Discussion Paper

Access to Gas Processing Facilities

August 2006

Table of Contents

1 Executive Summary

Background

1.1 Under the GPS[1], the Gas Industry Co is expected to develop, and submit to the Minister of Energy for approval, "*[p]rotocols that set reasonable terms and conditions for access to gas processing facilities*" ("access protocols"). The GPS leaves open the scope and form of the access protocols.

1.2 In principle, available protocol choices span the spectrum from the status quo through to regulated access and pricing. The choice made will depend on the particular circumstances and issues to be addressed.

1.3 If regulations are required to deliver the access protocols, the Gas Act[2] provides for these under certain circumstances[3].

Objective of access protocols

1.4 The Gas Industry Co considers the objective of access protocols should be to promote efficient access to gas processing facilities to support Government's overall objective, and the specific outcomes it expects, for the gas industry.

1.5 In this regard, the Gas Industry Co is mindful that the interests of access seekers and facility owners will need to be weighed up carefully to ensure that access arrangements are also consistent with Government's wider objective of facilitating exploration and production ("E&P") investment in NZ.

Assessment

1.6 Based on the quantitative and qualitative analysis presented in this paper, and the desire to facilitate investment in E&P activity, the Gas Industry Co is drawn to the conclusion that the best form of access protocols in the current NZ gas processing market would be both low cost and light-handed.

1.7 However, the Gas Industry Co observes that the NZ gas market is undergoing a transformation from one to multiple sources of gas with a corresponding increased focus on smaller developments, perhaps with shorter lives. In this regard, past experience may not be a wholly accurate indicator of the future and this is an area that should be reviewed periodically.

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1 The Government Policy Statement on Gas Governance (October 2004).

2 The Gas Act 1992 ("Gas Act").

3 See section 43F(2)(b) of the Gas Act. The purposes specified require that the regulations are "*reasonably necessary to allow new fields to be developed*".

Conclusions

1.8 In light of the analysis and research presented in this paper, the Gas Industry Co proposes that access protocols based on information disclosure be developed whereby:

- gas processing facility owners would:
  - publish key information about each of their facilities, including physical location, upstream/downstream connections, nominal processing capacity and projected utilisation (gas, CO_2, liquids etc), specification of raw gas that can be processed, and contact details for, and general information required from, third parties seeking access; and
  - report to the Gas Industry Co any bona fide third party approaches for commercial access and the outcome of each approach (excluding commercial details).
- the Gas Industry Co would:
  - compile and publish annual statistics (from the information disclosed about individual facilities); and
  - maintain a watching brief on the efficiency of access to gas processing arrangements.

1.9 The information being sought is expected to be readily available to the facility owners and, therefore, compliance would incur minimal cost.

1.10 If the industry can demonstrate broad-based support for a voluntary regime, the Gas Industry Co would recommend voluntary information disclosure to the Minister. However, should broad-based support not be forthcoming then Gas Industry Co will need to consider regulating information disclosure.

Next steps

1.11 Following consideration of feedback received on this paper, Gas Industry Co intends to develop access protocols for the approval of the Minister of Energy.

Remainder of this paper

1.12 The remaining sections of this paper cover the following:

Section	Topic
2	Introduction and Submission Requirements
3	Regulatory Context and Objective for Access Protocols

Section	Topic
4	Possible form and scope of access protocols
5	Needs Assessment Framework
6	Technical/Economic Analysis
7	Qualitative Assessment
8	Identification of Alternatives
9	Assessment of Alternatives
10	Policy Instruments
11	Conclusions and Next Steps
Appendices	
I	Format for Submissions
II	Access Protocols in Other Jurisdictions
III	Transfield Worley Report: an independent technical study of the cost characteristics of gas processing
IV	Stakeholder Interview Summaries
V	Sample of Data Published in the UK
VI	Glossary of Terms

2 Introduction and Submission Requirements

2.1 The Gas Industry Co is expected to develop, and submit to the Minister of Energy for approval, protocols that set reasonable terms and conditions for access to gas processing facilities.

2.2 The purpose of this discussion paper is to set out the Gas Industry Co's assessment of protocols for access to gas processing facilities and to invite stakeholder submissions on this assessment.

2.3 Submissions on this paper must be received by 5pm on **Friday, 29 September 2006.** Please note that submissions received after this date are unlikely to be considered. The Gas Industry Co's preference is to receive one hard copy and one electronic copy (in Microsoft Word or Adobe Acrobat format).

2.4 The electronic version should be emailed to submissions@gasindustry.co.nz with the phrase "Submission on access to gas processing facilities" in the subject header. The hard copy should be posted to:

Ian Dempster
Senior Adviser – Wholesale Markets
Gas Industry Co
PO Box 10-646
Wellington
New Zealand

2.5 The Gas Industry Co will acknowledge receipt of all submissions electronically. Please contact Ian Dempster, on (04) 494 2467, if you do not receive electronic acknowledgement of your submission within two business days.

2.6 Submissions should be provided in the format shown in Appendix I. For the convenience of stakeholders, a Microsoft Word version of the appendix is available in the consultation section of the Gas Industry Co's website.

2.7 The Gas Industry Co values openness and transparency and, therefore, submissions will generally be made available to the public on the Gas Industry Co's website. Where submitters intend to provide confidential information as part of their submissions the Gas Industry Co asks that you discuss that with Gas Industry Co prior to lodging the submission.

3 Regulatory Context and Objective for Access Protocols

The GPS

General objectives and outcomes

3.1 The GPS sets out the Government's objectives and outcomes for governance of the New Zealand gas industry, and its expectations for industry action. Under section 43ZO of the Gas Act, Gas Industry Co must have regard to those objectives and outcomes when making recommendations for gas governance rules or regulations.

3.2 The Government's overall policy objective for the gas industry, as stated in paragraph 4 of the GPS, is:

"To ensure that gas is delivered to existing and new customers in a safe, efficient, fair, reliable, and environmentally sustainable manner."

3.3 Paragraph 5 of the GPS adds that, consistent with this overall objective, the Government is seeking certain specific outcomes which include:

"a) The facilitation and promotion of the ongoing supply of gas to meet New Zealand's energy needs, by providing access to essential infrastructure and competitive market arrangements;

…

c) Barriers to competition in the gas industry are minimised to the long-term benefit of end-users;

d) Incentives for investment in gas processing facilities, transmission and distribution, energy efficiency and demand-side management are maintained or enhanced;

…

f) Delivered gas costs and prices are subject to sustained downward pressure;"

Specific objectives for gas processing

3.4 At paragraph 9, the GPS states the Government expects the Gas Industry Co to develop recommendations for industry arrangements in a number of areas. In respect of gas processing facilities, the Government is seeking:

"Protocols that set reasonable terms and conditions for access to gas processing facilities."

3.5 Those arrangements may be implemented in a number of ways, including by way of a recommendation to the Minister of Energy for either rules or regulations.

Gas Act

Specific powers

3.6 If it were considered appropriate to implement access protocols by way of rules or regulations, the Gas Act contains specific provision for this at section 43F(2)(b):

"setting reasonable terms and conditions for access to, and use of, gas processing facilities where—

(i) this is reasonably necessary to allow new fields to be developed; and

(ii) spare capacity is available or could be made available if the person accessing or using the facilities paid the reasonable costs (including the costs of capital) of providing the additional capacity".

3.7 Thus, if it were determined in accordance with the Gas Act that difficulties in gaining access to gas processing facilities were likely to prevent the development of new fields, Gas Industry Co has the ability to make a recommendation to the Minister of Energy for rules or regulations to set terms and conditions for access.

Supplementary powers

3.8 In addition, under section 43S of the Gas Act, any regulation or rule made under Subpart 1 of Part 4A of the Gas Act (which includes rules or regulations under 43F(2)(b)) may include supplementary empowering provisions. Those provisions include the ability for rules or regulations to:

"…

(b) provide for systems, processes and procedures (including dispute resolution procedures), and the keeping, supply and disclosure of information, in relation to any matters specified in this subpart:

(c) prescribe the form and manner in which information is to be disclosed:

(d) require disclosed information, or information from which disclosed information is derived (in whole or in part), to be certified, in the prescribed form and manner, by persons belonging to any specified class of persons:

(e) prescribe when and for how long information must be disclosed:

(f) exempt or provide for exemptions (including provide for the revocation of exemptions), on any terms and conditions, of any person or class of persons from all or any of the requirements in regulations or rules made under this subpart:

(g) provide for the supply of information for the purpose of administration and enforcement of this Act, and regulations and rules made under this Act:

…"

Gas Industry Co Strategic Plan

3.9 The 2007-2009 Strategic Plan identifies six areas which Gas Industry Co considers are its key strategic priorities. One of these is the review of infrastructure access arrangements, which encompasses transmission access, access to gas processing and distribution contracts.

3.10 With regard to access to gas processing facilities, the Strategic Plan sets out the following milestones:

- issue proposal on access arrangements for gas processing facilities for consultation by September 2006;
- recommendation on access rules or protocols for processing facilities (if required) to the Minister by December 2006; and
- implementation of preferred option (if required) by June 2007.

3.11 This paper meets the first of these milestones.

Objective of access protocols

3.12 Consideration of any access protocols needs to fit within the Government's overall policy objective for the gas industry and the specific outcomes it is seeking for the sector as outlined above.

3.13 In developing access protocols there is a need to balance actively establishing access arrangements (which may lead to more gas being brought to market, at least in the shorter term) and allowing normal commercial processes to flow unimpeded (which is most likely to provide the best incentives for investment in gas processing facilities over the longer term).

3.14 It is also necessary to examine whether there is any evidence of inefficiency in this segment of the gas market and, if so, consider whether more proactive protocols could be used to rectify this. If, however, there is no evidence of systemic inefficiency and any issues experienced are of a purely commercial nature, Gas Industry Co does not believe it should intervene in such matters.

3.15 Accordingly, the Gas Industry Co considers the objective of any access to gas processing facilities protocols should be to facilitate access to such facilities where that is both economically efficient and where such protocols would contribute to the better achievement of the Government's overall policy objective for the gas industry and the specific outcomes outlined above.

Q1: *Do you agree that the overall objective of any protocols should be to facilitate access to gas processing facilities where that is both economically efficient and contributes to better achievement of Government's overall policy objective, taking account of the specific outcomes it expects of the sector? If not, what should the objective be?*

4 Possible form and scope of access protocols

Background

4.1 At present, gas processing facility owners and access seekers are free to negotiate any commercial arrangements they wish within the normal legal requirements governing commercial arrangements in NZ. This includes the Commerce Act, in particular section 36[4].

4.2 The GPS leaves open the design options for access protocols. This includes the possibility that existing commercial agreements may already set reasonable terms and conditions for access.

4.3 On the other hand, it might be that a stronger form of intervention may be necessary. The Gas Act[5] provides for making rules or regulations if:

- this is reasonably necessary to allow new fields to be developed; and
- provided spare capacity is available or could be made available if the person accessing or using the facilities paid the reasonable costs (including the costs of capital) of providing the additional capacity.

4.4 That aside, there is in principle a wide range of alternative protocols available to choose from, as illustrated in Figure 1 overleaf. The examples in Figure 1 move through the spectrum from light- to heavy-handed as you move from bottom-left to top-right. The design of non-regulatory protocols (e.g. voluntary industry protocols) is less constrained in terms of purpose than options requiring regulation. The choice of protocol, including the delivery mechanism (e.g. voluntary, regulatory or some form of industry contract), will depend on the nature and extent of any problems that need to be addressed in order to meet the objective.

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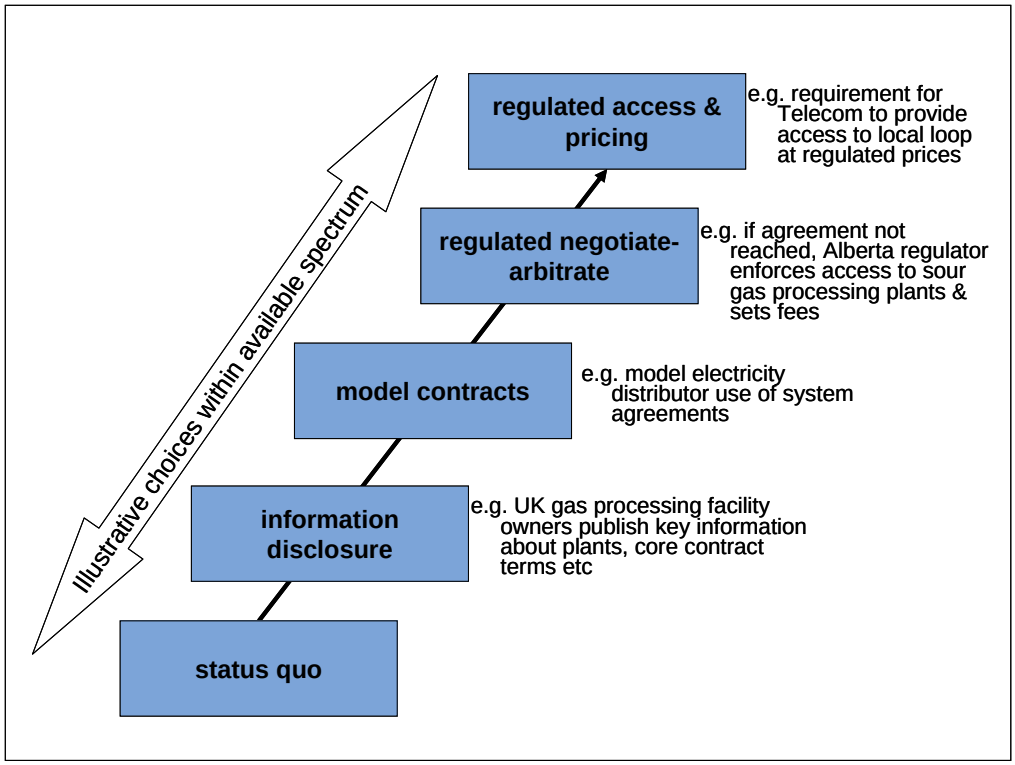
4 The key provision is section 36(2) *"A person that has a substantial degree of power in a market must not take advantage of that power for the purpose of - (a) Restricting the entry of a person into that or any other market; or (b) Preventing or deterring a person from engaging in competitive conduct in that or any other market; or (c) Eliminating a person from that or any other market."*

5 See section 3 of this paper.

Figure 1: A wide range of choices exist



4.5 Accordingly, the choice of which form of protocols should be developed (i.e. light- to heavy-handed) is informed by analysis and understanding of the current environment of access to gas processing facilities.

4.6 To provide some insights into the alternatives, Appendix II summarises and compares gas processing arrangements in the Australian, Canadian, UK and USA gas markets. As noted in the appendix, there are significant differences in approach and/or structure. The Gas Industry Co believes that while aspects of each jurisdiction are likely to be of interest, the choice of protocols in NZ needs to be based on the specific circumstances that exist here.

Coverage of any access protocols

4.7 For the purpose of this paper, the Gas Industry Co has adopted the commonly accepted meaning for the terms “gas processing” and “gas processing facility”, as detailed below.

Gas processing

4.8 Raw natural gas, which can be sourced from gas or gas/condensate wells, consists primarily of methane, but also contains a mixture of other hydrocarbons (for example, propane, butane and ethane) as well as water vapour, hydrogen sulphide, carbon dioxide, and other compounds. Such impurities must be removed before use.

4.9 "Gas processing" involves treating well streams[6] to separate out natural gas, water, liquids (condensate, natural gasoline and liquefied petroleum gas) and sometimes other substances such as naphtha, sulphur and carbon dioxide (CO_2).

4.10 Although some impurities may be removed at the wellhead, processing is typically required to ensure gas meets certain technical prerequisites[7] for injection into transmission and distribution pipelines and for subsequent use by consumers.

4.11 Gas processing is undertaken in stages with the particular requirements depending on the make up of the raw gas feed. There are generally four main processes: sulphur and CO_2 removal, oil and condensate removal, water removal, and removal of heavier hydrocarbons/natural gas liquids extraction.

4.12 More details on the technical aspects of gas processing are included in Appendix III.

Gas processing facility

4.13 The term "gas processing facility" is not specifically defined in the Gas Act or in the GPS. However, it is commonly used around the world to refer to the equipment, located at or near wells and/or further downstream, which processes raw gas or gas/condensate streams as described above. This could include on-site liquid storage where that is an integral part of a gas processing facility and could affect overall plant performance and capacity to process gas.

4.14 The definition of "gas processing facility" defined in separate regulations made under the Gas Act is consistent with the common usage noted above[8], indicating Parliament's view of the definition of gas processing facility.

4.15 The pipelines connecting fields to gas processing systems (or upstream gas processing systems to downstream gas processing systems) are commonly called gas gathering systems. Where a third party accesses a gas processing facility, this could involve either sharing part of an existing gas gathering pipeline or constructing a new pipeline. The Gas Industry Co notes that if there is a reasonable argument that proactive protocols for access to gas processing facilities should be developed, then it would also be necessary to consider whether such protocols should also extend to gas gathering pipelines.

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6 Or streams that have already been partially processed.

7 Energy content (Wobbe Index) and quality parameters (processed gas must meet technical specifications prior to injection into natural gas transmission or distribution pipelines. In NZ, the standard for reticulated gas is NZS 5442: 1999).

8 In the Gas (Information Disclosure) Regulations 1997 ("a facility for treating gas so that the treated gas is suitable for consumption") and the Gas (Statistics) Regulations 1997 ("a facility for treating gas for the purpose of making it suitable for domestic consumption").

Q2: *Do you agree with the proposed definition of gas processing facilities for the purpose of considering access protocols?*

4.16 Gas Industry Co is aware of concerns expressed by some industry participants regarding access to liquid storage facilities. A number of parties have suggested that access protocols be developed to assist them to resolve these difficulties.

4.17 Those facilities do not process gas and, therefore, do not fall within the scope of this paper.

5 Needs Assessment Framework

Background

5.1 The design of access protocols will depend on the extent to which they are needed to address any economic efficiency issues, i.e. to mitigate any identified inefficiencies that impede the achievement of the objective outlined in section 3.

5.2 The overall objective provides the basis for selecting the appropriate point on the spectrum of available choices for protocols discussed in section 4. This needs to be supported by a sector analysis and a set of evaluation criteria that flow from the objective.

5.3 The Gas Industry Co has developed a framework to assess whether there are identified inefficiencies (and the extent of these) that may need to be addressed by access protocols. As explained below, this framework includes both quantitative and qualitative elements.

Technical/economic analysis

5.4 For substantial inefficiencies to arise, the Gas Industry Co considers that the following circumstances would need to be present:

Circumstance	Rationale
(a) Gas processing must account for a substantial proportion of the costs of getting gas to market.	If new gas processing facilities account for only a small proportion of the cost of getting gas to market, then large inefficiencies will not arise.
(b) There must be strong economies of scale for gas processing facilities.	Strong economies of scale mean that small-scale gas processing plants would, in relative terms, be substantially more costly to build on a per unit basis. Owners of small fields would not be indifferent between building their own processing facility or leasing, on a fully-costed basis, existing processing capacity. In such circumstances it might therefore be possible for a processing facility owner either to restrict economic access to an existing facility or to extract rents and thereby deter field development.

Circumstance	Rationale
(c) There must be spare processing capacity or capacity that can be made available (e.g. plant expansions).	Without spare capacity, or the ability to expand a plant to create extra capacity, requiring a facility owner to provide third party access would be inappropriate.
(d) There is not likely to be strong competition between multiple existing processing facilities to process gas, perhaps due to the high cost of transporting unprocessed gas across large distances.	If there is workable competition between owners of gas processing facilities, an individual facility owner will not be able to restrict economic access to a facility.

5.5 The existence of these circumstances is explored in section 6.

Qualitative analysis

5.6 If technical/economic analysis indicates that efficiency concerns may exist, the Gas Industry Co would then expect to be able to identify situations where:

- parties have had difficulty bringing gas to market because there have been difficulties accessing existing gas processing facilities; and
- facility owners are unable to provide legitimate (efficient) reasons for not providing access to refute allegations made by those third parties.

5.7 In practice, there is a range of legitimate (i.e. efficient) reasons why third party access to a processing facility may not be provided or agreed. It may be difficult in every case to determine whether:

- apparently legitimate reasons advanced by a facility owner fully explain why a commercial access arrangement has not been possible; or
- whether additional illegitimate (inefficient) reasons have contributed to the situation (such as keeping a new entrant out of the gas market).

5.8 However, if there has been a repeated pattern of exclusionary behaviour, systematic enquiry would be expected to reveal this.

5.9 Analysis of historical cases should provide some guidance for the Gas Industry Co in deciding whether substantial inefficiency is likely to result in the future, e.g. whether it is likely that third parties could be inefficiently deterred from developing fields. Evidence of substantial inefficiency would warrant proactive intervention of some kind.

5.10 To this end, Gas Industry Co commissioned a survey of facility owners and access seekers. That survey was designed to elicit information on the gas

processing sector that would assist in determining the most appropriate form of access protocols.

5.11 As part of collecting historical background information, the Gas Industry Co has also sought to identify cases where:

- access to a processing facility has been agreed, or
- access has not been agreed, and the third party has decided to build its own processing facilities.

5.12 This information will be used by the Gas Industry Co in understanding issues involved in providing access to processing facilities, including negotiation processes and the availability of information.

Q3: *Do you agree that the framework outlined in section 5 is suitable for identifying whether there are substantial inefficiencies arising from current arrangements for access to gas processing facilities? If not, what alternative framework would provide a superior assessment?*

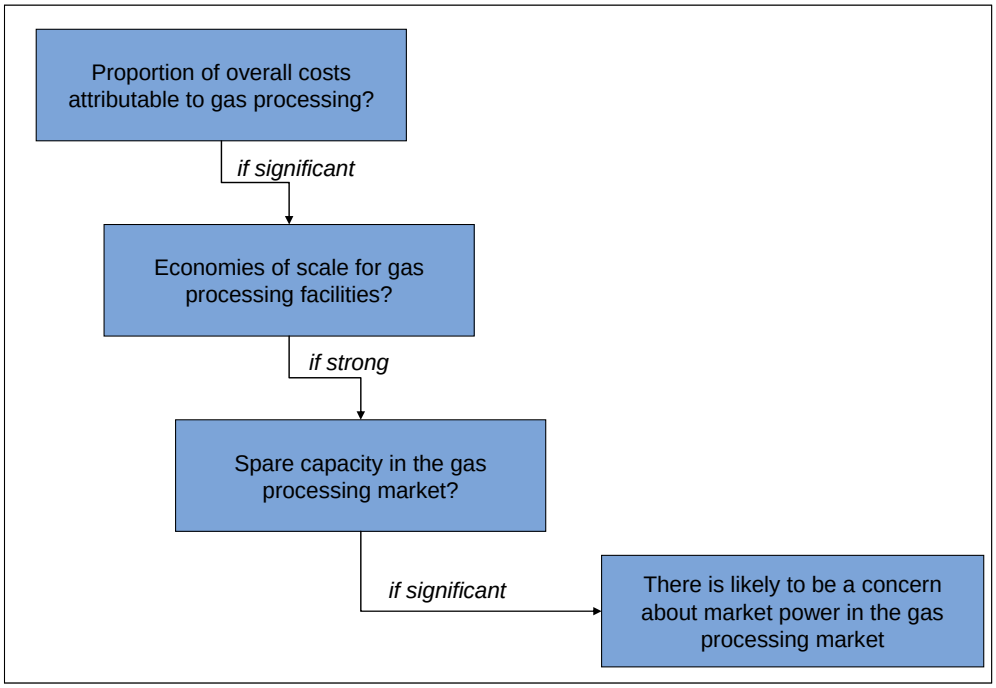
5.13 In the next section of this paper, a technical/economic assessment is undertaken. The qualitative assessment is discussed in section 7.

