



Review of policy on embedded generating units in operation prior to 1 January 2003

FINAL REPORT PREPARED FOR THE ENERGY MARKET AUTHORITY

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Executive summary

Introduction

Frontier Economics (Frontier) has been engaged by the Singapore Energy Market Authority (EMA or Authority) to undertake a review of the policy towards embedded generating units in operation prior to 1 January 2003.

The *Electricity Act* (the Act) requires that generators equal to or above 10 MW capacity are licensed. However, a number of companies that had planned embedded generating units before the Act took effect have been exempted from these requirements. The exemptions were granted subject to a number of conditions, including that the exempted companies must not increase their generation capacities beyond their pre-Act levels.

It now transpires that some exempted companies are planning to increase their generation capacity and are seeking preservation of their exemptions in respect of their pre-existing capacity and extension of their exemptions to new capacity.

In response, the EMA initiated a consultation process with the industry. The EMA's Consultation Paper proposed to permit the exempted companies to install new capacity while allowing their pre-existing capacity to remain exempted from licensing requirements. However, the exemptions would be revoked if the pre-existing units were retired or replaced, if their capacity was increased or if they injected into the grid (or otherwise participated in the market). A number of responses to the Consultation Paper were received from both licensed generators and exempted companies. They are discussed below.

Frontier then prepared a Draft Report and this circulated by the EMA for comment during August 2005. The Draft Report included an analysis of submissions on the EMA's Consultation Paper. A number of responses to the Draft Report were also received from both licensed generators and exempted companies. They are also discussed below.

The EMA now seeks to resolve the best approach for resolving the embedded generation policy.

Frontier's approach to the assignment

In Frontier's view, there are two sequential issues before the EMA:

- First, should the EMA maintain the status quo conditions of exemption when an exempted company makes an investment in new (additional) capacity, or should the conditions be relaxed such that the pre-existing capacity remains exempted from licensing requirements (First Decision); and
- If so, second, where replacement investment (of the same size or smaller than the capacity being replaced) is concerned, should the EMA implement:
 - Proposed Arrangement 1 – require licensing in respect of the replacement investment on the basis that the replacement investment is nevertheless a new investment that is planned and built after the commencement of the NEMS; or

- Proposed Arrangement 2 – allow the replacement investment to be exempted from licensing requirements, on the basis that the level of exempted capacity has not increased (Second Decision).

Stakeholder feedback and Frontier Economics responses

The EMA received 11 submissions on its Consultation Paper, 5 from licensed generators (Keppel Energy, Island Power, Power Seraya, Senoko Power and TUAS Power) and 6 from exempted companies (Seraya Chemicals, ExxonMobil, Petrochemical Corporation of Singapore, Linde Syngas, Shell Eastern Petroleum and Singapore Refining Company).

In general, the licensed generators argued that the existing exemptions should be abolished and definitely not extended to new capacity developed by the exempted companies. They argued this would be inappropriate for several reasons, summarised as follows:

- It would breach the conditions of the original granting of the exemptions;
- Exempt companies are already inappropriately favoured through lower market and regulatory charges;
- It would create a separate favoured class of participant, which could lead to gaming of the market;
- Its may enable exempted companies to inject into, and participate in, the market; and
- The size of exempted capacity is significant and could create system security and demand forecasting difficulties.

In general, Frontier believes that all but the first of these concerns are relevant to the *original granting* of the exemptions rather than the issue now before the EMA of whether to maintain the exemptions after the exempted companies invest in new capacity. The exemptions were originally granted in consideration of the fact that the exempted companies had planned or developed cogenerators without the intention of competing in the market and before the regulatory regime for the NEMS was known. They could not have reasonably anticipated that they would be required to be licensed, whereas the larger (now-licensed) generators should have reasonably expected that they would be subject to licensing and similar regulation following the start of the market. However, Frontier agrees that in order to preserve confidence in the robustness of the regulatory regime, policy change should not be undertaken lightly. Further, in relation to the extension of exemptions to new capacity, Frontier also agrees that this proposal must be examined carefully.

The exempted companies argued in favour of preserving their exemptions and extending them to new capacity. Their key arguments were:

- Generating electricity is not the exempted companies' 'core business';
- Embedded generating capacity is small and not a system security issue;
- Other markets charge loads with embedded generators on a 'net load' basis;
- Cogeneration plant are efficient and environmentally clean; and

- Exemptions are required to promote investment and offset the high cost of power in Singapore.

Frontier considers that the exempted companies did not make a convincing case for extension of the exemptions to new capacity. Whether or not electricity generation is a firm's core business should not, of itself, affect the way it is regulated. While other markets do treat customers with on-site generation on a net load basis, this does not seem to be optimal given the manner in which reserve and other costs arise. If cogeneration plant are efficient, they should be developed without needing to receive favourable treatment. If the Government wants to promote particular plant technologies for environmental reasons, it could do this through transparent assistance rather than altering the regulatory regime. Finally, the regulatory regime should promote efficiency, even if this affects the profitability of particular parties. To do otherwise would be to the detriment of the market as a whole.

Frontier's framework for review

The scope of the Review requires consideration of both the efficiency and fairness aspects of changes to the existing conditions of exemption.

Frontier's approach to assessing the efficiency of the Proposed Arrangements is based on cost-benefit analysis (CBA). CBA identifies, and if possible, quantifies the impact of a decision against a 'base case' state of the world. The CBA applied in this report takes into account benefits and costs that arise both in the short term and in the long term.

In the short term, exempted generators' decisions over whether or not they should invest in new embedded generation capacity may be directly affected by whether or not the EMA changes the embedded generation policy. In the longer term, exempted companies and licensed generators will need to decide how should they bid and operate their plant given the amount of capacity in the market. Both of these impacts are regarded in this report as *direct* effects of the embedded generation policy decision.

In addition, in the longer term, the EMA's policy decision could have some *indirect* impact on future investment decisions by affecting potential investors' confidence in the integrity of the regulatory arrangements.

The scope of the review also requires Frontier to consider the fairness of changing the conditions of exemption. While fairness is at least partly a subjective concept, it is reasonable to consider that it would include the extent to which regulatory arrangements treat parties in similar circumstances in a similar manner.

Moreover, as noted above, where participants are treated in a manner that is different to what they could have reasonably anticipated, this will influence the long term efficiency of the regulatory regime. Therefore, to some extent, efficiency incorporates a concept of fairness.

First decision – investment in additional capacity

As discussed above, Frontier's analysis is based on a sequential examination of two questions before the EMA.

The first policy decision is whether the existing conditions of exemption should continue to apply to an exempted company's pre-existing capacity where it seeks to invest in additional ('greenfields') generation capacity. Both sets of Proposed Arrangements would relax this condition of exemption.

The first step in assessing this issue is formulation of an appropriate base case for analysis. This includes the status quo arrangements for embedded generators, which comprises the existing conditions (and benefits) of exemption. The benefits are primarily derived from the fact that exempted companies are treated in the NEMS as a reduced (net metered) load rather than as separate (gross metered) load and generation. This offers exempted companies reduced fees in relation to the Market Support Services Charge, regulation and spinning reserves, uplift, licensing, PSO and EMC charges and the emergency fuel obligation. These benefits are annually worth approximately \$4.24/MWh of embedded generation output and \$140K in fixed fees, ignoring emergency fuel obligations.

The next step is to consider the impact of the Proposed Arrangements against the base case in relation to investment, competition and investor confidence.

Investment in generation

Under the status quo arrangements, if an exempted company invested in new capacity, it would lose its exemptions on its pre-existing capacity. Meanwhile, a licensed generator considering investment would not face the loss of any exemption. This implies that under the status quo arrangements, exempted companies face a higher barrier to new investment than other companies.

Both sets of Proposed Arrangements would enable the exempted companies to develop any proposed greenfields generation capacity without losing their exemptions in respect of their pre-existing generation. This would mean that the exempted companies would be on a more 'level playing field' with other parties in terms of the licensing and other regulatory costs of new generation investment.

Unfortunately, quantification of the direct investment efficiency benefits of introducing the Proposed Arrangements is not straightforward. It would fundamentally require an assessment of whether the change in the embedded generation policy *caused* exempted companies to switch from buying from the market to undertaking investment in generation, on the basis that supply from embedded plant was lower-cost than supply from the market. If market supply is always lower cost than embedded investment or if the policy change would not affect any exempted company's investment decision, there would be no direct investment efficiency benefit.

This exercise would need to be undertaken for every exempted company to arrive at a market-wide estimate of the direct investment efficiency implications of introducing the Proposed Arrangements. This would require detailed information about exempted companies' electricity needs, the size and costs of potential new generation projects and the cost structure of all licensed generators.

However, it is possible to produce an estimate of the *maximum potential direct investment efficiency improvement* of the Proposed Arrangements. This is equal to the

total value of the loss of licence exemptions. This is because the value of a licence exemption is the maximum that an exempt company would be willing to sacrifice in order to buy higher-cost electricity from the market. If the difference between the cost of embedded investment and market supply is smaller than the value of the licence exemption, the exempted company would buy from the market and avoid developing its own capacity and losing its exemption on its pre-existing capacity. This would be inefficient if the exempted company could produce power at lower cost than the market. If the difference between the cost of embedded investment and market supply is greater than the value of the licence exemption, the exempted company would simply give up its exemption and invest. This would be the efficient outcome assuming the exempted company could produce power at lower cost than the market. Hence, the value of the exemption caps the amount of inefficiency from the existing exemption conditions.

Unlike estimating the *actual* direct investment efficiency impacts of the Proposed Arrangements, estimating the *maximum* direct investment efficiency impacts across the NEMS is relatively straightforward. Based on what is known about the quantity of exempted capacity and the value of the exemptions, the maximum potential direct investment efficiency benefit of moving from the status quo arrangements to the Proposed Arrangements is approximately \$12.3 million.

The *actual* direct investment efficiency benefit from the Proposed Arrangements may be less than the maximum for a number of reasons. These reasons include that not all exempted companies require more electricity supply and that the change in the policy would not ‘tip’ all of the exempted companies’ investment decisions away from the wholesale market and towards embedded investment. The presence of market power would also reduce the potential benefits.

Therefore, the potential direct investment benefit from the Proposed Arrangements lies within a range of zero to \$12.3 million. Frontier believes that it would be towards the lower end of this range because of the improbable set of circumstances that would be required to derive the maximum benefit figure.

Effect of Proposed Arrangements on generator bidding and competition

This analysis is, by necessity, at a high-level because of the complexity of the factors influencing generator bidding. First, it can be said that if the Proposed Arrangements do not lead to different investment outcomes than in the status quo, there is no reason to believe that generator bidding will be any different to the status quo. Therefore, differences in generator bidding would arise only if the Proposed Arrangements have an impact on generation investment decisions.

Under the Proposed Arrangements, we would expect to observe, at the margin and other things being equal, more generation investment by the exempted companies and less by licensed generators than in the status quo as a result of the removal of the impost on new investment by the exempted companies. This would tend to reduce generator concentration and thereby reduce the ability of licensed generators to withhold capacity and bid up the wholesale price. Therefore, contrary to the suggestions made in some submissions, the Proposed

Arrangements are likely to lead to an increase in the competitiveness of the wholesale market compared to the status quo.

Indirect effects on the market

The implementation of either of the Proposed Arrangements represents a departure from the existing exemption conditions that were put in place in late 2002. This could negatively affect the NEMS investment environment, because potential investors could have less confidence in the stability of the market's legislative and regulatory requirements. However, the effect on future market behaviour and investment arising from this is difficult to predict.

Second decision – replacement investment

The second decision for the EMA is if the exempted companies' investments involve replacement of their pre-existing capacity, whether the replacement capacity should itself be exempted from licence requirements (like the capacity it replaces) or whether it should be treated as new investment and be licensed.

It is with respect to this decision that Proposed Arrangement 1 differs from Proposed Arrangement 2:

- Proposed Arrangement 1 requires licensing in respect of the replacement investment on the basis that the replacement investment is nevertheless new investment planned and developed after the commencement of the NEMS; and
- Proposed Arrangement 2 allows the replacement investment to remain exempt from licensing requirements, on the basis that the level of exempt capacity has not increased.

Therefore, the second decision involves considering whether Proposed Arrangement 2 offers net benefits (or costs) over Proposed Arrangement 1.

