## RESPONSE TO INDUSTRY COMMENTS ON THE CONSULTATION PAPER DATED 30TH JULY 2020

## FINANCIAL PARAMETERS

<table>
<tr><th>S/no</th><th>Reference</th><th>Industry comments</th><th>KPMG response</th></tr>
<tr><td>1</td><td colspan="3">Base Month, Risk Free Rate, Debt Premium (Sections 2.2, 2.4 and 2.5 of the EMA Consultation Paper)</td></tr>
<tr><td>1a.</td><td>YTL PowerSeraya Pte Ltd</td><td>Based on the current vesting price determination methodology, the Base Month for the final determination will be May 2020 (using data from Mar 2020 to May 2020).<br><br>On 23 Jan 2020, Singapore saw the first case of COVID-19. In 7 Feb 2020, MOH raises the Dorscon level from yellow to orange. On 7 Apr 2020, the circuit breaker measures kick in. On 1 Jun 2020, the circuit breaker was lifted and Singapore enter Phase 1 of Reopening. Singapore moves into Phase 2 of Reopening on 19 Jun 2020.<br><br>Below is a tabulation of the May 20 Base Month figures, Mar 20 Base Month figures, Alternative 1 and Alternative 2:<br><br>
<table>
<tr><th>Timing Scenario</th><th>Risk Free Rate</th><th>Debt Premium</th><th>Pre-tax Cost of Debt</th></tr>
<tr><td>Base Month - May (Mar to May 20)</td><td>1.46%</td><td>2.44%</td><td>3.90%</td></tr>
<tr><td>Base Month - March (Jan to Mar 20)</td><td>1.89%</td><td>1.80%</td><td>3.69%</td></tr>
<tr><td>Alternative 1 (Dec 19 to Feb 20)</td><td>2.04%</td><td>1.42%</td><td>3.46%</td></tr>
<tr><td>Alternative 2 (Oct to Dec 19)</td><td>2.07%</td><td>1.48%</td><td>3.55%</td></tr>
</table>
<br>The COVID-19 global pandemic introduced volatility to the market. Based on the above table, the volatility in the parameters for the months when the averaging period falls within the circuit period (Apr to May 20) is high. To ensure that the averaging period is not affected by this unprecedented event, it warrants a deviation from the use of Mar 2020 to May 2020 (i.e. Base Month of May 2020) for this vesting parameter review.</td><td>We acknowledge that the market is facing unprecedented conditions due to the COVID-19 global pandemic. Nevertheless, our view is that the parameters should correspond with the conditions that a new entrant would face and that the parameters in our draft final report should reflect expectations of 2021-2022.<br><br>We note the risk free rate has continued to decline through to May, with a three-month average of 1.46% reflecting a drop from the draft report (1.89%) and a December 2019 Alternative Base Month (2.07%). Recent July and August trends in the selected SGS for our risk free rate</td></tr>
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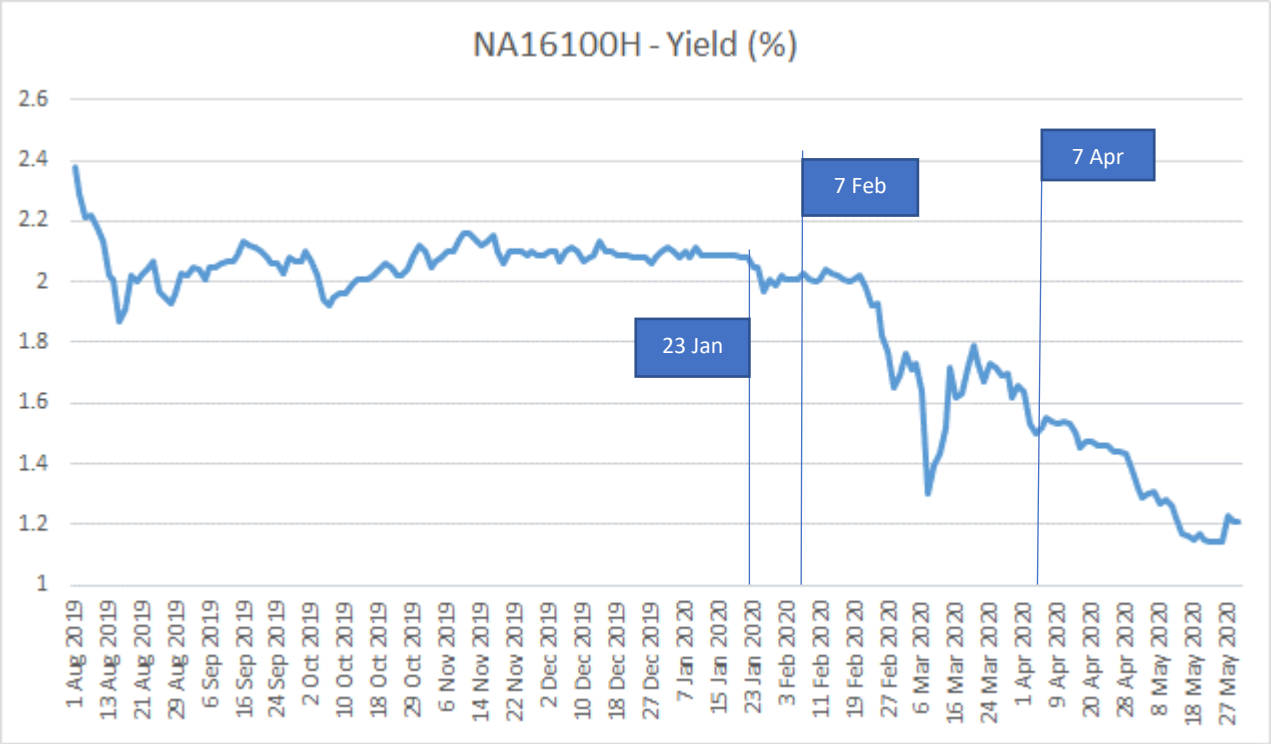
| S/no | Reference | Industry comments | KPMG response |
|---|---|---|---|
| | |  <br>Based on the Risk Free Rate trend as shown above for the period from Aug 2019 to May 2020, the RFR was volatile post 7 Feb 2020 when MOH raises the DORSCON level to Orange.<br>As such, for the final determination, we would suggest the use of data between Oct to Dec 19 (before the first case of COVID 19) to determine the RFR and Debt Premium. This would represent a more reasonable set of data not impacted by the COVID-19 global pandemic. | (NA16100H) indicate the average yields have stayed at, or below, the levels noted for March through May 2020. This has also been reflected in other rates, such as swap rates across various tenors. Additionally, our review of recent market research from several leading Singaporean banks is that they expect rates will remain lower towards 4Q20 and into 2021.<br>We consider that the historical (2020 trends in SGS and interest rates) and future (bank market research expectations) trends point towards a low interest rate environment for the timeframe that this review encompasses. On that basis, and along with comparing trends in other factors that make up the WACC (some of which increased), we have retained the Base Month as May 2020.<br>We have separately surveyed several banks active in Singapore's power market to |
| 1b. | Tuas Power Generation Pte. Ltd. | With the base month updated to May-20 for the draft and final determination paper, the three-month time period will coincide with the start of the circuit breaker in Singapore on 7 April 20, during which there is a significant slow down in economic activities. We propose not to include the months when the circuit breaker was enforced to be used to determine financial parameters, i.e. risk free rate and debt premium, and technical parameters, i.e. carrying backup fuel cost and Brent Index Price. | |

