

Munmorah Gas Turbine Facility Supporting Information for Section 75W Application

February 2007

Delta Electricity



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1. Introduction

This report provides supporting information to the application currently being prepared by Delta Electricity to amend Clause 2.12 and Clause 2.13 of the General Terms of Approval (GTA) issued for the Munmorah Gas Turbine Facility (application No: 05_0195, File No: 9037381, dated 31 July 2006).

The application is being prepared in accordance with Section 75W of the *Environmental Planning and Assessment Act 1979* and approval is being sought from the Minister of Planning for the proposed amendments to the GTA.

The key issues, supporting information and justification relating to environmental noise issues associated with the proposed amendments are detailed below.

1.1 Background

Maximum allowable noise contributions and ancillary requirements (as related to operational noise) are provided within Clause 2.12 and Clause 2.13 of the GTA.

During the preferred tenderer selection process, all tenderers demonstrated compliance with the requirements of Clause 2.12. However, compliance with Clause 2.13b of the GTA was not achievable using technically feasible and/or economically reasonable means.

The tenderers have identified that out of the six modifying factors stipulated in Section 4 of the NSW Industrial Noise Policy, only the low frequency noise penalty would be applicable i.e. the tenderers would be required to add a 5 dB correction factor to the predicted noise levels. This would result in a potential non-compliance for the tenderers to the allowable maximum noise contributions stipulated within the GTA.

Delta Electricity has asked Parsons Brinckerhoff to review the information provided by tenderers during the tender selection/negotiation process to assess compliance in accordance with Clause 2.12 and Clause 2.13 of the GTA..

2. Results of review

2.1 Existing ambient noise levels

Ambient noise monitoring was carried out at a number of residential locations during the original Environmental Assessment (EA) and subsequent Submissions Report (SR) phase of the project. Ambient noise level measurements, and measured night-time Rating Background Levels (RBLs) are provided in Table 2-1.

Table 2-1: Summary of ambient noise data

| | Ambient noise monitoring location | Noise catchment area ¹ | Nearest receptor ² | Measured RBL (dB(A)) | | |
|---|---|-----------------------------------|-------------------------------|----------------------|--------------|-----------------|
| | | | | Day | Evening | Night |
| 1 | Bevington Shores, north-west corner ^{SR} | B | P2 | 34.5 (37-38) | 35.5 (na) | 38 (37-38) |
| 2 | Bevington Shores, north-east corner ^{SR} | B | P1 | 35.5 (<33) | 35 (na) | 34.5 (32-34) |
| 3 | 127 Woolana Avenue, Halekulani ^{EA} | C | P3, P4 | 36 (<36) | 33 (na) | 34 (29-31) |
| 4 | 32 Barega Close, Buff Point ^{EA} | D | P5 | 37 (<37) | 40 (na) | 36 (<36) |
| 5 | 83 Perouse Avenue, San Remo ^{EA} | E | P6, P7 | 39 (<37.5) | 38 (na) | 34 (<28) |

Notes to Table 2-1: Values in brackets (xx) denote industrial noise influence measured during attended noise monitoring; (na) - Not assessed; 1 - Table 10.1 of EA; 2 - Table 3 of GTA

A map showing the ambient noise monitoring locations, noise catchment areas described in the EA and the receptor locations (as stipulated in Table 3 of the GTA) nearest to the ambient noise monitoring locations has been included as an attachment to this letter.

Environmental noise goals were conservatively established during the EA approval phase by adopting the lowest Assessment Background Level (ABL) measured at all of the monitoring locations and establishing intrusive noise goals with reference to this single value. A noise design goal of 37 dB(A) (32 dB(A) + 5 dB(A)) was then established.

Although the Maximum Allowable Noise Contributions stipulated in Table 3 of the GTA were based on predicted noise levels rather than the established noise design goal, closer inspection of the existing ambient noise profile data indicates that an increase in site-specific noise design objectives is considered reasonable in terms of maintaining local noise amenity and limiting noise intrusion potential.

Further detail is provided in Table 2-2 below.