Investment in generation

Under Proposed Arrangement 2, an exempted company considering replacing its pre-existing units would not have to factor in licensing and regulatory costs, whereas an investor in greenfields capacity would have to consider these costs. Therefore, other things being equal, investment in replacement plant by the exempted companies would be more attractive than greenfields investment by any company, including the exempted companies.

Favourable treatment of investment in embedded replacement capacity would be appropriate if such replacement investment did not impose as high regulatory and administrative costs on the market as greenfields investment. However, our understanding is that embedded on-site generation capacity imposes similar market and regulatory costs (such as ancillary services costs) as a similar quantity of non-embedded generation capacity. Therefore, we consider that Proposed Arrangement 2 is likely to inefficiently promote replacement embedded investment over greenfields investment compared to the base case of Proposed Arrangement 1.

Effect on generator bidding and competition

Under Proposed Arrangement 2, the likelihood of new generation investment by the exempted companies rather than licensed generators is slightly greater than in Proposed Arrangement 1. Therefore, in our view, Proposed Arrangement 2 is likely to promote slightly more competition in the wholesale market than Proposed Arrangement 1, other things being equal.

Indirect effects on the market

The implementation of either of the Proposed Arrangements represents a departure from the existing exemption conditions. Therefore, in comparing Proposed Arrangement 2 with the base case of Proposed Arrangement 1, the likely indirect impacts on potential investors' confidence are difficult to determine and may be negligible.

On balance, Frontier submits that the Proposed Arrangement 1 should be adopted in preference to Proposed Arrangement 2.

Additional option – extension of exemptions to all embedded generation

In light of the extensive comments to the EMA Consultation Paper from exempted companies seeking an extension of licence exemptions to all embedded generation, it is worth examining this option.

The exempted companies' arguments for the extension of exemptions to all embedded generation (also referred to as cogeneration) were based on the treatment of embedded generation in other markets, lack of power export, that generation is not their core business, that Singapore market prices are too high and that embedded generation is efficient and environmentally beneficial.

Frontier does not consider that it would be appropriate to extend licence exemption to all embedded generation. As noted above, many regulatory costs, such as spinning and regulation reserve, are related to the gross load and generation connected to the grid rather than the net load. Therefore, it would be inappropriate to provide licence exemptions in relation to all embedded generators without a thorough technical analysis of the system implications of embedded generators. None of the other reasons provided by the exempted generators imply that the regulatory regime should favour embedded generation – there may be other more transparent ways to achieve other social objectives.

Draft Recommendations

Frontier recommended that the EMA adopt Proposed Arrangement 1. The EMA should allow the exempted companies to invest in generation without losing their exemptions on their pre-existing capacity. Replacement investment should be treated the same as greenfields investment – to the extent pre-existing capacity is replaced, the exempted companies should lose their exemptions in relation that the replaced capacity. Further, the exemptions should not be extended to all embedded generation plant.

Stakeholder submissions on Draft Report

The EMA received 8 submissions on its Consultation Paper, 5 from licensed generators (Keppel Energy, Island Power, Power Seraya, Senoko Power and

TUAS Power) and 3 from exempted companies (ExxonMobil, Petrochemical Corporation of Singapore and Singapore Refining Company).

Two of the five licensed generators (Keppel Energy and Island Power) agreed with the analysis and findings of the Draft Report. The remaining three licensed generators argued that exemption conditions should not be changed in accordance with the draft recommendations because to do so would create an ‘unlevel playing field’ for generators in the NEMS. They also argued that the benefits of Proposed Arrangement 1 had not been properly calculated and that the sovereign risks had not been adequately taken into account.

Frontier disagrees that Proposed Arrangement 1 would create an unlevel playing field for new generation investment. It is true that maintaining the exemptions would maintain benefits for the exempted companies, but it must be remembered that the exemptions were granted on the basis that the relevant embedded capacity was planned at a time when they were not expected to be required to participate in the market. This rationale for the exemptions has not changed. Proposed Arrangement 1 should help promote efficiency in generation investment decisions going forward.

As they did in response to the EMA’s Consultation Paper, the exempted companies argued in favour of extending their exemptions to new embedded capacity. Their key arguments were:

- Generating electricity is not the exempted companies’ ‘core business’;
- Other markets charge loads with embedded generators on a ‘net load’ basis;
- Cogeneration plants are efficient and environmentally clean; and
- Exemptions are required to promote investment and offset the high cost of power in Singapore.

Once again, Frontier does not believe that the ‘core business’ of the exempted companies is relevant in determining whether or not their embedded plant should be licensed. The EMA has implemented a threshold for licensing (10MW) and this is partly in recognition of the system operation cost implications of embedded generators. If there is to be a separate threshold for the licensing of embedded generation, this should only be considered after a full technical review of the costs that embedded generators impose on the power system. At this stage, it is Frontier’s understanding that embedded generators impose costs on the system that are not reflected in a ‘net load’ treatment from a charging point of view. Further, any environmental or national development benefits of embedded generation should be dealt with directly through specific legislation or transparent taxes or subsidies to promote embedded generation.

Final recommendations

Frontier does not consider that the submissions to the Draft Report raised any new issues of sufficient weight to warrant changing the draft recommendations. Therefore, Frontier’s final recommendations are the same as the draft recommendations – to implement Proposed Arrangement 1.

That said, if different information on the technical and cost implications of embedded generators in the Singapore market comes to light, it may be necessary to revisit this recommendation.

1 Introduction

1.1 BACKGROUND

Frontier Economics (Frontier) has been engaged by the Singapore Energy Market Authority (EMA or Authority) to undertake a review of the policy towards embedded generating units in operation prior to 1 January 2003 (the Review).

Presently in the National Electricity Market of Singapore (NEMS), the *Electricity Act* (the Act) requires that generators equal to or above 10 MW capacity are licensed. Licenses set out minimum standards of generator participation, including specific obligations. The rationale for generator licensing is contained in the memorandum from PA Consulting Group to the EMA dated 21 March 2002. The key reasons are:

- Unlicensed generators could free-ride on the benefits provided by others; and
- Unlicensed generators could undermine the market.

Generators below a size at which they could technically or commercially undermine the market or create public safety issues (that are not addressed elsewhere) do not need to be licensed – hence the 10 MW threshold.

However, a number of companies had planned on-site generating units before the licensing requirements of the Act took effect on 1 January 2003. The Singapore Government granted generation license exemptions to these companies in respect of their on-site (embedded) capacity. These companies will be referred to as “exempted companies” and their existing units will be referred to as “exempted” or “pre-existing” capacity. The capacities of the exempted companies’ embedded generators range from 2 MW to 176 MW.

The exemptions were granted to the exempted companies subject to the following conditions:

- The company shall not inject electricity into the transmission system;
- The company shall not register itself as a market participant of the generation licensee class as stipulated in the market rules;
- The company shall not increase its generation capacity beyond [its pre-existing capacity]; and
- The company shall comply with any code of practice and direction issued, approved, or given by the Authority under sections 16 and 17 of the Act, respectively.

It now transpires that some of the exempted companies are seeking to increase their generation capacity and have requested the EMA to preserve their exemption status in respect of their pre-existing capacity and extend it to their new capacity.

In response, the EMA published a consultation paper entitled, “Exemption of embedded generating units in operation prior to 1 January 2003 from the

licensing requirements under the Electricity Act”, dated 26 April 2005 (the Consultation Paper).

The Consultation Paper proposed to permit the exempted companies to install new capacity while allowing their pre-existing capacity to remain exempted from licensing requirements. However, the exemptions would be revoked if the pre-existing units were retired or replaced, if their capacity was increased or if they injected into the grid (or otherwise participated in the market).

A number of responses to the Consultation Paper were received. The submitting parties were:

- Keppel Energy;
- Island Power;
- Power Seraya;
- Senoko Power;
- TUAS Power;
- Seraya Chemicals Singapore;
- ExxonMobil;
- Petrochemical Corporation of Singapore;
- Linde Syngas Singapore;
- Shell Eastern Petroleum; and
- Singapore Refining Company.

Frontier then prepared a Draft Report that was circulated for consultation with stakeholders in August 2005. Eight submissions were received on the Draft Report, from:

- Keppel Energy;
- Island Power;
- Power Seraya;
- Senoko Power;
- TUAS Power;
- ExxonMobil;
- Petrochemical Corporation of Singapore; and
- Singapore Refining Company.

The EMA now seeks to resolve the best approach for managing the issues raised in the Consultation Paper.

1.2 SCOPE OF WORK

The EMA has requested Frontier to, in brief:

- Review and respond to submissions made to the Consultation Paper;
- Both:
 - assess the fairness of the regulatory practice; and
 - quantify the impact on competition,
 of allowing the exempted companies to install new generating units while permitting their pre-existing capacity to remain exempted from licensing requirements and either:
 - revoking the exemption status of a pre-existing generating unit if it is retired or replaced (Proposed Arrangement 1); or
 - revoking the exemption status of a pre-existing generating unit that is retired unless it is replaced by a new unit of the same or smaller capacity (Proposed Arrangement 2);
- Assess and make recommendations on the appropriate treatment of the exempted companies, including, if appropriate, proposing an alternative model; and
- Provide insights into the treatment of embedded generation internationally.

Prior to the commencement of this Review, the EMA confirmed that the assessment should be supported by a cost-benefit analysis (CBA) of the Proposed Arrangements. The CBA should include the potential impacts of the Proposed Arrangements both on generation investment and on future generator behaviour and competition.

The EMA's Tender Document required the consultant to produce a number of separate reports, all of which are included in this report.

1.3 FRONTIER'S APPROACH TO THE ASSIGNMENT

In Frontier's view, there are two sequential issues before the EMA:

- First, should the EMA maintain the status quo conditions of exemption when an exempted company makes an investment in new (additional) capacity, or should the conditions be relaxed such that the pre-existing capacity remains exempted from licensing requirements; and
- If so, second, where replacement investment (of the same size or smaller than the existing capacity being replaced) is concerned, should the EMA implement:
 - Proposed Arrangement 1 – require licensing in respect of the replacement investment on the basis that the replacement investment is nevertheless a new investment that is planned and built after the commencement of the NEMS; or

- Proposed Arrangement 2 – allow the replacement investment to be exempted from licensing requirements, on the basis that the level of exempted capacity has not increased.

These issues will be addressed in turn in the context of the framework developed in this report.

1.4 STRUCTURE OF THIS REPORT

Frontier seeks to meet the requirements of the scope of work as follows:

- An executive summary of all submissions to the EMA Consultation Paper, Frontier's responses to all comments and Frontier's recommendations (see above);
- A table of unabridged comments from stakeholder submissions and Frontier's detailed responses to those comments (section 2);
- Frontier's review, assessment and draft recommendations in accordance with the scope of work and our approach to the assignment discussed above (section 3); and
- A review of stakeholder submissions on the Draft Report, Frontier's responses and final recommendations (section 4).

2 Stakeholder comments and Frontier's detailed responses

Table 1 below sets out the required table of stakeholder comments and feedback to the EMA's Consultation Paper, as well as Frontier's responses to each comment. The stakeholders are ordered as licensed generating companies first and exempted companies second.