| S/no | Reference | Industry comments | KPMG response |
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| 1c. | Senoko Energy Pte Ltd | We understand that EMA intends to update the base month to May 2020 to be consistent with past practice. However, shifting the base month from March 2020 to May 2020 (I.E., using data from 1 March 2020 – 31 May 2020) will incorporate data akin to a black swan event, where the Covid ’19 impact was felt the hardest by many.<br>We observe that the financial market has been gradually recovering from the lows seen in March / April 2020, and therefore strongly recommend that EMA should adopt a more appropriate base month which will better reflect the market conditions for the timeframe that this review encompasses. | receive quotes on an indicative debt premium for a new entrant. Under this project finance approach, an all-in cost of debt of 3.89% was identified, which is not materially different from the market-based approach which provided an all-in cost of debt of 3.90%. |
| 1d. | SP Group | The risk-free rate is calculated based on the yield of the Singapore Government Security (“SGS”) with a remaining maturity period that most closely matches the economic life of the relevant asset.<br>Two important factors in considering a suitable treasury bond to use as the risk-free rate for the calculation of WACC in the Vesting Contracts are:<br>• **Relevance**: the government bond should be aligned to the Singapore market and reflect the risk conditions of this country; and<br>• **Tenure**: The tenure of the selected government bond should be aligned to the useful life of the asset that the WACC relates to. The useful life for the theoretical power plant is **25 years**, pursuant to WSP’s review of technical parameters. Thus, a treasury bond should be chosen with a maturity that is closest to this.<br>SP Group agrees with EMA and the consultant’s assessment that the risk-free rate tenure should be aligned to the useful life of the asset that the WACC relates to.<br>To ensure a level playing field, the same principle should be fairly applied across all entities regulated by EMA including SP. | EMA notes SP Group’s comments. The WACC methodology in question is specific to a new entrant genco, which is taken separately from other regulated entities. |
| **2** | **Debt Premium (Section 2.5 of the EMA Consultation Paper, Appendix C of Review of Vesting Contract Financial Parameters – Draft Report)** | | |
| 2a. | Sembcorp Cogen Pte Ltd | The coronavirus pandemic has led to adverse merchant market conditions in Singapore. The decrease in Cost of Debt, as compared to the last review, is in contrary to the uncertain times and challenges ahead.<br>Based on our request for an indicative quote by a local bank, a new entrant will be priced a debt premium in the range between 2.75% p.a. to 3.00% p.a. for a 15-year project finance under current market conditions. | We acknowledge the view that a new power plant entrant is likely to utilise |

| S/no | Reference | Industry comments | KPMG response |
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| | | As such, this would bring the total Cost of Debt to a range between 5% and 6% which would be reasonably sufficient to reflect the current market condition. | project finance as part of their debt financing strategy.<br><br>In preparing the draft final report, we surveyed several banks active in Singapore's power market to receive quotes on an indicative debt premium for a new power plant entrant.<br><br>Under the project finance approach, an all-in cost of debt of 3.89% was identified, implying a debt premium of 2.43%.<br><br>When considering the updated Base Month for the draft final Report, the market approach provided an all-in cost of debt of 3.90%, implying a debt premium of 2.44%.<br><br>Accordingly, we have maintained use of the market approach for the draft final report as the minor difference between approaches does not justify consideration of a change to the project finance methodology. Furthermore, adopting the market approach is consistent with |

| S/no | Reference | Industry comments | KPMG response |
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| | | | the baseline method to estimate a debt premium. |
| **3** | **Market Risk Premium (Section 2.6.1 of the EMA Consultation Paper)** | | |
| 3a. | SP Group | The MRP is 6.70% based on the mean of forward-looking MRPs and comparable overseas jurisdictions.<br>The market risk premium (MRP) represents the rate of return in excess of a risk-free rate that an investor expects to receive from a risky investment. While there are numerous methods for estimating the MRP,<br>we have utilised the following three in determining the MRP based on feedback from EMA:<br>• Implied MRP<br>• Overseas benchmarks and<br>• Dividend growth model<br>SP agrees with EMA's assessment that the MRP should be based on the mean of forward-looking MRPs and comparable overseas jurisdictions.<br>To ensure a level playing field, the same approach to estimating MRP should be fairly applied across all entities regulated by EMA including SP since the entities operate in the same Singapore market and are faced with similar market risk. | Refer to the response in 1d. |