6 Technical/Economic Analysis

Background

6.1 The technical/economic part of the needs assessment framework discussed in section 5 has been used, as depicted in Figure 2, to analyse whether the structure of gas processing costs is such that there are likely to be inefficient barriers to accessing gas processing facilities. To assist in this analysis, the Gas Industry Co commissioned Transfield Worley to undertake an independent technical study of the cost characteristics of gas processing facilities. A copy of Transfield Worley's report is included as Appendix III.

Figure 2: Application of technical/economic assessment framework



6.2 Before discussing the technical/economic assessment described above, it is helpful to first consider the factors that may affect "gas processing decisions".

Considerations that affect gas processing decisions

6.3 By "gas processing decisions", the Gas Industry Co means decision-making by:

- a third party to either pay for access to an existing facility or to build a new plant; and
- by a processing facility owner to provide access to a third party, and if so on what terms.

6.4 The owner of an existing processing facility will take a range of matters into account when deciding whether to provide access to a third party and on what terms. Those matters may include:

- the facility owner's view of the cost of processing gas through its plant, including costs of capital;
- the price that a third party may be willing to pay for access;
- the possibility that the facility owner may need the capacity for itself in future (e.g. to bring new gas finds to market in a timely manner);
- risk and liability issues (e.g. the chance that the third party's gas might damage the facility, particularly given that it may have different characteristics, and whether the third party would be in a position to compensate the facility owner);
- the reliability, priority and flexibility being sought (e.g. if the facility is old, it may not be able easily to deliver sufficient reliability);
- the implications for additional CAPEX, for the life of the facility and for maintenance requirements; and
- the value of any lost flexibility in the way the facility is managed (e.g. difficulties over scheduling of maintenance).

6.5 The potential access seeker will take similar issues into account (but from a different perspective) when deciding whether to use existing processing facilities, or whether to build its own facilities (perhaps to utilise the gas at source or even to postpone developing the field). In addition, the third party may consider:

- restrictions on its access to capital (tight restrictions on capital may make the option of building a new processing plant unattractive); and
- the cost of transporting unprocessed gas to the existing processing facility (e.g. cost of laying a new pipeline). However, that cost needs to be balanced against the cost of transporting *processed* gas to a transmission pipeline (if the potential access seeker built its own processing facility instead).

6.6 The key point to note is that gas processing decisions will be made on the basis of a wide range of factors. The relative cost to a third party of accessing an existing processing facility compared with building its own plant may be a significant issue, or it may be outweighed by other factors in making a final decision.

Proportion of costs attributable to gas processing plants

6.7 From the Transfield Worley study, the annualised cost of building and operating a small gas processing plant of around 5 PJ pa capacity is estimated to be within the range 7% to 14% of the wholesale price of gas[9]. The comparable range for a 100 PJ pa plant is approximately 4% to 7.5%. Other things equal, the difference would be of the order of 3 – 7%. These proportions will vary according to the technical capability of a particular processing plant, e.g. the level of condensate in the raw gas feed, CO_2 removal or LPG extraction or storage capabilities. The above analysis also ignores the sale of other products such as LPG or condensate.

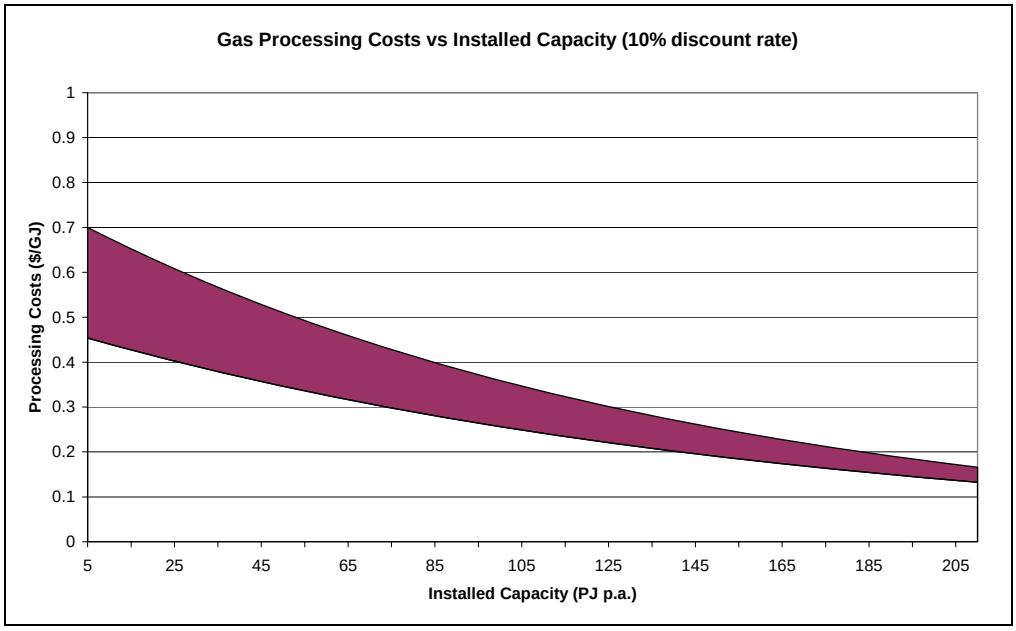
6.8 It appears reasonable to conclude that the proportion of overall costs attributable specifically to a gas processing plant could be significant, particularly for a gas field but perhaps less so for an oil field with associated gas. For a given processing requirement, gas processing costs will be much more certain than upstream costs. However, as noted above, the difference in costs between large and small processing plants is less significant.

Economies of scale for gas processing

Generic characteristics

6.9 Figure 3 shows Transfield Worley's estimate of annualised gas processing plant costs in the NZ setting. The shaded band reflects uncertainty about actual operating and maintenance costs.

Figure 3: Annualised gas processing costs



9 Based on Transfield Worley's estimated range of annualised gas processing costs and a wholesale gas price range of $5 to $7 per GJ.

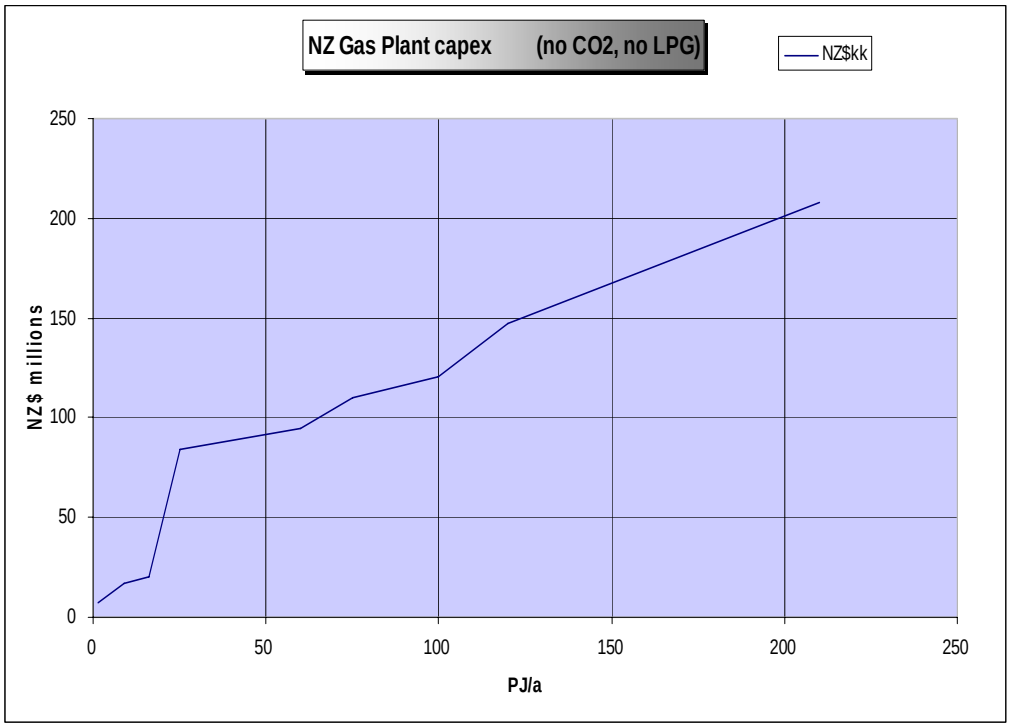
6.10 This suggests that there are some economies of scale associated with gas processing plants, assuming a standard design. The Gas Industry Co notes that the slope of the graph is steeper than might be expected from other jurisdictions. It is suggested that in Canada, for example, there may be greater use of "off the shelf" components which will tend to reduce scale economies.

Practical considerations

6.11 Figure 4 shows the estimated capital cost based on costs of actual processing facilities in NZ. The irregular shape of the curve, particularly for smaller plants, highlights the point that actual plant costs may vary considerably in practice depending on circumstances. Note that Figure 4 excludes the cost of CO_2 removal and LPG extraction facilities (although LPG costs would be offset by additional revenue in practice).

6.12 Figure 4 suggests that small skid mounted processing plants (the left hand end of the curve) may be relatively inexpensive to build. The Transfield Worley report indicates that, from an engineering perspective, the crossover from skid mounted facilities to "stick built" plant could be between 8 - 30 PJ/annum. It should be noted, however, that the smaller plants can be more expensive to maintain and operate, particularly if higher levels of reliability are needed. This explains the apparent discrepancy in the shapes of the curves between Figure 3 and Figure 4.

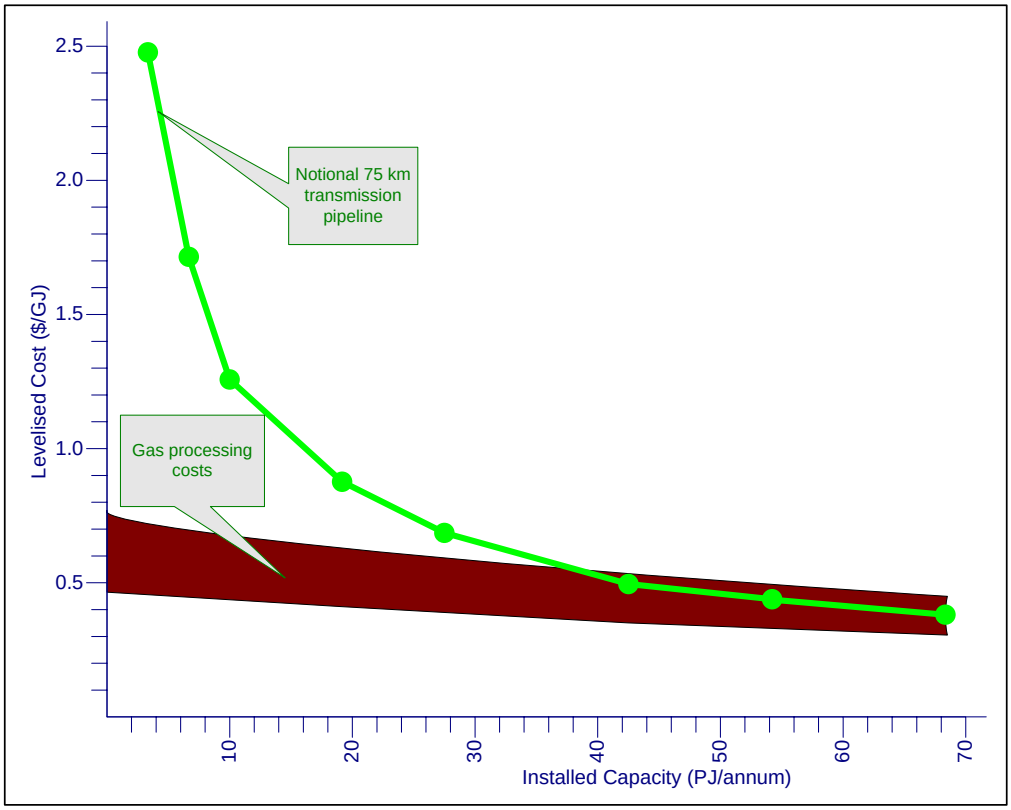
Figure 4: Gas processing capital costs



Comparative economies of scale

6.13 Although some economies of scale appear to be present, they are significantly less than for "natural monopoly" assets, such as gas transmission pipelines, which are typically regulated. This is illustrated in Figure 5, which compares gas processing and pipeline costs. The pipeline costs have been calculated, on the same basis as the gas processing costs estimated in Figure 3, for a 75 km length of pipeline at the stated PJ pa capacity.

Figure 5: Relative economies of scale



6.14 While gas processing facilities exhibit some economies of scale, these are not particularly strong when compared with those of an accepted natural monopoly such as pipelines. This suggests securing access to existing processing facilities at reasonable prices is likely to be a less significant issue for field owners as they have a credible alternative.

Other factors

6.15 It is important to recognise also that the above analysis of economies of scale focuses on the estimated costs of generic gas processing capacity. Other direct costs are also likely to influence decision making. For example, the Transfield Worley report indicates that "*physical constraints are unlikely to be the limiting factor when it comes to assessing the feasible set of processing plants that are within range of a particular well. Instead, it seems much more likely that, in the absence of an existing nearby gas gathering line, the cost of running a new pipe to a processing plant will be the limiting factor*".

6.16 To illustrate the above, using data from Figures 1.6.1 and 1.6.2 in the Transfield Worley report, a 25km pipeline capable of transporting 2 to 3 PJ pa would cost around $18m to construct. A 2 to 3 PJ pa gas processing facility would cost a similar amount (refer Figure 4 above).

6.17 Other issues may thus dominate in the decision-making process to the extent that a third party will prefer to build its own facilities rather than access an existing facility. As discussed later in section 7, larger developments tend to favour dedicated gas processing facilities but a number of small gas processing plants have also been constructed in NZ suggesting that economies of scale have not been an impediment to their development.

Overall implications

6.18 In conclusion, while there are some economies of scale for gas processing, other factors can also be expected to influence gas processing decisions. Historical practice has therefore been explored with the industry to assess whether there are any substantive efficiency problems, such as the development of smaller fields being deterred because of difficulties accessing an existing processing facility. This is discussed in section 7.

Spare capacity and competition assessment

6.19 The location, ownership and capacity of existing processing facilities are covered in section 7. It also provides an indication of the likely level of utilisation of each plant at present. It is clear that some spare capacity exists although in some instances it is likely this has been reserved by the facility owners for planned or possible future developments. It is also likely that additional spare capacity could be made available through plant expansions.

6.20 The qualitative assessment in section 7 is also helpful in considering the extent to which there is currently workable competition in relation to access to gas processing facilities.

Assessment

6.21 The technical/economic analysis part of the Gas Industry Co's needs assessment framework suggests that:

- the cost of a gas processing facility, based on estimates derived from the Transfield Worley study, accounts for a moderate proportion of the wholesale price of gas (perhaps 4 to 14 percent depending on facility size);
- there are some economies of scale for gas processing facilities although these are relatively weak compared to those associated with natural monopoly assets; and

- there is some spare processing capacity, and more capacity could be made available through expansions of existing facilities (it is understood that plants are relatively modular in nature and, subject to available land and resource consents, expansion is relatively straightforward).

6.22 Figure 6, in section 7, shows the location of existing gas fields in Taranaki[10], gas processing facilities and key pipelines. Although there is a strong network of transmission pipelines in Taranaki, these pipelines are predominantly used for carrying *processed* gas. There is not a strong network of transmission pipelines capable of, and available for, transporting *unprocessed* gas over long distances.

6.23 If it is viable to transport unprocessed gas to a particular existing processing facility, it is possible that that facility may have some ability to set the access price for a small field developer above a cost-based (competitive) price. But the scope for that behaviour (and resulting impact) is limited by both the ability of the third party to build its own processing facility and the existence of any other facilities nearby.

Conclusions

6.24 The findings in this section are not a strong indicator that efficiency problems will exist. However, they do justify some investigation of historical cases to determine whether there are in practice substantial efficiency concerns that need to be addressed.

6.25 It should be noted that there is a wide range of field specific and geographical factors that could mean, from the perspective of an economic planner, use of an existing processing facility would not be the best way to bring a new gas field to market. The cost structure of gas processing alone cannot take account of these broader factors. The circumstances of each individual case may frequently dominate any apparent cost advantages of an existing facility.

Q4: *Do you agree with the technical/economic assessment presented in section 6?*

[10] There are no existing gas processing facilities outside Taranaki.

7 Qualitative Assessment

Introduction

7.1 This section includes:

- a summary of current gas processing facilities in NZ;
- a summary of perspectives of facility owners and access seekers; and
- consideration of historical practices with regard to gas processing.

The NZ gas processing market

Table 1: Current & committed processing facilities

Facility	Owner(s)	Estimated Capacity (PJ pa)	Estimated Utilisation
Kahili Separation	Vector	1.73[11]	0%
Kaimiro	Greymouth Petroleum	1.2	100%
Kapuni–KGTP (CO_2 removal)	Vector	26[12]	90%
Kapuni–KGTP (no CO_2 removal)	Vector	52[13]	0%
Kapuni (upstream)	Shell/Todd	70	40%[12]
Kupe	Origin/Genesis/NZOG/Mitsui	20-25	80-100%
McKee	Todd	8	100%
Mangahewa	Todd	12	100%
Oaonui (Maui)	Shell/Todd/OMV	175[14]	25% avg 55% peak[15]
Pohokura	Shell/Todd/OMV	80	100%[16]
Radnor	Bridge/Westech	4	0% - 100%[17]
Rimu/Kauri	Swift	10	50%
Waihapa (TAWN)	Swift	17	30%

11 Capacity could be doubled.

12 Constrained by very high (43%) CO_2 gas. Some ability to process larger volumes of gas if some feedstock replaced with lower (15-25%) CO_2 gas before throughput and changes made to hydrocarbon dewpointing system capacity.

13 For low-CO_2 gas. Capacity can be increased to 70 PJ p.a. with reduced hydrocarbon dewpointing.

14 Economic capacity subject to review.

15 From 2007.

16 Figures provided by Todd. No data from Shell or OMV.

17 Bridge expects future 100% utilisation.

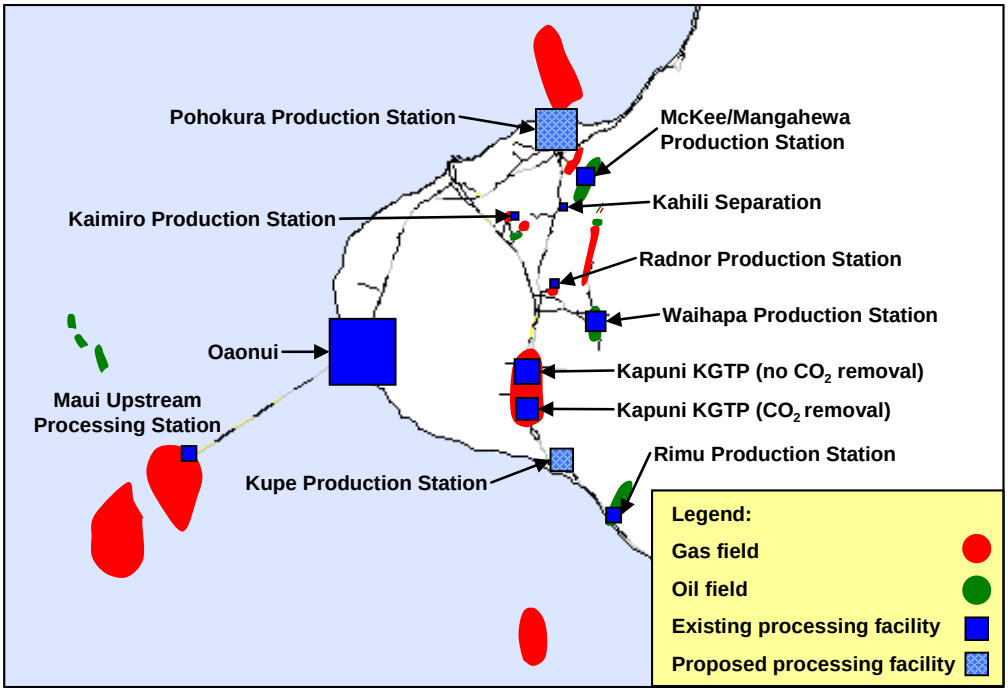
7.2 Table 1 provides a summary of gas processing facilities in NZ. The information in Table 1 was provided to the Gas Industry Co via industry interviews.

7.3 Table 1 is notable for the wide range of facility sizes, suggesting that small-scale gas processing plants can be economically viable in the NZ context.

7.4 The Gas Industry Co understands the ownership of gas processing facilities is similar in most cases to the ownership of the field the facility serves. As there is diverse ownership of fields this has led to a diverse ownership of gas processing facilities.

7.5 Figure 6 illustrates the locations of fields, processing facilities and key transmission pipelines in the Taranaki region.

Figure 6: Location of fields and processing facilities



Industry perspectives

7.6 The Gas Industry Co arranged a series of independent interviews with companies representative of the range of interests in gas processing in NZ. The purpose of the interviews was to examine historical experience in NZ from the perspective of both facility owners and access seekers. The interviews focused on:

- the capacity and utilisation (historical and expected) of NZ gas processing facilities;
- experiences in seeking, negotiating or operating commercial agreements to process gas;

- views on financial, technical and other factors considered relevant to commercially acceptable third party access arrangements;
- factors influencing facility access versus build decisions;
- whether protocols for access to gas processing facilities in NZ are needed and what form of access protocols would be appropriate; and
- any other issues the firm considered relevant to the Gas Industry Co's considerations.

7.7 Table 2 lists the companies[18] that were interviewed[19] and their interests in the NZ gas sector.

Table 2: List of companies interviewed

NZ Interest[20] / Company	E&P		Gas Processing		Downstream		
	Permit Holder	Op'r	Owner	Access [21]	Trans /Dist	User	Retailer
Austral Pacific	✓	✓		✓			
Bridge Petroleum	✓	✓	✓	✓			
Contact Energy	✓	✓				✓	✓
Genesis Energy	✓		✓	✓		✓	✓
Greymouth Petroleum	✓	✓	✓	✓			
Mighty River Power	✓			✓		✓	✓
NZOG	✓	✓	✓	✓			
OMV	✓	✓	✓		✓		
Shell	✓	✓	✓		✓		
Swift	✓	✓	✓		✓		
Tap Oil	✓	✓		✓			
Todd Energy	✓	✓	✓	✓	✓		
Vector			✓		✓		✓

7.8 The rest of section 7 represents an overview of the perspectives and issues that emerged from these interviews. Summaries of individual interviews, as confirmed with each organisation, are included in Appendix IV. Some specific information discussed during the interviews has been omitted from the summaries because of commercial sensitivities. Where relevant, this information has been factored into the following summary in a generic manner.

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18 Origin Energy did not respond formally but indicated an intention to make a submission on this discussion paper.

19 Greymouth Petroleum responded to some questions by email rather than be interviewed.

20 In some instances, permits and processing facilities are jointly owned. This is not shown in Table 2 but in relation to gas processing facilities, joint ownership is shown in Table 1.