Stakeholder	Comments	Frontier Economics response
Keppel Energy	<p>Opposes change to the exemption conditions because:</p> <ol style="list-style-type: none"> 1. It would breach the original conditions on which the exemption was given; 2. Development of new generation capacity would provide a good opportunity to address the legacy issue; 3. Creating a special class of exempt generators may create volatility and lead to 'gaming of the market' through the withdrawal of unlicensed generation capacity; and 4. All participants should be treated equally to avoid cross-subsidies and distortions to competition. 	<ol style="list-style-type: none"> 1. Agree it is important that regulation should operate in accordance with participant expectations. Changing established policy should not be undertaken lightly. 2. The present situation could be used to abolish the exemptions, but question whether this is desirable given the potential efficiency and competition benefits of the Proposed Arrangements (see section 3.2 below). 3. It is unclear how the Proposed Arrangements would facilitate gaming by exempted companies. In fact, other things being equal, the Proposed Arrangements should reduce generator concentration and reduce the scope for exercising market power in the long term (see section 3.2.3 below). 4. The appropriateness of the treatment of exempted companies was explicitly considered when the exemptions were granted. The exemptions were given on the basis that the exempt companies did not develop their plant with the intention of competing in the market and could not have reasonably anticipated that they would be required to be licensed. The treatment of new capacity is a separate matter and needs to be considered on its merits. Maintaining license

Stakeholder comments and Frontier’s detailed responses

		<p>exemptions on the exempted companies' pre-existing capacity could have significant beneficial efficiency effects (see section 3.2 below).</p>
<p>Island Power</p>	<p>Opposes change to the exemption conditions because:</p> <ol style="list-style-type: none"> 1. Conditions of exemption were accepted by industry at commencement of the market; 2. Exempted companies already avoid many of the costs that non-exempted generators must bear – for example, emergency fuel and reserve payments; 3. Concern that exempted parties will participate in the pool directly or indirectly; 4. Continuation of exemption bestows competitive advantage on exempt companies; 5. Size of exempted capacity is significant and failure could put strain on system; and 6. Equal treatment requires exempted companies lose exemption if they want to participate in the market. 	<ol style="list-style-type: none"> 1. Agree it is important that regulation should operate in accordance with participant expectations. Changing established policy should not be undertaken lightly. 2. The appropriateness of the treatment of exempted companies was explicitly considered when the exemptions were granted. The exemptions were given on the basis that the exempt companies did not develop their plant with the intention of competing in the market and could not have reasonably anticipated that they would be required to be licensed. The treatment of new capacity is a separate matter and needs to be considered on its merits. Maintaining license exemptions on the exempted companies' pre-existing capacity could have significant beneficial efficiency effects (see section 3.2 below). 3. If new embedded capacity is licensed, it may be eligible to participate in the market. However, exempted capacity cannot participate. How this is enforced is an operational matter for the EMA. 4. See response to (2) above. 5. At least with respect to pre-existing exempted capacity, system security issues have been managed thus far. Treatment of new embedded capacity is a separate matter and needs to be

		<p>considered on its merits.</p> <p>6. Disagree – status quo conditions create an unlevel investment ‘playing field’ and may inefficiently deter investment by exempt companies (see section 3.2 below).</p>
<p>Power Seraya</p>	<p>Opposes change to the exemption conditions because:</p> <ol style="list-style-type: none"> 1. Exempted companies will be active participants once they build new plant and inject into the system; 2. Exempted companies are fully aware of the exemption conditions and cannot now claim ignorance; 3. Position of on-site generators is already favourable – there is no need to further advantage on-site plant by extending exemptions; 4. Not clear how EMA will police requirement to not inject into system. 	<ol style="list-style-type: none"> 1. While exempted companies’ new plant may compete with licensed generators’ plant, that does not mean that pre-existing capacity should lose their exemptions. The exemptions were given on the basis that the exempt companies did not develop their plant with the intention of competing in the market and could not have reasonably anticipated that they would be required to be licensed. 2. Agree that policy change should not be undertaken lightly. 3. The appropriateness of the treatment of exempted companies was explicitly considered when the exemptions were granted. The exemptions were given on the basis that the exempt companies did not develop their plant with the intention of competing in the market and could not have reasonably anticipated that they would be required to be licensed. The treatment of new capacity is a separate matter and needs to be considered on its merits. Maintaining license exemptions on the exempted companies’ pre-existing capacity could have significant beneficial efficiency effects (see section 3.2 below).

		<p>4. Enforcement is an operational matter for the EMA to address.</p>
<p>Senoko Power</p>	<p>Opposes change to the exemption conditions because:</p> <ol style="list-style-type: none"> 1. Singapore market is a 'gross pool', so all electricity must be transacted through pool; 2. EMA's proposal would create two classes of market participant – exempted and licensed, with portion of exempted companies' capacity exempted from market rules and obligations such as reserve. This is inequitable and discriminatory; 3. Exemption is a time-related privilege that should be phased out and not extended by discriminatory granting of additional licensed capacity; 4. Exempted generation is not small – over 300 MW. This 'shadow capacity' will make it hard to accurately forecast demand; 5. The privileged position will enable exempted companies to influence wholesale prices and create volatility in pool prices; 6. Current licensees do not enjoy exemptions for ancillary use of electricity; 7. EMA proposal would complicate the principles of the market. 	<ol style="list-style-type: none"> 1. Other markets such as Australia are also gross pools and also give similar treatment to embedded on-site generators. 2. The appropriateness of the treatment of exempted companies was explicitly considered when the exemptions were granted. The exemptions were given on the basis that the exempt companies did not develop their plant with the intention of competing in the market and could not have reasonably anticipated that they would be required to be licensed. The treatment of new capacity is a separate matter and needs to be considered on its merits. Maintaining license exemptions on the exempted companies' pre-existing capacity could have significant beneficial efficiency effects (see section 3.2 below). 3. As above. 4. The issue of 'shadow capacity', if there is one, should reduce over time as demand grows. 5. Disagree – extension of exemption should put investment by exempted companies on a 'level playing field' with investment by licensed companies, thereby promoting competition. 6. This is a wider policy issue (see section 3.4 below). Note that non-exempt embedded generators would also not receive exempt

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		<p>treatment.</p> <p>7. Disagree – EMA proposal is simply to change a condition of exemption. This is not a major change to the market arrangements.</p>
TUAS Power	<p>Opposes change to the exemption conditions because:</p> <ol style="list-style-type: none"> 1. Exemptions given on very specific conditions, with full knowledge of companies; 2. Would perpetuate an unlevel playing field because exempted companies already avoid paying market charges on their gross load and reserve charges on their gross generation; and 3. Once exemptions are given, could open the floodgates to other exemptions, disregarding the interests of generators and the basis of the Electricity Act. 	<ol style="list-style-type: none"> 1. Agree – therefore, it is important that policy change should not be undertaken lightly. However, present exemption conditions may produce inefficiency (see section 3.2 below). 2. The appropriateness of the treatment of exempted companies was explicitly considered when the exemptions were granted. The exemptions were given on the basis that the exempt companies did not develop their plant with the intention of competing in the market and could not have reasonably anticipated that they would be required to be licensed. The treatment of new capacity is a separate matter and needs to be considered on its merits. Maintaining license exemptions on the exempted companies' pre-existing capacity could have significant beneficial efficiency effects (see section 3.2 below). 3. This is a matter for the EMA to manage – the EMA will presumably treat each issue on its merits.
Seraya Chemicals Singapore	<p>Supports continuation of exemption and application of exemption to future cogeneration because:</p> <ol style="list-style-type: none"> 1. It is not our core business to generate, sell and buy electricity; 	<ol style="list-style-type: none"> 1. Disagree – what is and is not a company's 'core business' should not affect how they are regulated. 2. Energy prices for all customers should ideally

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	<ol style="list-style-type: none"> 2. If forced to participate in wholesale market, variable costs would increase. This would weaken our competitive position because current Singapore electricity prices are relatively high; 3. Cogeneration plant are efficient and environmentally friendly and should not be penalised; 4. With respect to spinning reserve, we are similar to many loads with high peak demand and low continuous demand; 5. Application of the exemptions to new capacity would attract more foreign investors in power generation. 	<p>reflect efficient costs, even if this has implications for particular customers' profitability. To do otherwise would make the market as a whole worse off.</p> <ol style="list-style-type: none"> 3. If cogeneration plant are efficient, they will still be attractive if treated in the same manner as other plant. The promotion of plant providing environmental benefits should be dealt with as a separate policy matter. 4. Disagree – our understanding is that spinning reserve requirements relate to the gross size of generation and load rather than the size of net load. 5. Again, efficiency should be the overriding objective of the regulatory regime. This should not be compromised in order to attract investors to a particular activity, because the market as a whole would be worse off.
<p>ExxonMobil</p>	<p>Supports continuation of exemption and application of exemption to future cogeneration because:</p> <ol style="list-style-type: none"> 1. Cogeneration should be treated on a net basis like in other markets – identical to a load customer with varying power requirements; 2. Cogeneration plant that do not export power into the grid should not be required to participate in the market and hold a generation licence; 3. Government should consider positive incentives for cogeneration plant. 	<ol style="list-style-type: none"> 1. While many markets use a 'net load' approach, we are not convinced this is appropriate for the NEMS (see section 3.4 below). 2. As above. 3. If cogeneration plant are efficient, they will still be attractive if treated in the same manner as other plant. The promotion of plant providing environmental benefits should be dealt with as a separate policy matter.

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<p>Petrochemical Corporation of Singapore</p>	<p>Supports continuation of exemption and application of exemption to future cogeneration because:</p> <ol style="list-style-type: none"> 1. Embedded generators are built for self-consumption and we are not in the business of generation for the market; 2. Our generation capacity remains small and has an insignificant impact on system security; 3. Current charges are paid on net load – no need to charge again on generation; 4. Embedded generation units are highly efficiency and clean; 5. Restrictive regulations on embedded generation will deter new investment. 	<ol style="list-style-type: none"> 1. Disagree – what is and is not a company’s ‘core business’ should not affect how they are regulated. 2. While the system security issues of existing exempted generation have been managed to date, this may not be the case if there is a future expansion of embedded generation. The EMA has separately considered the appropriate capacity size for licensing and this is 10 MW. 3. Net load treatment of embedded generators is a wider policy issue (see section 3.4 below). 4. If cogeneration plant are efficient, they will still be attractive if treated in the same manner as other plant. The promotion of plant providing environmental benefits should be dealt with as a separate policy matter. 5. Efficiency should be the overriding objective of the regulatory regime. This should not be compromised in order to attract investors to a particular activity, because the market as a whole would be worse off.
<p>Linde Syngas Singapore</p>	<p>Supports continuation of exemption and application of exemption to future cogeneration investment because:</p> <ol style="list-style-type: none"> 1. Units do not inject electricity into transmission network; 2. Generation capacity is small and insignificant to system security; 	<ol style="list-style-type: none"> 1. Given that many regulatory costs (such as spinning and regulation reserve) are related to gross load and generation rather than net load, whether or not a customer exports into the grid is not determinative of whether they should be licensed. 2. While the system security issues of existing

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	<ol style="list-style-type: none"> 3. Load is equipped with load limiting device (LLD) in the event of loss of embedded generation to avoid instantaneous power demand from network; 4. Further exemption should apply to new units if the existing unit is obsolete, the new unit is more efficient or the new generation capacity is small and is equipped with a LLD. 	<p>exempted generation have been managed to date, this may not be the case if there is a future expansion of embedded generation. The EMA has separately considered that 10 MW is the appropriate threshold for licensing.</p> <ol style="list-style-type: none"> 3. This should be considered as part of the wider policy issue of whether embedded generators in general should be exempt from licensing (see section 3.4 below). 4. As above.
<p>Shell Eastern Petroleum</p>	<p>Supports continuation of exemption and application of exemption to future cogeneration investment because:</p> <ol style="list-style-type: none"> 1. Electricity costs in Singapore are higher than elsewhere, so self-generation (without cost penalty) is necessary for industry to remain competitive; 2. Self-generation helps reduce CO2 emissions; 3. Core business of exempt companies is not generation – we generate for our own consumption. 	<ol style="list-style-type: none"> 1. Energy prices for all customers should ideally reflect efficient costs, even if this has implications for particular customers' profitability. To do otherwise would make the market as a whole worse off. 2. Any environmental benefits of cogeneration should be dealt with as a separate policy issue. 3. Disagree – what is and is not a company's 'core business' should not affect how they are regulated.
<p>Singapore Refining Company</p>	<p>Supports continuation of exemption and application of exemption to future cogeneration investment because:</p> <ol style="list-style-type: none"> 1. Not extending exemption to new investment would penalise potential investment in efficient and green plant; 2. Refineries elsewhere are allowed to stay 	<ol style="list-style-type: none"> 1. If cogeneration plant are efficient, they will still be attractive if treated in the same manner as other plant. The promotion of plant providing environmental benefits should be dealt with as a separate policy matter. 2. This goes to the wider policy issue of whether embedded generators in general should be

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	<p>connected for back-up power and avoid participation and licensing costs;</p> <ol style="list-style-type: none"> 3. SRC is faced with high electricity costs so investment in new load projects will be deterred if exemption ends; 4. SRC will be forced to purchase electricity at high prices in wholesale market; 5. SRC not in the business of earning revenue from electricity sales; 6. SRC already pays considerable back-up charges and spinning reserve charges; 7. No need to charge embedded generators for spinning reserve because they do not impose additional costs on the system (only draw spinning reserves infrequently). 	<p>exempt from licensing requirements (see section 3.4 below).</p> <ol style="list-style-type: none"> 3. Efficiency should be the overriding objective of the regulatory regime. This should not be compromised in order to attract investors to a particular activity, because the market as a whole would be worse off. 4. As above. 5. What is and is not a company's 'core business' should not affect how they are regulated. 6. The question is whether license and regulatory fees are appropriate, not whether a particular company pays a 'considerable' amount. 7. Disagree – our understanding is that spinning reserve requirements relate to the gross size of generation and load rather than the size of net load (see section 3.4 below).
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Table 1: Stakeholder comments and Frontier responses

3 Frontier’s review, assessment and Draft Recommendations

3.1 FRAMEWORK FOR REVIEW

The scope of this Review requires Frontier to consider both the efficiency and fairness aspects of making changes to the existing conditions of exemption from generator licensing requirements.