## TECHNICAL PARAMETERS

<table>
<tr><th>S/no</th><th>Reference</th><th>Industry comments</th><th>WSP response</th></tr>
<tr><td>1</td><td colspan="3">Heat Rate (Section 2.5 of Review of vesting contract technical parameters and Section 3.4 of Consultation paper)</td></tr>
<tr><td>1a.</td><td>Keppel Energy Pte Ltd</td><td>Keppel disagree to the inclusion of Ansaldo / GT26 is a part of the GT models used to evaluate the heat rate. This is because Ansaldo / GT26 is an upgraded version that is a hybrid of F-class flexibility with H-class efficiency. This upgraded hybrid F-class technology does not fall within the category of the current F-class fleet that contribute to more than 25% the Singapore total demand.<br><br>On other fronts, we also think it is not realistic for 494 MW unit to be planted in Singapore when the largest unit is currently only 431 MW, as a 494 MW unit will incur significantly higher reserve costs due to the market’s runway model for reserve cost allocation.<br><br>The benefits from the lower heat rate of the unit will be reduced due to the unit having to operating at a lower load versus smaller CCGTs. Hence, from a commercial standpoint, GT26 is not the most cost-efficient.</td><td>There is no standard for reporting a gas turbine as F-class and the nomenclature is not fixed. For example, in 2013 General Electric re-labelled its F-class 9FB.05 gas turbine as H-class viz/ 9HA.01.<br><br>Ansaldo Energia has categorised the GT26 as an F-class gas turbine. There are variants of the GT26, as OEMs upgrade their gas turbine models over time. After further review, it is noted that the variant of the GT26 adopted in the Consultation Paper has adopted some elements of H-class technology.<br><br>On this consideration, another variant model of GT26, which is more comparable to the models used in the Singapore market, has been adopted instead. A comparison of the performance parameters is below:<br><br>
<table>
<tr><th>GT26</th><th>Consultation Paper</th><th>Draft Determination Paper</th></tr>
<tr><td>Gross power</td><td>499.439 MW</td><td>452.463MW</td></tr>
<tr><td>Net LHV heat rate</td><td>6,068 kJ/kWh</td><td>6,136 kJ/kWh</td></tr>
</table>
</td></tr>
<tr><td>1b.</td><td>Sembcorp Cogen Pte Ltd</td><td>The GT26 seems to be an even advanced version than the MXL3 version on offer from Ansaldo or the HE version from GE. The MXL3 version has zero units in service globally and is essentially an upgrade to the existing GT26 units. Similarly, the HE version also has zero units installed in service globally as of today and is an upgrade to the existing units.<br><br>Even with the MXL3 / HE upgrade to the existing GT26 units in Singapore, the expected load increase is around 16.5 to 18 MW (with heat rate improvement of up to 2.8% @ ISO & Base load conditions). This would bring an existing 400 MW unit up to 420 MW. This increase is as opposed to the 494 MW capacity unit</td><td>Refer to the response in 1a.</td></tr>
</table>

| S/no | Reference | Industry comments | WSP response |
|---|---|---|---|
| | | (an additional 90 MW) input to the calculation in GTPRO. The selection of such machine used for the comparison and analysis may have produce an unfair set of heat rates.<br>We request for the selection of a realistic GT26 unit as an input to the GTPRO calculation. | |
| **2** | **Adjustment for Gas Compression** (Section 2.5.2 of Review of vesting contract technical parameters) | | |
| 2a. | Keppel Energy Pte Ltd | We wish to clarify if the high consumption for gas consumption in figure 2.2 is for 2 blocks or 1 block. | The gas consumption in Figure 2.2 is for 1 block. |
| 2b. | Keppel Energy Pte Ltd | EMA has recently revised the requirements for the minimum NG pressure at site boundary to be 16 Barg.<br>With the above, the Consultant should factor in factor in (i) power losses and (ii) impact to heat rate and (iii) increased capital cost due to incorporation of a gas compressor to a new plant. | The minimum design pressure of fuel gas compressors has been adjusted to 16barg, resulting in adjustments to capacity, heat rate and capital costs. |
| **3** | **Initial Plant Capital Costs** (Section 3.3 of Review of vesting contract technical parameters) | | |
| 3a. | Tuas Power Generation Pte. Ltd. | The additional regulation imposed by the government on the construction industry due to Covid-19, such as cohorting requirements, dedicated transport requirements for the foreign construction workers etc., will result in significant cost increase and potential schedule delay for the plant construction.<br>We would like to propose for WSP to review the construction cost and the build duration (currently at 30 months) during the Covid-19 period. | Based on WSP's recent project experience, an additional construction cost of 5% has been accounted for civil, mechanical, and electrical assembly & wiring costs under initial plant costs (i.e. items 3, 4 and 5 of Table 3.2).<br>Based on WSP's recent project experience, it is also estimated that the loss in productivity will result in a 45-day delay for the construction of a new CCGT. This has been accounted for under build duration. |
| 3b. | Senoko Energy Pte Ltd | The initial plant capital cost includes the following modifications applied to a typical two-unit CCGT plant. This is done to reflect the design features required for a power plant in Singapore. Where plant equipment or infrastructure is shared between the two units, the **costs are halved**. | Building and structure costs, and civil costs are calculated on a 2-unit basis in GTPro. The draft final report has been updated to convert these costs to a 1-unit basis using cost factors of 0.88 for building and structures, and 0.6 for civil costs. |

