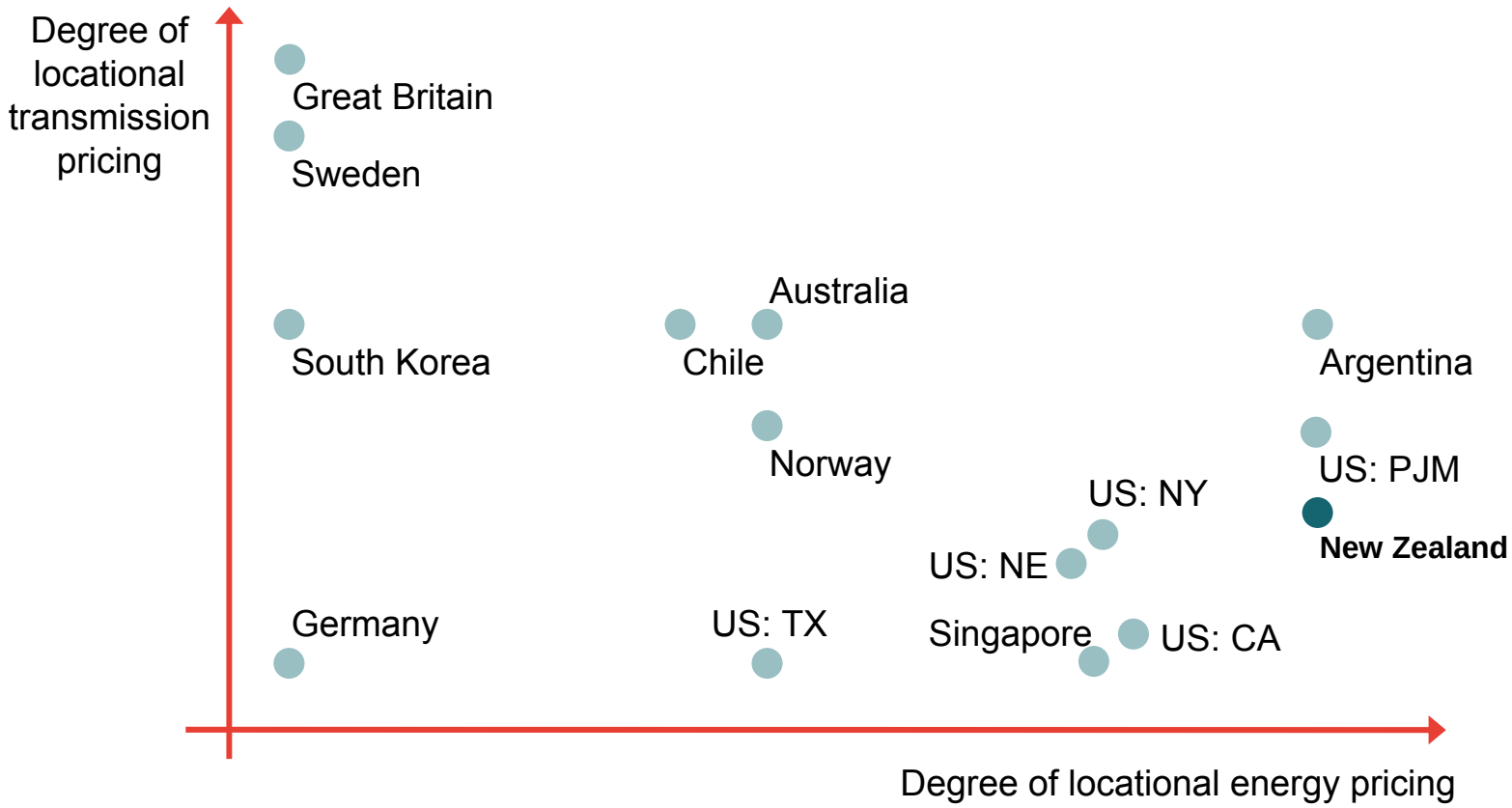
Unclear – transmission pricing may not be the appropriate tool to tackle these forms of 'market failure'

Unclear – constraint of the 'real world'

To augment or 'boost' muted nodal price signals – muted by excessive or premature transmission investment

International Review – Key finding

Locational energy vs locational transmission pricing: an (apparent) trade-off?