21 The "Access" column indicates a company that currently has third party access to a facility, has sought access and/or likely to seek future access.

Need for access protocols

7.9 Most companies consider that:

- where an arrangement would benefit both parties commercially, it should be possible to negotiate access to gas processing facilities without being constrained by mandatory access protocols;
- forcing third party access to gas processing facilities, or regulating fees, would increase the commercial risks faced by E&P companies in NZ and likely act as a disincentive to future investment in NZ.

7.10 One company considers that regulatory intervention is required, as noted below. Another company expressed strong concerns about its ability to obtain access to infrastructure generally, and in one instance relating to a gas processing facility, but has not provided details or indicated how its problems should be resolved.

Scope of possible access protocols

7.11 Most companies consider that to the extent access protocols are to be considered, their scope should be limited to gas processing facilities. However, whether the scope should extend beyond gas processing equipment, to include associated pipelines, was not always clear from the discussions.

7.12 One company considers that regulations governing access and fees are needed and that the scope of gas processing should be extended to include bottlenecks (e.g. oil storage tanks) that indirectly constrain gas flows to market[22]. As noted in section 4, the coverage of any protocols developed by the Gas Industry Co is limited to the commonly accepted meaning of gas processing facilities. Further the application of the Gas Act[23] specifically excludes compounds that are liquid at ambient temperature and pressure, meaning that Gas Industry Co does not have the ability to intervene in this area.

7.13 One company indicated a desire to gain access to gas fired power stations and petrochemicals manufacturing facilities. Other companies noted[24] that these activities must be excluded from any definition of gas processing facilities and consideration of access protocols. As noted above, the Gas Industry Co does not think either gas fired power stations or petrochemicals manufacturing facilities fall within the normal meaning of gas processing facilities.

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22 If condensate storage is restricted, this can impose a constraint on the production of natural gas from a condensate-rich field, since the production of natural gas also results in the production of condensate.

23 Section 3 of the Gas Act.

24 But preferred that the comments not be included in their interview summaries.

Importance of gas processing relative to other issues

7.14 Gas processing of itself is generally not seen as a significant issue. Ensuring open access to transmission services is widely considered to be much more important. Some companies also identified that resolution of oil storage bottle neck issues was a much higher priority issue than access to gas processing facilities.

7.15 Feedback on the proportion of overall costs attributable to gas processing varied although only ball park indications were discussed. To some extent it is likely that this variability reflects the uncertain and significant costs associated with exploration and also different processing and gas gathering pipeline requirements and, therefore, costs. Although differing proportions of overall costs were attributed to gas processing during interviews, and in some instances figures of 20% to 30% were used, interviews generally confirmed the analysis presented in section 6, that gas processing costs are likely to represent a moderate proportion of overall costs.

7.16 Qualitative feedback supported the view that whilst there are some economies of scale associated with gas processing plants these effects are likely to be dominated by other factors (such as pipeline costs and specific technical processing requirements).

Factors influencing access versus build decisions

7.17 For larger gas developments, building a dedicated facility is seen as more likely. Decisions to build or negotiate access to existing, or expanded, gas processing facilities can be dominated by factors such as long term contractual certainty and technical risks to gas flows.

7.18 The cost of gathering pipelines and/or extra processing equipment can also be significant factors. For example, if the capacity of an existing plant has to be expanded, or the raw gas requires pre-processing to match an existing plant's processing capability, this could involve significant costs.

7.19 From a facility owner's perspective, there are also technical risks (e.g. damage or plugging due to contaminants), capital risks (e.g. sunk expansion costs should a third party field run down prematurely) and loss of the option to use existing spare processing capacity, or to expand capacity, for their own needs in future.

7.20 Some smaller companies indicated they would prefer, all other things being equal, to have gas processed by a third party (reserving capital for E&P activities). In general, these companies believe that they will be able to negotiate commercially acceptable access agreements. It was noted that some trade-offs in costs are able to be made in developing new facilities. For example, it was noted that whereas larger processing facilities tend to be designed to meet contractual performance requirements and/or some companies have very high internal technical standards, for smaller facilities reliability may be less critical, with corresponding cost savings. It is also

easier to relocate small skid mounted processing facilities should a field not perform as expected.

7.21 As noted above, economies of scale were generally acknowledged to exist but did not appear to a substantive concern.

Experience

7.22 Examples of access arrangements that have been sought in NZ include:

Kahili

- the JV owners of the Kahili permit[25] sought third party access;
- offers were made by Swift (Waihapa facility) and NGC (now Vector);
- the NGC option was chosen - it built the Kahili facility (see Figure 6*)* and pipeline, at a cost of around $9 million to NGC; and
- the processing facility is unused at present, as production dried up (it is hoped the facility will still be needed although it could also be relocated).

Radnor (2005)

- Bridge Petroleum looked at third party access at Waihapa for the Radnor product:
    - the high wax content of the condensate would have required heating of the storage tanks and pipelines to maintain the viscosity of the liquid during transportation;
    - due to this, and the low flow rate from the Radnor well, using the Waihapa facility was uneconomic;
- it was decided to build a dedicated Radnor facility (see Figure 6); and
- the processing facility is unused at present, however indications are that the well should be producing within the next few months.

Kupe (committed)

- Kupe JV[26] considered multiple gas processing options:
    - Vector's Kapuni facility - required significant additional plant to enable it to process gas from the Kupe field;
    - Swift's Rimu facility – again significant investment in capital would have been needed;

[25] Austral Pacific, Arrowhead Energy, Millennium Oil and Gas and Tap Oil.

[26] Origin Energy, Genesis Energy, NZOG and Mitsui E&P New Zealand.

- the Shell/Todd/OMV Oaonui facility – it appears this was not seriously considered so it is unclear what would have been needed; and

- it was decided to build a dedicated facility for Kupe (see Figure 6).

7.23 A number of facilities have been developed in NZ, as can be seen in Table 1 and Figure 6, including a number of smaller facilities. More recent examples where a facility has been built in preference to using an existing facility include:

Rimu (2002)

- having full control (and unrestricted access) of processing facilities when needed is critical to a pure E & P company's commercial success; and

- Swift decided to build the purpose built processing facility at Rimu.

Radnor (2005)

- see above.

Pohokura (under construction)

- the JV[27] also jointly owns the processing facility at Oaonui;

- the Pohokura discovery is roughly 70 km NE of the Oaonui facility; and

- instead of building a pipeline linking Pohokura to Oaonui, a new facility adjacent to the Pohokura field is being built.

Kupe (committed)

- see above.

7.24 Situations where difficulties in seeking access agreements have been reported include:

- a situation involving a commercial dispute over ownership of extracted liquids that was subsequently resolved in court; and

- a company indicated that it had been unable to obtain access to Vector's Kapuni processing facility, but did not provide any background details.

Factors relevant to negotiating access

7.25 Factors which are considered to be important by industry participants in negotiating commercial arrangements include:

- fees need to reflect the value of spare processing capacity (e.g. the fees may be very high if a facility owner perceives a future need unless the capacity is only offered on a short-term or interruptible basis), any capital risks (e.g. for expansion or major maintenance/refurbishment), risks to

[27] Shell, OMV and Todd Energy.

original or third party raw and processed gas streams, and value of by-products to either party;

- operating/maintenance costs should be allocated fairly between the parties (e.g. higher utilisation can lower per unit operating/maintenance costs for the facility owner and the cost of any additional processing requirements should not be borne by the facility owner);

- a facility owner needs confidence about the prospective third party's detailed gas composition and processing requirements, expected production profiles, reserves commitment, term, and desired service levels (e.g. firm versus interruptible);

- a third party needs confidence about the availability of spare capacity (current and expected) and technical processing capabilities; and

- there should be contractual clarity about what happens if there is insufficient capacity (e.g. which streams get backed out first), commercial entitlements to and accounting for raw gas, processed gas and by-products, and coordination of maintenance schedules.

Form of protocols

7.26 Most companies indicated they are happy to seek/offer spare processing capacity and to negotiate access agreements on commercial terms without the need for either prescriptive access protocols or regulatory interventions.

7.27 Most companies are strongly opposed to any measures that could force an asset owner to provide access to a third party or that could force non-commercial outcomes. They noted that this would deter future investment in gas exploration and development. Some suggested that, while they consider protocols are not needed, if any measures were to be introduced these should be light-handed only, e.g. voluntary disclosure/information based.

7.28 Some companies indicated that information was reasonably easy to obtain (e.g. technical information about original gas composition assessments and, in some instances, facility design information from permit information published on the Crown Minerals website). The Gas Industry Co observes that some of this information tends to be static and excludes information about current and expected utilisation of processing facilities.

7.29 Two companies indicated that if protocols are to be implemented, they favour the Jumping Pound methodology (discussed in Appendix II). One of these companies indicated it is adapting this to NZ conditions as a basis for offering access agreements for its own gas processing facilities. The other company indicated that although particular problems may not be evident at present, the gas exploration environment is evolving to one where there is a greater focus on smaller and previously less economic developments. It suggested that adopting some light handed protocols now would therefore be prudent rather than waiting until problems arise. It felt that the Jumping Pound methodology could be adopted voluntarily along with dispute resolution arrangements.

7.30 One company considers that fees need to be regulated, although its concerns also extend to access to pipelines and oil storage tanks (see paragraph 7.12). Another company with similar concerns about access to gas processing, but who also desires access to power stations and petrochemical facilities, did not offer any views on the possible form of protocols.

Conclusions

7.31 Stakeholder discussions tend to reinforce the technical/economic analysis undertaken in section 6, in that gas processing costs can be significant and there are some economies of scale for gas processing plants.

7.32 However, discussions also support the Gas Industry Co's technical/economic analysis that it is unlikely that these factors are of sufficient magnitude as to introduce inefficiencies. A number of smaller plants have been built indicating that it is economic to do so. Most companies believe that they will be able to negotiate commercial arrangements without the assistance of prescriptive access protocols.

7.33 Stakeholder interviews have not identified any systematic problems relating specifically to gas processing facilities.

Q5: *Do you agree with the conclusion that there do not appear to be substantial inefficiency problems with access to gas processing facilities?*

8 Identification of Alternatives

8.1 Without evidence of systematic gas processing access problems and substantial inefficiencies it is difficult to justify access protocols that would intervene in existing ownership and commercial transactions in any substantial way.

8.2 All but relatively benign interventions carry the risk of deterring E&P investment[28] and compromising a number of the GPS objectives.

8.3 It would also be difficult to justify expending significant effort and cost to develop complex access protocols or to impose substantial compliance or regulatory costs on the sector when no efficiency benefits have been identified.

8.4 The Gas Industry Co therefore considers that the only alternatives for meeting its objective are limited to low cost, light-handed options.

8.5 The only alternatives to the status quo which may meet the objective are information disclosure (to promote access and enable better monitoring) and, possibly, the development of a model contract. These are explored and assessed in the following section.

Q6: *Do you agree that alternatives to the status quo that may meet the objective are limited to low cost, light-handed measures?*

[28] A common point made in interviews is that NZ is not as attractive to E&P parties as other jurisdictions with higher prospectivity and deeper gas markets, even if these jurisidictions are more regulated, and that heavy handed upstream interventions in NZ could therefore be a significant deterrent to E&P activity.

9 Assessment of Alternatives

9.1 As discussed in section 8, the following alternatives are assessed in this section:

- model contracts regime;
- information disclosure; and
- maintaining the status quo.

Model contracts regime

Description

9.2 Under this alternative, a model contract setting out standard terms and conditions would be developed and promulgated for the industry to adopt as a starting point for negotiating commercial access agreements. An example is the model use of system agreements developed for electricity distributor access agreements with retailers.

9.3 Ideally, model contracts serve a number of purposes. They can help to redress asymmetries in negotiating positions as well as reduce transaction costs where numerous such contracts are being entered into.

9.4 A range of gas processing commercial arrangements are possible and it would be desirable, to ensure that innovation and efficiency are not stifled, to include a range of contracting choices within any model access contract. For example, agreements can be structured around fees for service, keep whole or gas (and/or by-product) purchase agreements, joint ownership of any expansion etc. These are the range of choices available to gas field owners in the US who have their gas processed by mid-stream companies.

Analysis

9.5 Such arrangements are useful in situations where widespread adoption of a relatively uniform approach to contracting can yield significant efficiency gains, and are particularly well suited to circumstances where the product or service is of a homogeneous nature.

9.6 Given the size of the gas processing market in NZ and the less homogeneous nature of the well fluids to be processed, the relative cost of developing and promulgating a suitable model contract is likely to be significant. It is possible that an existing model contract from elsewhere could be adopted as a starting point and tailored to suit the NZ commercial and operating environments.

9.7 From a potential E&P investor's perspective, a suitably flexible/permissive model contract is unlikely to be a substantial deterrent to investment in NZ. However, a more intrusive/less flexible regime could be detrimental.

9.8 To be effective, a model contract would need to be able to deal adequately with the depth and breadth of issues involved in gas processing, including fee structures. While it may be possible to justify this cost in a large gas processing market, it would be much more difficult to justify in the small NZ gas processing market where each situation is likely to be reasonably unique in a technical sense and various forms of agreement would need to be provided for[29].

Information disclosure

Description

9.9 This option would involve:

- gas processing facility owners:
  - publishing key information about each of their facilities, including physical location, upstream/downstream connections, nominal processing capacity and projected utilisation (gas, CO_2, liquids etc), specification of raw gas that can be processed, and contact details for, and general information required from, third parties seeking access; and
  - reporting to the Gas Industry Co any bona fide third party approaches for commercial access and the outcome of each approach (excluding commercial details); and
- the Gas Industry Co:
  - compiling and publishing annual statistics (from the information disclosed about individual facilities); and
  - maintaining a watching brief on the efficiency of gas processing arrangements.

9.10 The delivery mechanism could be regulatory or voluntary.

Analysis

9.11 An information disclosure and reporting regime option, if adopted by the industry or imposed by rules, would be a low cost means of enabling:

- access seekers to identify and assess potential processing options;

[29] Two companies indicated (in interviews) support for voluntary protocols based around the Jumping Pound methodology. Model contracts as such were not suggested in the interview process although it is understood that one company is developing a standard form contract for its own facilities which it plans to use in conjunction with the Jumping Pound fee methodology. Other companies are likely to have their own preferences.

- a watching brief to be maintained on the efficiency of gas processing arrangements as the NZ gas market continues to evolve (noting that the past may not necessarily be an accurate indicator of the future); and

- a formal review (in, say, four years time) to either confirm the current analysis and conclusions or to consider alternatives in light of any new information.

9.12 This option appears to meet the objective well in that it assists with the flow of information to access seekers and provides a sound basis for a later review.

9.13 From a potential E&P investor's perspective, the disclosure of information that is readily available and which confers no commercial advantage on competitors is unlikely to be a deterrent to future investment in NZ.

Status quo

Description

9.14 Facility owners and access seekers would continue to negotiate access arrangements within the normal commercial framework, subject to Commerce Act provisions.

Analysis

9.15 The analysis in this paper suggests that only low cost interventions are likely to be warranted. The status quo is clearly a low cost option. However, under the status quo it could be more costly to maintain a watching brief on the efficiency of gas processing arrangements as the market evolves. Any future review of this segment may require an exercise, similar to the current process undertaken by the Gas Industry Co, to gather and assess the information.

Overall assessment

9.16 The Gas Industry Co considers that an information disclosure regime would be the most consistent with the objective for making a proposal.

9.17 The information disclosure regime would be much less costly to implement than a model contract regime, which would also have uncertain benefits and take longer to implement.

9.18 The information disclosure regime would be relatively inexpensive to comply with and is expected to have greater benefits than the status quo. In particular, compared to the status quo, the information disclosure regime would:

- involve little additional cost;

- enable third parties to more readily identify and assess possible options;

- enable a watching brief to be maintained on the efficiency of gas processing arrangements as the gas industry evolves; and

- assist in conducting a future review to confirm the efficiency of gas processing arrangements (or otherwise to reconsider access protocol requirements).

Q7:	*Do you agree with the assessment and that information disclosure is the preferred means of meeting the objective? If not, why not?*

10 Policy Instruments

10.1 There are two distinct options for delivering protocols based on information disclosure:

- a scheme whereby the facility owners voluntarily opt-in to a code of practice specifying the form, content and frequency of information disclosed; or
- rules approved by the Minister that specify the form, content and frequency of information disclosure together with associated compliance mechanisms.

Voluntary information disclosure

10.2 Clearly the first of these options requires the support of facility owners in order to be viable. In that regard, it may be that facility owners will be incentivised to support an opt-in arrangement as a means of demonstrating support for an industry-led solution in this area.

10.3 However, such a scheme will continue to be exposed to a number of risks:

- withdrawal by one or more facility owners;
- a facility changing hands and the new owner choosing not to opt-in; and
- the owner of any new facility who chooses not to opt-in.

10.4 The advantage of an opt-in scheme is that it may be easier to change the form and content of disclosures (in light of feedback and experience) as compared with a regulated alternative.

Mandatory information disclosure

10.5 The second means of delivering information disclosure is to provide a mandatory scheme by introducing legislative rules or regulations.

10.6 In the event the facility owners do not universally support voluntary disclosure the only practicable option is mandatory information disclosure, i.e. a legislative obligation that would require facility owners to make certain information available.

Analysis

10.7 It would appear that the costs involved in both delivery mechanisms are relatively small. In the case of the opt-in scheme the costs would include:

- designing the form and scope of information to be disclosed;

- drafting the opt-in agreement, including provision for revising the disclosure requirements from time to time; and
- communicating with facility owners to get their agreement and to achieve universal support.

10.8 In the case of the legislative obligation, the costs would include:

- designing the form and scope of information to be disclosed;
- preparing a proposal on the information disclosure regime, including drafting the disclosure rules, and consulting on that proposal;
- preparing a recommendation to the Minister; and
- implementing the rules.

10.9 Given that there is likely to be very little difference in cost between the two options, and assuming the benefits are the same in both cases (i.e. both result in the information being disclosed), the voluntary scheme appears to offer a marginally greater degree of flexibility. However, the Gas Industry Co acknowledges it is also exposed to a greater risk of non-compliance.

10.10 On balance, Gas Industry Co is inclined to offer industry participants the opportunity to volunteer to provide the necessary information. In the event that participants choose not to opt-in to such a scheme (or opt-in but levels of compliance fall below 100%) the option to regulate for information disclosure would remain available.

Q8: *Do you concur with Gas Industry Co's assessment that the industry be invited to adopt a voluntary information disclosure regime? If not, please give your reasons.*

11 Conclusion and Next Steps

Conclusion

11.1 The Gas Industry Co's view is that the objective of any protocols should be to facilitate access to gas processing facilities only where that is both economically efficient and contributes to better achievement of the Government's overall policy objective.

11.2 Neither the quantitative or qualitative analysis undertaken suggests any substantive policy intervention is warranted. Heavy handed interventions would be expected to impose unnecessary costs on the sector and could, as a result, deter investment in E&P activities.

11.3 The preferred option is the development of an information disclosure regime. Such a regime would ensure that possible access options are able to be ascertained without constraining the ability of parties to negotiate access agreements in a form that suits their particular requirements. It should reduce the costs of assessing access options. Also, the preferred option will facilitate a watching brief on access arrangements.

11.4 The Gas Industry Co concludes that:

- it should seek (initially through this paper) industry support for a voluntary information disclosure regime of the form described; and
- if the industry is willing to embrace a voluntary regime, it should seek the Minister's approval in accordance with the GPS requirement; or
- if the industry is not willing to support a voluntary regime, it should instead prepare a proposal recommending to the Minister to implement a mandatory information disclosure regime.

11.5 It is also recommended that gas processing facilities access arrangements should be reviewed in four years time to confirm arrangements are economically efficient or, if not, to address the issues identified at that time.

Next Steps

11.6 After taking into account submissions on this paper and making any necessary revisions, Gas Industry Co will seek formal expressions of support for a voluntary disclosure regime. This would take the form of an invitation to agree to the annual provision of information in a specified form.

11.7 Depending on the level of support, Gas Industry Co would either:

- recommend to the Minister access protocols in the form of voluntary information disclosure; or

- prepare a proposal for the Minister recommending a set of legislative rules or regulations providing for access protocols in the form of mandatory information disclosure with accompanying compliance and enforcement provisions.

Appendix I: Format for Submissions

To assist the Gas Industry Co in the orderly and efficient consideration of stakeholders' responses, a suggested format for submissions has been prepared. This is drawn from the questions posed throughout the body of this discussion document. Respondents are also free to include other material in their responses.

Recommended Format for Submissions

Submission from: (company name and contact person)

QUESTION	COMMENT
Q1: Do you agree that the overall objective of any protocols should be to facilitate access to gas processing facilities where that is both economically efficient and contributes to better achievement of Government's overall policy objective, taking account of the specific outcomes it expects of the sector? If not, what should the objective be?	
Q2: Do you agree with the proposed definition of gas processing facilities for the purpose of considering access protocols?	

QUESTION	COMMENT
Q3: Do you agree that the framework outlined in section 5 is suitable for identifying whether there are substantial inefficiencies arising from current arrangements for access to gas processing facilities? If not, what alternative framework would provide a superior assessment?	
Q4: Do you agree with the technical/economic assessment presented in section 6?	
Q5: Do you agree with the conclusion that there do not appear to be substantial inefficiency problems with access to gas processing facilities?	
Q6: Do you agree that alternatives to the status quo that may meet the objective are limited to low cost, light-handed measures?	
Q7: Do you agree with the assessment and that information disclosure is the preferred means of meeting the objective? If not, why not?	
Q8: Do you concur with Gas Industry Co's assessment that the industry be invited to adopt a voluntary information disclosure regime? If not, please give your reasons.	

Appendix II: Access Protocols in Other Jurisdictions

Background

The Gas Industry Co has undertaken a limited review of gas processing arrangements in other jurisdictions.

In general, parties are expected to negotiate access arrangements on a commercial basis. In some jurisdictions, notably the United Kingdom and Canada (Alberta), industry codes for access to gas processing facilities have been developed. In both of these jurisdictions, there is regulatory oversight and, if necessary, intervention under certain circumstances to resolve access arrangements.

Australia

Industry

Each Australian state acquires its gas from different fields, and only New South Wales and South Australia have transmission pipeline interconnections with each other. Therefore, while production is significant on a world scale, there are in effect a number of smaller gas markets. Although each separate market is not large, there are a number of large companies involved in the Australian gas sector.

Access regime

Access to pipelines is regulated under legislation which enables facilities to be designated to be of national importance[30]. Upstream activities, including gas processing, are not subject to economic regulation. It is understood (from interviews) that third party access agreements have been negotiated. This is consistent with information from the Australian Petroleum Production and Exploration Association which records a number of third party tolling arrangements.[31] The need for regulation of upstream facilities has been examined on a number of occasions. A 1998 review recommended that a mandatory access scheme was not necessary. APPEA subsequently issued a statement of best practice principles for the commercial negotiation of third party access to upstream facilities.

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30 Trade Practices Act 1974 establishes a legal regime providing for third party access to a range of facilities of national importance. The Gas Pipelines Access (South Australia) Act 1997 is the 'lead legislation' for the National Third Party Access Code for Natural Gas Pipeline Systems (the Code) that regulates the provision of third party access to gas pipelines. The Gas Pipelines Access (Commonwealth) Act 1998 facilitates the national coverage of the Access Regime by ensuring it will apply to offshore waters.