| S/no | Reference | Industry comments | WSP response |
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| | | This report states that "building and structures costs" and "civil costs" are calculated on a 2-unit station basis and then divided by half to get a unit basis cost.<br>While we do agree that there will be some savings on shared equipment / resources, the GTpro software suggests that the factor should not be 0.5 for both components listed above. Instead a **cost factor of 0.88 for the building and structures costs** when changing the configuration of a 2-unit station to a single-unit station, and a **cost factor of 0.6 for the civil costs** when changing the configuration of a 2-unit station to a single-unit station. | |
| 3c. | Keppel Energy Pte Ltd | The Safe Management Measures required at the workplace will result in higher construction cost (e.g. increase dormitory housing requirement and dormitory operating cost) and longer build duration which in turn lead to higher construction cost again. The Consultant should incorporate such increased cost in table 3.2 of the "Initial Plant Capital Cost". According to the Straits Times article published on 5 Jun 2020 on "Coronavirus: Dorm operators expect changes to push up costs by at least 50%", building costs is expected to double, along with a 50 per cent increase in operating costs.<br>Referring to Table 3.2, can we seek Consultant's explanation on why the cost for "Other equipment" had decreased significantly (43%) from S$ 30.9 MM to S$ 17.6 MM. | Refer to the response in 3a for COVID-related adjustments.<br>In the previous review, the cost of the gas compression system was included under other equipment (item 2 of Table 3.2). In the current review, the cost of gas compression system (item 10 of Table 3.2) is accounted for separately from other equipment. Hence, items 2 and 10 of Table 3.2 need to be compared together. |
| 3d. | Senoko Energy Pte Ltd | **Table 3.2 Initial plant capital costs summary and compared with previous reviews (1 unit).**<br>**Item 1 "Specialised equipment"** | The fuel gas performance heater is already accounted for under the cost of specialized equipment (item 1 in Table 3.2). |

| S/no | Reference | Industry comments | WSP response |
|---|---|---|---|
| | | Unlike previous reviews, this review does not cater for the fuel gas heater under the "specialised equipment" category. In addition, with reference to Appendix C, none of the F-class units therein considers a fuel gas heater.<br>Based on Thermoflow, the cost of 1 fuel gas heater is approximately MUSD 0.5 and believe that this cost should be factored into the formulation of the vesting parameters. | Appendix C has been updated to reflect the fuel gas performance heaters. |
| 3e. | Senoko Energy Pte Ltd | **Table 3.2 Initial plant capital costs summary and compared with previous reviews (1 unit)**<br>**Item 14 "Additional security measures and cyber security measures"**<br>Plants operating in the SWEM are all required to maintain the long-term operational & maintenance data, hence, we believe that the costs of a data historian and a Computerized Maintenance Management System (CMMS) should be included into the initial plant costs where it could potentially fall under a re-termed item 14. | The computerized maintenance management system is already accounted for under the distributed control system. |
| 3f. | Senoko Energy Pte Ltd | **Table 3.2 Initial plant capital costs summary and compared with previous reviews (1 unit)**<br>**Item 15 "Air filters"**<br>The cost quoted for an air filter of SGD 148K is very much on the low side, and we believe the actual cost should be closer to SGD 475K for a set of high quality 3-stage air filter. | The air filters in item 15 of Table 3.2 is referring to the cost of additional spares beyond standard filters.<br>The cost of standard air filters of $475k is already accounted for under specialised equipment (item 1 of Table 3.2). |
| **4** | **Through-life Capital Costs** (Section 3.4 of Review of vesting contract technical parameters) | | |
| 4a. | Senoko Energy Pte Ltd | **Table 3.3 Through life capital costs (1 unit)**<br>**Item 1 "Distributed Control System (DCS)"** | These items are already accounted for under the distributed control system replacement. |

| S/no | Reference | Industry comments | WSP response |
|---|---|---|---|
| | | This report only contemplates the replacement of the DCS after 15 years, however, we should note that there are other microprocessor-based systems (listed below) that have inherent obsolescence and would likely need to be replaced.<br>- Vibration monitoring systems<br>- Fire protection system / instruments<br>- Water treatment control systems<br>- Chemistry analysers<br>- Digital relays<br>- CEMS<br>- UPS / Battery chargers<br>As such, we urge EMA to consider these listed systems to form part of the "through life capital costs". | |
| 4b. | Keppel Energy Pte Ltd | **<u>Time within project for Distributed Control System</u>**<br>Based on our operating experience, the time within project for Distributed Control System is much shorter than 15 years. We believe 8- 10 years is more reasonable due to the following factors:<br>- It is an industry common practice for an EPC contractor to select a proven product that has met the contractual and warranty obligations instead of a new product for installation in a new built. For the product to be proven, it has to be in the market for a while.<br>- By the time the contractor hands over, the product would have exhausted close to quarter or half-life after taking into consideration the years it has been in the market as well as the time taken for selection, installation, and commissioning. | We are not aware of owners doing a DCS replacement at such a short timescale. Owners tend to stretch controls replacements out as long as possible, and we are aware of several systems still operating over 20 years. 15 years is a common assumption that is considered the standard. |