International Review – Summary

1. Apparent trade-off between locational energy and transmission pricing
2. Locational transmission prices can be imposed through:
   - deep connection charging (PJM)
   - use of system charges (Great Britain, Norway) or
   - a combination of both (Sweden)
3. Many jurisdictions levy charges on both generators and loads
4. Load-flow analysis used to signal the LRMC of transmission services at different points on the network (Great Britain, Australia, Chile, Argentina)
5. Complementarity between locational hedging and connection charging to avoid ‘over-signalling’ location (US experience)

High-level options and filtering criteria

Scope of options…

Locational cost allocation

- How much locational variation?
- How to effect locational variation?
- Recovery from generators vs loads

Pricing structure

- Basis of charge (MWh, MW, etc)

All considered here in Stage 1

Deferred to Stage 2

Relevant policy and regulatory considerations…

- Electricity Act principal objective (s.172N)
- Part F Pricing Principles
- Government Policy Statement (GPS)

… All suggest need for tradeoffs

High-level options

Option 1: Status Quo …

- Incorporates:
  - Connection charge
  - Interconnection charge
  - HVDC charge
- Implies loads do not require locational signals beyond connection charge
- Implies generators do not require locational signals beyond connection charge and HVDC

High-level options – continued

Option 2: ‘Tilted’ postage stamp …

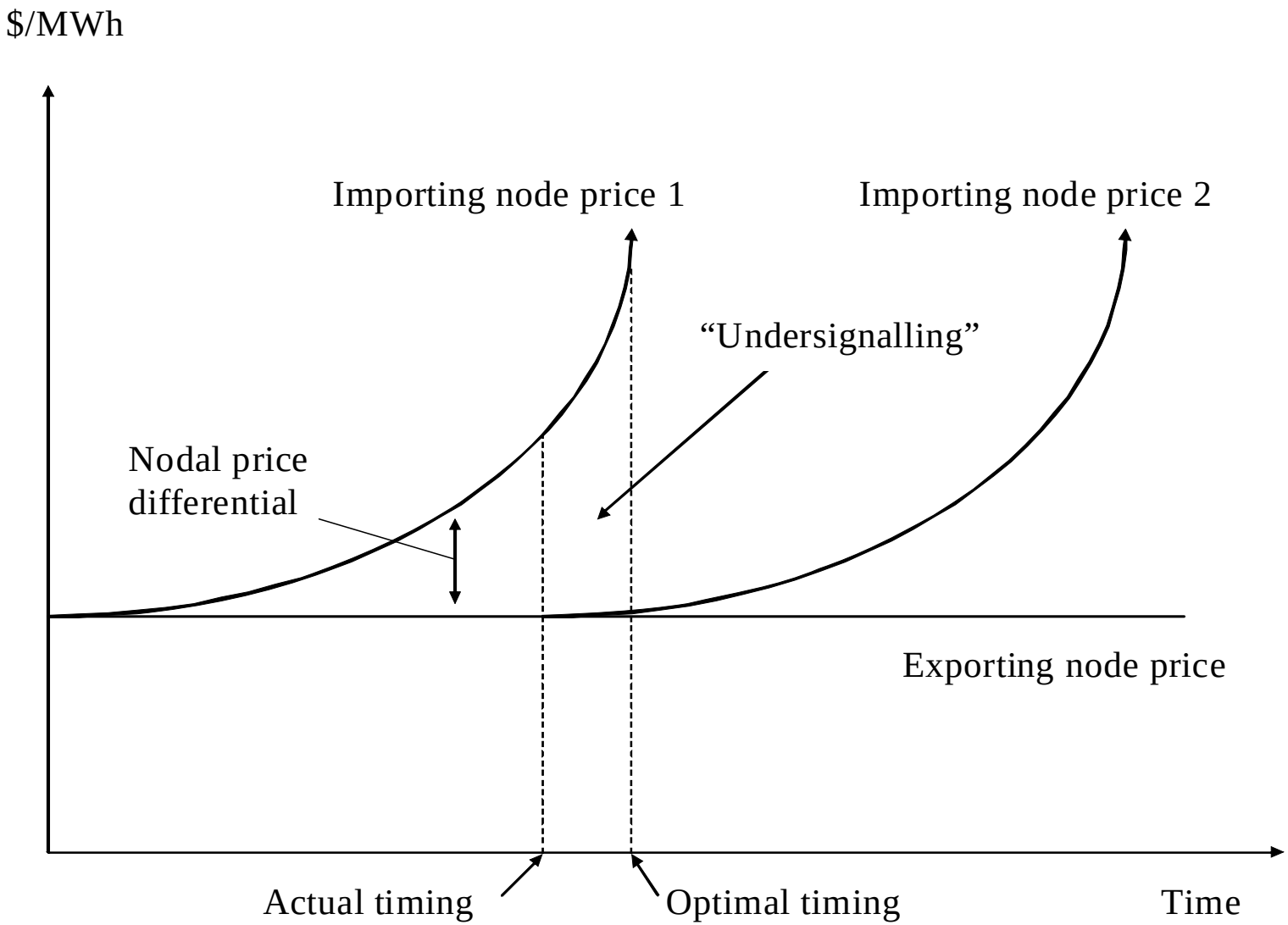
- Simplified locational pricing signal proposed by Grant Read
- Expect :
  - Higher charges for loads in north than in south
  - Lower charges (or subsidy) for generators in north compared with south
- Need greater differentiation if transmission investment driven by reliability standards (ie before efficient)
- Degree of ‘tilt’ should follow divergence in nodal price differentials to reflect changing LRMC of network usage over time