3.1.1 Efficiency

Frontier’s approach to assessing the efficiency implications of the EMA’s Proposed Arrangements is based on cost-benefit analysis (CBA). The purpose of CBA is to identify and, if possible, quantify the impacts of a decision (such as a policy decision, an investment decision or an operating decision) compared to the ‘base case’. The base case is the most likely state of the world that would prevail if the decision to do or change something had not been made. Therefore, the benefits and costs of a decision (such as a change to the embedded generation policy) can only be estimated by comparing two states of the world – the state of the world in which the decision to do or change something has been made with the base case state of the world.

In economics and CBA specifically, a benefit is anything that increases the sum of consumer and producer surplus in a market, while a cost is anything that reduces the sum of consumer and producer surplus. Consumer surplus is the difference between what consumers are willing to pay for a good or service and what they are required to pay. Producer surplus is the difference between what producers receive for their good or service and what it costs them to produce it.

A benefit that exists in both the decision and base case states of the world is not a benefit of the decision. Similarly, a cost that exists in both states of the world is not a cost of the decision. The benefits and costs of a decision are only those that exist in the decision state of the world but not the base case state of the world.

The CBA applied in this report takes into account benefits and costs that arise both in the short term and in the long term.

In the short term, exempted generators are faced with a decision: whether or not they should invest in new on-site (embedded) generation capacity. This decision may be directly affected by whether or not the EMA changes its policy towards the licensing of existing exempted embedded generators.

In the longer term, after the investment decision has been made, exempted companies and licensed generators will be faced with another decision: taking as given the amount of capacity in the market, how should they bid and operate their plant.

Both of these impacts are regarded in this report as *direct* effects of the embedded generation policy decision.

In addition, in the longer term, the EMA's policy decision could have some *indirect* impact on the future investment decisions of all market participants including licensed generators and loads. For example, potential investors in (non-embedded) generation may be concerned if the EMA changes the conditions of exemption after they have been in place for over 2 years. These likely indirect impacts will be conditioned on both:

- The extent to which the EMA's policy decision is in accordance with the market's prior expectations; and
- The robustness of the EMA's rationale and reasoning for its decision.

3.1.2 Fairness

The scope of the review also requires Frontier to consider the fairness of changing the conditions of exemption. While fairness is at least partly a subjective concept, it is reasonable to consider that it would include the extent to which regulatory arrangements treat parties in similar circumstances in a similar manner. Therefore, it would be fair for two parties considering similar types of investment to receive similar regulatory treatment, subject to having similar underlying costs and benefits.

Moreover, as noted above, where participants are treated in a manner that is different to what they could have reasonably anticipated, this will influence the long term efficiency of the regulatory regime. Therefore, to some extent, efficiency incorporates a concept of fairness.

3.2 FIRST DECISION – INVESTMENT IN ADDITIONAL CAPACITY

As discussed in section 1.3 above, Frontier's analysis is based on a sequential examination of the two questions before the EMA.

The first policy decision is whether the existing conditions of exemption should continue to apply to an exempted company's pre-existing capacity where it seeks to invest in additional ('greenfields') generation capacity. In other words, if an exempted company invests in new capacity, should this still trigger a requirement for its pre-existing capacity to become licensed. Both sets of Proposed Arrangements would relax this condition of exemption, which would be likely to have an effect on generator investment and bidding as well as investor confidence. Note that this first decision is still based on the assumption that any new plant developed would have to be licensed.

The steps involved in assessing this issue are:

- Formulation of an appropriate base case for analysis (see section 3.2.1);
- Consideration of the impact of the Proposed Arrangements against the base case in relation to:
 - investment by the exempted and other companies (see section 3.2.2);
 - bidding and generator competition (see section 3.2.3); and

- investor confidence in the regulatory arrangements (see section 3.2.4).

Section 3.2.5 provides our conclusion on the first decision.

3.2.1 Base case

CBA requires a base case for comparison of any proposed changes. In relation to the first question before the EMA, the base case is the status quo arrangements for embedded generators, which comprises the existing conditions (and benefits) of exemption. Most relevantly, these conditions make it clear that the exempted companies are not permitted to increase their generation capacity beyond what was in place as at 1 January 2003. If an exempted company breaches this or any other condition, it loses the benefits of the exemption. The benefits are primarily derived from the fact that exempted companies are treated in the NEMS as a reduced (net metered) load rather than as separate (gross metered) load and generation. This means that, compared to a customer with a load and on-site generator that are metered and settled separately, an exempted company benefits from:

- Reduced meter reading and account management costs (part of the Market Support Services (MSS) charge) – these are fairly small fixed monthly fees so this is a relatively minor benefit;
- Reduced market data administration charges (also part of the MSS charge) – this is currently set at \$1.61/MWh and charged to loads;
- Not having to pay a \$/unit/day for spinning reserve – based on the 2004 average and a 50 MW unit, this saving was worth \$45/unit/day (\$16,425/unit/year). (Note, the average size of the exempted units that would need to be licensed but for the exemption is closer to 40 MW. Therefore, this figure is a small overstatement for the average exempted unit);
- Reduced regulation reserve charge – over 2004, the average of this charge was \$0.82/MWh and it was charged to loads and to the first 5MWh of generation output in each half-hour (correspondingly less for generators producing at less than 10MW);
- Reduced monthly energy uplift charge – this is currently set at \$0.22/MWh and charged to loads;
- Reduced PSO fee – this is currently set at \$0.245/MWh and is charged to *both* loads and generators; and
- Reduced EMC administration fee – this is currently set at \$0.46/MWh and is charged to *both* loads and generators;
- Not having to pay a generation licence fee – this is currently set at \$50,000 in the first year and approximately \$50,000 plus \$180/GWh on the previous year's output;¹

¹ See EMA, *Guide for embedded generation*, December 2004.

- Not having to pay a market registration fee in respect of generation facilities – this is currently set at a once-off and non-refundable charge of \$5,000; and
- Not being subject to emergency fuel requirements – we have not placed a cost on this obligation, but it is likely to be considerable.

Grid charges are based on load less embedded on-site generation (ie net load), whether or not a license exemption applies to the relevant customer. This means that exempted companies do not benefit from lower grid charges than non-exempt companies with embedded generation.

In total, licence and regulatory cost savings available to an exempted company with embedded generation are worth approximately:

- \$4.24/MWh on generation output per annum; and
- \$140K fixed fees per annum (treating the regulation reserves charge on generators as a fixed cost and assuming the exempted company has one unit), ignoring emergency fuel obligations.

Note these figures are not intended to be precise because of conditions applying to many of the charges.

3.2.2 Effect of Proposed Arrangements on new generation investment

This section considers the effect of the Proposed Arrangements on generator investment, both in relation to greenfields generation investment by the exempted companies, and by any potential future investment in generation by other parties. The issue of replacement investment by the exempted companies is discussed in section 3.3 below.

High level impact

Under the status quo arrangements, if the exempted companies decided to increase their generation capacity, they would lose their exemptions in relation to their pre-existing generation. Consequently, they would lose the benefits of exemption (which were outlined in section 3.2.1 above) in relation to their pre-existing generation. Importantly, if a licensed generator decided to increase its capacity, it would not have to face the loss of any benefits of exemption – simply because it is not exempted in relation to its existing capacity.

The implication of the status quo arrangements is that, if an exempted company decided to invest in new generation, its license fees and other regulatory charges would *increase by more* than if a non-exempt company invested in the same quantity of new generation capacity. For example, consider an exempted company with 100 MW of pre-existing generation wishing to invest in an additional 10 MW of new capacity. If it undertook the investment in new capacity, it would need to pay licence and other regulatory fees not only in relation to its new capacity of 10 MW, but also in relation to its pre-existing capacity of 100 MW. A non-exempt company with 100 MW of pre-existing capacity wishing to invest in an additional 10 MW of new capacity would only

need to pay licence and regulatory fees in relation to the additional 10 MW of capacity (not its pre-existing 100 MW capacity).

This means that under the status quo arrangements, the exempted companies would face a higher barrier to new investment than other companies. These barriers arise as a result of the loss of their exemptions on pre-existing capacity.

Conversely, both sets of Proposed Arrangements would enable the exempted companies to develop any proposed greenfields generation capacity without losing their exemptions in respect of their pre-existing generation. This would mean that the exempted companies would be on a more 'level playing field' with other parties in terms of the licensing and other regulatory costs of new generation investment. That is, in determining whether or not to invest in greenfields generation plant, the exempted companies would only need to consider the licence and regulatory fees charged on their *new* capacity rather than on *all* of their capacity (including their pre-existing capacity).

The magnitude of the effect on investment by the exempted companies partly depends on the size of their greenfields generation capacity *relative* to the size of the pre-existing capacity. The larger the pre-existing capacity relative to the proposed greenfields capacity, the larger is the deterrent to new investment under the status quo arrangements. This is because the benefits of licence exemption are related to the level of generation output from pre-existing capacity.

Therefore, leaving aside the (indirect) impact on investor expectations from changing the embedded generation policy (discussed in section 3.2.4 below), the Proposed Arrangements are likely, on the margin, to improve the efficiency of generation investment decisions compared to the status quo arrangements. This is because the Proposed Arrangements reduce exempted companies' barriers to generation investment that apply under the status quo exemption conditions.

Quantification of direct investment benefits of Proposed Arrangements

Unfortunately, quantification of the direct investment efficiency benefits of introducing the Proposed Arrangements is not straightforward. The steps required to quantify the benefits would be:

- Consider the future electricity requirements of each exempted company;
- Consider the options for each exempted company in sourcing their electricity requirements (assuming that the likely value of electricity used will exceed any reasonable estimate of its costs);
- Comparing, for each exempted company:
 - the costs of supply from investment in embedded capacity *under the status quo arrangements*, including the value of the loss of licence exemption on its pre-existing capacity,
 with
 - the price of electricity sourced from the wholesale market (ie supplied by licensed generators),

in order to determine what would be the cheapest supply option from the perspective of the exempted company under the status quo exemption arrangements;

- Comparing, for each exempted company:
 - the costs of supply from investment in embedded capacity *under the Proposed Arrangements* (under which exemption benefits on pre-existing capacity are not lost due to new investment),

with

- the price of electricity sourced from the wholesale market,

in order to determine what would be the cheapest supply option from the perspective of the exempted company under the Proposed Arrangements;

- Comparing:
 - the underlying production cost of investment in embedded capacity,
 with
 - the underlying production cost of electricity sourced from the wholesale market,

in order to determine the most efficient option from the perspective of the market as a whole;

- Working out whether the Proposed Arrangements are likely to lead to a more efficient investment decision: It is only if the change in exemption conditions *causes* an exempted company to find it profitable to invest in more embedded generation instead of buying from the market and where this is lower-cost from the perspective of the market as a whole, is there a direct investment efficiency benefit. If the exemption policy change would not affect an exempted company's investment decision, there will be no direct investment efficiency benefit.

A hypothetical example of this calculation based on 100 MW of new supply is illustrated in Table 2 below.

	Exempted company new investment	Wholesale market supply
Production cost	\$95m	\$100m
Market charges on new capacity/supply	\$5m	\$5m
Impact of loss of exemption (ie market charges on pre-existing capacity)	\$7m	Not applicable
Total payment	\$107m	\$105m
Potential inefficiency of status quo	-\$5m (difference in production cost between wholesale supply and embedded investment)	
Potential efficiency benefit of moving to the Proposed Arrangements	\$5m (avoiding inefficiency of status quo)	

Table 2: Example of direct investment efficiency benefits of Proposed Arrangements

Based on the assumed data used in Table 2, it is lower cost, from the perspective of the market as a whole, for the exempted company to source electricity from new embedded generation investment rather than from the market. This may be because the exempted company has access to cheap land or fuel or because the embedded generator is a cogenerator that offers other (cost-offsetting) benefits. In any case, the market as a whole would be \$5 million better off if the exempted company chose to invest in embedded generation rather than procuring its electricity needs from the market. However, under the status quo exemption conditions, investment by the exempted company would trigger loss of its exemption in relation to its pre-existing capacity. This would make it privately unattractive for the exempted company to invest, even though this would be efficient. The exempted company would prefer to purchase from the market because the price of supply to itself would be only \$105 million compared with the \$107 million total payment for embedded generation investment.