<table>
<tr><th>S/no</th><th>Reference</th><th>Industry comments</th><th>WSP response</th></tr>
<tr><td></td><td></td><td>Besides, based on our operating experience, contractor have proposed system upgrade due obsoleted electronic parts and reduce/discontinue support on software after 10 years of commercial operation.</td><td></td></tr>
<tr><td>4c.</td><td>Senoko Energy Pte Ltd</td><td><u>Table 3.3 Through life capital costs (1 unit)</u><br><u>Item 2 “Gas turbine rotor”</u><br>It should be made known explicitly if the GT rotor is bladed or un-bladed. If the latter is true, then the cost of one full set of compressor blades should also be included.<br><br>In addition, Senoko’s sponsor believes that the following items should be included in the derivation of the GT rotor costs:<br>Reinvestment Cost per GT<table><tr><th></th><th>US$ million</th></tr><tr><td>CVC1</td><td>0.6</td></tr><tr><td>CVC2</td><td>3.5</td></tr><tr><td>TVC</td><td>1.3</td></tr><tr><td>Heat shields</td><td>2.4</td></tr><tr><td>Burners</td><td>3.7</td></tr><tr><td>Compressor blades</td><td>8.5</td></tr><tr><td>Generator rotor rewind</td><td>2.0</td></tr><tr><td>Stator rewind</td><td>3.0</td></tr><tr><td>ST nozzle block</td><td>0.4</td></tr><tr><td>ST LP last stage blades</td><td>0.8</td></tr><tr><td>Turbine control system</td><td>0.5</td></tr><tr><td>Generator Excitation system</td><td>0.5</td></tr><tr><td>GT startup system</td><td>0.5</td></tr><tr><td>Total per GT</td><td>27.7</td></tr></table></td><td>The scope of a half-life refit depends on the owner’s expected life and the timing of the refit. The 25-year life assumption is relatively short compared to the actual operational life. A larger refit would likely occur at the 20-25th year for 30-40-year life plant, rather than at the 15th year for a 25-year life plant.<br>The assumption is for an unbladed rotor and this is already a conservative assumption at the 15th year for a 25-year life plant. We do not believe that a new rotor plus a set of blades is the likely or expected outcome for this scenario. OEMs are moving towards inspection options for rotors rather than expecting replacement. It is not expected that blades would be sized into the rotor requiring replacement at the 15th year.<br>The “reinvestment cost” list submitted is not considered to be expected or typical for a unit at the 15th year for a 25-year life plant. The items listed are more akin to a refit seeking a longer life, upgraded performance, or are contingencies rather than typical or expected scope items. For example, generator rewind would not be an expected outcome within a 25-year life plant. It is therefore not considered appropriate to add these items.</td></tr>
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<table>
<tr><th>S/no</th><th>Reference</th><th>Industry comments</th><th>WSP response</th></tr>
<tr><td>5</td><td colspan="3">Electrical Connection Costs (Section 3.6.1 of Review of vesting contract technical parameters)</td></tr>
<tr><td>5a.</td><td>Keppel Energy Pte Ltd</td><td>What is the allowable limit for short-circuit contribution (for 3-phase and single phase-to-ground) for this review? The additional CAPEX and OPEX required (e.g. Neutral Ground Reactor, larger generator step-up transformer with higher impedance) should be taken into account in “Initial Plant Capital Cost” and “Annual Fixed Running Cost”.<br><br>We wish to check if compliance of Transmission Code by the hypothetical new unit has been reviewed? For example, the in-rush current for the energization of the generator step-up transformer for the new unit must not exceed the limits stipulated in the Transmission Code. If additional safe-guard is required (e.g. “point-of-wave” switching), additional CAPEX incurred should be taken in account.</td><td>We considered the following short-circuit contribution values for 100MW capacity:<br><table><tr><th>Description</th><th>Short-circuit contribution</th></tr><tr><td>Three phase</td><td>4.5 to 5 kA</td></tr><tr><td>Single phase</td><td>5 to 5.5 kA</td></tr></table>The equipment and components considered are adequate for compliance with the prevailing Transmission Code.</td></tr>
<tr><td>6</td><td colspan="3">Owners Costs After Financial Close (Section 3.7 of Review of vesting contract technical parameters)</td></tr>
<tr><td>6a.</td><td>Senoko Energy Pte Ltd</td><td><u>Table 3.7 Owner’s cost after Financial Close</u><br><u>Item 3 “Initial spares”</u><br>Based on the experience of Senoko’s sponsor in dealing with multiple F-class units with various OEMS, the quoted cost of initial spares of MSGD 11.28 is deemed to be on the lower end of the scale.<br><br>Senoko’s sponsor believes that a more reflective cost of the spares is approximately:<br>- Operational plant spares for planned routine consumption (MSGD 10 per unit)<br>- Strategic spares, combining long lead time critical spares and insurance / risk spares (MSGD 5 per unit)<br>- Approximate total cost is MSGD 15 per unit</td><td>The estimation of cost of initial spares is a function of LTSA scope, guarantees and warrantees, insurance cover, the risks appetite of the Genco’s, number of units in the fleet or in a pooled arrangement, which particularly applied to strategic spares which are shared among a significant fleet.<br><br>The initial spares allowance (comprising 2% of EPC and connection cost) is consistently applied in previous reviews and is assessed to be adequate for a hypothetical new entrant.</td></tr>
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| S/no | Reference | Industry comments | WSP response |
|---|---|---|---|
| | | Also note that these values do not include the LTSA buffer stock, which is assumed to have been provided and maintained under title by the OEM. | |
| **7** | **Average Expected Utilisation Factor** (Section 3.8 of Consultation paper and section 5.3 of Review of vesting contract technical parameters) | | |
| 7a. | Tuas Power Generation Pte. Ltd. | EMA has advised an average expected utilization factor of 62.17%, i.e. computed from the actual historic plant load factor of the existing F-class plant for the previous 12 months from April-19 to March-20.<br>The computation of the plant load factor should take into consideration the potential reduction in electricity generation due to new generation capacity, electricity import and solar growth expected to occur in 2021-2022:<br>1. Commercial operation of 120MW TuasOne Waste-to-Energy plant is expected in Jan-21;<br>2. Electricity imports of 100MW by 2021 and 200MW by 2022;<br>3. Quadratic solar growth to 2GWp by 2030<br>4. Coupled with the prolonged impact of Covid-19, i.e. slowing economy and a weakened demand that may take a few years to recover, we propose to reduce the average utilisation factor from 62.17% to 59%.<br>References:<br>https://www.straitstimes.com/business/companies-markets/tuasone-expected-to-be-operational-in-jan-2021-says-nea<br>EMA Information Paper published on 28 May 2020 on Enhancing the Singapore Wholesale Electricity Market for Supply Reliability, Economic Efficiency and Financial Sustainability | We have updated the average expected utilisation factor to 61.77%, this takes into account:<br>1. Actual performance of existing F-class CCGTs in operation over the period Jun 2019 to May 2020;<br>2. The additional supply from TuasOne;<br>3. Expected generation output from solar; and<br>4. Expected electricity imports. |
| 7b. | Senoko Energy Pte Ltd | The PLF is set at 62.2% based on the actual performance of existing F-class CCGTs in operation (viz. Keppel's CCP 3 and 4, | Refer to the response in 7a. |