High-level options – continued

Option 3: Augmented nodal pricing…

- Compensates for 'muting' of nodal price signals caused by network 'overbuilding'
- Muting worse if spot prices not set to the value of unserved energy when load shed
- Charges highest for generators and loads that benefit most from over-investment in transmission (eg SI generators and NI loads)
- Charges lowest (or negative) for generators and loads that are most worse off due to over-investment in transmission (eg NI generators and SI loads)
- Charges most extreme on low load/capacity factor participants (ie peaky loads and peaking generators)
- Implementation issues considerable – base charges on comparison to hypothetical counterfactual of efficiently-developed grid

High-level options – continued



High-level options – continued

Option 4: Load flow approaches…

- Seek to broadly signal LRMC of network usage
- Involves attributing costs to locations based on a network analysis of assets 'used' to convey power from generators to loads
- Can be based on:
  - Existing network costs (Australia) – 'CRNP' T-price model
  - Forward-looking network development costs (GB) – 'ICRP' DC transport model
- Risk of perverse signals where network either lightly loaded or heavily utilised
- May be overcome with 'utilisation-adjusted' CRNP (eg South Australia)
- Could be calibrated to provide similar signals to Options 2 and 3
- Recover remaining proportion of costs through postage-stamped charges
- Lacks transparency but easily replicable using standardised software

Filtering criteria

1. **Divergence from optimal transmission investment** – drives need to supplement 'muted' nodal pricing signals and move away from postage-stamping
2. **Theoretical precision** – provides efficiency yardstick of option
3. **Locational hedging option** – choice of option may 'improve some signals and distort others' (Read)
4. **Network topology** – certain approaches may be better suited to meshed or radial networks
5. **Information requirements and implementation difficulty** – postage-stamped approaches have the advantage over augmented nodal pricing and load flow options

Filtering criteria – continued

6. **Governance arrangements** – who pays may influence scrutiny of transmission investment decisions
7. **Good regulatory practice** – incorporates minimising subjectivity, enabling replicability and promoting transparency and predictability; contribute to confidence in TPM signals
8. **Stakeholder acceptability** – helps limit pressure for ongoing review and revision of TPM

High-level options and filtering criteria (7)

Preliminary evaluation of options

Option 1: Status Quo

- Economic appropriateness depends on adequacy of present nodal price signals, which in turn depends on efficiency of network investment and VoLL pricing
- Minimal information requirements and no implementation issues
- Lacks drivers for good governance

Option 2: Tilted postage stamp

- Lacks theoretical precision due to arbitrariness
- Some information requirements and implementation issues, especially at margin
- May be more acceptable than other approaches

High-level options and filtering criteria (7)

Preliminary evaluation of options

Option 3: Augmented nodal signals

- Best satisfies requirements of theoretical precision
- Novel approach that is likely to be somewhat complicated to implement
- Involves subjectivity but likely to yield predictable and robust signals

Option 4: Load flow approaches

- Seeks to signal LRMC of network usage to loads (and generators)
- Could be calibrated to provide similar signals to Options 2 and 3
- Lacks transparency and has arbitrary elements but is replicable

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BRISBANE | MELBOURNE | SYDNEY

Frontier Economics Pty Ltd, 395 Collins Street, Melbourne, Vic 3000

Tel. +61 (0)3 9620 4488 Fax. +61 (0)3 9620 4499 www.frontier-economics.com