Implementing the Proposed Arrangements would overcome this private disincentive for the exempted company to invest, thereby aligning the exempted company's private incentives with overall market efficiency. It is clear from Table 2 that if the \$7 million impost from loss of the exemption were removed, the exempted company would indeed prefer to invest rather than buy from the market. Therefore, the value to the market of implementing the Proposed Arrangements in this example would be the \$5 million difference in underlying costs between the embedded generation investment and supply from the wholesale market.

It is important to note that Table 2 is merely illustrative of the potential benefits that could arise from the Proposed Arrangements. It is not intended to be a realistic reflection of the actual costs and benefits of changing the exemption policy.

This exercise would need to be undertaken for each exempted company and aggregated to arrive at a market-wide estimate of the direct investment efficiency implications of introducing the Proposed Arrangements.

As should be clear, applying this methodology across all the exempted companies in order to get a robust estimate of the likely benefits of the Proposed Arrangements would require highly detailed and accurate information about the nature of exempted companies' electricity needs and the size and costs of potential new generation projects available to both exempted companies and existing licensed generators. It would also require detailed information on the underlying cost structure of all of the licensed generators. Without this information, it would be impossible to quantify the precise benefits arising from improvements in greenfields investment efficiency yielded by a move from the status quo to either of the Proposed Arrangements.

However, it is possible to produce an estimate of the *maximum potential direct investment efficiency improvement* of the Proposed Arrangements by making certain assumptions about the required data.

Maximum potential benefits

Drawing from the methodology explained above, it is possible to show that the size of the value of the loss of licence exemption determines the maximum potential direct investment efficiency benefits of the Proposed Arrangements.

Consider a similar hypothetical situation to that illustrated in Table 2, except that the cost of wholesale market supply is now \$101.9 million. This situation is illustrated in Table 3 below.

Now, the inefficiency resulting from the status quo is \$6.9 million because that is the difference between the underlying costs of wholesale supply and embedded investment. Yet, it is still privately attractive for the exempted company to purchase from the market rather than invest, due to the financial impost created by the loss of its exemption on its pre-existing capacity.

	Exempt company new investment	Wholesale market supply
Production cost	\$95m	\$101.9m
Market charges on new capacity/supply	\$5m	\$5m
Impact of loss of exemption (ie market charges on pre-existing capacity)	\$7m	Not applicable
Total payment	\$107m	\$106.9m
Potential inefficiency of status quo	-\$6.9m (difference in production cost between wholesale supply and embedded investment)	
Potential efficiency benefit of moving to the Proposed Arrangements	\$6.9m (avoiding the inefficiency of the status quo)	

Table 3: Example of maximum investment efficiency benefits of Proposed Arrangements

Table 4 shows that the maximum potential benefit of moving to the Proposed Arrangements is capped by the financial impact of the loss of the exemption.

	Exempt company new investment	Wholesale market supply
Production cost	\$95m	\$102.1m
Market charges on new capacity/supply	\$5m	\$5m
Impact of loss of exemption (ie market charges on pre-existing capacity)	\$7m	Not applicable
Total payment	\$107m	\$107.1m
Potential inefficiency of status quo	\$0 (because exempted company will choose to invest in embedded capacity)	
Potential efficiency benefit of moving to the Proposed Arrangements	\$0	

Table 4: Example of loss of exemption capping the potential investment efficiency benefits of Proposed Arrangements

Here, because the price of wholesale market supply (\$107.1 million) has exceeded the total cost of embedded investment to the exempted company (\$107 million), the exempted company will choose to invest rather than buy from the market. Given the hypothetical data used, this would be the efficient outcome because the underlying production cost of embedded investment (\$95 million) is less than the underlying cost of supply from the market (\$102.1 million).

Hence, the maximum potential benefit of the Proposed Arrangements, in terms of direct impacts on investment, is always capped by the value of the exempted companies' loss of licence exemptions on their pre-existing capacity.

Unlike estimating the *actual* direct investment efficiency impacts of the Proposed Arrangements, estimating the *maximum* direct investment efficiency impacts across the NEMS is relatively straightforward. This is possible because:

- The aggregate quantity of exempted companies' generation capacity that would need to be licensed but for the exemptions is known – 315 MW;
- The aggregate number of exempt companies' generation units is known – 7 units;
- The benefits of exemption are also known – as outlined in section 3.2.1, they are approximately \$4.24/MWh of generation output per annum and \$140,000 per exempted company per annum (although \$55,000 of this [\$50,000 licence fee plus \$5,000 registration fees] will be paid if the exempted company has other [non-exempt] capacity. Therefore, the *incremental* fixed component of the value of exemption for an exempted company investing in new capacity is \$85,000. This is because, any new entrant generation investor (not just an exempt company) would need to pay the \$55,000 fees for licensing and registration – this \$55,000 is not part of the impost or 'tax' an exempt company faces but a non-exempt company avoids when deciding whether to invest in new capacity); and
- The most extreme assumption that can be made about volume of output is based on a 100% capacity factor (ie exempted companies' plant operating at their maximum output for 8,760 hours per annum).

Therefore, the maximum value of the loss of licence exemption is the sum of:

- Fixed loss:
\$85,000 * 7 units = \$595,000; and
- Variable loss:
 $315 \text{ MW} * 8760 \text{ hours} * \$4.24/\text{MWh} = \$11,699,856$

Therefore, the maximum potential direct investment efficiency benefit of moving from the status quo arrangements to the Proposed Arrangements is approximately \$12.3 million.

The *actual* direct investment efficiency benefit from the Proposed Arrangements may be less than the maximum for a number of reasons. These reasons include:

- Not all exempted companies require more electricity supply – the fewer companies seeking more electricity, the smaller is the scope for investment

inefficiency under the status quo arrangements and the lower the benefit in adopting the Proposed Arrangements;

- The change in the policy would not ‘tip’ all of the exempted companies’ investment decisions away from the wholesale market and towards embedded investment – if the change in policy influences fewer investment/purchase decisions, there is correspondingly less benefit from changing the policy;
- The capacity factor of exempted companies’ existing generators is less than 100% (ie output varies over a day, week, month or year) – a lower capacity factor means lower potential output, which means the size of the value of the loss of exemption is reduced, thereby reducing the potential benefit of the change in policy;
- The price of electricity supplied from the wholesale market is not substantially higher (or is lower) than the cost of supply from exempted companies’ embedded generators – the smaller is the difference between the cost of embedded generation and wholesale supply, the smaller is the potential inefficiency under the existing arrangements and the smaller is the potential benefits of moving to the Proposed Arrangements; and
- Market power in the wholesale market means that the wholesale price of electricity is greater than the underlying costs of providing it – if the status quo exemption arrangements deter an exempted company from investing and encourage purchasing from the wholesale market, market power means that the difference between the wholesale price and cost of embedded investment overstates the extent of the resulting inefficiency. Therefore, the benefits from the Proposed Arrangements in avoiding this inefficiency is correspondingly smaller.

The minimum direct investment benefit of the Proposed Arrangements is nil. This would be the case if, for example, the exempted companies did not find it profitable to invest in new generation in either the status quo or under the Proposed Arrangements, or if the change in policy did not affect *any* exempted company’s investment/purchasing decision.

Therefore, the potential direct investment benefit from the Proposed Arrangements lies within a range of zero to \$12.3 million. Although it is not possible to predict the precise benefit within this range, Frontier believes that it would be towards the lower end because of the improbable set of circumstances that would be required to derive the maximum benefit figure.

3.2.3 Effect of Proposed Arrangements on generator bidding and competition

Moving to the next stage of the analysis, this section considers the likely impact of the Proposed Arrangements on generator bidding behaviour and wholesale prices compared to the likely outcomes in the status quo. If the Proposed Arrangements are expected to lead to more aggressive bidding (ie bidding closer to short run marginal cost (SRMC)) than the status quo, this would be likely to lead to lower wholesale prices and, at least in the long term, produce a net

economic benefit as customers expand their demand for power and consumer surplus rises.

This analysis is, by necessity, at a high-level because of the complexity of the factors influencing generator bidding.

First, it can be said that if the Proposed Arrangements do not lead to different investment outcomes than in the status quo base case, there is no reason to believe that generator bidding will be any different to the status quo.

Therefore, differences in generator bidding would arise only if the Proposed Arrangements have an impact on generation investment decisions.

Under the Proposed Arrangements, we would expect to observe, on the margin and other things being equal, more generation investment by the exempted companies and less by licensed generators than in the status quo as a result of the removal of the impost on new investment by the exempted companies. This would mean that, assuming exempted companies' generation were treated as a load offset, net load in the Singapore wholesale market would decrease, while the capacity of licensed generators would not be affected.

This would tend to reduce the ability of licensed generators to withhold capacity and bid up the wholesale price. To see why this is the case, consider the following hypothetical example:

- Singapore net load is 3000 MW;
- Singapore licensed generation capacity is 4000 MW, spread equally between four licensed generators (ie 4 x 1000MW generators);
- If, under the Proposed Arrangements, the exempted companies' embedded generation increases by 1000 MW, this would reduce net load to 2000 MW; while
- If, under the status quo, the licensed generators invested (equally and in aggregate) in 1000 MW more capacity, net load would remain at 3000 MW while the four licensed generators would each have 1,250 MW.

Under the Proposed Arrangements, two licensed generators would become superfluous to meeting demand (ignoring reserve requirements), while under the status quo, only one licensed generator would be superfluous, for the same amount of generation investment. The more participants whose capacity is superfluous, the more aggressive generator bidding is likely to be, all other things being equal.

Therefore, contrary to the suggestions made in some submissions, the Proposed Arrangements are likely to lead to an increase in the competitiveness of the wholesale market compared to the status quo. Unfortunately, estimating this increase is extremely difficult in the absence of detailed pool modelling.

Of course, to the extent that new generation investment was undertaken by completely new entrants (neither the existing licensed generators nor the exempted companies), the pro-competitive and pro-efficiency impacts of the Proposed Arrangements compared to the status quo would be reduced.

3.2.4 Indirect effects on the market

The implementation of either of the Proposed Arrangements represents a departure from the existing exemption conditions that were put in place in late 2002. Although it is true that the circumstances under which the exemptions were granted (ie that the relevant plant were planned before NEMS start) are part of history, the fact remains that changing the policy towards exempt embedded generators is contrary to participants' expectations. This could negatively affect the NEMS investment environment, because potential investors will have less confidence in the stability of the legislative and regulatory requirements of the market. It is impossible to predict with any accuracy the magnitude of this effect – it may be immaterial or it may be significant. There is even a possibility that participants will, on reflection, agree that the policy changes are reasonable and even desirable. Therefore, the effect on future market behaviour and investment is difficult to predict.

3.2.5 Conclusion on first decision

On balance, in light of the potential benefits from changing the licence exemption conditions, Frontier believes that it would be reasonable to allow the exempted companies to invest in new greenfields generation capacity without losing their exemptions in relation to their pre-existing capacity.

3.3 SECOND DECISION – REPLACEMENT INVESTMENT

The second decision for the EMA follows the first decision, discussed above. If the EMA allows the exempted companies to invest in new greenfields generation capacity without losing their exemptions in relation to their pre-existing capacity, the next issue is if the exempted companies' investment takes the form of replacement of their pre-existing capacity, whether:

- the replacement capacity should itself be exempted from licence requirements, like the capacity it replaces; or
- the replacement capacity should be treated as new investment and be licensed.

For example, consider an exempted company with 80 MW of pre-existing capacity, made up of 4 * 20 MW units. Assume one 20 MW unit needs to be retired and the exempted company wishes to replace it with a new 20 MW unit. The issue is whether the licence exemption should now apply to:

- the remaining 60 MW of pre-existing capacity (meaning that the new 20 MW replacement unit is required to be licensed); or
- the entire 80 MW of capacity (meaning that the replacement unit is also licence-exempt).