31 Submission to the Productivity Commission Inquiry into the National Access Regime, 2001, APPEA

Canada

Industry

The Canadian gas market is large, with approximately 80% of production concentrated within Alberta. There are many companies involved, with the top nine accounting for around 75% of gas and oil production.

About 30% of Alberta's gas production is sour gas (contains significant amounts of hydrogen sulphide), which is processed in approximately 250 gas processing plants. For environmental reasons, the development and location of sour gas processing facilities is subject to tight regulatory controls. Specifically, the regulatory regime in Alberta aims to minimise proliferation of sour gas processing plants. A number of companies have gas gathering businesses.

Access regime

It is understood that the majority of companies seeking access to pipelines or gas processing plants are able to agree contracts. However, if a party applies to the regulator, it has the power to impose common carrier/processor status on infrastructure and to set tariff rates.

There is a strong focus in Alberta on avoiding new sour gas processing plants. Regulator[32] approval is required before a new sour gas facility can be developed and there are very stringent controls. For example, all technically viable existing facilities must first be investigated thoroughly (including upgrading options) and applicants must justify a new sour gas plant within 15 kilometres of an existing plant in terms of social and environmental effects. The extent of regulatory control is illustrated by the following statement[33]:

> *"if the primary rationale for establishing a new facility is related to economic considerations, including processing fees or inability to obtain firm capacity access, applicants must include supporting information in their applications to the EUB. The EUB may not consider high fees for using existing or modified facilities as an acceptable justification of new sour gas plants. In such situations, the EUB has processes for dispute resolution and EUB legislation provides for the review of facility processing fees".*

The industry has developed voluntary guidelines (Jumping Pound methodology) for oil and gas processing tariffs to promote commercial

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32 The Energy Utilities Board (EUB) of Alberta is the provincial regulator. Permission is also required from an environmental agency.

33 Sulphur recovery guidelines for the province of Alberta, Interim Directive, ID2001-3.

negotiations for processing agreements[34] (called custom agreements in Canada). Model agreements developed by the industry are also widely used. It is understood that, if setting gas processing tariffs, the regulator would apply the Jumping Pound methodology but that few, if any, such interventions have been necessary.

The Jumping Pound methodology establishes fee guidelines for:

- *return on capital* - between 20% of historic capital cost[35] and 20% of replacement capital cost[36]. The rationale for the range is that fees should reflect commercial risks – for example, an interruptible agreement at a facility that is under-utilised would tend to the lower end of the guideline fee range and a firm contract at a facility at full capacity would tend to the upper end of the range;
- *operating and maintenance costs* – actual operating and maintenance costs are allocated across all users by volume;
- *allowance for cost of working capital* - e.g. invoice lags; and
- *other costs* – e.g. environmental restoration and end of life disestablishment costs.

A variety of contracting options are contemplated, e.g. upfront capital (capacity expansion risks), linking fees to the gas or oil market price and process volume risks, products in lieu of fees etc.

The United Kingdom

Industry

The UK gas sector is mature with a significant number of companies involved. As the large North Sea reserves run down there is significant spare pipeline and processing capacity and a focus on smaller, less economic developments.

Access regime

The owners of gas processing facilities or pipelines connecting facilities to the transmission system or to larger users are required[37] to publish annually their main commercial conditions for access: e.g. how to apply; response times;

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34 The Jumping Pound methodology dates back to a processing tariff case decided by the Canadian National Energy Board in 1990. The methodology was most recently revised in 2005. Jumping Pound is the location of the Shell gas processing plant at the centre of the case.

35 Straight line depreciated over 20 years.

36 Actual cost inflated at 3% pa or determined by an engineering study.

37 Gas (Third Party Access and Accounts) Regulations 2000 (SI 2000/1937), section 12 of the Gas Act 1995 and section 10C of the Pipe-lines Act 1962.

sample tariffs and/or methodology; expected capacity/constraints; terms and conditions on use of the infrastructure payments[38]; technical, operating, environmental protection and safety requirements. Access disputes can be resolved by a secretary of state.

It is understood that there are two key drivers - the UK government's desire to maximise hydrocarbon recoveries from the North Sea and an EU directive[39] which requires the UK to ensure third party access to gas infrastructure and facilities (which appears to include gas processing facilities).

Under a non statutory industry code (ICOP[40]) first introduced in 1996:

- facility owners publish certain data via a web portal;
- access seekers submit key information (outline of development, services sought, quality etc) to demonstrate a bona fide application;
- negotiating parties agree a work plan, notify the Secretary of State (DTI)[41];
- the Secretary is notified of a concluded agreement; and
- the Secretary can intervene after six months if the parties are unable or unwilling to reach agreement (and has powers to determine access terms although it is understood this is rarely if ever used).

USA

Industry

The US gas market is mature and large. Most gas (approximately 68 percent) is processed in Louisiana, Texas, and Alaska. The USA has over 8000 gas producers (many very small) and approximately 600 gas processing plants. Restructuring has lead to a number of large dedicated gas gathering and processing businesses being formed[42] with gas being gathered over hundreds of kilometres in some instances.

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38 Including allocation, attribution and substitution procedures and terms, priorities, ownership, voting rights, confidentiality terms, governing law, jurisdiction, licences, rights of termination, liabilities, indemnities, duration of contract dedication etc.

39 European Second Directive on Gas.

40 Code of Practice on Access to Upstream Oil and Gas Infrastructure on the UK Continental Shelf.

41 Department of Trade and Industry.

42 Following a FERC (Federal Energy Regulatory Commission) order (636) in 1992, many companies restructured so that their gathering, processing, and transportation functions were placed into affiliated companies, spun off or sold.

Access regime

There is significant regulatory oversight of transmission and distribution. Inter-state pipeline access, rates, siting and construction are directly regulated by FERC[43]. Local distribution companies are similarly regulated by state utility commissions.

Gas production activities, including gas processing, are not directly regulated. A variety of gas processing facility access arrangements are negotiated e.g. fees for service, keep whole (processed gas returned to third party equals energy content of raw gas in), percent of proceeds etc.

Summary

All of the above jurisdictions directly regulate access to transmission pipelines but have adopted differing approaches to gas processing. There is a stark contrast between Canada and the USA, which both have very large gas markets, with significant factors appearing to be sour gas environmental concerns in Alberta and the federal directive that accompanied deregulation in the USA. Neither would appear to be directly applicable to the NZ gas market. The Gas Industry Co is aware that Swift Energy is intending to offer access contracts based on the Canadian Jumping Pound fee methodology.

An aspect of the UK regime that is possibly similar to the NZ context, market size aside, is that the policy driver appears to be to maximise the utilisation of existing infrastructure as oil and gas reserves run down, including ensuring that it remains in place as smaller less economic reserves are developed. Such a concern is understandable in the context of offshore reserves which, but for the existence of nearby infrastructure, may not be economic to recover. Such concerns are much less relevant in the New Zealand situation. In addition, the UK access regime also appears to be in part to meet the EU Second Directive.

Both the Canadian Jumping Pound methodology and the UK ICOP have been established by industry and are in one sense voluntary. The Jumping Pound methodology is only a guideline although favoured by the regulator if it has to intervene and set terms for access to sour gas facilities. Direct regulatory intervention/dispute resolution sits behind the UK regime whereas the Canadian regime can force an owner to provide, or a developer to accept, access to an existing sour gas processing facility, including expansion, on terms including fees that it determines. Dispute resolution provisions aside, the UK regulations only require that facility owners are to publish certain information and that certain information is to be exchanged between facility owners and access seekers.

The Australian gas market is relatively large but as it is not fully interconnected, some regions could be likened to the NZ market, currently concentrated around Taranaki. In the Australian gas market, designated

[43] Federal Energy Regulatory Commission.

pipelines downstream of gas processing facilities are directly regulated. Gas processing and upstream elements are not subject to economic regulation.

In each jurisdiction, gas processing access agreements are negotiated and, for specific reasons, two of the jurisdictions have a fall-back to arbitration.

There is no particular jurisdiction that matches NZ's circumstances well. There are perhaps, at face value, some similarities between gas markets in NZ and some Australian states (which are not interconnected). It is also possible that with increasing development of smaller gas fields in NZ, market scale aside, there may be some similarities with the UK market going forward.

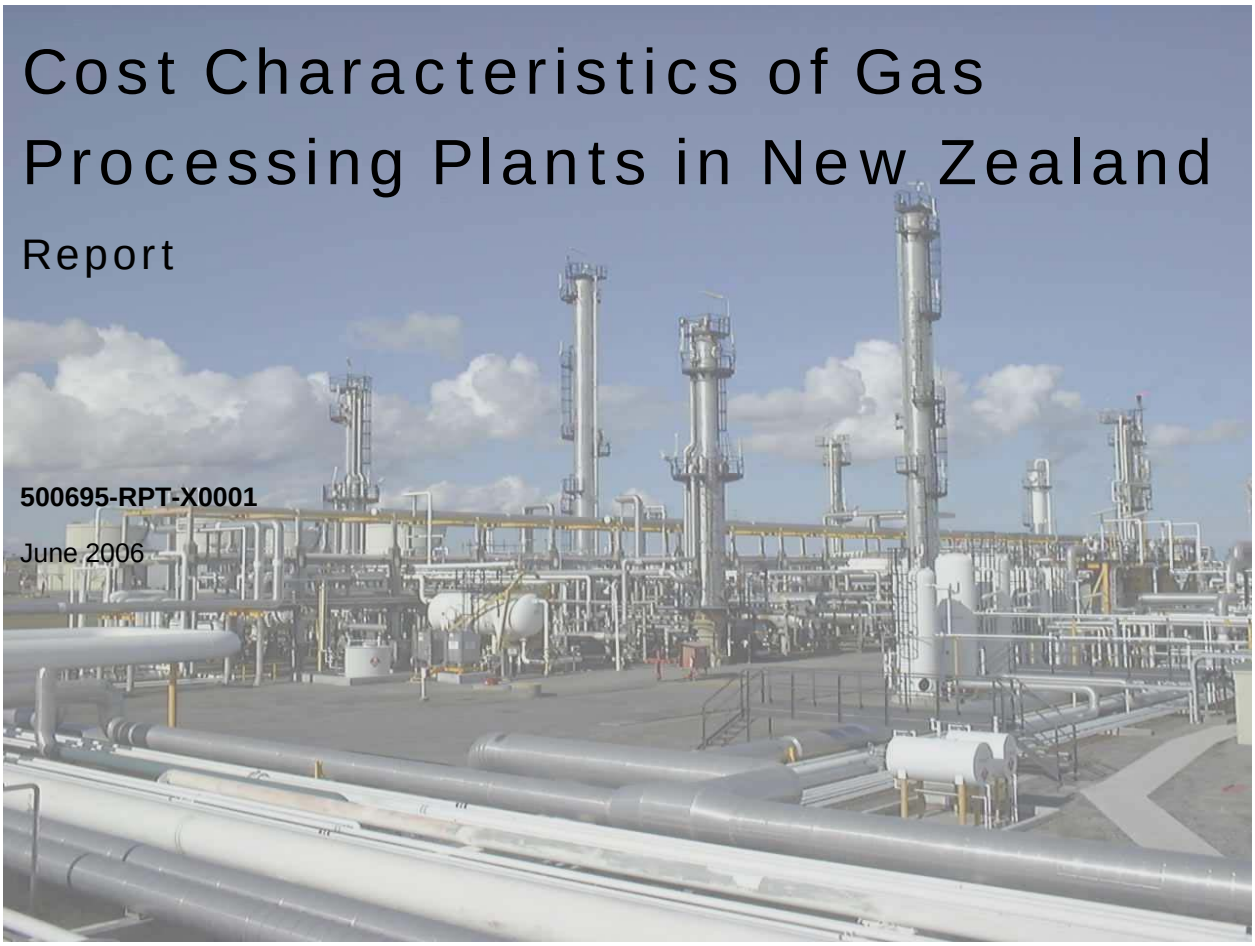
The Gas Industry Co considers that while it may be useful to consider some aspects of arrangements in other jurisdictions, the requirement for and form of any gas processing protocols should be designed to address NZ circumstances.

Appendix III: Transfield Worley Report

GAS INDUSTRY COMPANY LTD

Cost Characteristics of Gas Processing Plants in New Zealand

Report



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EXECUTIVE SUMMARY

The primary objective of this report is to provide an analysis of the cost characteristics of gas processing facilities within the New Zealand setting.

The report provides summary graphical representation of gas plant capital cost without CO_2 Removal facilities versus gas processing capacity in the New Zealand environment. Information on CO_2 removal is also provided.

In addition further information and narrative is provided to assist the Gas Industry Company (within the Terms of Reference for the report) to determine whether, and to what extent, economies of scale exist.

The key findings of the analysis are:

- Smaller skid built gas processing plants in New Zealand are generally less complex than larger site fabricated plants however larger plants are less expensive per PJ/annum in CAPEX terms .
- The main source of gas plant cost estimate variability is due to the reliability or availability requirements for the process plant being estimated.
- There is no simple correlation relating to the CAPEX of LPG extraction and export versus the PJ/annum of the main gas flow.
- The CAPEX of CO_2 removal plants is dictated more by the quantity of CO_2 removed per hour, than a direct relationship to the total gas flow processed.
- The CAPEX of a standalone CO_2 removal plant would be considerably more than a CO_2 removal plant included with a gas plant design.
- The CAPEX for most carbon steel on-shore gas pipelines may be obtained by applying a simple formula. This formula is not applicable to difficult terrain, or very small or very large pipelines, or to lines made from more exotic materials.
- Normally expected annual OPEX (operations, maintenance, and consumables/ utilities only) is typically in the range 3-6% of CAPEX for large gas plants and 10-15% for small ones. If support engineering, 5 year Marine & Industrial (M & I) inspection, and home office administration overhead costs, are included, this increases OPEX by somewhere between 1.5 to 2 times.
- In approximate terms, fixed development costs (excluding land acquisition costs) may add up to between 5% and 10% of final constructed CAPEX. The actual cost determination of individual line items will vary substantially between developments.

ABBREVIATIONS & DEFINITIONS

CAPEX	Capital Expenditure
CE	Chemical Engineering
CO_2	Carbon Dioxide (invert contaminant gas)
CPI	Consumers Price Index
E&I	Electrical & Instrumentation
GJ	Giga-Joule
JT	Joule-Thomson
LPG	Liquefied Petroleum Gas
M&I	Marine & Industrial
OPEX	Operational Expenditure
PJ	Peta-Joule
RVP	Reid Vapour Pressure (It is an indication of the propensity of the liquid to evaporate).
Sweet gas	Well gas with low sulphur content (<4ppm H_2S)
tph	Tonnes per hour
TWNZ	Transfield Worley New Zealand
US	United States of America
Wobbe Index	The ratio of the heat of combustion of a gas to its specific gravity

CONTENTS

1. CAPITAL COSTS SUMMARY

1.1 Estimating Basis and Assumptions

The following sections provide the background to the estimating methodology used and the assumptions made for analysing gas plant capital cost versus gas processing capacity in New Zealand.

The range of capital costs represented applies to "sweet gas" processing only, with no allowance for CO_2 or mercury removal, nor for the fractionation, storage, and export of propane and butane. These aspects are discussed separately in this report.

While typical gas receiving facilities are included in the CAPEX, special requirements for declining reservoir conditions, such as slug catchers or inlet compressors, have been excluded.

For the purpose of this report it is assumed there is no differential in gas plant CAPEX between an offshore source of wellstream gas supply and an onshore wellstream gas supply.

The graph in Figure 1.4.1 shows typical CAPEX costs for New Zealand gas plants over the range 2–200+ PJ/ annum. This graph is based on New Zealand gas plant data in the Transfield Worley cost data base, and includes both recent estimates and actual final cost data.

The estimates selected for this analysis were all structured on a similar format and have used a similar methodology to that used for the most recently constructed gas plants in Taranaki. Final actual costs for these plants were between the estimated constructed final cost and the bottom line constructed final cost plus contingency. Where hard cost data does not exist for a particular data point the corresponding estimate has been used.

The estimating methodology is based on major equipment items, with total installed costs being factored from both equipment cost and equipment count. The methodology is quite mature, and uses a database of New Zealand gas plant, refinery and petrochemical costs systematically collected over the last 20 years, and is applied with current home office, fabrication shop and field labour rates.

Equipment costs for recent estimates were generated from data base cost curves for static equipment, together with vendor advice for large rotating and special equipment.

To allow for escalation, all base cost data has been manipulated with appropriate cost indices to bring it to a common 2006 baseline. With the discontinuation of the "Works CCI index" some years ago, several different scaling factors have been used for the five separate main parts of the estimate – equipment, bulk materials, field labour, indirects(PM & design), and below the line items, such as local infrastructure and client engineering / or consenting costs. Refer to Table 1.3 for escalation factors used.

For equipment, much of which is imported, the well recognised Chemical Engineering's Plant Cost Index (CEPCI), as published by the US Industry magazine Chemical Engineering, has been used. Most bulk materials such as piping and instrumentation are imported into New Zealand, so again the appropriate CE indices for bulks are probably the most representative index of cost change in time. A

composite index was calculated from the separate CE piping, CE structural, CE E & I published indices.

For local construction labour, and also for local design and project management services, a New Zealand index is more appropriate. Accordingly, the CPI as published by the NZ Reserve bank was used.

The resulting graph illustrates industry trends for the capital cost of gas plants i.e., small gas plants and large ones do not lie on the same cost curve.

Small gas plants are invariably skid mounted, often with second-hand, mass produced components, while larger plants involve increasing amounts of site “stick built” content, using one off special equipment designs. This substantially increases the fabrication and installation costs of the larger plants and the time to actually build the plant.

The other factor that affects CAPEX is contractual deliverability. Large gas plants, for example Maui Production Station, are contractually required to run, essentially 24/7 365 days/year with a long advance period of notice for infrequent shutdowns - as required by the Maui White paper. Small plants are normally not designed to meet such stringent deliverability requirements, and so in consequence, do not have the same built-in redundancy and reliability.

In general terms the construction times for skid mounted process plant can be substantially less than conventional stick build gas plants. There is far less on site fabrication, welding, cabling, testing, inspection and pre-commissioning. Weather downtime on site has less impact.

In summary, while the small skidded plants are generally less expensive per PJ/a in CAPEX terms than stick built plants, small skidded plants still follow the guiding axiom of cost engineering in that small things always cost more on a unit basis (i.e. per PJ) than large ones.

1.2 Cost Variation

Transfield Worley’s experience has shown there are numerous influences (controllable and uncontrollable) that may cause variations in the compilation of costs estimates. The main source of cost estimate variability is due to the reliability or availability requirements for the process plant being estimated. For instance, if a plant is required >99% of the time, then the cost of sparing critical equipment (e.g. duty & standby equipment) and redundant control and safety systems increases to ensure this reliability or availability is met. This is in contrast to a plant that may be required to operate for 95% of the time with little or no built in redundancy.

The main factors which can cause variations in gas plant cost estimates are summarised below:

- Plant Deliverability (e.g. reliability and availability requirements).
- Fluid composition variations that affect the equipment selection and process.
- Exchange Rates.
- Prices of Materials e.g. steel prices have doubled over the last few years.
- Uncertainty over future labour rates .
- Changes or Omissions in Project Scope (e.g. increased equipment and facilities).

- Scale up of existing Plant (for increased capacity).

1.3 Escalation Table

The following escalation values were used in the assembly of the curve cost data points, seen in Table 1.3.

Table 1.3 - Escalation Values

Year	NZRB CPI	CE(US) Bulks	CE(US) Equipment
1990	1.400	1.31	1.40
1991	1.339	1.30	1.38
1992	1.329	1.29	1.39
1993	1.316	1.28	1.39
1994	1.299	1.26	1.35
1995	1.249	1.24	1.28
1996	1.222	1.2	1.28
1997	1.200	1.18	1.26
1998	1.185	1.17	1.26
1999	1.186	1.16	1.25
2000	1.169	1.13	1.25
2001	1.134	1.12	1.27
2002	1.106	1.11	1.26
2003	1.078	1.08	1.14
2004	1.062	1.06	1.08
2005	1.033	1.03	1.04
2006	1.000	1.00	1.00

The NZ Reserve bank CPI applies to field construction costs, NZ home office engineering and design costs, and to client Below the Line costs.

The US based CE equipment index applies to both static and rotating equipment, while the calculated CE composite bulks scale applies to bulk materials.

1.4 Gas Plant CAPEX

Figure 1.4.1 below plots the approximate CAPEX (in NZ$) required to process wet sweet gas at the PJ/ annum rates shown. Removal of CO_2, and separation and export of LPG (propane & butane) are not included. Corresponding unit costs (CAPEX per PJ/annum) are indicated in Figure 1.4.2.

Currency is New Zealand 2006 dollars.

The CAPEX graph shows two distinct parts, one curve for small skid-mounted plants, and the other for larger modular plants with a high site fabrication or “stick build” content.

There is an overlap area somewhere between 8 - 30 PJ/annum where either skid based or “Stick” build gas plant scenarios may apply. The choice between these options in the overlap area is likely to be determined by both the relative economics of the technologies and the required plant factor.