| S/no | Reference | Industry comments | WSP response |
|---|---|---|---|
| | | PacificLight Power's CCP 1 and 2, Sembcorp's CCP 3, Senoko Energy's CCP 3 to 7, Tuas Power Generation's CCP 1 to 5, Tuaspring BLK1 and YTL PowerSeraya's CCP 1 to 4) over the period April 2019 to March 2020. This has been checked to be achievable for 2021 and 2022. Generation output for meeting internal station load is excluded when determining the PLF.<br><br>The practice of using historical data to arrive at PLF may be suitable for the previous reviews, however in view of the current Covid '19 pandemic, we are all acutely aware that this situation is here to stay for the near future. Therefore, using historical generation as a reference point in formulating SWEM's F-class units' average PLF will not be representative for the future years that this review is covering.<br><br>Adding on, we also see the continued drive for, and penetration of renewable energy entering the market. The FCM paper also mentioned that we can expect imports of 100 MW by 2021 and a further 100 MW in 2022/2023.<br><br>As such, we believe that the actual PLF value will be much lower than the currently calculated value of 62.2%. To better reflect the expected market conditions in 2021/2022, we strongly urge EMA to formulate the PLF using a probabilistic forecasting approach, accounting for the Covid '19 impact and residual effects, renewable penetration and energy imports in 2021 and 2022. | |
| 7c. | Keppel Energy Pte Ltd | There has been a substantial drop in system demand following the implementation of Circuit Breaker (CB) in Apr 2020. The system wide electricity demand has yet to recover to pre-CB level and we are expecting the after-effects to extend into the next few years amidst a global economic downturn.<br><br>As such, it would be inaccurate to rely on the historic 12-months' (May 19 – Apr 20) capacity factor as a forecast for 2021/2022. | Refer to the response in 7a. |

| S/no | Reference | Industry comments | WSP response |
|---|---|---|---|
| | | We suggest for the Consultant utilize a lower plant load plant factor than 62.17%. These could be done in two ways:<br>- Incorporate a downwards adjustment based on a correlation to the projection decrease in system demand in 2021 to 2023<br>- Take reference from May 19 to the month prior to publication of the final determination paper. Based on our analysis, the average plant load factor from May 19 to Jun 20 is below 61.5%.<br>Besides, we also suggest the EMA/Consultant to apply another downward adjustment component to the plant load factor due to increasing peak load shaving effect from the increasing solar energy supply. | |
| 7d. | PacificLight Power Pte Ltd | The current draft report states that the average historic capacity factor of the existing F-class CCGT for the previous 12 months leading to the base month (Mar 2020) is 62.2%. It is further proposed to use this figure for the Vesting price for both 2021 and 2022. However, we do not believe that this accurately reflects the likely PLF that would materialise in 2021 and 2022 for the following reasons:<br>1. Increase of Solar capacity - In the Oct 2018 Final Determination Paper on Intermittency Pricing Mechanism, EMA specified that the Government aims to increase the adoption of solar power to 350 MWp by 2020. Since then, implementation of new solar capacity has increased considerably such that the target was reached by Q4 2019. Over the span of a year, solar deployment has significantly increased by over 67% from 208.2 MWp in 2018 to 349.3 MWp in 2019. Solar capacity is set to further accelerate in the next decade. In MTI's statement during the SIEW in Oct 2019, the Government revealed its plans to ramp up solar | Refer to the response in 7a. |

| S/no | Reference | Industry comments | WSP response |
|---|---|---|---|
| | | capacity by more than seven times from mid-2019 levels. This means a target of 2GWp by 2030, which can be translated to an annual increase of 200MWp from 2021<br>2. Additional capacity - 120MW TuasOne Waste-to-Energy facility, expected to be operational in Jan 2021;<br>3. Impact of Covid19 – the Implementation of Circuit Breaker since Apr 2020 has led to a decrease in electricity demand – a trend also seen globally. Based on a report issued by the International Energy Agency in July 2020, global electricity demand is expected to fall by at least 5%, with 10% expected in some regions. In Singapore, from April 2020 onwards, demand has dropped by 6-8% as compared to same month in 2019.<br>Based on the above factors which will each have a negative and significant impact on the PLF, we would propose that the PLF for 2021 and 2022 is reduced by at least 3% points from 62.2% to 59.2%. | |
| 7e. | YTL PowerSeraya Pte Ltd | The use of the historical actual performance of existing F-class CCGTs in operation to determine the PLF is a good reference point for determining the expected PLF if there are no significant changes in the demand and supply condition in the Singapore electricity market.<br>The 62.2% PLF should be adjusted to account for the following changes expected in 2021 and 2022:<br>i. Lower electricity demand compared to the Apr 19 to Mar 20 with the shrinking of the economy as the Ministry of Trade and Industry (“MTI”) now predicting gross domestic product (“GDP”) will shrink between 5 per cent and 7 per cent in 2020.<br>ii. Commissioning of the TuasOne Waste-to-Energy Plant in 2020 (https://www.straitstimes.com/business/companies- | Refer to the response in 7a. |