It is with respect to this decision that Proposed Arrangement 1 differs from Proposed Arrangement 2:

- Proposed Arrangement 1 requires licensing in respect of the replacement investment on the basis that the replacement investment is nevertheless new

investment planned and developed after the commencement of the NEMS;
and

- Proposed Arrangement 2 allows the replacement investment to remain exempt from licensing requirements, on the basis that the level of exempt capacity has not increased.

As with the first decision, the analysis involves the following steps:

- Formulation of an appropriate base case for analysis (see section 3.3.1);
- Consideration of the impact of the Proposed Arrangements against the base case in relation to:
 - investment by the exempted and other companies (see section 3.3.2);
 - bidding and generator competition (see section 3.3.3); and
 - investor confidence in the regulatory arrangements (see section 3.3.4).

Section 3.3.5 provides our conclusion on the second decision.

3.3.1 Base case

The appropriate base case for the second decision – concerning replacement investment – is the outcome of Frontier’s proposed resolution to the first issue – to require licensing of all new investment by the exempted companies.

Therefore, for the purposes the second decision, the base case state of the world is that if an exempted company undertakes replacement investment, it will lose its exemption on the capacity replaced (but not on its pre-existing capacity that has not been replaced). This is equivalent to the adoption of Proposed Arrangement 1.

Meanwhile, the policy change to be considered is whether replacement capacity should also be exempt from licensing. This is equivalent to Proposed Arrangement 2.

Therefore, the second decision involves considering whether Proposed Arrangement 2 offers net benefits (or costs) over Proposed Arrangement 1.

3.3.2 Effect of Proposed Arrangement 2 on generation investment

Under the base case (Proposed Arrangement 1), the same license fee and regulatory costs would apply to all new generation investment, whether it is investment in additional greenfields capacity or in replacement capacity. Therefore, from the above example, while the pre-existing 60 MW of capacity would remain licence exempt, the replacement 20 MW would need to be licensed.

Under Proposed Arrangement 2, replacement investment would remain licence exempt. Therefore, in the above example, all 80 MW of capacity would be exempt from licence requirements.

Under Proposed Arrangement 2, an exempted company considering replacing its pre-existing units would face lower incremental licence fee and regulatory costs than an investor in any other type of plant. This is because an exempted company considering replacement investment would not have to factor in licensing and regulatory costs, while an investor in greenfields capacity would have to consider these costs. Other things being equal, investment in replacement plant by the exempted companies would be more attractive than greenfields investment by any company, including the exempted companies.

Table 5 below illustrates, through another example, how Proposed Arrangement 2 could create a bias in favour of replacement investment over market supply. In this example, supply from the wholesale market is lowest cost, but under Proposed Arrangement 2, replacement investment would be licence-exempt and would therefore be cheaper to the exempted company.

	Exempt company replacement investment – exemption does not apply to investment (Proposed Arrangement 1)	Exempt company replacement investment – exemption applies to investment (Proposed Arrangement 2)	Wholesale market supply
Production cost	\$100m	\$100m	\$80m
Market charges on new capacity/supply	\$40m	-	\$40m
Impact of loss of exemption (ie market charges on pre-existing capacity)	-	-	-
Total payment	\$140m	\$100m	\$120m
Efficient outcome is:	Not lowest cost – will not be chosen	Not lowest cost – but most attractive	Lowest cost – but not chosen

Table 5: Example of inefficiency of Proposed Arrangement 2

Favourable treatment of investment in embedded replacement capacity would be appropriate if such replacement investment did not impose as high regulatory and administrative costs on the market as greenfields investment. However, our understanding is that embedded on-site generation capacity imposes similar market and regulatory costs (such as ancillary services costs) as a similar quantity of remote generation capacity (see section 3.4 below).

Therefore, we consider that Proposed Arrangement 2 is likely to inefficiently promote replacement investment over greenfields investment compared to the base case of Proposed Arrangement 1.

3.3.3 Effect of Proposed Arrangement 2 on generator bidding and competition

Under Proposed Arrangement 2, replacement generation investment by the exempted companies would be favoured over greenfields investment by any party compared with the base case of Proposed Arrangement 1. This suggests that, other things being equal, the likelihood of new generation investment by the exempted companies rather than licensed generators is slightly greater than in Proposed Arrangement 1. In the long term, this would be likely to lead, at the margin, to a decrease in industry concentration compared to the outcome under Proposed Arrangement 1.

Therefore, in our view, Proposed Arrangement 2 is likely to promote slightly more competition in the wholesale market than Proposed Arrangement 1, other things being equal.

3.3.4 Indirect effects on the market

As noted in section 3.2.4 above, the implementation of either of the Proposed Arrangements represents a departure from the existing exemption conditions that were put in place in late 2002. Further, it is impossible to predict with any accuracy the magnitude of this effect on investors' perceptions of the integrity of the regulatory regime. Whether Proposed Arrangement 1 or Proposed Arrangement 2 is implemented would seem to make little difference to the impression that investors will form of the NEMS regulatory environment. Therefore, in comparing Proposed Arrangement 2 with the base case of Proposed Arrangement 1, the likely indirect impacts on potential investors' confidence are difficult to determine and may be negligible.

3.3.5 Conclusion on second decision

Frontier believes that Proposed Arrangement 2 does not offer net benefits over Proposed Arrangement 1. While Proposed Arrangement 2 may lead to a slightly more competitive market structure than Proposed Arrangement 1 in the long term, Proposed Arrangement 2 is significantly more likely to promote inefficient replacement investment.

On balance, Frontier submits that the second decision should be resolved against the extension of the licence exemptions to investment in replacement capacity. Therefore, Proposed Arrangement 1 is to be preferred over Proposed Arrangement 2.

3.4 ADDITIONAL OPTION – EXTENSION OF EXEMPTIONS TO ALL EMBEDDED GENERATION

As highlighted in section 1.2, the scope of work requires Frontier to assess and make recommendations on the appropriate regulatory treatment of the exempted companies, including, if appropriate, proposing an alternative model.

In light of the extensive comments to the Consultation Paper from exempted companies seeking an extension of licence exemptions to all embedded generation, it is worth briefly examining this option. As with the assessment of replacement investment, the appropriate base case is the resolution from the first decision – Proposed Arrangement 1.

The arguments for the extension of exemptions to all embedded generation (also referred to as cogeneration) are broadly as follows:

- Cogeneration is treated on a ‘net’ basis in other markets – identical to a load customer with varying power requirements;
- Customers with cogeneration plant do not export power into the grid and hence should not need to be licensed;
- Generating electricity is not the ‘core business’ of the exempted companies;
- Government should encourage (rather than penalise) cogeneration plant because it is efficient and environmentally friendly;
- Singapore electricity prices are high, so that industrial customers cannot compete on world markets without access to cheaper power than in the wholesale market; and
- There is no need to charge embedded generators for spinning reserve because they do not impose additional costs on the system (only draw spinning reserve occasionally).

Frontier does not consider that it would be appropriate to extend licence exemption to all on-site generation. Our reply to the above arguments is as follows:

- Treatment in other markets – it is true that some other markets charge customers market and regulatory charges on the basis of net load. However, our understanding, based on informal discussions with staff at NEMMCO in Australia and the New Zealand Electricity Commission, is that many regulatory costs, such as spinning and regulation reserve, are related to the gross load and generation connected to the grid rather than the net load. Therefore, in our view, it would be inappropriate to provide licence exemptions in relation to all embedded generators without a thorough technical analysis of the system implications of embedded generators;
- No power export – in light of the above point, whether or not a customer with an embedded generator exports into the grid is not determinative of whether that customer should be licensed (as opposed to the separate issue of registration);

- Not ‘core business’ – whether or not electricity generation is the ‘core business’ of a particular customer with embedded generation should not determine how the regulatory regime deals with embedded generation, especially if differential treatment harms economic efficiency;
- Need to encourage efficient and green cogeneration – to the extent cogeneration is more efficient than non-embedded generation, Proposed Arrangement 1 should help ensure that cogeneration is undertaken in preference to non-embedded generation. With respect to environmental benefits, if the Government wishes to encourage particular technologies because of environmental benefits, this should be undertaken separately in a transparent manner, rather than by implementing arrangements that systematically favour cogeneration over non-embedded generation (see next point). Favouring cogeneration would be a blunt and non-transparent way of improving environmental outcomes;
- Singapore wholesale prices are too high – the regulatory arrangements should promote efficient electricity investment and prices. This objective of the arrangements should not be compromised because it may disadvantage particular customers or industries. If the Government wishes to assist particular electricity users, it may provide assistance in other, less distortionary ways. For example, the Government could offer direct subsidies or tax benefits to particular firms, or to all firms in relation to the adoption or development of particular technologies, such as environmentally approved generation plant;
- Embedded generators do not impose substantial costs on the system – as discussed above, it is not clear that a customer with a given net load (made up of a load and embedded generator) imposes the same ancillary service and other costs on the market as a customer with the same size gross load. Therefore, Frontier is not convinced that the net load treatment for customers with embedded generators is appropriate.

3.5 DRAFT RECOMMENDATIONS

Given the analysis undertaken for this section of the report, Frontier recommends that the EMA adopt Proposed Arrangement 1. The EMA should allow the exempted companies to invest in generation without losing their exemptions on their pre-existing capacity. At the same time, replacement investment should be treated the same as greenfields investment – to the extent pre-existing capacity is replaced, the exempt companies should lose their exemptions in relation to the replaced capacity.

Frontier believes the adoption of Proposed Arrangement 1 is likely to:

- Reduce the bias in the status quo arrangements against generation investment by the exempted companies vis-à-vis licensed generators and new entrants, thereby producing more efficient investment outcomes than the status quo;
- Not inefficiently promote replacement investment over greenfields investment, as would occur under Proposed Arrangement 2;

- Promote the competitiveness of the wholesale market, to the extent it leads to more generation investment by the exempted companies and less by the licensed companies; and
- Have minimal impact on participants' confidence in the investment climate in the NEMS.

4 Stakeholder submissions on Draft Report, Frontier responses and Final Recommendations

4.1 BACKGROUND

Following the preparation of the Draft Report, the EMA circulated it for consultation with stakeholders. Eight submissions were received in response:

- Keppel Energy;
- Island Power;
- Power Seraya;
- Senoko Power;
- TUAS Power;
- ExxonMobil;
- Petrochemical Corporation of Singapore; and
- Singapore Refining Company.

This section describes the issues raised by the submitting parties and provides Frontier's response to the issues.

4.2 KEPPEL ENERGY

4.2.1 Issues raised

Keppel says it generally agrees with the Draft Report.

4.2.2 Frontier response

No response is required.

4.3 ISLAND POWER

4.3.1 Issues raised

Island Power says it is supportive of the Draft Report recommendations and the assessment of the issues. Island Power says it is keen to see the draft recommendations implemented as soon as possible.

4.3.2 Frontier response

No response is required.

4.4 POWER SERAYA

4.4.1 Breach of conditions in Exemption Order

Power Seraya says that the rationale for licensing was set out by PA Consulting Group’s memorandum, which pointed out that unlicensed generators could ‘free-ride’ on the benefits provided by others and undermine the market. Power Seraya also said that the request to increase capacity is a clear breach of the intent of the Exemption Order the industry has agreed on.

Frontier response

Frontier agrees that the proposed changes are contrary to the original intent of the exemptions, but believes that are sufficient potential efficiency benefits to offset these concerns. Frontier also agrees that removing all regulatory requirements from embedded generation would be inefficient on the basis of present information. The Draft Report recommendations ensure that all future investment in embedded generation capacity will be licensed.

4.4.2 Unlevel playing field should not be prolonged

Power Seraya notes that exempted companies receive significant savings from exemption, which create an unlevel playing field. It says, “The conditions in the Exemption Order are drafted in the current manner and supported by the industry participants to ensure that the ‘preferential treatment’ will be short-lived.” According to Power Seraya, the proposed extension of the exemption would prolong an unlevel playing field that should not exist in the first place.