Figure 1.4.1 - Gas Plant CAPEX

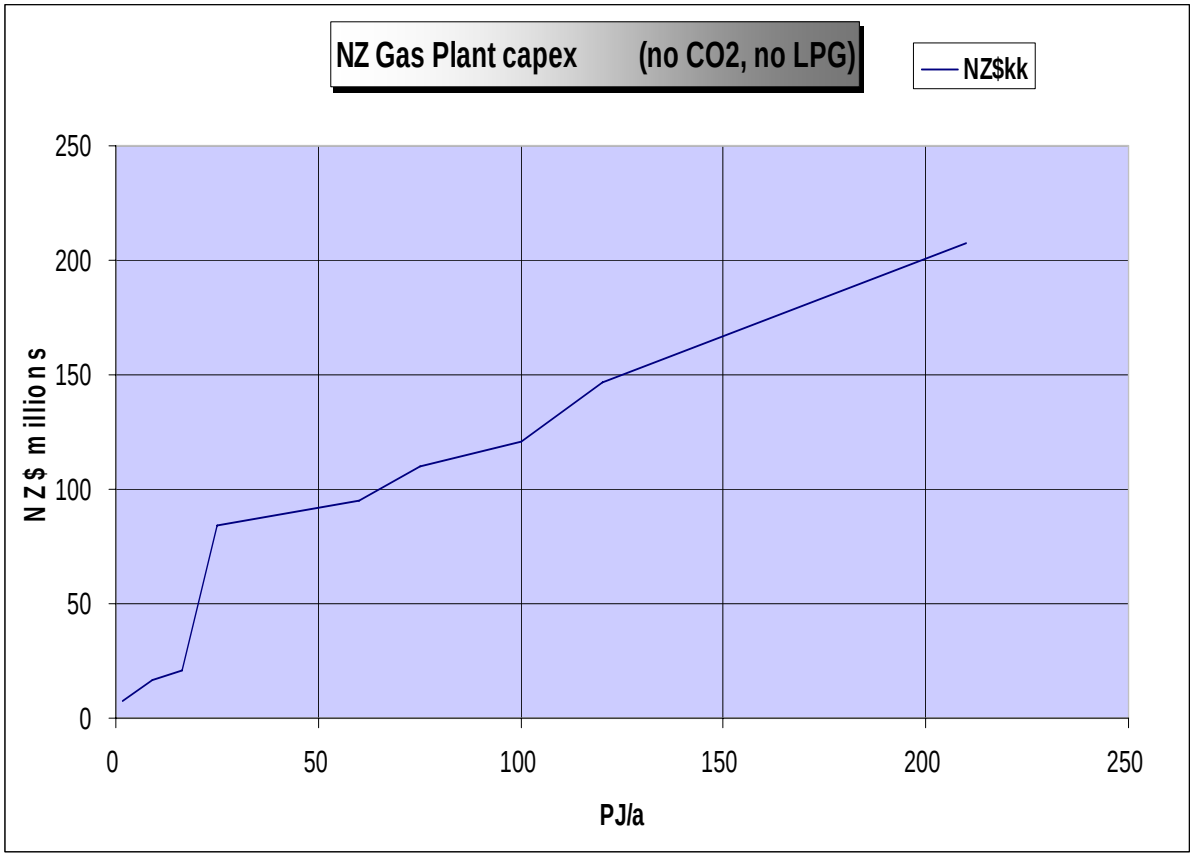
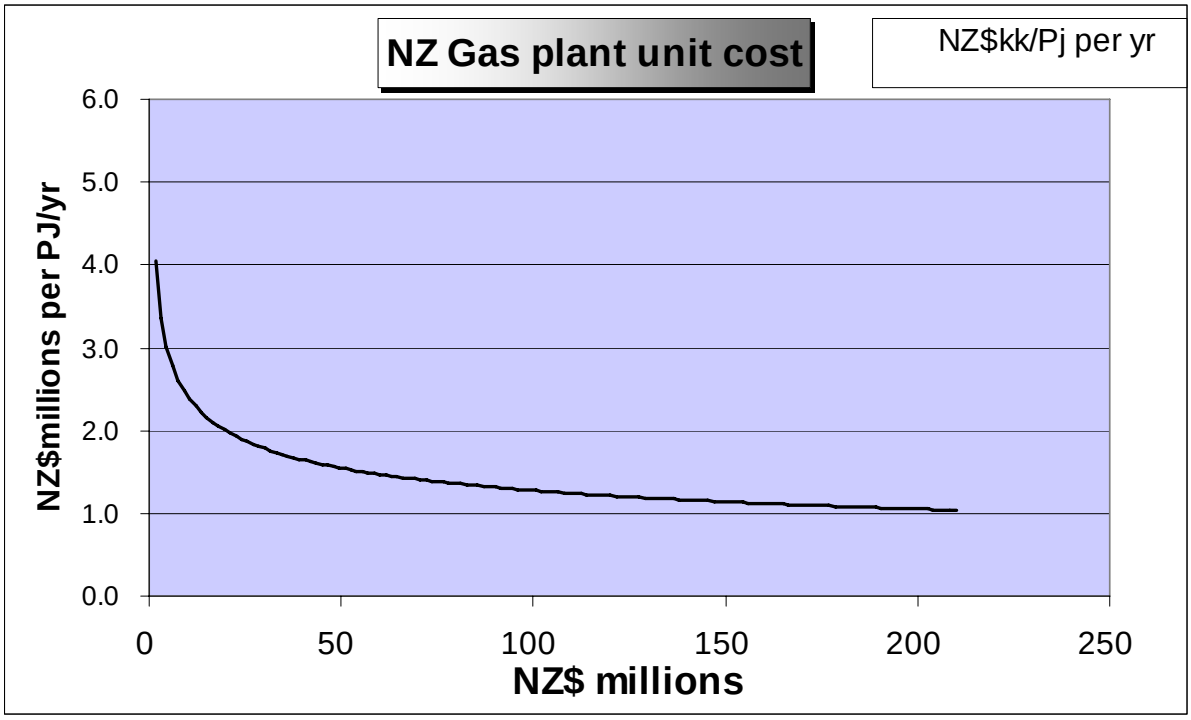


Figure 1.4.2 - Gas Plant Unit Costs



LPG Extraction

Additional CAPEX for LPG separation and export is dependent on the LPG content or "richness" of the gas stream and the extent of storage required. The resulting additional cost of extracting and exporting LPG is broadly determined by the liquid flow rate. This cost can vary greatly within a wide range - 30% to 80% of base gas plant CAPEX.

In summary there is no simple correlation relating to the CAPEX of LPG extraction and export versus the PJ/annum of the main gas flow.

However, for the purposes of this report this issue has been set aside. If it were determined that LPG extraction from a gas stream were warranted, then the additional expenditure involved would be more than offset by the additional revenue from the gas liquids recovered. Accordingly, it seems reasonable to set this issue aside for the purposes of establishing economies of scale for gas processing plants.

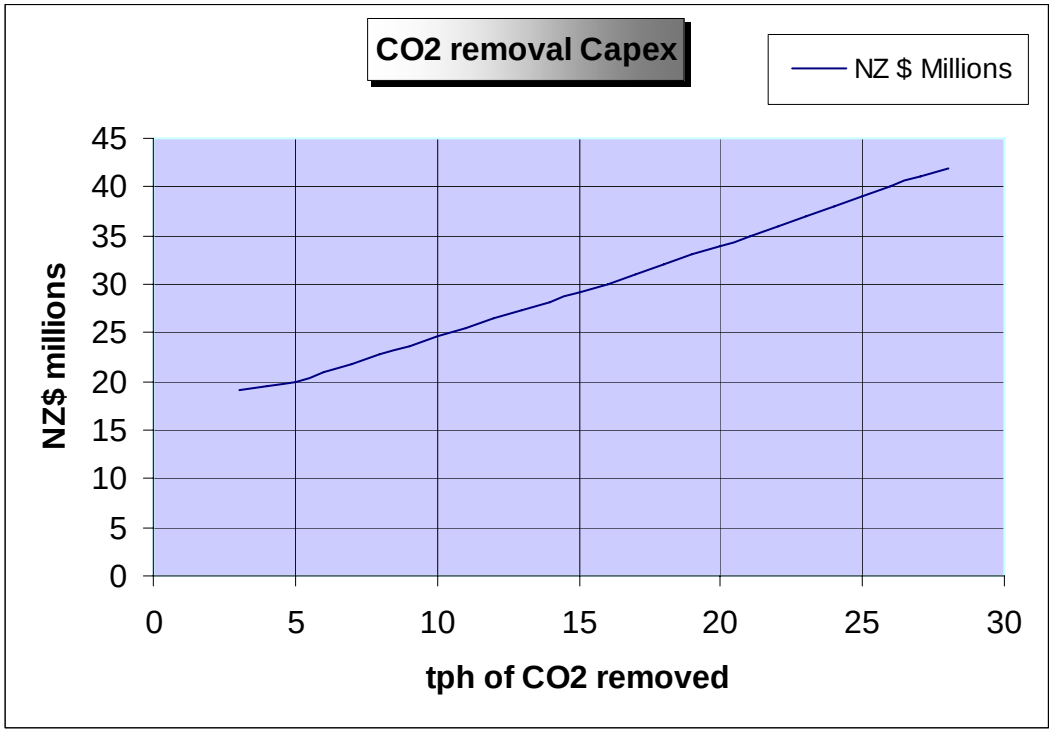
1.5 CO_2 Removal Plant CAPEX

The CAPEX of CO_2 removal plants is dictated more by the quantity of CO_2 removed per hour, rather than a direct relationship to the total gas flow processed.

Figure 1.5 curve below provides indicative CAPEX costs for New Zealand CO_2 removal facilities. This is considered as an addition to an existing gas plant and not on a standalone basis. (Note this is because there are many common shared facilities / utilities between a CO_2 removal plant and the associated gas plant).

In contrast, a standalone CO_2 removal plant (inclusive of all required utilities) would cost considerably more.

Figure 1.5 - CO_2 Removal Plant CAPEX



The following table provides a range of large gas plant sizes and CO_2 removal cases to illustrate this relationship. Percentage values provided are % increase to overall Gas Plant CAPEX, in Table 1.5.

Table 1.5 - CO_2 Removal % Increase to CAPEX

Gas Plant Size	60 PJ/Annum	75 PJ/Annum	100 PJ/Annum
10 Tonne/hr CO_2 Removal	+26%	+23%	+21%
18 Tonne/hr CO_2 Removal	+34%	+29%	+26%
25 Tonne/hr CO_2 Removal	+41%	+35%	+32%

From the above graph it can be concluded that there is a significant fixed cost element to the removal of CO_2 (i.e. the intercept at zero looks to lie somewhere between $15 and $20 million). Thus, at low levels of CO_2 removal there are significant economies of scale, but these disappear at levels above five tonne per hour.

1.6 Cost of Cross-Country Pipe Lines

At the conceptual level, the cost for most carbon steel on-shore gas pipelines may be obtained by applying the following simple formula:

Installed pipeline cost = km x pipe diam-inches x NZ$50,000 per inch (diameter)-kilometre + $crossings + $valve stations

The formula is plotted in Figure 1.6.1 below. For high pressure lines (schedule 80 wall thickness and above), the cost factor should be increased to NZ$65k per inch-km.

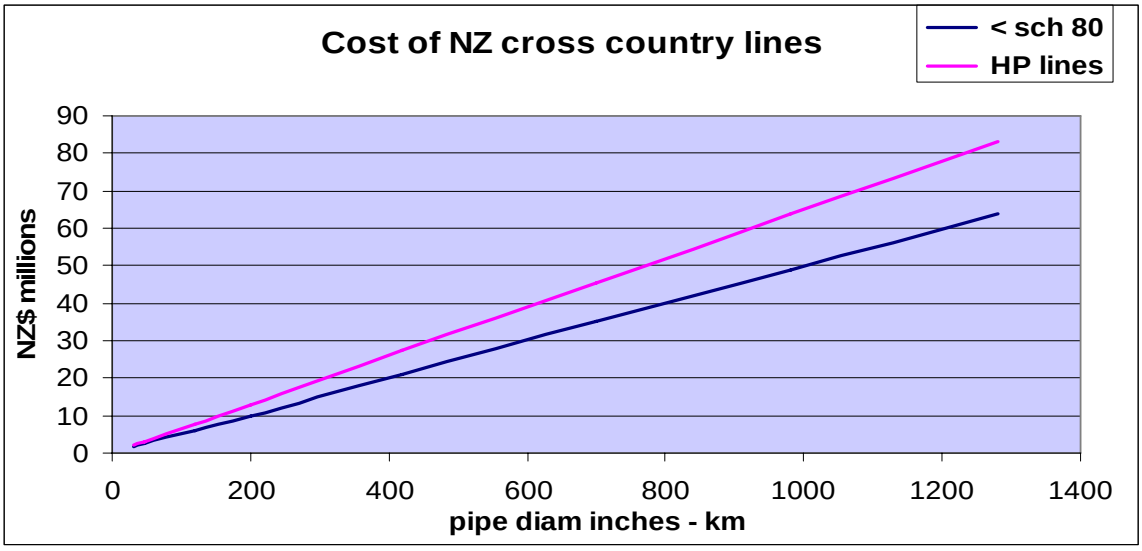
The cost of crossings can vary from approximately $10k for crossing a rural road, $25k for crossing a creek, up to $250k for crossing rivers or major obstacles. Any horizontal directional drilling, or valve stations, needs to be separately costed as these vary greatly depending on terrain and line size.

This formula has been found to be useful in relatively easy, open terrain, for example in the Taranaki volcanic ring plain, and in the pipeline size range 4" to 16". In this region and pipeline size range, the formula allows for consents, easements, materials, construction plant and labour, engineering/ design and supervision.

For difficult steep and rugged country higher rates would apply. In such cases it would be more appropriate to conduct a separate engineering study, including perhaps a quantitative risk assessment, rather than rely on a simple formula.

The above formula is not applicable to very small (<4") or very large pipelines (>16"), or to lines made from exotic materials (other than carbon steel) used for highly corrosive wellstream fluids.

Figure 1.6.1 - Cross-country Pipeline Costs

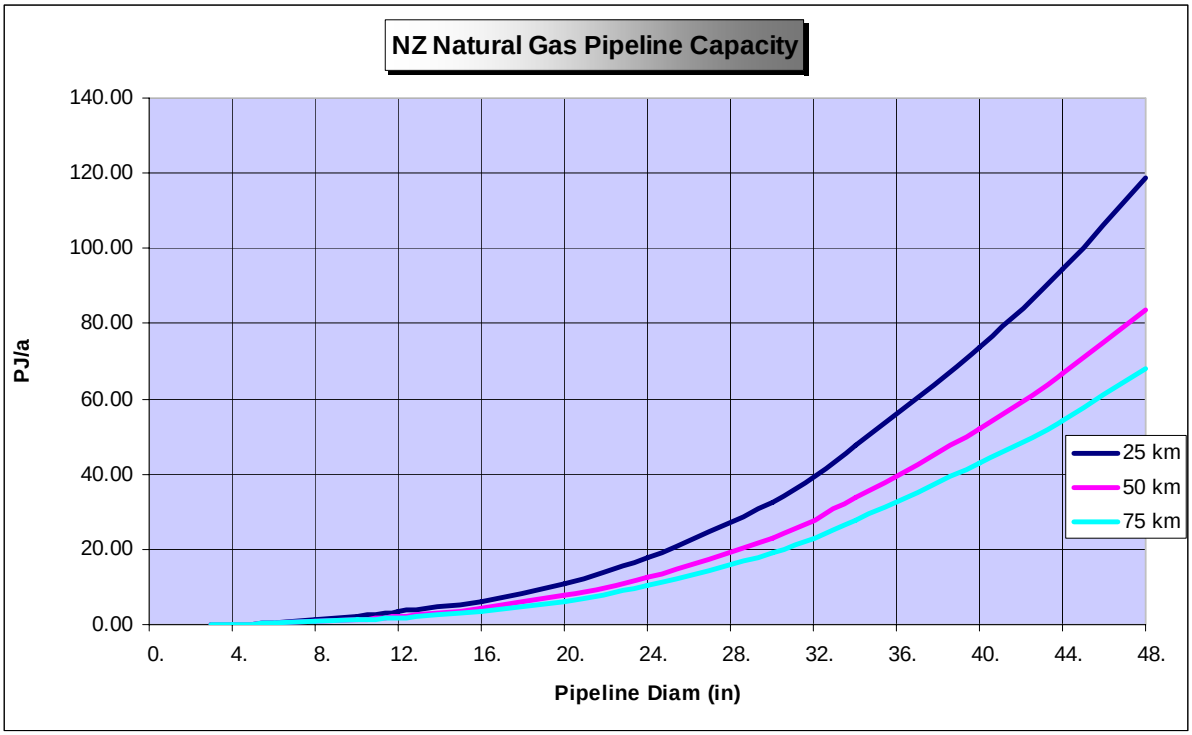


Gas Pipeline Capacity

Gas transmission pipelines follow a squared relationship between diameter and capacity given similar inlet process conditions, pressure drop and transmission distance. The following chart (Figure 1.6.2)

indicates the relationship between pipeline diameter and maximum flowing capacity assuming typical processed gas to NZS 5442, 53 bar inlet pressure, 25km, 50km and 75km carbon steel pipeline length and 10 bar pressure drop across the pipeline and a 10% allowance for road and river crossings.

Figure 1.6.2 - Gas Transmission Pipeline Capacities



Wet Gas (Multiphase) Pipelines

Wet gas (multiphase) pipelines may initially operate at pressures far in excess of normal gas transmission pressure and will therefore have greater volumetric capacity for the same diameter pipeline. In general multiphase pipelines from wellhead to processing plant are sized for end of field conditions (low pressure) and may be oversized at start of field (high pressure) conditions. Multiphase pipelines also tend to have higher design pressures (for reservoir conditions) which requires increased wall thickness and cost. Due to the wide range of variables for multiphase fluid transport it is not possible to determine an economic model that fits all cases.

2. ESTIMATE OF OPERATING COSTS

2.1 Estimating Gas Plant OPEX

OPEX costs vary depending on the size of the gas plant, and its contractual deliverability requirements. It is less in percentage terms for larger plants than for small ones.

Transfield Worley's cost database does not have access to actual New Zealand Gas Plant OPEX data therefore it is difficult to provide specific local OPEX data however based on international norms an expected annual OPEX (operations, maintenance, and consumables/ utilities only) is typically in the range 3-6% of CAPEX for large gas plants and 10-15% for smaller plants.

If support engineering, 5 year M & I statutory inspection, and home office administration overhead costs are required to be included in the OPEX then the above percentages could be increased by somewhere between 1.5 to 2 times.

3. PHYSICAL LIMITATIONS TO THE TRANSPORT OF WELL FLUIDS

3.1 Wellhead Fluid Composition & Condition

The composition and condition of well fluids from New Zealand fields varies widely and this will have a major impact on the economic distance over which the well fluids can be transported to the processing plant. Some of these factors are discussed below.

WELLHEAD PRESSURE

The wellhead pressure will depend on the reservoir pressure and the processing rate. For example, the well head pressure for the Pohokura field will be of the order of 315 barg whereas that for Kahili was 40 barg.

WELLHEAD PRESSURE VARIATION

The variation of wellhead pressure with time will depend on the type, size and processing rate of the field. A reservoir with water drive, such as Maui, is more likely to maintain a constant wellhead pressure over the life of the field. In contrast, for a depletion field such as Pohokura, the wellhead pressure will decline as well fluids are withdrawn. The initial facilities installed for a depletion field will need to take into account the impact of declining wellhead pressure with time e.g. it may be necessary to pre-invest with larger diameter pipelines or make allowances for booster compression later in the field life.

VAPOUR/LIQUID

The vapour/liquid ratio and water content of well fluids from NZ gas fields varies widely. The flow regime in the pipe work will depend on liquid content. Well fluids with a high liquid ratio have potential for slug flow which will probably require installation of additional equipment to control the slugging (e.g. a slug catcher at the inlet to the processing plant). The slugging severity will be affected by factors such as the terrain, pipe diameter and the temperature. The well fluid composition will generally vary with time as depletion of the field progresses. Typically, the well fluids become lighter (less liquids) with time. The propensity for slugging may decline as the quantity of liquids reduces and the pressure in pipeline declines but this may be counteracted as production decreases (i.e. lower pipeline velocity).

NZ WELL FLUIDS COMPOSITION

The composition of NZ well fluids varies widely across the different gas producing reservoirs and structures. For example the carbon dioxide content varies from about 2% by volume for Rimu, through 12% by volume for Kupe to 44% by volume for Kapuni. This affects the corrosivity of the well fluids particularly if the well fluids contain significant quantities of water. As a consequence it may be necessary to remove the free water at the well head, use higher specification pipeline and valve materials or inject a corrosion inhibitor. A high CO_2 content may also mean that, all other factors being equal, a larger pipe diameter may be required to transport the same quantity of gas based on energy

content (i.e. a larger pipe diameter will be needed for the same number of TJ/d transported). The CO_2 content will also have a major impact on the facilities required at the treatment plant. Thus, to meet the New Zealand Gas specification for calorific value and Wobbe Index, CO_2 must be removed from the high CO_2 gases (e.g. Kapuni) whereas additional inert gas may need to be injected into the low CO_2 content gases (e.g. Rimu).

NZ Well Fluid Wax Content

Some NZ well fluids contain significant quantities of wax (e.g. Kapuni and Kupe) and this can deposit in the pipeline as the well fluids are cooled. Pipeline pressure drops will increase and, in extreme cases, the pipeline can block. This problem will be exacerbated if pipeline flow is interrupted by a shutdown. Where wax deposition can occur, a number of remedies are available including the addition of a pour point depressant, pipeline insulation, installation of a hot oil circulation system and pipeline heating. In most cases, the addition of a pour point depressant will be sufficient. The additional capital costs of pipeline insulation, installation of a hot oil circulation system and pipeline heating will severely restrict the distance over which the well fluids can be transported.

Well Fluids Arrival Pressure

The pressure of the well fluids arriving at the processing plant will determine the specific nature of the facilities required (and hence the plant CAPEX) to treat the fluids. The arrival pressure will be determined by the well head pressure, the pipe diameter and pipe length. If the well fluids arrive at high pressure, a simple Joule-Thomson process plant may be used to treat the gas component. At lower pressures, this option may not be feasible unless additional compression is installed. Alternative, more expensive options such as refrigeration of the gas may be necessary to meet the New Zealand gas specification.

Reservoir Philosophy

The nature of the reservoir, the reservoir management philosophy and the well fluid composition will determine how the production rate, well fluid composition and well head conditions (especially pressure) vary during the life of the field. This in turn will determine the nature of the facilities installed and whether additional facilities will be required as the reservoir declines. This will become more important as the distance between the well head and processing plant increases. For example it may be necessary to install an intermediate compression station on the pipeline. For wellstream fluids with significant liquids content, the compression station may also require liquids separation and re-injection facilities.

3.2 Transporting Wellstream Fluids

The economic distance over which well fluids can be transported will be determined by all the factors outlined in the previous section. It is clear from the wide variations in reservoir types, well fluid compositions and terrain variations in New Zealand that no general, realistic correlations can be derived.

In recent years computer modelling and prediction of the physical behaviour of wellstream fluids in pipeline transport with varying compositions, impurities, subsea and land terrain and reservoir

characteristics has been advanced. This has provided more confidence and less conservatism in mitigating technical and commercial risk to pipeline transport of wellstream fluids.

In New Zealand Maui well fluids are separated on the Maui A Platform and the gas and liquid phases are transported to shore in separate 60km pipelines to shore.

For the Kupe development it is proposed to transport wellstream fluids from an offshore wellhead platform approximately 32kms to shore via a multi-phase pipeline and treat the well fluids on shore.

For the Pohokura development wellstream fluids from the offshore wells will be transported to shore via a 6km multi-phase flexible pipeline and wellstream fluids treated on shore.

Overseas well fluids are transported over considerably greater distances (e.g. Bass Straight Gas fluids are transported about 160km from the reservoir).

This all suggests that physical constraints are unlikely to be the limiting factor when it comes to assessing the feasible set of processing plants that are within range of a particular well. Instead, it seems much more likely that, in the absence of an existing nearby gas gathering line, the cost of running a new pipe to a processing plant will be the limiting factor.

4. GAS PLANT FIXED COSTS (INDEPENDENT OF PROCESSING CAPACITY)

Gas plant fixed costs that are relatively independent of gas processing capacity include:

- cost of acquiring land for gas plant
- resource consenting costs
- client in-house engineering
- client legal services
- corporate administration and overheads
- other site specific miscellaneous items - particularly relating to infra-structure such as roading, power, sewage etc.

For the purposes of this report and excluding the cost of land, an allowance for most of the other costs has been included in the plant CAPEX costs presented in Figure 1.4. 1.

In approximate terms these “Below the Line” items usually add up to between 5% and 10% of the final constructed CAPEX, however the cost determination of individual line items will vary substantially between individual developments.

5. TECHNICAL ISSUES

5.1 Processing New Zealand Wellstream Fluids

The compositions of New Zealand wellstream fluids vary widely ranging from predominantly gas, with only small amounts of accompanying condensate, to predominantly crude with small quantities of gas. The well fluids are generally sweet (i.e. low sulphur content) and the liquids are frequently paraffinic and can be waxy.