<table>
<tr><th>S/no</th><th>Reference</th><th>Industry comments</th><th>WSP response</th></tr>
<tr><td></td><td></td><td>markets/tuasone-expected-to-be-operational-in-jan-2021-says-nea) which has an installed capacity of approx. 136 MW.<br>iii. Based on the Information Paper published by EMA on “Enhancing the Singapore Wholesale Electricity Market for Supply Reliability, Economic Efficiency and Financial Sustainability” dated 28 May 2020, there will be power import of 100 MW in 2021 through a trial, and another 100 MW of imports in 2022.<br>iv. Based on the Information Paper published by EMA on “Enhancing the Singapore Wholesale Electricity Market for Supply Reliability, Economic Efficiency and Financial Sustainability” dated 28 May 2020, there will be Quadratic growth in solar generation to 2GWp by 2030 and linear growth to 4GWp by 2050.<br><br>
<table>
<tr><td>Historical PLF</td><td>[a]</td><td>62.2%</td><td></td></tr>
<tr><td>Total Installed Capacity of existing F-class CCGTs in operation as per Table 2.1 of WSP report</td><td>[b]</td><td>7,744 MW</td><td></td></tr>
<tr><td>Generation achieved for Apr 19 to Mar 20</td><td>[c] = [a] x [b]</td><td>4,817 MW</td><td></td></tr>
<tr><td><u>Adjustments:</u></td><td></td><td></td><td></td></tr>
<tr><td>1) Lower System Demand</td><td></td><td>(100) MW</td><td></td></tr>
<tr><td>2) Additional Solar</td><td></td><td>(15) MW</td><td>Additional 100 MWp with PLF of 15%</td></tr>
<tr><td>3) New Generation Capacity</td><td></td><td>(100) MW</td><td>TuasOne with installed capacity of 136 MW</td></tr>
<tr><td>4) Power Import</td><td></td><td>(150) MW</td><td>100 MW in 2021 and 100 MW more in 2022.</td></tr>
<tr><td>Total Adjustments</td><td>[d]</td><td>(365) MW</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>Expected Generation from F-class unit in 2021-22</td><td>[e] = [c] + [d]</td><td>4,452 MW</td><td></td></tr>
<tr><td>Adjusted PLF</td><td>[e] / [b]</td><td>57.5%</td><td></td></tr>
</table>
Based on our simple analysis as shown above, a reasonable PLF would be around 57.5%.</td><td></td></tr>
</table>

| S/no | Reference | Industry comments | WSP response |
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| **8** | **Fuel Costs** (Section 3.11 of Consultation paper) | | |
| 8a. | Tuas Power Generation Pte. Ltd. | The power generation market has been saddled with overcapacity and excess gas commitment made during the development of the LNG terminal. In 2019, EMA facilitated measures with LNG supplier to temporarily ease the surplus gas in the power generation industry from 2019 to 2022, during which gas reduction costs are incurred. We are proposing for the gas reduction costs to be considered in the LRMC review. | The restructuring fee incurred by gencos to reprofile LNG contract in 2019 will not be incurred by a new entrant genco. |
| **9** | **Fixed Annual Running Costs** (Section 4.1 of Review of vesting contract technical parameters and Section 3.10.1 of Consultation paper) | | |
| 9a. | Keppel Energy Pte Ltd | In light of the recent news of Hin Leong Trading, we seek the Consultant's review of the cost of emergency fuel supply as we are expecting it to increase. | Considering the historical diesel price from Apr 2020 to Aug 2020, as well as the global slowdown in oil demand, an increase in the cost of emergency fuel supply is not expected. |
| 9b. | YTL PowerSeraya Pte Ltd | **Additional Safety Requirements Post-COVID 19**<br>There are additional costs incurred by businesses to meet additional safety requirements mandated by the government when resuming existing infrastructure projects. We would like to request the consultant to propose what would be a reasonable unavoidable expense that should be included into the fixed annual running cost for the additional safety requirements arising from COVID-19 global pandemic.<br>Minister Lawrence Wong acknowledged that putting in place tighter measures to prevent the spread of COVID-19 means extra costs for the construction industry.<br>Enhanced measures for construction dormitories would increase cost by at least 67%, simply based on increase in space (translates to more land lease cost). Lost productive days due to travel restrictions and quarantine requirements, which is likely to be built into labour cost and owner's cost. | We expect the COVID-19 situation to mostly affect the construction phase of the CCGT, accordingly this has been factored in (with reference to the response in 3a).<br>Items i to iii have been accounted for under item 14 of Table 3.2. Items iv to x have been accounted for under item 4 of Table 4.1. |