Frontier response

Frontier understands that the exemptions were given on the basis that the exempt units were planned before it could be reasonably expected that they would need to participate in the market. Therefore, the existing exemptions do not create an ‘unlevel playing field’ – they merely insulate the exempted companies from the then-unforeseeable changes to the market design. Frontier also believes that the benefits arising from the exemptions do not create an ‘unlevel playing field’ in terms of new investment. The recommended Proposed Arrangement 1 ensures that both exempt companies and non-exempt companies will choose to invest in generation if (and only if) it is cheaper than taking supply from the market. Indeed, it is the status quo arrangements that embody an unlevel playing field, because exempt companies are deterred from investing even where it would be efficient for them to do so.

4.4.3 Incomplete cost-benefit analysis

Power Seraya says that the CBA is based on unsupported assumptions because it is debateable whether the exempted companies have a lower cost than the market, given the degree of excess generation capacity in Singapore.

Power Seraya says that in the absence of the quantification of the precise benefits of extending the exemption, using detailed information, the probable benefits

derived in the Draft Report are questionable. Power Seraya notes that the Draft Report omitted to estimate the impact on investor confidence of changing the exemption conditions.

Finally, Power Seraya suggests that the additional cost to the market of prolonging the exemption needs to be considered.

Frontier response

Frontier’s analysis of the Proposed Arrangements against the status quo was intended to provide an estimate of the *maximum potential direct investment efficiency impacts* of a change from the status quo, not the *actual impacts*. As stated in section 3.2.2 above, an analysis of the actual impacts would require very detailed information and even then would involve assumptions about the future behaviour of licensed generators and the exempted companies. The analysis undertaken for the Draft Report showed that implementing Proposed Arrangement 1 could bring significant net benefits. Just because it is not possible to quantify the precise benefits of extending the exemption does not imply that a policy decision on the basis of the analysis available is invalid.

Power Seraya also criticises the Draft Report on the basis that it failed to quantify the negative impact on the market of continuing the exemption. While measuring the effect on investor confidence is extremely difficult to do, the fact that – as pointed out by Power Seraya – there is a great deal of spare capacity in the Singapore market suggests that any *incremental* impact of continuing the exemption on future investment is likely to be very small.

4.4.4 Compliance and enforcement issues

Power Seraya says that the “EMA would need to address the concerns of the industry that the proposed new generation capacities are not providing on-site load and thus avoiding consumer charges.” The EMA would also need to ensure the units were not participating in the market directly or indirectly.

Frontier response

Under Proposed Arrangement 1, any new or replacement capacity developed by the exempted companies would need to be licensed and treated as licensed embedded generation. This will provide some TUoS benefits, but in other respects, the additional generation would be liable for the same charges other generators have to pay.

4.4.5 Conclusion

Power Seraya states that the handling of the licensing exemptions is an important issue for implementing a fair and equitable competitive market in Singapore. The existing Exemption Order conditions should remain.

Frontier response

Frontier agrees that the handling of the licensing exemptions is an important issue but believes that Proposed Arrangement 1 is the best solution.

4.5 SENOKO POWER

4.5.1 Disregard of conditions associated with previous exemption

Senoko believes that Frontier’s Draft Report should not have treated the initial decision to exempt the exempted companies as a matter not to be raised again. The exemption was granted under very clear conditions and should not be dismissed without clear and accepted justification.

Frontier response

Frontier reiterates that the initial decision to grant the exemptions was based on a policy view that the exempted capacity was committed without knowledge of the changes to the market design. To review this decision would increase regulatory risk in the Singapore market far more than anything else that has been proposed. The task presently before the EMA is to choose a response that promotes efficiency while maintaining investor confidence to the greatest degree possible.

Proposed Arrangement 1 does change the conditions of exemption, but for justifiable efficiency reasons. Senoko has not described the harm to efficiency from adopting Proposed Arrangement 1.

4.5.2 Concerns about an unlevel playing field

Senoko believes that allowing exempted companies to hold both exempted and licensed capacities may grant these companies an unfair competitive advantage in the market. Senoko argues that this concern should not be treated merely as an operational issue and that Frontier should have given greater consideration to the problems potentially caused by ‘dual status participants’.

Frontier response

It is difficult to see what additional *competitive* concerns are raised by Proposed Arrangement 1 compared with the status quo – indeed, Senoko itself does not describe the nature of these risks. Under Proposed Arrangement 1, any new or replacement capacity developed by the exempted companies must be licensed, as is the case with investment by the licensed generators. The EMA does need to ensure that exempted capacity is not injected into the grid, but the EMA is already responsible for ensuring this does not occur. To the extent new investment by the exempted companies increases the scope for them to (unlawfully) inject exempted capacity into the grid, Frontier believes that this *is* an operational issue for the regulator to manage.

4.5.3 Proposed Arrangement 1 is workable but the issue should be more holistically addressed

Senoko submits that Proposed Arrangement 1 is a compromise solution, not a comprehensive one. Inequity would still exist in the market and the EMA should comprehensively review the issue of embedded generation from a policy perspective.

Frontier response

Frontier agrees that Proposed Arrangement 1 is a compromise solution, but in our view is the best solution available under the circumstances. The equity of the original granting of the exemption was dealt with at the time of the granting. It may be worthwhile to review the overall arrangements for embedded generation, but this should be done with a view to setting up an efficient and cost-reflective regulatory regime, not necessarily banning or mandating embedded generation outright.

4.5.4 Conclusion

Senoko argues that a comprehensive evaluation of the overall market framework is required. Proposed Arrangement 1 is only a stop-gap measure.

Frontier response

An overarching review of embedded generation is a matter for the EMA.

4.6 TUAS POWER**4.6.1 Proposed Arrangement 1 maintains an unlevel playing field**

TUAS Power believes that Proposed Arrangement maintains an unlevel playing field because the exempted companies were granted a privileged position with respect to other players on the basis that they did not invest in new capacity.

Frontier response

It is true that the exempted companies receive certain benefits in respect of their pre-existing capacity. However, these benefits were granted on the basis that the exempt units were planned before it could be reasonably expected that they would need to participate in the market. Therefore, the existing exemptions do not create an ‘unlevel playing field’ – they merely insulate the exempted companies from the then-unforeseeable changes to the market design.

4.6.2 Sovereign risk

TUAS Power submits that most of the market would view the implementation of Proposed Arrangement 1 negatively because it favours only a few participants and not the market in general. Maintaining the exemption does not efficiently allocate costs to those using it. In other jurisdictions, embedded generators pay their fair share of market charges.

Frontier response

Frontier disagrees that Proposed Arrangement 1 does not benefit the market in general. Section 3 above shows how Proposed Arrangement 1 should lead to some net benefits to the market as a whole by promoting lower cost supply.

While in New Zealand, embedded generators are metered and billed for market charges on the basis of their gross generation, in the Australian NEM, embedded generation is netted off from gross load to reduce net metered load.

4.6.3 Welfare impacts

TUAS Power believes that the amount cited as foregone welfare in the Draft Report due to the status quo exemption conditions is zero because any charges paid by the exempted companies would result in lower charges to other market participants.

Frontier response

Frontier disagrees with TUAS Power on this point. Under the status quo, if the exempted companies wish to invest in new capacity, they face a large cost disincentive because they would lose their exemptions on their pre-existing capacity. This disincentive to invest may lead to inefficient investment by other market participants. This is a distinct issue from who pays the market charges.

4.6.4 Unlikely to improve efficiency

TUAS Power notes that the exempted companies argue that embedded generation is more efficient than non-embedded generation and the market has already produced many embedded plant. Therefore, TUAS Power argues the proposed changes will not *improve* efficiency any further. Moreover, any efficiency improvement is likely to be small, as noted in the Draft Report. If the potential efficiency improvement is substantial, TUAS Power says that the EMA should review the overall policy towards embedded generation.

Frontier response

Whether embedded generators are more or less efficient than non-embedded plant is an empirical question that the Draft Report did not attempt to answer. However, in our view, Proposed Arrangement 1 is likely to produce some benefits without significant costs. Importantly, the issue is not whether *some* embedded generation would go ahead without changing the exemption conditions; the issue is the effect of changing the conditions on investment *at the margin*. CBA is always about the incremental impacts of a change on the margin.

4.7 EXXONMOBIL

4.7.1 Exemption should apply to replacement investment

ExxonMobil supports allowing the exempted companies to invest in new capacity, but says that developing rules to practically separate ‘new’ from ‘replacement’ investment would be problematic. Therefore, the exemption should apply up to a certain level of capacity.

Frontier response

Frontier believes that the EMA should be able to devise operational rules to define what is meant by ‘replacement investment’ compared with expenditure on unit repairs. *Prima facie*, the replacement of worn parts of a unit should not trigger the ending of the exemption, but a substantial refurbishment may be considered replacement. The key in developing such rules is to determine whether the expenditure would go ahead if it were not for the impact on the license exemption – expenditures driven by the benefits of retaining a license exemption rather than underlying costs reduce the overall efficiency of the market and should be classed as ‘replacement investment’.

4.7.2 Treatment of future embedded generation units

ExxonMobil says that embedded generation brings many economic and environmental benefits such as lower transmission losses, lower emissions and supply security. ExxonMobil believes that the Government should introduce programs to remove the barriers to new embedded generation investment. Embedded generators exist primarily to serve the needs of a load rather than to participate in the market. Therefore, ExxonMobil submits that they should comply with all the physical requirements to be part of the system but not be required to become a direct market player. If they choose to enter the market, they should be able to contract with a market player for market services.

ExxonMobil argues that the current ‘gross’ treatment of embedded generators under the rules discriminates against them. The impact of embedded generators is simply to produce a (net) load with fluctuating power requirements and occasional need for back-up power. However, embedded generators currently have to pay a high capacity charge regardless of whether back-up is actually used.

Frontier response

Even if embedded generators are required to be licensed, Frontier’s understanding is that they will continue to reduce the transmission charges payable by their attendant load. The regime for back-up power is a separate issue from licensing that should be dealt with separately. Similarly, whether the Government should do other things to reduce the barriers for embedded generation is a separate policy issue to the question of licensing.

It should be remembered that an important reason why generators are required to be licensed is due to their physical effect on the power system operation and costs. That said, there may be ways – other than through licensing – that the physical aspects of embedded generators could be handled without requiring them to be licensed. ExxonMobil could perhaps suggest such ways to the EMA for their consideration. Frontier believes that if such changes were to be considered, it would be necessary to undertake a full technical review of the impact of embedded generators on the costs of operating the Singapore power system. At this stage, Frontier’s understanding is that embedded generators do impose costs on the running of the system that are not reflected in a ‘net load’ treatment of embedded generation.

4.8 PETROCHEMICAL CORPORATION OF SINGAPORE (PCS)

4.8.1 General

PCS argues that embedded cogeneration is typically built for on-site consumption and is typically small.

Frontier response

As noted above, the intention to participate in the market is not the driver for licensing. A key reason why generators are required to be licensed is due to their physical effect on the power system operation and costs.

4.8.2 Existing exempted cogeneration

PCS supports the draft recommendation in favour of allowing exempted companies to invest in new plant without losing their exemptions on pre-existing capacity.

Frontier response

No response required.

4.8.3 Treatment of new cogeneration

PCS argues that cogeneration should not be treated in the same way as other generation. Owners of cogenerators are not in the business of electricity supply. Cogenerators should be in a separate class.

Frontier response

See the response to the first point above. Even if embedded generators were placed in a separate class of participant and not required to pay direct license fees, such arrangements would not necessarily excuse embedded generators from the need to pay the bulk of the charges they would pay if they were licensed, such as for ancillary services and uplift. Frontier believes that if such changes were to be considered, it would be necessary to undertake a full technical review of the impact of embedded generators on the costs of operating the Singapore power system. At this stage, Frontier's understanding is that embedded generators do impose costs on the running of the system that are not reflected in a 'net load' treatment of embedded generation.

4.8.4 Cost concerns

PCS is concerned that licensing implies high costs that may not be applicable to them, such as participation in the wholesale market, fuel stock reserve and responsibilities under emergency.

Frontier response

The EMA has taken a view on the appropriate capacity threshold for licensing (10MW). If a different threshold is to apply to embedded generators, this should

only occur after a full technical review of the impact of embedded generators on the costs of operating the Singapore power system. Frontier's present understanding is that embedded generators do impose costs on the running of the system that are not reflected in a 'net load' treatment of embedded generation.

4.8.5 Recommendations

PCS recommends that the EMA should develop a separate set of rules governing the operation of cogeneration that minimise the cost impacts and remove unnecessary obligations.

Frontier response

See previous response.