A typical processing facility may incorporate the following steps:

Preliminary Wellstream Fluids Separation

Preliminary separation of wellstream fluids to raw gas, unstabilised hydrocarbon liquids, water and possibly solids (e.g. sand from the formation structure)

Dew Point

Dew pointing of the raw gas to meet the sales gas specification. This involves removal of heavier hydrocarbons and some LPG components. Options for dew pointing include a simple Joule-Thomson (JT) process in which the gas pressure is reduced across a choke valve (together with heat exchangers etc), refrigeration (using ammonia or propane as a refrigerant) or a turbo expander when a high liquids recovery is required (e.g. for LPG production). The JT process will often be used when the raw gas pressure is much higher then the sales gas pressure. If the arrival pressure is insufficient, installation of a sales gas compressor may be required in addition to the JT unit. The pressure drop across a refrigeration unit is normally relatively low and it is less likely to require a sales gas compressor. As an example the Maui process involves an off-shore JT process on the Maui A platform to treat the gas sufficiently for transport to shore and a propane refrigeration system on-shore to produce sales gas quality.

Sale Gas Compression

Sales gas compressors are frequently required particularly when the well head pressure is low or a JT process is used. If the reservoir does not have water drive, the well head pressure will drop as the reservoir depletes. In this case, an intermediate compressor may be required to maintain the operating pressure of the plant and hence the sales gas pressure (typically 50 barg).

Stabilisation Of The Well Liquids

Stabilisation of the well liquids to allow safe handling and transport typically requires a maximum Reid Vapour Pressure (RVP) of 69kPa to meet New Zealand specifications. The wellstream liquids may be combined with the light hydrocarbons separated from the gas dew pointing process. The liquids will then be treated in a stabiliser column and cooled. Any off gases are normally sent to the gas plant fuel gas system. Condensate storage tanks and a load out system are required. This can vary from truck load-out to potentially a pipeline to the local port.

LPG Production

If the quantity of propane and butane in the well fluids is such that they cannot be combined with the sales gas and stabilised liquid without exceeding the product specifications and without exceeding the fuel gas demand, then LPG recovery will be required. LPG production may also be favoured if market demand and economics are favourable. Production of LPG will require a number of additional columns (e.g. a de-ethaniser, depropansier and debutaniser) together with an LPG drier (e.g. mol sieve unit), LPG storage bullets, road tanker load out and possibly a LPG pipeline to the local port.

Ancillary Processes

Water will need to be treated prior to discharge including removal of any ethylene glycol (Note: glycol is required to prevent hydrate formation in the wet gas stream). In addition a number of utility systems are required (air, nitrogen, flare etc systems).

5.2 Gas Stream Contaminants

Contaminants that occur in the New Zealand gas industry and may require treatment or removal are itemised below:

Carbon Dioxide

CO_2 is usually present and varies from a few percent up to 44% volume. Although there is no CO_2 specification for sales gas in NZS5442, CO_2 reduces both the Wobbe Index and calorific value. Thus, for the higher CO_2 content fields, CO_2 must be removed. For example Benfield units are installed at the Vector plant at Kapuni to reduce the CO_2 content with some of this CO_2 is recovered for the production of food grade liquid CO_2. For intermediate CO_2 content, it may be possible to meet the sales gas Wobbe specification by retaining LPG components (propane and butane) in the sales gas provided these heavier hydrocarbons do not cause the gas density and hydrocarbon dew point specifications to be exceeded.

Sulphur (Hydrogen Sulphide)

The sales gas specification requires the H_2S content to be below 5 mg/m3. The H_2S content of sales gas derived from some New Zealand fields New Zealand can approach this limit and may require addition of an H_2S scavenger or an H_2S adsorption unit.

Mercury

Some well fluids in New Zealand contain trace levels of mercury. This can accumulate in the processing equipment and present both health and emission problems. In such cases it may be necessary to install a mercury adsorption bed.

Produced Water

Wellstream water will normally be present in most New Zealand hydrocarbon production. This can range from small quantities of condensed water, which separates due to cooling in the treatment process, to relative large quantities of formation water. The formation water will contain dissolved

salts. In both cases the water may contain additives added at the well head (e.g. methanol or ethylene glycol added to remedy/prevent hydrate formation). For economic reasons the ethylene glycol is normally recovered from the water and recycled within the process. The salt content in the formation water however can cause fouling of the ethylene glycol recovery unit and may necessitate additional equipment and higher than expected operations costs. The quantity of formation water will normally increase with time. Water treatment and/or re-injection into the formation may be required for environmental compliance.

WAX

Hydrocarbon liquids from a number of New Zealand reservoirs are waxy. The wax can separate out as the well fluids cool and during the treatment process when the gases are removed and the liquid is stabilised. Remedial measures required will depend on the physical pour point of the waxy liquid. This can include heat tracing of equipment and pipe work, heating of storage tanks and addition of a pour point depressant.

ASPHALTENES

Some heavier wellstream fluids contain significant quantities of asphaltenes which can deposit during the processing of the fluids and foul heat exchangers and other process equipment. The potential risk of fouling is normally allowed for in the equipment design and may require installation of redundancy of equipment to facilitate on-line cleaning.

6. ESTIMATE OF UNIT COSTS

From sections 1 and 2 it can be seen that the capital cost per GJ produced falls off with installed capacity while operating cost shows the opposite trend. To be able to assess the trade-offs between these two opposing tends it is necessary to calculate the costs over the lifespan of the project. A useful way to do this is to use the concept of "levelised" costs. It is relatively easy to calculate an annuity stream of equal cash flows over the productive life of a project where, at a given discount rate, the constant annuity stream is equivalent to the stream of actual costs incurred. This process is known as levelising. In the case of a project which has constant annual production, dividing the annuity by the annual production gives a levelised unit cost.[1] If all of the output from the project were to be sold at the levelised unit cost then the net present value of the project's costs and revenues would equate to zero.

A variant on this method, which is numerically equivalent but which also handles non-constant production, is provided by the equation:

$$LUC = \frac{PV(costs)}{PV(production)} = \frac{\sum C_t/(1+r^t)}{\sum P_t/(1+r^t)}$$

Where:

LUC is levelised unit cost;

C_t is the cost incurred in year t (capital and/or operating);

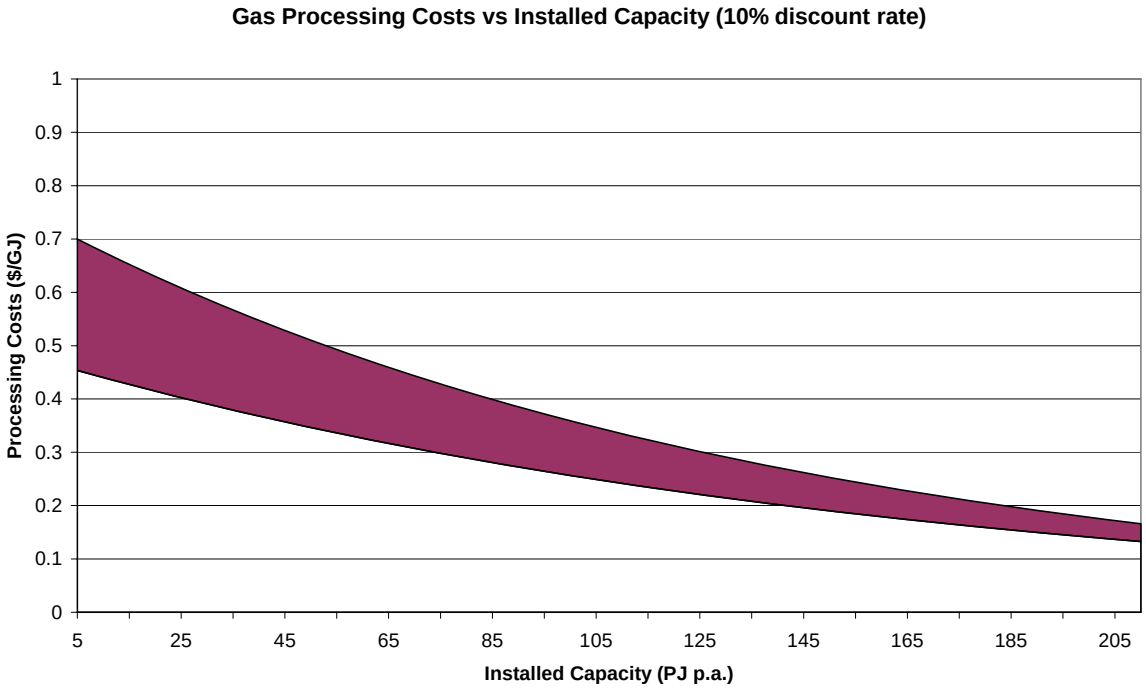
P_t is the production in year t; and

r is the discount rate.

1 OECD/IEA (ed.), Guidelines for the Economic Analysis of Renewable Energy Technology Applications, Paris, 1991.

The following chart (Figure 6.1) shows the region within which it is estimated the unit costs of gas processing lie. The upper and lower levels of the region correspond to the high and low OPEX costs respectively.

Figure 6.1 - Levelised Gas Processing Costs



6.1 Interpretation of Results

The shape of the graph indicates that there are returns to scale for gas processing plants. This begs the question as to how significant these are both in absolute terms (i.e. considering the economics of bringing gas to market) and in relative terms (i.e. are the scale economies as significant as those exhibited by, say, pipelines).

Addressing the first question, the cost of gas processing vis-à-vis other costs of bringing sales gas to market, quantitatively is beyond the terms of reference of this report. However, it is possible to make qualitative observations:

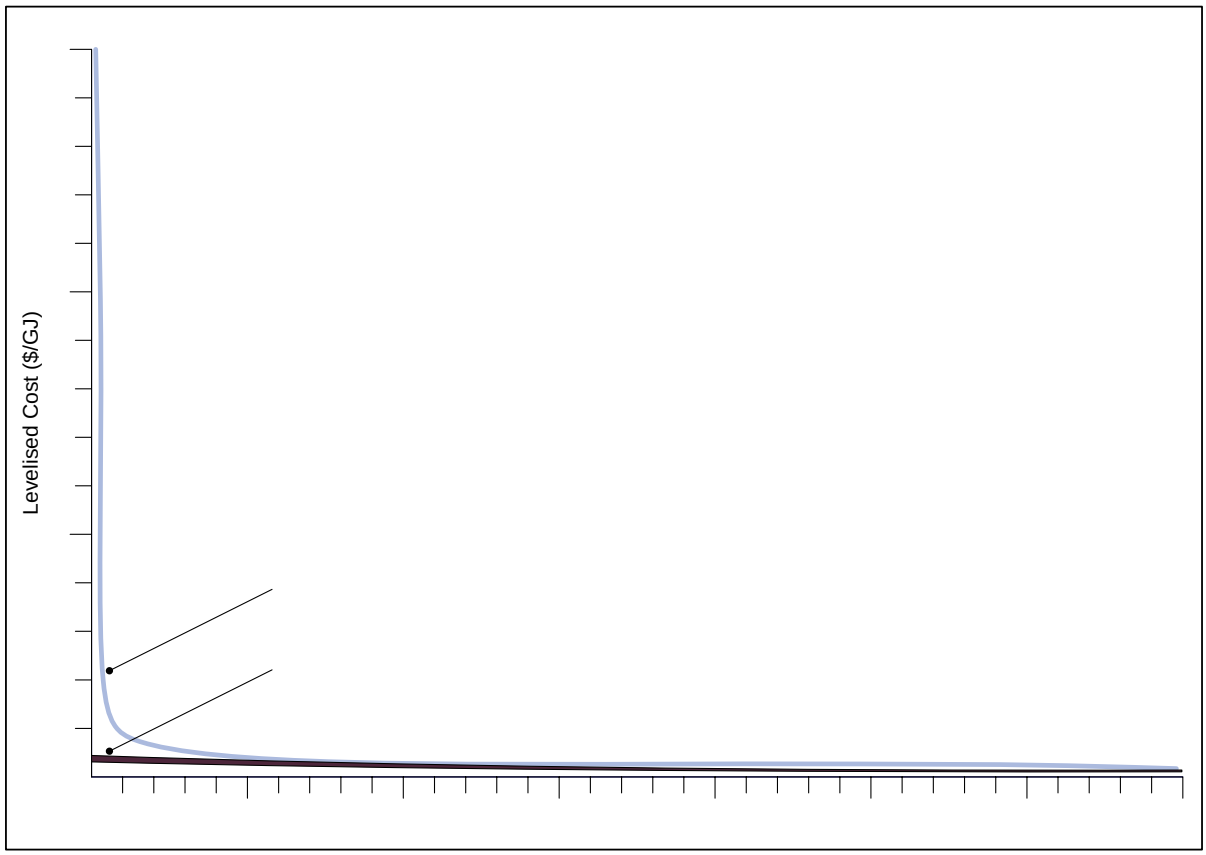
- there are a range of sizes of explorers and their cost structures are markedly different;
- the so-called “majors” will tend to seek and exploit very large deposits and their cost structures reflect this, typically making smaller finds uneconomic for them to develop;
- by contrast, smaller companies with lower administrative and other overhead costs are generally more efficient at developing smaller resources; and
- a number of small-scale processing installations have already been put in place in New Zealand (and such plants are commonplace around the world), thereby indicating that their

owners did not find the relatively higher processing cost a barrier to competing in the market.

This last point is an important one. The fact that there is a steady demand for smaller, skid-mounted processing plant in many jurisdictions would tend to suggest that many exploration and production companies see no problem with getting their product to market despite having to process their gas at an apparently higher cost. It may be that a significant proportion of that cost difference is negated by the generally lower cost structures of such organisations as well as their ability to bring small finds to market more swiftly than their larger competitors.

The second question is best addressed by looking at the relative economies of scale exhibited by gas pipelines. Figure 6.2 below compares the shape of the gas processing graph (Figure 6.1) with the costs of gas transmission pipelines. The specific parameters of the transmission pipelines are not particularly relevant, what is important is the respective shapes of the two curves. In Figure 6.2 we have taken data on the costs of building a 75 km gas transmission pipeline able to deliver gas in a range of quantities up to 70 PJ/annum.

Figure 6.2 - Levelised Gas Processing Costs Compared With Costs of Transmission



Appendix IV: Stakeholder Interview Summaries

Austral Pacific:								
Rick Webber, CEO	**Exploration**	✓	**Gas Processing**				**Downstream**	
	Current production		**Owner:**		**Operator:**	**Third party user:**		
Interests:	• Cheal field, NE of Kapuni o 37% share, operator o shallow discovery, should be producing within the next six months o Oil: to be sent by road to Omata tank farm o Gas: either E to Waihapa, or SW to Kapuni or N to Radnor (currently in negotiations) • Cardiff - deep gas discovery, NE of Kapuni - no production yet o 25% share, operator o Options include processing at Radnor or Kapuni or stand alone • Multiple onshore exploration permits spread throughout Taranaki • Offshore exploration permit between Kupe and the south Taranaki coast, and in the Canterbury Basin • Kahili: o Negotiated with NGC to buy gas at well (NGC built processing facility and pipeline; currently not producing but hoping to reinstate)							
Overall perspectives:	• All other things being equal, would prefer to toll gas through another company's facility rather than build their own. An approach that not only allows the preservation of capital for other uses (e.g. core business) but also it is by definition a more efficient use of capital • Considers that protocols are not required (but if any protocols were to be introduced, there should be a backstop arrangement to resolve disputes) • Very concerned about prospect of forcing parties into an agreement which is not commercially favourable for both sides							
NZ Experience:	• Has negotiated a contract with another party within NZ (Kahili gathering/processing contract with NGC) o Also considered offer from Swift for use of the Waihapa gas processing facilities • Expects to be able to negotiate future access arrangements (in discussion)							
International experience:	• Exploration onshore in Papua New Guinea • Extensive personal experience negotiating gathering/processing with third parties in UK (North Sea)							

Austral Pacific:	
Factors relevant to negotiating access?	• Access arrangement must be commercially attractive to both parties • Composition and production profile of the gas must be known to check that processing the gas at the facility is technically feasible and to assess commercial risks • Need confidence in the operator of the facility • Tariff arrangements must by definition be better than building a stand alone facility • Priority and throughput rights would be important • The nomination process for deliveries would be important • Liability would also be covered in the agreement • There are a number of other less notable issues as well, all of which would be covered in a Processing Agreement
Factors relevant to building vs access?	• Would prefer to toll gas through a third party processing facility rather than build their own o Minimise expenditure on capital so as to preserve money for E&P. Scarce capital can then be employed in core aspects of the business plus it just makes plain common sense as it results in a more efficient use of capital – why duplicate facilities for the sake of it? o Minimise the risk - why elect to put oneself through the RMA hoops (delays and increased costs) if there is a viable alternative?
Relative importance – regulatory:	• Low priority - believes that if a deal needed to be done between two parties, they would be able to come to an agreement if it was commercially favourable for both parties
Relative importance – cost:	•
Factors which make NZ a potentially good prospecting region:	• NZ has low prospectivity for oil and gas.
Other comments:	• Unaware of any developments that may have been deterred in NZ because of lack of access to gas processing facilities.

Bridge Petroleum:									
Kevin Johnson	**Exploration**	✓	**Gas Processing**					**Downstream**	
	Current production		**Owner:**	✓	**Operator:**	✓	**Third party user:**		
Interests:	• Radnor Production Facility o serves the Radnor field – High CO_2 gas (no CO_2 removal), H_2S (scavenger chemical extraction) ▪ capacity 4 PJ pa, build up to 100% capacity utilisation within the next two years ▪ not running currently, new well in next few months o gas to either Swift TAW pipeline or Vector LTS pipeline								
Overall perspectives:	• There has not been a need for protocols in the past, or currently, however that does not mean they will not be required in the future o multiple large gas fields are coming on-stream o higher number of small gas fields playing a more important role o some form of light handed protocols will be necessary to develop the market • Jumping Pound ("JP") 05 methodology - sensible, would work well in New Zealand - but not regulated, only voluntary o effective protocols take longer than expected to put in place – cannot wait until the protocols are needed before deciding which one to use o to have JP or similar "sitting on the shelf to roll out" when needed is better than a wait and see approach o for JP to work, would require a fallback measure to ensure negotiations proceeded								
NZ Experience:	• Looked at third party access for Radnor product – due to low flow, running liquids to Waihapa was not warranted o high wax content of condensate would have required storage and pipeline heating to maintain viscosity – expensive o decided to build own processing facility at Radnor • Swift offered gas transportation from Radnor on interruptible basis - not favourable								
International experience:	• Partner Westech is an American based company, call on them for knowledge from time to time								

Bridge Petroleum:	

Factors relevant to negotiating access?	• Capital cost and operating cost should be shared by the parties
	• Information required from facility owners:
	  o current throughput of the facility
	  o plans for plant modifications (capacity or efficiency)
	• Information required from access seeker:
	  o capacity required
	  o wellhead information
	  o independent reserve report
	  o production profile
	  o development and product intention of the field
	• Bridge would release information only to serious requests for access
	  o would only be likely to release capacity and utilisation information to informal requests

Factors relevant to building vs access?	• Depends on the well stream composition
	  o Radnor condensate requires a wax treatment and specialised H_2S treatment
	• Geographical issues
	  o Radnor is relatively remote
	• Electricity generation for gas
	  o ownership of pipelines close by, and connection to pipeline access, means utilisation of assets drives the decision to use the pipeline instead
	  o also the spec gas price is generally higher than the price received for generation
	• These factors drove the decision to build the Radnor production facility as opposed to third party access
	• Strategic issues are arising due to the changing market
	  o as we move into a period where there is likely to be a surplus of gas for a short period the market dynamics will change
	  o those that have processing and transport capacity will gain the market power from the existing gas supply end of the value chain
	  o this will be due to the currently available capacities becoming a constraint on expansion of the gas market at the high user end i.e. industrial and power generation

Relative importance – regulatory:	• Gas processing is not as important as other issues
	• Pipeline access is more important
	• Monitoring liquid storage is also important
	  o bottlenecks could flow back and affect production levels
	• Access to gas processing facilities is not deterring and has not deterred development in New Zealand
	  o however this does not mean it won't in the future

Bridge Petroleum:	

Relative importance – cost:	• Depends on the processing capabilities of the facility
	  o CO_2 or H_2S removal increases the cost
	• Relative costs can vary as facilities are designed fit for purpose (e.g. smaller developments may trade off reliability vs cost)
	• Smaller facilities allow for flexibility in production
	• For a larger facility there are economies of scale in terms of $/GJ of gas production
	  o however these are offset by the need for strict design specification required in a large scale facility compared to smaller facilities

Factors which make NZ potentially good prospecting region:	• New Zealand's prospectivity is neutral
	  o people are exploring and doing ok
	  o access to pipelines has improved
	  o no major deterrent
	• However
	  o no market is established
	  o most fields are a mixture of gas and oil (pure oil is far more valuable)
	  o industry is currently changing
	  ▪ need to put protocols in place to make sure industry develops, but also make sure the protocols do not restrict development

Other Comments:	•

Contact Energy: Jon Hare & Liz Kelly	Exploration ✓	Gas Processing				Downstream ✓
	Current production	Owner:		Operator:	Third party user:	Electricity generation Gas retailer
Interests:	• Major user of gas for electricity generation • Gas retailer • Offshore exploration – west of Maui					
Overall perspectives:	• Does not see any need for gas processing facility access protocols • Protocols with a forced outcome create nervousness in the industry • Protocols could extend the power beyond the boundaries of the Commerce Act and make the environment unfavourable to invest in • There are a series of factual/technical hurdles that would make proving availability or compatibility of spare capacity extremely difficult					
NZ Experience:	• Unaware of any fields not being developed due to a lack of access to gas processing facilities					
International experience:	• None					
Factors relevant to negotiating access?	• The gas processing facility must: o have spare capacity (having taken into account the owner's future reasonable needs) o be able to process the composition/temperature/pressure of the third party gas o not be commercially hindered by tolling the third party gas • Gas quality and make up could alter the value of the original gas or the cost of the existing operation. It's not just a case of making (spare or additional) capacity available • Drive to maximise return from existing assets would mean companies look to fill spare capacity if they can do so (presumably within some sort of risk/reward framework - depending on other interests, future development expectations, assessment of counter party risk etc) • Range of negotiation should be determined on a reasonable economic alternative – next best option, bypass option					
Factors relevant to building vs access?	• An offshore discovery that is economically viable would be relatively large and warrant building a processing facility of its own: o unsure as to whether Contact would seek an arrangement with existing owners for the use of their facilities should there be spare capacity available • It seems that parties have been able to justify new build even in very small developments and suspect that there is considerable value in being in control of the processing. May also reflect limited infrastructure to move the gas to an alternative point for processing particularly if it contains CO_2					

Contact Energy:	
Relative importance – regulatory:	• Open access to pipelines and liquid storage issue appear to be a higher priority • Dangerous to have commercial agreements forced upon non-monopoly assets, as opposed to looking at the access to the monopoly assets (i.e. pipeline access) • Protocols should set a framework upon which both parties would be able to have a commercial discussion, not prescribe an outcome to the discussion
Relative importance – cost:	• Depends on size of development, location, etc
Factors which make NZ potentially good prospecting region:	• Lack of access to oil storage could make New Zealand an unattractive place to invest in exploration • Size of market makes it difficult for participants as does distance, cost of equipment (drilling rigs etc), demobilisation and mobilisation costs
Other Comments:	• If it was decided that information disclosure protocols were to be introduced, then the information should be released as a response to a request not on a regular basis (i.e. monthly or weekly available capacity) • If there are any attempts at protocols, they must be balanced (and include expectations on access seekers not just the facility owner)