<table>
<tr><th>S/no</th><th>Reference</th><th>Industry comments</th><th>WSP response</th></tr>
<tr><td></td><td></td><td><u>Cyber Security Cost</u><br>We noted that $283,000 additional cyber security maintenance has been included in the annual fixed running cost. We would like to seek clarification with WSP if the following costs have been included:<br>i. Implementation of Network Traffic Analyser (~$140,000)<br>ii. Implementation of Privileged Access Management and Web Isolation Tools (~$160,000)<br>iii. Implementation of the Network Intrusion Detection System (~$600,000)<br>iv. Annual Firewall/VPN Maintenance (~$20,000)<br>v. Annual Security Services (~$50,000)<br>vi. Annual Endpoint Protection and Email Protection ($25,000)<br>vii. Annual Security Training Subscription and External Website Security Protection i.e. Encapsula (~$20,000)<br>viii. Annual ISO 27001 Certification Audit and Consultancy (~$10,000)<br>ix. Annual Risk and Vulnerability Assessment (~$60,000)<br>x. Annual CCoP Compliance Audit (~$20,000)</td><td></td></tr>
<tr><td>10</td><td colspan="3">Variable Non-Fuel Costs (Section 4.2 of Review of vesting contract technical parameters)</td></tr>
<tr><td>10a.</td><td>YTL PowerSeraya Pte Ltd</td><td>Reserve Cost<br>Generation company in the Singapore Wholesale Electricity Market is subject to primary and contingency reserve costs based on the “runway” model i.e. the largest machine is allocated a higher proportion of the reserve cost.<br><table><tr><th>GT OEM / GT Model</th><th>Gross Power [MW]</th><th>Aux. Power [MW]</th><th>Net Power [MW]</th></tr><tr><td>Ansaldo / GT26</td><td>494.439</td><td>10.391</td><td>484.048</td></tr><tr><td>GE / 9F.05</td><td>431.242</td><td>9.213</td><td>422.029</td></tr><tr><td>MHPS / 701 F4</td><td>453.388</td><td>9.204</td><td>444.184</td></tr><tr><td>Siemens / SGT5-4000F</td><td>435.298</td><td>8.877</td><td>426.421</td></tr><tr><td>Average</td><td>453.592</td><td>9.421</td><td>444.171</td></tr></table></td><td>AGC requirement in Singapore is not considered to be materially different from other jurisdictions, where minor perturbations of output on account of AGC (for those units in the system providing AGC service) or on droop-control are part of normal operations for which no specific extra allowance is considered appropriate. The impact of operating the plant at part-load on account of the need for regulation and contingency reserve ancillary services is already accounted for within the load factor correction.</td></tr>
</table>

| S/no | Reference | Industry comments | WSP response |
|---|---|---|---|
| | | The newer F-class machines that has been used in the evaluation have bigger capacity than the existing fleet of F-class machines operating in the system. As such, it warrants WSP to review the necessity to include the reserve cost in the variable non-fuel cost in addition to the EMC and PSO cost. | As mentioned in the response in 1a, a variant of the GT26 has been referenced instead, resulting in a lower plant capacity of 419.9MW. |
| **11** | **Build Duration** (Section 5.1 of Review of vesting contract technical parameters) | | |
| 11a. | Keppel Energy Pte Ltd | We suggest the Consultant to consider a more longer build duration timeline compared to the past assumption of 30 months due to the following two regulatory requirements:<br>- The Safe Management Measures required at the workplace will result in longer build duration<br>- Referring to Infrastructure Protection Act, Security By Design (SBD), is applicable for projects from Jan 2020 onwards (point 45 of the Act). The review and approval process will already require 9 to 12 months (point 65 of the Act). | Refer to the response in 3a. |
| 11b. | YTL PowerSeraya Pte Ltd | HDB has announced that the completion of some BTO projects was expected to be delayed by up to six months due to the halt in construction works during the two-month circuit breaker period which started on April 7.<br>Even though construction works have resumed gradually since June 2, when the circuit breaker measures eased, companies have had to adhere to strict safe management measure at worksites amid the Covid-19 outbreak.<br>HDB mentioned in the article that while the delay is still up to six months for most projects, there are some blocks in a few projects where the delay could be longer, by up to nine months.<br>(https://www.straitstimes.com/singapore/housing/some-bto-flats-may-be-delayed-up-to-nine-months-up-from-previous-six-months-hdb) | Refer to the response in 3a. |

| S/no | Reference | Industry comments | WSP response |
|---|---|---|---|
| | | Drawing reference from HDB projects, the Build Duration should include an additional 6 to 9 months. | |
| **12** | **Thermodynamic Analysis** (Appendix C of Review of vesting contract technical parameters) | | |
| 12a. | Keppel Energy Pte Ltd | Please provide a more detailed schematic, especially on the HRSG (refer to previous years report).<br>We suggest the Consultant to review and verify that all the operating parameters are achievable and do not cause any adverse impact to the lifetime of the plant equipment. For example, can the flue gas temperature at outlet of Gas Turbine be achievable, and whether such high temperature can affect the lifetime of HRSG due to creep? To illustrate, for AE GT 26, this flue gas temperature at Gas Turbine outlet is stated as 645 deg C (which is much higher than 622 to 627 deg C as reported in previous reports.)<br>For GE 9F, the flue gas temperature at outlet of Gas Turbine is 652 deg C (slightly lower than previous report of 656 deg C), and the HP steam to Steam Turbine is 592 deg C, 145 bar (significantly higher than previous report of 579 deg C, 124 bar), can the Consultant share their review if latest operating parameters are achievable, and what is the technical basis for this significant improvement, which will result in better thermal efficiency? | Consistent with previous reviews, we used the bottoming cycle design based on GTPro. Based on our recent projects, we believe that the GTPro operating parameters are achievable.<br>Any new entrant will look for most efficient machine which will be more competitive in markets. The use of GTPro operation parameters is a conservative assumption on the HBD analysis. |
| **13** | **Proposed Approach to Update Capital Costs Parameters in 2022 for 2023** (Appendix D of Review of vesting contract technical parameters) | | |
| 13a. | Keppel Energy Pte Ltd | Could EMA/Consultant elaborate more on the decrease in EPC (Specialised Equipment and Other Equipment) from S$250.4 mil for the period of 2019/2020 to S$247.8 mil for the period of 2021/2022? | Refer to the response in 3c. |