4.9 SINGAPORE REFINING COMPANY (SRC)

4.9.1 Electricity generation is not SRC's core business

SRC submits that the EMA's recommendations will have unacceptable implications for SRC's capacity to invest in cogeneration plant. Electricity generation is not SRC's core business, only a support function.

Frontier response

As noted in Table 1, whether or not electricity generation is the 'core business' of a firm is not the key issue for determining whether the firm should be licensed. A key reason why generators are required to be licensed is due to their physical effect on the power system operation and costs.

4.9.2 Future investment at risk

SRC says it requires additional embedded generation capacity to provide steam and power. SRC says it will not invest in such a plant if it is forced to become licensed and this will reduce its competitiveness in petroleum refining.

Frontier response

Frontier understands that it would be costly for SRC to become licensed in respect of a new embedded plant. However, the EMA has taken a view on the appropriate capacity threshold for licensing (10MW). If a different threshold is to apply to embedded generators, this should only occur after a full technical review of the impact of embedded generators on the costs of operating the Singapore power system. Frontier's present understanding is that embedded generators do impose costs on the running of the system that are not reflected in a 'net load' treatment of embedded generation.

4.9.3 Cogeneration plant provide environmental benefits

SRC argues that cogeneration plant provide environmental benefits currently being pursued by the NEA.

Frontier response

If the Singapore Government wishes to promote cogeneration for environmental reasons, this should occur in a transparent manner such as specific legal requirements or direct taxes or subsidies rather than through a different licensing treatment of embedded generators.

4.9.4 Separate rules should apply to cogeneration

SRC believes that the petroleum industry should be encouraged to invest in embedded cogeneration without having to become licensed where power generation is not their core business and they do not export into the grid. A new set of rules should be developed by the Government in consultation with the industry.

Frontier response

As noted in previous responses, the current threshold for generator licensing is a capacity of 10MW. If a different threshold is to apply to embedded generators, this should only occur after a full technical review of the impact of embedded generators on the costs of operating the Singapore power system. Frontier's present understanding is that embedded generators do impose costs on the running of the system that are not reflected in a 'net load' treatment of embedded generation.

Alternatively if the Government wishes to favour cogeneration for national development or other reasons, then as with environmental benefits, this should occur through specific laws or transparent taxes or subsidies, rather than through differential licensing treatment.

4.9.5 The Australian NEM applies a 'net load' treatment to embedded generation

SRC says that the NEMS was based on the Australian NEM architecture and the NEM applies a net load treatment of embedded generation. If the NEM criteria for registration were applied, SRC says it would not need to be licensed in respect of its proposed investment.

Frontier response

Frontier is familiar with the generator registration criteria in the Australia NEM. However, our understanding, based on discussions with NEMMCO staff, is that embedded generators do impose costs on the running of the system that are not reflected in a 'net load' treatment of embedded generation. Therefore, the current Australian NEM Rules may not be optimal from a cost-reflectivity perspective. If a different licensing threshold is to apply to embedded generators in Singapore, this should only occur after a full technical review of the impact of embedded generators on the costs of operating the Singapore power system.

4.9.6 Possible shortcomings of the Draft Report

SRC makes the following additional points in its submission:

- Frontier did not substantiate its finding that Proposed Arrangement 1 would increase the competitiveness of the market, given that embedded generators would not be provided with a vesting contract. Therefore, the market power of the incumbent generators could increase as a result of the proposed recommendation.
- The Draft Report did not take account of the cost differential of producing steam as a result of continuing or not continuing the exemption.
- The Draft Report ignores that the exempted companies are contestable customers in the retail market with existing supply arrangements in place.
- The Draft Report also ignored the added costs of licensing to embedded generators.
- In other markets, a ‘net load’ concept applies to embedded generation.
- The question is whether there will be an adverse effect on the Singapore chemical and petrochemical clusters.

Frontier responses

- ***Competitiveness*** – it is Frontier’s understanding that the volume of vesting cover will not increase in Singapore in the future, but rather, fall over time. Therefore, whether new generation is developed by the exempted companies or licensed generators would not seem to affect the overall level of vesting cover and the general manner of generator behaviour.
- ***Cost of steam*** – Proposed Arrangement 1 reduces the cost of investment in new embedded capacity by the exempted companies compared with the existing licence exemption conditions. Therefore, it will help reduce the cost of steam for the exempted companies compared to the existing license exemptions. As discussed earlier, if a different licensing threshold is to apply to embedded generators, this should only occur after a full technical review of the impact of embedded generators on the costs of operating the Singapore power system.
- ***Exempted companies are contestable customers*** – the Draft Report made the simplifying assumption that exempted companies face a choice between investment in new embedded capacity and purchasing from the market. However, the Draft Report also assumed that if the exempted companies purchased from the market, they would have to pay the same costs as any other load – this would be financially equivalent to purchasing power from the retail market. To the extent that exempted companies have existing retail arrangements in place, this would reduce the need for them to either invest or buy from the market, making licensing issues less important.
- ***Added costs*** – it is true that a requirement to be licensed would impose a number of administrative and IT-related costs on the exempted companies. This is unfortunate, but this would be the case for any potential generator in

the NEMS and was presumably considered when the original licensing threshold was set. If a different licensing threshold is to apply to embedded generators, this should only occur after a full technical review of the impact of embedded generators on the costs of operating the Singapore power system.

- ***Other markets*** – as noted above, the treatment of embedded generation varies across markets. The Australian NEM applies a ‘net load’ treatment while New Zealand applies a gross load and generation treatment.
- ***Adverse industry effects*** – the regulatory regime for licensing should strive to promote efficiency and a ‘level playing field’ for future decision-making. If particular industries or customers are to receive specific benefits, it is Frontier’s view that such benefits should be provided directly through taxes or subsidies rather than through differential licensing requirements.

4.10 FINAL RECOMMENDATIONS

Having considered stakeholder responses to the Draft Report, Frontier does not believe that there is a strong justification for changing the Draft Recommendations. That is, Frontier proposes the adoption of Proposed Arrangement 1 for the reasons provided in section 3 above.

There is some uncertainty about the impact of embedded generators on the costs of operating the NEMS. Our understanding, based on informal discussions with NEMMCO staff in Australia, is that embedded generators impose higher costs of system operation than a ‘net load’ treatment would imply. Therefore, extending license exemption to all embedded generator plant would potentially be inefficient. On this basis, Proposed Arrangement 1 appears to provide the best outcome. However, if different information on the technical and cost implications of embedded generators in the Singapore market comes to light, it may be necessary to revisit this recommendation.

Annex 1 – Treatment of embedded generation in other jurisdictions

The scope of work for this review required us to provide insights into the treatment of embedded generators who generate power for their own use in other jurisdictions.

Britain

Generators and suppliers directly connected to the transmission network pay charges for:

- Transmission network use of system (TNUoS) – for use of the transmission network;
- Balancing services use of system (BSUoS) – as signatories to the Balancing and Settlement Code (BSC); and
- BSCCo costs (including operational and NETA development costs) – also as signatories to the BSC.

Smaller embedded generators, which are neither connected to the grid nor signatories to the BSC, are not subject to these charges, thereby gaining a benefit from being embedded in the distribution network. These are known as 'embedded benefits'.

Retailers (or their customers) that contract with embedded generators incur reduced TNUoS and BSUoS charges, since use of the locally generated electricity by that party reduces the extent to which they have to use National Grid Company's transmission system and energy balancing services. Initially, these savings to retailers and customers were the subject of negotiation between them and the embedded generator. However, modifications to the relevant rules now mean that embedded generators can access these benefits directly, without negotiation with the retailer/customer.

Therefore, embedded generators receive relatively favourable treatment in the British electricity market.

United States

In the United States, regulation of embedded generation is complicated by the division of regulatory responsibility among federal, state and local governments. Under the original framework established by the *Federal Power Act* 1935 (FPA), the federal government has responsibility for the regulation of pricing and access in the wholesale markets and the states have responsibility for the retail markets served by investor-owned utilities. The state-owned, municipal and cooperative utilities that also serve retail customers set their own rules for pricing and service.

The connection arrangements for embedded generators are largely within the control of State Governments. However, Federal legislation is relevant where the

generator is connected to the grid, such that there is the possibility of power going back into the network. Until recently, the *Public Utility Regulatory Policies Act* 1978 obliged utilities to purchase power from cogeneration and alternative plant based on the cost the utility was expected to avoid. This obligation and the other major Federal Act regulating electricity, the *Public Utility Holding Company Act* 1935 (PUHCA) were repealed in the newly-enacted *Energy Policy Act* 2005.

The key barriers to embedded generators in the United States are:

- Technical interconnection requirements;
- Surcharges imposed by utilities on operators of embedded generators for standby service;
- Pricing of electricity injected back into the grid (average rather than marginal (peak) cost); and
- Environmental and planning requirements of local governments.

Wholesale market charges tend to be based on metered load and generation at the connection point. For example, in the Pennsylvania-New Jersey-Maryland market (PJM), charges for scheduling, system control and dispatch service are in \$/MWh based on offtakes from, or injections into, the interconnected system.

Finally, there are also arrangements in place in some States for ‘net metering’. This is mainly an issue for loads with smaller on-site generators, below 1 MW. In many cases, these firms are paid lower prices for their surplus power from their local utility than they pay for their consumption.

Australia (NEM)

Under the National Electricity Rules (Rules), which govern the NEM, all generators that are connected to the transmission or distribution network must be registered with NEMMCO, the market and system operator. Generators can be licensed in one of several categories, depending on their size and whether they send electricity into the network

A scheduled generator (generally >30 MW nameplate capacity) must participate in the central dispatch process operated by NEMMCO, while non-scheduled generators do not participate in dispatch. A generator with capacity above 30 MW may be registered as a non-scheduled generator if its primary purpose is local use and it rarely, if ever, sends more than 30 MW into the network or if its output is intermittent (eg windfarms).

A market generator is a generator whose output is not purchased in its entirety by the local retailer or (large) customer located at the same transmission connection point. A non-market generator is a generator whose output is purchased in its entirety by the local retailer or customer. Non-market generators do not get paid for their generation by NEMMCO except in very specific circumstances.

Licensing is a State responsibility and is generally required of all generators. For example, in Victoria, section 16 of the *Electricity Industry Act* 2000 prohibits a person from engaging in the generation of electricity for supply or sale unless the

person is licensed or has an exemption. Generally, a generator that is below 30 MW, non-scheduled and non-market does not need to be licensed. Further, a number of specific exemptions have been granted in respect of on-site generation plant.

The license (or the order granting an exemption) is normally the vehicle for various obligations to be imposed on the generator, such as compliance with the Rules, codes, standards and procedures, information provision and accounts. License fees are normally payable for each license.

In general, charges for market fees in the NEM are based on metered load or generation at the transmission connection point. For example, aggregate market fees for the current financial year are \$0.24845/MWh of (metered) customer load.

Further, under the Rules, embedded generators get paid rebates for 100% of 'avoided TUoS'. That is, to the extent that embedded generators that generate in excess of their owner's use reduce the variable component of transmission charges paid by the local distributor, the generators are entitled to receive the sum that the distributor would have had to pay to the transmission company in transmission charges. Note that this rebate does not include the fixed component of transmission charges, which is about half the overall charge.

New Zealand

The New Zealand Electricity Governance Regulations and Rules set out a number of obligations for embedded generators. These obligations include:

- Registration – embedded generators must be registered if their plant are larger than 5 MW in capacity;
- Advise system operator – if any unit is greater than 1 MW in capacity, the owner of the embedded generator must advise Transpower, the system operator, of its intention to connect and provide information such as an asset capability statement;
- Advise reconciliation manager – where the embedded generator does not generate solely for its own use, it must notify Energy Market Services of whether it intends to sell to the clearing manager (M-co) or to a retailer trading on the network it is connected;
- Provide market offers – if the embedded generating plant is above 10 MW capacity, Transpower may require it to provide market offers.

However, the Electricity Governance Regulations, a business is exempt from registration (although not exempt from the other obligations in the Regulations) if it only carries out certain activities set out in the *Electricity Industry Reform Act* (EIRA). These activities include generating solely for its own consumption or consumption of its associates. Therefore, embedded generators may not be required to be registered, although they must still comply with all the other obligations in the Regulations.

This means that embedded generation, whether it is sold to a local retailer or supplies an on-site load, is reconciled and settled separately from load and is not netted off the load.

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