Genesis Energy:							
Murray Jackson, CEO	**Exploration** ✓		**Gas Processing**			**Downstream**	✓
	Current production		**Owner:**	**Operator:**	**Third party user:**	**Electricity generation** **Gas retail**	
Interests:	• Partner in the Kupe development (31% field owner, Origin 50%, NZOG 15%, Mitsui 4%): o dedicated Kupe gas processing facility: 20 PJ/pa capacity, approx expected utilisation 100% • 40% non operating partner in the Cardiff field • Major downstream user of gas – electricity generation and retail						
Overall perspectives:	• Protocols are not needed • Option to build a gas processing facility, if access to another party's processing facility cannot be agreed. Kupe gas has high wax component requiring additional treatment.						
NZ Experience:	• Relatively easy to access land in Taranaki for gas processing facilities • Considered options to process Kupe gas: o NGC's Kapuni gas processing facility – required significant additional plant/cost o Swift's Rimu processing facility – too small o Shell's Oaonui processing facility – could not process the Kupe gas specification • Building a processing facility specifically to process Kupe gas						
International experience:	• BAS Gas (Origin Energy) similar configuration to Kupe.						
Factors relevant to negotiating access?	• The desired quantity/production profile and reliability • Certainty (e.g. whether the owner wants to reserve spare capacity for future use) • Whether third party gas is of similar quality specifications to original gas						
Factors relevant to building vs access?	• May not be economic for a small discovery to build a processing facility of its own • A small company may prefer to seek third party access to an existing facility (to preserve capital for exploration) • A facility owned by another party must be able to process the quality (e.g. composition of the gas) and quantity that needs to be processed • Other factors: o Genesis safety standards must be met o cost of alterations to the facility must be less than the cost for Genesis to build a new facility						
Relative importance – regulatory:	• There are no issues in gas processing which need to be resolved by regulation						

Genesis Energy:	
Relative importance – cost:	• Gas processing is a major component of overall production costs o Kupe oil and gas processing facility will cost approximately $300 million or around 30% of the overall development
Factors which make NZ a potentially good prospecting region:	• Access to Maui pipeline suits Taranaki region. Absence of local demand departs from exploration in other regions.
Other comments:	•

Greymouth Petroleum (provided by email):									
Mark Dunphy	**Exploration**	✓	**Gas Processing**					**Downstream**	**?**
	Production	✓	**Owner:**	✓	**Operator:**	✓	**Third party user:**		
Interests:	• Producing oil and gas from: o PML 38091 Kaimiro (100%) - onshore, NE of Mt Taranaki o PMP 38148 Ngatoro (100%) - onshore, NE of Mt Taranaki o PMP 38161 Turangi (100%) - onshore, Taranaki coast ▪ awaiting Maui pipeline access (delayed for 6 months by unavailability of access) before coming on-stream • Exploration permits o PEP 38464 (98%) – offshore, New Plymouth shoreline, Moturoa oil field ▪ Ngati Te Whiti Hapu Society Inc - 2%. o PEP 38739 (100%) - onshore, east Taranaki (Eastern Margin) o PEP 38747 (100%) - onshore, borders the west side of the Kaimiro permit • All producing and exploration permit interests are Greymouth Petroleum operated • Owner operator of Kaimiro Gas Processing Facility o 100% utilisation								
Overall perspectives:	•								
NZ Experience:	• Appears impossible in NZ to achieve third party access to transport and/or process gas. Access to the following facilities is needed to enhance the market: o pipeline easements o high CO_2 or non-spec gas lines (e.g. Vector owned LTS line; Swift owned TAWN to NPPS line, Shell Todd owned Kapuni to Whareroa line) o non-spec gas processing e.g. Vector owned Kapuni facilities o methanol manufacturing and power generating facilities • No gas processing access arrangements in place (either as owner of facility or access to it).								
International experience:	• Currently preparing a paper about overseas regulatory regimes/access protocols								
Factors relevant to negotiating access?	•								
Factors relevant to building vs access?	•								
Relative importance –	•								

Greymouth Petroleum (provided by email):	
regulatory:	
Relative importance – cost:	•
Factors which make NZ potentially good prospecting region:	•
Other Comments:	•

Mighty River Power:										
Steve Rawson & Neil Williams	**Exploration**	✓	**Gas Processing**					**Downstream**	✓	
	Current Production		**Owner:**		**Operator:**		**Third party user:**		**Electricity Generation Gas Retail**	

Interests:	• Holds interests in exploration and mining permits o PEP 38719 surrounding Rimu/Kauri (MRP 50% share, Swift 50% share - operating party) o PEP 38495 borders Kupe (MRP 50% share, Swift 50% share - operating party) o PEP 38491 North of Pohokura (MRP 40% share, Westech 20% share, North Taranaki Exploration Limited 40% share - operating party) o Options to participate in PEPs 38488, 38489, 38490 by carrying out various activities o Participant with Swift in exploring the deep gas rights in PMLs 38140 and 38141 • Retailer of gas, through Mercury Energy • Consumer at Southdown Co-generation plant
Overall perspectives:	• Protocols are not needed - parties should be free to negotiate on a commercial basis • Concerned about free-rider issues o for example, newcomer should not expect marginal cost tolling of gas through processing facilities • Commercial arrangements need to recognise capital outlay and risks taken in acquiring, building and operating a gas processing facility. Access price is thus higher than marginal and less than the cost to build a green field plant, but is calculable by some agreed formula and is "guaranteed" • There are existing avenues if a third party has concerns about anti-competitive behaviour (Commerce Commission)
NZ Experience:	• Not tried to negotiate access to date but aware that some arrangements have been agreed • If gas is found at PEP 38495 (borders Kupe) o multiple processing facility options nearby, including Rimu facility owned by Swift (field partner) o believes it would be practical to negotiate access to a processing facility • If gas is found at PEP 38491 (north of Pohokura), it is unlikely they would be able to negotiate access to processing facilities given that JV partners have excluded one another from other storage facilities onshore. They are unlikely to willingly accommodate a competitor's product in the market unless all of their production is sold already
International experience:	• None as a company
Factors relevant to negotiating access?	• Primarily a risk/reward issue - any agreement must provide an appropriate commercial return reflecting the opportunity costs and risks taken by the owner in building and operating a facility or in the expansion or re-design of an existing one o marginal cost tolling takes no account of technical and commercial risks

Mighty River Power:	
Factors relevant to building vs access?	• Each facility is customised to the field it services o building a new facility is “safer and settled” • A large discovery can justify the building of a processing facility on a per barrel or per molecule processed basis, whereas a smaller one may not • There are also alternatives for smaller discoveries (e.g. electricity generation on site)
Relative importance – regulatory:	• Access to transmission and distribution networks is higher priority • Liquid storage and access to port loading facilities are high priority also
Relative importance – cost:	• Cost of processing facilities depends on gas quality/composition
Factors which make NZ potentially good prospecting region:	• Personal safety, under-explored territory
Other Comments:	• dedicated Kupe processing facility being developed in spite of Kapuni option, believed to be mainly due to refusal of nearby landowners to grant access consents (in time? or asking too high a price?) • Unaware of any gas not coming to market due to an inability to get access to processing facilities • Information about facilities is not relatively common knowledge, but it is available through various forms of interrogation. Most is not secret, plant visits and so forth will enable “tourists” to get data, so a central database should not be difficult

NZOG:								
Gordon Ward	**Exploration**	✓	**Gas Processing**				**Downstream**	
	Current production		**Owner:**	✓	**Operator:**	**Third party user:**		
Interests:	• Partner in the Kupe development (15% field owner, Origin Energy 50%, Genesis Energy 31%, Mitsui 4%) o dedicated Kupe gas processing facility (approximate expected utilisation 20 PJ pa) • Tui Oil fields development 12.5% share • Exploration o Offshore PEP 38483 18.9% share (non operator) – Deep offshore exploration, west of Maui o Onshore PEP 38729 75% operating share – north Taranaki • Pike River coalfield development (majority owner)							
Overall perspectives:	• Not in favour of regulating access to gas processing facilities o exploration would be less attractive if third party access to a gas processing facility could be forced, and regulated fee structures were in place • Light-handed (e.g. voluntary measures) such as info disclosure re facilities or key contract terms are the thin end of the wedge (i.e. there are more important issues to deal with) • Forced gas blending through a gas processing facility could significantly interfere with owners' operations and materially reduce the value of their asset for which purpose the plant was built. This may be through unavailability of plant for own operations (increased production or new projects) due to third party product, or affecting quality of own gas • RMA issues are hindering development within the industry. Massive hidden time and opportunity cost							
NZ Experience:	• Kupe Gas o Looked at using Swift (Rimu), Oaonui (Shell/Todd/OMV), Kapuni (NGC) o Due to need to substantially increase capacity of existing plants (and therefore limited cost saving of using existing plant) and to ensure tight management control of gas quality and operation of the offshore unmanned platform from onshore, decided to build dedicated own plant							
International experience:	• In Western Australia, there is a regulated fee scale for access to a monopoly asset pipeline o increased confidence in the ability to get gas to market. o regulation has the intention of preventing unnecessary duplication of pipelines. o appears to have been accepted by industry without too much drama							
Factors relevant to negotiating access?	•							
Factors relevant to building vs access?	• Location of the discovery • Size of the discovery • Composition of the product from the discovery • A lack of options for tolling gas, makes building a facility favourable • All things being equal, NZOG would probably build its own gas processing facility							

NZOG:	
Relative importance – regulatory:	• Open access to pipelines on a long-term basis at a reasonable rate is a far higher priority issue o major existing pipelines (like the Maui pipeline) have been paid off several times over – access cost should reflect that o regulated pricing of the pipeline worth considering o inability to build a secondary pipeline from Taranaki to Auckland (cost issues) warrants a control on the rate of return received by the owners. This should apply to all monopoly assets (i.e. including liquid storage) and connecting pipelines (providing owners right to move own product is not restricted) • Liquid storage at New Plymouth is a higher priority • Access to gas processing facilities is not seen as a significant issue
Relative importance – cost:	• The relative cost of a gas processing plant compared to the entire cost of production (including E&P/drilling and transmission pipelines) ranges, but maybe 33% to 100% plus of the total drilling and field development costs – it largely depends on the discovery size
Factors which make NZ potentially good prospecting region:	• Regulation will deter exploration, making New Zealand a potentially poorer prospecting region o RMA is already a major deterrent o remote location a major hurdle o some large discoveries (Maui, Kapuni) and a number of smaller discoveries (Tui, Kupe, Pohokura, Maari, Waihapa, Rimu). The first four of the smaller discoveries are now being simultaneously developed so industry is very active
Other Comments:	• RMA hinders the development of infrastructure • Liquid storage o facilities need to be near the port, and the land near the port is extremely hard to acquire compared to the land in the rural areas o the existing tanks are few and access should therefore be regulated o there are no drivers for owners to make tanks available to third parties (rates demanded for storage are high or access is not given at all) o critical tanks and storage should be treated the same as the Maui pipeline in terms of open access

OMV:									
George Goodsir & John Burt	**Exploration**	✓	**Gas Processing**					**Downstream**	✓
	Current production	✓	**Owner:**	✓	**Operator:**	**Third party user:**		**Wholesale**	
Interests:	• Pohokura – 26% interest in field (Shell 48%/operator; Todd 26%) o Pohokura gas processing facility • Maui – 10% share (Shell 84%/operator; Todd 6%) o Oaonui								
Overall perspectives:	• Do not see the need for gas processing protocols o in a commercial environment, companies can build a facility to suit the gas quantity and quality, and possibly build additional capacity for future own use or third party use o a regulated approach risks multiple facilities being built to handle the specific quantity and spec of each discovery o results in capital being wasted with multiple small facilities built • What constitutes a *gas processing facility* is internationally recognised								
NZ Experience:	• Pohokura - built a gas processing facility to suit the specifications of the discovery • Same partners own Oaonui gas processing facility but this was not a viable option to process Pohokura								
International experience:	• An OMV gas discovery in Pakistan was able to negotiate access to an existing nearby 'white elephant' processing facility • The agreement involved: o OMV adding extra equipment to the plant to enable the plant to process gas more efficiently o OMV earning 50% ownership of the plant by bearing the extra equipment cost								
Factors relevant to negotiating access?	• Quality of the gas • Profile of the production • Gas specifications of the raw product • Timing of the development of the field • Pipeline arrangements • Fees and access terms need to reflect any risks to the owner's ability to process its own gas being restricted (current and expected spare capacity; contaminant risks etc)								
Factors relevant to building vs access?	• Size and composition of the discovery • The costs of accessing an existing facility increase with distance o i.e. pipeline costs, and any pre-processing requirements to transport or match the gas feed to the remote processing facility o these costs can outweigh the cost of developing a dedicated facility (e.g. Oaonui was not viable for Pohokura)								

OMV:	
Relative importance – regulatory:	• While open access to transmission has its place, imposing protocols closer to production activities creates uncertainties for E&P parties and could deter investment in the sector
Relative importance – cost:	• Depends on the scale of processing required • Relatively more expensive in NZ than in the US or Canada, due to ordering time, import costs etc • A rough estimate of processing costs is somewhere between 25-30% of total costs of the operation
Factors which make NZ potentially good/bad prospecting region:	• OMV acquired NZ interests through an unrelated merger in Australia not because of NZ's prospecting potential which makes it less attractive to developers o Maui, Pohokura, Kupe and Kapuni are the only major discoveries, and all in Taranaki o infrastructure for liquid discoveries is not such a problem (easy to transport) but would be a problem for a major gas discovery if there is no infrastructure/demand for the gas
Other Comments:	•

Shell:									
Ajit Bansal	**Exploration**	✓	**Gas Processing**					**Downstream**	✓
	Production	✓	**Owner:**	✓	**Operator:**	✓	**User:**	**Wholesale**	
Interests:	• Maui: operator, 84% share (Todd 6%; OMV 10%) o Oaonui processing facility: capacity approx 480 TJ/day (or 175 PJ pa) ▪ economy of maintaining this capacity to be reviewed in context of forecast low capacity utilisation ▪ beyond 2007, expected utilisation approximately 25% average/55% peak • Kapuni: 50% share (Todd 50%) o Kapuni upstream processing – PJ pa capacity? Approximate utilisation? • Pohokura: operator, 48% (OMV 26%, Todd 26%) o Pohokura processing facility: approx 220 TJ/day (or 80 PJ pa) capacity o expected utilisation not yet available • Owns the Omata tank farm and numerous pipelines								
Overall perspectives:	• Does not see the need for protocols • Believe that if the deal is commercially favourable for both parties then an agreement will be reached • Protocols will discourage investment in the industry, especially offshore investment, where the cost and risks are high o if protocols were to effectively grant third party access to processing facilities, companies could hold off oil/gas exploration, and then once oil/gas is found, and a processing facility is built, use that facility instead of taking the risk and building their own o if protocols are in place, and a third party is demanding access, it would be easy for a gas processing facility owner to say that it is unable to process any more gas because its capacity is fully utilised or is likely to be needed in future o regulated returns on gas pipelines has lead to a lack of investment in infrastructure in a number of jurisdictions • Forcing protocols upon parties could force parties to accept another company's standards of practice								

Shell:	

NZ Experience:	• Shell is happy to enter commercial discussions with third parties where it has spare processing capacity available, subject to provision of all relevant technical information from the applicant
	• Kupe:
	  o Oaonui gas processing facility was discussed with Kupe partners but no formal offer was made
	• Pohokura:
	  o built the onshore processing facility with JV partners (before my time but I would imagine economics (or lack of) drove the decision to build separate facilities)
	  o unable to agree terms for pipelines with JV partners, so each built their own
	• Tui:
	  o production at Maui in decline (STOS formally entered into discussions with Tui)
	  o however, gas flow from Tui was peaky with uncertain composition risks
	  o Tui received Government dispensation to flare gas at field, then Maui processes the oil

International experience:	• Worldwide experience in negotiating deals for processing • Believes protocols that required Shell to make facilities available to third parties in NZ will discourage Shell from exploring here, forcing exploration overseas
Factors relevant to negotiating access?	• Composition of gas to be processed at the facility • The situation must be commercially beneficial to both sides • Shell has a formal process that is the same for every company wishing to negotiate with them, so that the process is fair • Pricing structure is based on opportunity cost for Shell, taking into account its estimate of what a third party can afford to pay and its alternative options

Factors relevant to building vs access?	• If the size of the discovery is big enough, a party will build its own processing facility. If Shell makes the first discovery, and further prospects in the region are good, it may build a 'hub' for other discoveries in the region to toll their gas through once the production from their own discovery decreases
	• Companies have different operating standards
	  o i.e. Shell does not flare gas, requires high safety levels
	  o if a party wishes to toll its gas through a Shell facility it must meet Shell's operating standards

Relative importance – regulatory:	• Higher priority is gas transmission protocols
Relative importance – cost:	• Processing facility costs are very field specific, there is no simple rule of thumb for the cost • Great Southern Basin estimate could be 20-30% of total cost • Pohokura o approximately $1 billion investment
Factors which make NZ potentially good prospecting region:	• Being lightly regulated, NZ is a relatively attractive place to invest – protocols would adversely effect this

Shell:	
Other Comments:	• Need to define what is meant by a “processing facility” and whether the GPS protocols are intended to apply to offshore or onshore facilities • Controls on the price of LPG have meant that LPG is no longer economic to produce, and so LPG extraction facilities are not being built

Swift Energy:									
Chris Bush	**Exploration**	✓	**Gas Processing**					**Downstream**	✓
	Current Production	✓	**Owner:**	✓	**Operator:**	✓	**Third party user:**		**Wholesale**

Interests:

- Houston based independent Oil & Gas company
- Pure E&P company (no downstream operations and reinvests cash flow in further E&P activities)
- TAWN fields – Central Taranaki
  - Waihapa Production Station (WPS) comprising the Waihapa oil plant and the TAG gas plant
    TAG plant capacity = 17 PJ pa capacity
    Approximate utilisation = 30%
- Rimu/Kauri fields – South Taranaki
  - Rimu Production Station (RPS) comprising an integrated oil and gas plant
    10 PJ pa capacity
    Approximate utilisation = 50%
- TAW gas pipeline and TAWN oil pipeline which connect the WPS to New Plymouth Power Station (gas) and Omata Tank Farm (oil)
- Exploration
  - Onshore: TAWN mining License Area, PEP-38742 (JV) North Taranaki, PEP-38179 and PEP-3849501 (JV) South Taranaki
  - Offshore: PEP-38495 (JV) South Taranaki

Overall perspectives:

- Protocols not needed to stimulate or encourage oil and gas E&P/development
- Access to processing facilities is not deterring exploration or development
- There are no barriers to entry for new participants building their own processing capacity if they can't access existing infrastructure (e.g. Rimu Production Station, Radnor Production Station and Kupe Production Station)
- Third party transportation and processing offers are being made (e.g. Kahili and Kupe) and agreed in some instances (e.g. Kahili)
- Believes that where a situation will benefit both parties, they will be able to negotiate access arrangements and appropriate commercial terms without the need for protocols or regulations
- If protocols were to be implemented, would recommend adopting the Canadian Jumping Pound methodology which is supported by industry and the regulator and has been in use since 1990

Swift Energy:	

NZ Experience:	• Has negotiated contracts with a number of other parties within NZ
	  o gas transportation for Contact and Methanex
	  o oil transportation for Greymouth
	  o oil purchase, water disposal and well site services for Westech at Waihapa
	  o oil purchase, water disposal and transportation for Austral Pacific
	• Although these contracts do not involve pure gas processing, they do utilise infrastructure which is important in bringing gas to market
	• Has offered its facilities for processing gas:
	  o Genesis/Origin Kupe gas – offered RPS and WPS in a variety of configurations
	  ▪ Origin chose to build their own "green fields" facility
	  o Austral Pacific Kahili gas – offered gathering lines, compression and WPS
	  ▪ Austral Pacific chose to go with a competing proposal from NGC (extended pipeline, custom built processing facility)

International experience:	• Extensive E&P operations in Texas and Louisiana • Swift previously owned a 20% share in the Brookeland gas processing plant, Louisiana. This interest was sold in April 2006. Swift remains a customer and continues to access processing facilities

Factors relevant to negotiating access?	• E&P companies invest in processing capacity to produce their proven oil and gas reserves and to assist E&P activities in the basin. Spare processing capacity has a material value to the active E&P company
	• Processing agreements should be commercially negotiated between the parties, taking into account such factors as:
	  o availability of capacity
	  o level of reserves commitment
	  o term
	  o level of service (firm or interruptible)
	• The negotiated fees need to be "fair and reasonable" to both parties, reflect capital investments/risks, and fairly allocate the costs of operating and maintaining the processing facility (e.g. fuel, flare, direct opex, G&A and working capital)
	• Processing agreements need to clearly spell out what happens when there is insufficient capacity (i.e. which streams get backed out first)

Swift Energy:	
Factors relevant to building vs access?	• For an active E&P company, access to its own facilities is an important factor for commercial success. Once a discovery is made, fast hook-up and production are important to securing ongoing cash flow • If some capacity is allocated to a third party on a firm basis, the fee should reflect the opportunity cost of Swift not being able to process its own gas should it make a new discovery (i.e. full replacement cost) • Building new facilities and pipelines onshore is not a barrier to entry. This has clearly been shown by: o Swift's RPS (up and running in under 12 months) o Radnor Production Station o Kahili Production Station o Turangi Production Station • Most E&P companies would prefer not to invest in pipelines and facilities. However, control of your own production logistics is often an over riding consideration and leads to a new build decision
Relative Importance - regulatory	• The definition of "gas processing facilities" needs further work. As well as gas plants it should include any downstream infrastructure that impacts on achieving the Government's stated policy objectives in the GPS. To the extent it impacts on getting gas to market, it also needs to include export systems such as the Liquigas LPG facilities, the Omata Tank Farm and LPG/oil export facilities.
Relative importance – cost:	• There are economies of scale in building larger gas processing facilities, however there are offsetting factors such as the requirement for conditioning and metering systems at the well head and the length of gathering pipelines required to hook into existing systems • The cost of a gas processing facility is dependent on a range of factors including capacity, composition, pipelines, location etc. By way of an example only, RPS cost USD 25 million to build in 2002/3 and has ongoing operating costs. In contrast, it can cost ~US$10 million per deep gas exploration well, and not all wells are successful.
Factors which make NZ potentially good prospecting region:	• NZ already has significant disadvantages when compared to other locations (e.g. remoteness, high costs, and low gas prices) in competing for E&P capital. Regulatory control of oil and gas infrastructure could have a negative impact on achieving the governments stated policy objectives in the GPS by further dis-incentivising investment in E&P activities.
Other Comments:	• If, despite the various submissions, a decision is made to implement regulatory control, Swift strongly advocates adoption of a proven system such as the Canadian JP methodology. This is an industry developed solution which has been widely adopted in Canada and has approval of the Alberta Energy and Utilities Board (regulator). Further information is available in the report: **"**JP-05: A Recommended Practice For The Negotiation Of Processing Fees" - Joint Industry Task Force Report prepared by Canadian Association of Petroleum Producers, Gas Processing Association Canada, Petroleum Joint Venture Association, Small Explorers and Producers Association of Canada. October 2005 at: http://www.gpacanada.com/committees/JP-05_final_report(endorsed).pdf

Tap Oil:									
Clyde Bennett	**Exploration**	✓	**Gas Processing**					**Downstream**	
	Current Production		**Owner:**		**Operator:**		**Third party user:**		
Interests:	• Has an interest in four offshore exploration permits (Taranaki, East Coast (x2), Canterbury basin) • Recently sold interests in eight onshore exploration permits and one mining permit								
Overall perspectives:	• Considers that protocols are not needed and that if third party access is required, can work through issues to negotiate agreements • Due to the small size of the industry, general information about gas processing facilities is readily accessible								
NZ Experience:	• Previously held a share in the Kahili field o Multiple options for processing were available o Acquired access to processing facilities (NGC) o NGC purchased the gas and processed it at a purpose built site • Drilling a well in the offshore Canterbury region later this year.								
International experience:	• Has been involved in third party access negotiations, as an asset owner and a third party user, in Australia								
Factors relevant to negotiating access?	• The characteristics of the gas must match the processing facility capabilities in terms of quality, pressures, temperatures etc								
Factors relevant to building vs access?	• For a large discovery, certainty of production favours building a processing facility • Different characteristics of gas govern the ability to toll the gas through a facility, because each facility is built to handle different gas specifications. It is only after processing that a common specification is likely to be attained. • Australian experience is that the state does not regulate access to processing facilities. Companies negotiate commercial agreements								
Relative importance – regulatory:	• Access to gas processing facilities not seen as a significant issue • Access to transmission and distribution pipelines is much more important • Small size of NZ gas market has an impact on exploration economics								
Relative importance – cost:	• Seeking specific information from Australia about relative costs								
Factors which make NZ potentially good prospecting region:	• Reasonable geology • Not overly explored • Few regulations • Issues with uncertainties generated by aspects of the Resource Management Act, Carbon tax etc								
Other Comments:	• Unaware of any developments that have been significantly impacted by a lack of access to processing facilities								

Todd Energy:									
Rodney Deppe	**Exploration**	✓	**Gas Processing**					**Downstream**	✓
	Current Production	✓	**Owner:**	✓	**Operator:**	✓	**Third party user:** ✓	**Wholesale, Generation Gas retailer**	
Interests:	• Pohokura – 26% non operating interest in field (Shell 48% + operator; OMV 26%) o Pohokura gas processing facility, 84 PJ pa capacity, Todd expects 100% utilisation • Maui – 6% share (Shell 84%; OMV 10%) o Oaonui gas processing facility operated by STOS[44] (50% owned by Todd) o 487 TJ/day (approx 170 PJ pa) capacity; utilisation post Pohokura start-up may only be 25-50% • Kapuni – 50% share (Shell 50%) o Upstream (at field) Kapuni gas processing facility 50:50 by Todd/Shell (70 PJ pa capacity, approx utilisation 28 PJ pa) o Downstream gas processing facility owned by Vector (23 PJ pa capacity; expect approx 100% utilisation) • McKee owner and operator – processing facility capacity 8 PJ pa; expect approx 100% utilisation • Mangahewa owner and operator – processing facility capacity 12 PJ pa; expect around 100% utilisation • Maari - 16% share in field (oil)								

[44] Shell Todd Operating Services

Todd Energy:	

Overall perspectives:	• In considering the need for gas processing protocols:
	  o the definition of gas processing should include any infrastructure elements that can affect getting gas to market (e.g. liquid storage bottlenecks limit condensate and therefore gas flows)
	  o access to all such infrastructure should be guaranteed where capacity is available by protocols that include compulsory arbitration and at a reasonable price (long term marginal cost)
	• Asset owners are arguing that the Gas Act requires that the protocols should only apply to enable new fields to be developed and do not apply on an ongoing basis or to existing projects:
	  o this would make protocols ineffective because, what happens when the access contract period expires or a renewal has to be negotiated?
	  ▪ existing fields also need secure access to essential facilities because, without secure access, their production could be cut-off, and the market affected
	  ▪ existing fields are equally important and should have access via the same protocols
	  o a narrow definition of gas processing will mean critical bottle necks do not get addressed
	• A party wanting access has NO ability to obtain access on reasonable terms in NZ because under the Commerce Act monopolies in NZ are allowed to extract a monopoly rent (Baumol Willig rule)
	  o denying entry then is as simple as requiring a very high fee
	  o in sharp contrast, other first world countries have multiple means of obtaining access to essential infrastructure on reasonable terms (including protocols, essential facilities legislation and anti-trust legislation)
	  o in NZ, only the Minister can implement price control but this is never done for individual parties and officials have indicated a general reluctance to impose price control
	  o a private party therefore has NO ability to obtain access to essential infrastructure on reasonable terms in NZ and there are numerous current and past examples of asset owners using the market dominance provided by their infrastructure to reduce competition
	• Systemic failure to gain easy, certain, economic access to monopoly infrastructure is a major disincentive for exploration and production
	  o the Ministry has recognised this in the recent amendments to the Gas Act
	  o however infrastructure owners are using small anomalies in the Gas Act to resist change
	  o it appears likely therefore that the Gas Act may need some minor amendments to achieve its objective
	• Separate selling has made access to infrastructure far more important - the recent use of infrastructure to control competition at Kapuni, Maui and Pohokura is an illustration of what is likely to be the trend from now on

NZ Experience:	• Pohokura
	  o JV partnership (with Shell and OMV) built a new processing facility on site but separate marketing/selling of gas
	  o Todd was forced to build separate pipelines from the Pohokura production station to the Maui pipeline and a liquids line to connect up to the Todd McKee line because it could not secure access to the Methanex pipelines brought by Shell/OMV, unless it gave Shell/OMV the right to reduce and control Todd's entitlement and also the ability to hold Pohokura production back at well below capacity (to reduce competition with Maui production)
	  o Todd is concerned that OMV and Shell have passed a resolution to give Shell, as operator, the right to limit Todd's access to its own infrastructure to treat its Pohokura entitlement

Todd Energy:	
	o Todd is in dispute with Shell regarding contractual access to storage tanks in New Plymouth, although it (and a separate party) consider they have existing contractual rights • Kapuni o Todd's request to NGC (now Vector) for access to treat Kapuni gas in 1995 and use its pipeline was declined o Todd and Shell therefore built a 22 km bypass pipeline to the Hawera Dairy factory and had to sell untreated gas o In 1997, the court granted Todd and Shell the right in court to sell half the Kapuni gas and required compulsory arbitration to grant access if access negotiations failed ▪ negotiations failed because NGC offered very high fees ▪ compulsory arbitration resulted in a substantially lower fee being determined ▪ NGC claimed it owned (by right of removal) LPG extracted during gas processing but arbitration/court required payment of a credit for the LPG to Todd and Shell o Supply to the dairy factory is now threatened by difficulties in accessing this pipeline at reasonable rates when the gas contract expires shortly. Shell no longer wishes to supply the plant and is demanding more than twice the ODV value of the pipeline for access o for the last decade Todd has had access to Kapuni treatment plant but Vector will not provide equal priority access rights to treatment ▪ e.g. if there is a force majeure (FM) event at the Kapuni facility, Todd is forced off first (and Vector last) forcing it to absorb a disproportionately larger amount of Vector's FM risk • Access to essential infrastructure – tanks and port infrastructure o access at a reasonable cost to the tank farm, port pipelines and loading infrastructure is an industry problem because lack of certainty about tank farm access affects not only the liquids market but also the gas market (all liquids pipelines converge on the tank farm and it is the route for the evacuation of liquids from Taranaki) o Shell has a controlling interest in all oil and condensate tanks and pipelines and loading infrastructure and gaining access (even where previously contracted) is a major problem • Bligh NZ o was a small company owned by Bligh Oil and Minerals (50%) and Todd (50%) which owned a small interest in the TAWN fields in the early 1990s o liquids were pumped to the Omata tank Farm o over time, storage and marketing fees[45] increased so much that Bligh and eventually Todd sold out • gaining access to essential infrastructure such as storage tanks and other port infrastructure has, for a long time, discouraged small players to continue investing in oil and gas in NZ

[45] To FCL Energy at that time.

Todd Energy:	
International experience:	• The absence of effective means of gaining quick economic access in NZ is in sharp contrast to the regimes established in other first world countries o e.g. Australia, UK, Canada and US all have multiple means of gaining access to monopoly infrastructure at a reasonable cost (long run marginal cost) • these include essential facilities doctrine or legislation; protocols that grant access at a competitive market price; and anti-trust legislation
Factors relevant to negotiating access?	• Spare capacity • The amount to be treated, gas spec, term • Costs of treatment • Amount of other gas using the facilities
Factors relevant to building vs access?	• Access needs to be on reasonable terms, quick and certain (longer term)

Relative importance – regulatory:	• Very important to regulate and/or provide protocols for access at a reasonable price to the monopoly elements in the entire product chain within the industry, not just access to gas processing plants. There are other more essential infrastructure bottlenecks e.g. tanks/storage and port infrastructure
	  o the definition of gas processing facilities should be widened to acknowledge that other infrastructure/bottlenecks can affect gas processing throughput
	  o first need to guarantee access at a reasonable price to the essential infrastructure – tanks and port infrastructure
	• There are no major world players exploring in NZ, only medium sized companies
	• Access protocols, under the suggested broader definition of gas processing, would make it more attractive for small to medium sized companies, with new ideas, to explore here

Relative importance – cost:	• The cost of gas processing at the well head relative to other infrastructure costs varies from field to field
	• There are no real standards and the cost depends on numerous factors including:
	  o the unprocessed gas spec
	  o whether it is offshore/onshore
	• Size of the field, depth of wells

Factors which make NZ potentially good prospecting region:	• Inability to gain access to infrastructure quickly, with certainty and at a reasonable cost, remains a major disincentive for exploration and development
Other Comments:	•

Vector:								
Ewan Gebbie (et al)	**Exploration**		**Gas Processing**				**Downstream**	✓
	Production		**Owner:**	✓	**Operator:**	✓	**Third party user:**	**Transmission, distribution, retail**

Interests:

- Kapuni processing facilities – 100% owned
  - Kapuni gas treatment plant (KGTP):
    - CO_2 removal, dehydration and hydrocarbon dewpointing facilities
    - capacity 75 TJ/d (26 PJ/a); current utilisation 67 TJ/d (23 PJ/a) (of very high (43%) CO_2 gas, constrained by CO_2 removal)
    - some ability to process larger volumes of gas if some feedstock replaced with lower (15 - 25%) CO_2 gas before throughput constraint changes to hydrocarbon dewpointing system capacity
  - gas conditioning plant (currently mothballed)
    - two trains each capable of 75 TJ/d (26 PJ/a) of low CO_2 gas
    - throughput can be increased to 100 TJ/d (35 PJ/a) per train with reduced hydrocarbon dewpointing
    - output is 12% less than the input
  - LPG fractionation: capacity 250 tonnes/day (90,000 tonnes pa) of LPG; current utilisation 40,000 tonnes pa
- Kahili gas processing facility – 100% owned
  - capacity 5 TJ/d (1.73 PJ/a); relatively easy to double capacity to 10 TJ/d; current utilisation nil
- Gas transmission network
  - Including high CO_2 pipeline from Kapuni to Methanex
    - three reservoirs feed into this pipeline - Kahili, Radnor, and Windsor
    - have recently been using this pipeline as a gas gathering facility
    - if conditions permit, can operate in either direction depending on Methanex demand

Overall perspectives:

- Not in favour of gas processing facility access protocols
  - do not see a clear policy problem
  - facilities are often “built for purpose” – why should anyone but a person benefiting or causing the need for alterations pay for changes?
  - information disclosure protocols are not needed - information on processing plants is public knowledge
  - too many ‘outs’ would make it impractical to enforce protocols
    - e.g. the third party gas devalues original gas, existing capacity is reserved for future discoveries etc
    - different gas specs in, multiple products out – protocols could distort efficient production
- Vector has incentives to utilise any spare capacity it has subject to acceptable technical and commercial risks

Vector:	

NZ Experience:	• Has negotiated contracts involving gas processing:
	  o Kahili – spent approximately $9 million on processing station and pipeline
	  o plus gas purchase agreement
	• Has offered to process gas through Kapuni facility
	  o Swift Rimu gas - chose to build their own facility
	  o Genesis/Origin Kupe gas – chose to build their own facility
	  o Cardiff – discovery is too small to build CO_2 removal plant – in negotiations

International experience:	•
Factors relevant to negotiating access?	• An agreement which minimises the risk of the type of access offered o e.g. underwrite risks with minimum payment guaranteed for processing if no gas flow • Access may not be favourable due to third party gas decreasing the value of first user gas
Factors relevant to building vs access?	• Prefer to use own facility, and avoid losing control of gas flow through business • Undertaking a gas gathering strategy with the high CO_2 pipeline • Logistical question for a small discovery o use closest non-owned plant (e.g. Cheal gas - possibly process through Swift's TAWN facility)
Relative importance – regulatory:	• As stated above, this issue has no clear definition of a policy problem, not one that relates to commercial situations anyway

Relative importance – cost:	• Depends on processing capability of the facility
	  o LPG extraction adds $80-100million to costs
	  o depends on composition of gas

Factors which make NZ potentially good prospecting region:	• Investment is not being discouraged, no lack of processing facilities • However access to pipelines in the region of exploration may discourage international exploration
Other Comments:	• Understand the broad issue MED were trying to address but the issue should be further assessed at a policy level

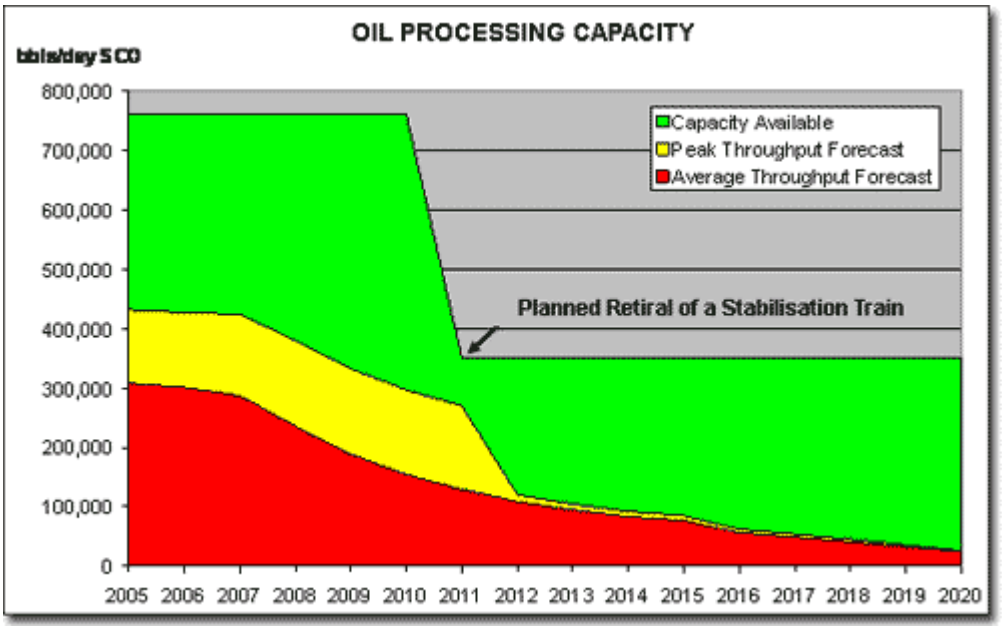
Appendix V: Sample of Data Published in the UK

As discussed in Appendix II, the UK has an infrastructure code of practice ("ICOP"). Part of the ICOP requires infrastructure owners to publish some information regarding their plant's capabilities and ullage profile. Examples of this data are shown in this appendix.

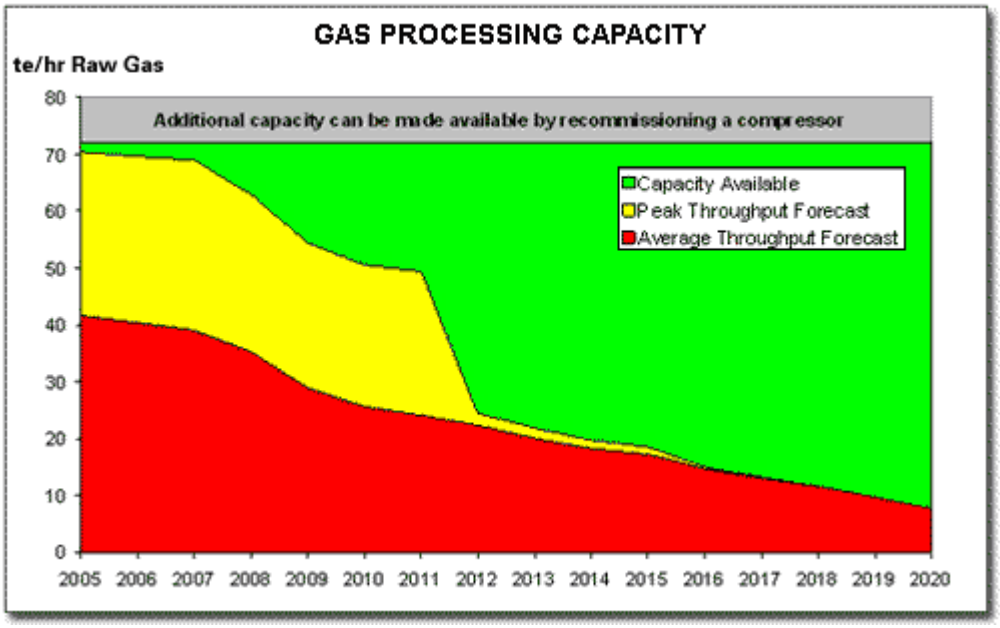
Set out below is an extract from BP's website[46] concerning the Sullom Voe terminal in the UK. It comprises a forecast of processing capacity which provides an indication of spare capacity that may be available.

BP – Sullom Voe Terminal

Infrastructure Specific Information
SVT does not operate a capacity booking system. Decisions leading to increase or decrease in capacity are anticipated on the basis of forecast throughput, may incur additional cost and (subject to that) are reversible.



[46] https://www.icmmed0ty.com/bpnsi/index.asp?id=7369643D312669643D323033.



Public available Infrastructure Specific Information

(a)	Entry specification (pipeline)	BS&W True vapour Pressure H	max 5% vol max 220 psia at 100>
(b)	Exit specification	-	-

Stabilized Crude Oil

	Level	**Test Method**
Reid Vapour Pressure, psi	target 10.0	IP 69 (mod)
BS & W vol%	max 0.5	IP386 (mod)
Acidity mgKOH/g	target 0.05 max	-
Density at 15oC	to be reported	SVTA 101
Salt Content 1bs/10000bbl	to be reported	IP265 (mod)

LPG Specification

TEST	**PROPANE Mole %**	**BUTANE Mole %**	**METHOD NUMBER**
Ethane (C2)	2.0 max	-	ASTM D2163 (mod)
Propane (C3)	95.0 min	3.0 max	ASTM D2163 (mod)
Butanes (iC4 & nC4)		95.0 max	ASTM D2163 (mod)
Butanes & Heavier (C4+)	2.5 max		ASTM D2163 (mod)
Pentanes & Heavier (C5+)	0.5 max	2.0 max	ASTM D2163 (mod)

Vapour Pressure	14.34 max	4.83 max	ASTM D1838 (mod)
Copper Strip	No. 1	No. 1	ASTM D4084 (mod)
Total Sulphur PPM by Wt	15.0 max	15.0 max	ASTM D4468 (mod)
Hydrogen Sulphide (H2S) PPM by vol.	0.5 max	0.5 max	ASTM D4084 (mod)
Residue Number (R)	10.0 max	10.0 max	ASTM D2158
Oil Stain Number (O)	Pass (34.0 max)	Pass (34.0 max)	ASTM D2158
Oily Residue PPM by Wt	20.0 max	30.0 max	SVTA 109
Moisture Content	Pass		ASTM D2713 (mod)
Free Water Content		None	SVTA 108
Methanol	to be reported if present	to be reported if present	
Olefins	to be reported if present	to be reported if present	

(c)	Details of primary separation processing facilities	Three stabilisation trains of respective capacity (bbls/day) 350,000, 410,000 and 410,000 (retired)
(d)	Details of Gas treatment facilities	Fractionation to commercial propane & butane and fuel gas (which is burnt in the onsite power station)
(e)	Oil export capacity	620,000 bbls/day (capacity for export of Brent Blend - can be increased by recommissioning a jetty).
(f)	Gas compression capacity	N/A
(g)	Gas export capacity	N/A
(h)	Gas lift capacity	N/A
(i)	Produced water handling capacity	1200 M^3/hr
(j)	Gas Dehydration capacity	not a bottleneck
(k)	H_2S removal capacity	N/A (H_2S is burnt with fuel gas in power station)
(l)	Water injection capacity	N/A

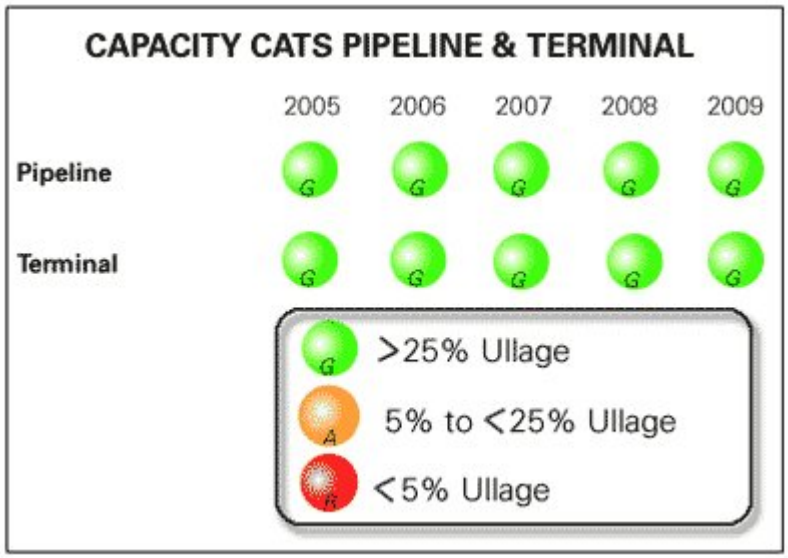
Modified January 2005

Central Area Transmission System

Shown below is an extract from the website of the Central Area Transmission System ("CATS")[47]. This depicts ullage using a very simple "traffic lights" model and would appear to be an approach that would be relatively easy for asset owners to adopt. The owners of CATS also publish a technical brochure which can be found at https://www.icmmed0ty.com/cats/content/brochure/extras/technical/CATS%20Technical%20Brochure.pdf.

CATS Ullage

Due to the decline in production from some of the existing CATS customers, ullage is opening up and CATS currently has the following capacity available for new customers.



[47] https://www.icmmed0ty.com/cats/content/brochure/brochure.asp?sectionid=29.

Appendix VI: Glossary of Terms

Term	Meaning
Gas Act	The Gas Act 1992
E&P	[Petroleum] exploration and production
Gas gathering	Transporting raw gas to a gas processing facility
Gas processing	See section 4.5, page 10 of this paper
GPS	Government Policy Statement on Gas Governance (October 2004)
ICOP	A non statutory code used in the UK (Code of Practice on Access to Upstream Oil and Gas Infrastructure) for publishing information and negotiating access arrangements in accordance with Regulations.
Jumping Pound	Voluntary guidelines for setting gas processing facility fees, used in Canada. See Appendix II, section on Canada.
Sour gas	Gas with a significant hydrogen sulphide (H_2S) content