Table 2-2: Summary of revised assessment benchmarks

| Receptor | Location | Current GTA | Intrusive Goal (RBL + 5 ¹) | Amenity Goal ² (night time) | |
|----------|----------------------------|----------------|--|---|-----------------|
| | | | | Rural or Suburban | Urban |
| P1 | Sunnylake Caravan Park | 35 | 39.5 | 40 | NA |
| P2 | Macleay Drive | 41 | 43 | NA | 45 ³ |
| P3 | Woolana Avenue, Halekulani | 40 | 39 | 40 | NA |
| P4 | Ulana Avenue, Budgewoi | 38 | 39 | 40 | NA |
| P5 | Barega close, Buff Point | 35 | 41 | 38 | NA |
| P6 | Barker Avenue, San Remo | 35 | 39 | 40 | NA |
| P7 | Denman Street, Doyalson | 35 | 39 | 40 | NA |

Notes to Table 2-2: all values expressed as dB(A); L_{eq} levels presented; 1: Based on measured night-time RBL at each location, Daytime intrusive noise design goals would be typically higher; 2: Based on characteristics of existing noise environment in conjunction with measured existing industrial influence at each location; 3: A worse case scenario may consider an indicative noise amenity area classified as urban/industrial interface, i.e. existing power station.

Typically the more conservative of the intrusive and amenity goal would apply and have been highlighted in Table 2-2 above.

In all cases, the revised noise assessment benchmark would be higher than the current Maximum Allowable Noise Contributions stipulated in Table 3 of the GTA. The exception to this is receptor location P3 – Woolana Avenue, Halekulani (ambient noise monitoring location 3, 127 Woolana Avenue, Halekulani), where a 1 dB(A) differential is observed.

The above summary indicates that an amendment to the current GTA levels would not necessarily correlate to a degradation of existing community standards.

2.2 Noise predictions and performance guarantees

The Maximum Allowable Noise Contributions stipulated in Table 3 of the GTA, the assessment benchmarks and the Preferred Tenderer noise performance guarantees are compared in Tables 2-3 and 2-4.

In Table 2-3, the Preferred Tenderer's guarantees, based on worst-case noise enhancing meteorological conditions for each receiver are depicted, excluding the low frequency correction factor of 5 dB.

Table 2-3: Comparison of GTA levels and Preferred Tenderer Guarantees (without low frequency adjustment)

| Receptor | Location | Current GTA | Assessment Benchmark (Table 2) | Preferred Tenderer's Guarantee (Without the Low Frequency Adjustment) |
|----------|----------------------------|-------------|--------------------------------|---|
| P1 | Sunnylake Caravan Park | 35 | 39.5 | 35 |
| P2 | Macleay Drive | 41 | 43 | 41 |
| P3 | Woolana Avenue, Halekulani | 40 | 39 | 40 |
| P4 | Ulane Avenue, Budgewoi | 38 | 39 | 38 |
| P5 | Barega close, Buff Point | 35 | 38 | 35 |
| P6 | Barker Avenue, San Remo | 35 | 39 | 35 |
| P7 | Denman Street, Doyalson | 35 | 39 | 35 |

Notes to Table 2-3: All values presented are dB(A);L_{Aeq} levels; 1: Intrusive goal from Table 2.

In Table 2-4, the Preferred Tenderer guarantees are based on worst-case noise enhancing meteorological conditions for each receiver have been modified to include low frequency components. This modifying correction factor was not applied to the predicted noise levels during the EA assessment. The base assumption was that the modifying factors under Table 4.1 of the Industrial Noise Policy would not be associated with the measured noise levels. However, all tenderer's noise predictions exceed the 15 dB differential for low frequency which resulted in no tenderer being in compliance with the current GTA.

Negotiations with the Preferred Tenderer established guaranteed far field noise levels based on the noise predictions including the +5 dB modifying correction factor are shown in Table 2-4 and compared with current GTA and the assessment benchmarks.

Table 2-4: Comparison of GTA levels and Preferred Tenderer Guarantees (with low frequency adjustment)

| Receptor | Location | Current GTA | Assessment Benchmark (Table 2) | Preferred Tenderer's Guarantee (With the Low Frequency Adjustment) |
|----------|----------------------------|-------------|--------------------------------|--|
| P1 | Sunnylake Caravan Park | 35 | 39.5 | 40 |
| P2 | Macleay Drive | 41 | 43 | 45 |
| P3 | Woolana Avenue, Halekulani | 40 | 39 | 41 |
| P4 | Ulane Avenue, Budgewoi | 38 | 39 | 41 |
| P5 | Barega close, Buff Point | 35 | 38 | 39.5 |
| P6 | Barker Avenue, San Remo | 35 | 39 | 40 |
| P7 | Denman Street, Doyalson | 35 | 39 | 39.5 |

Notes to Table 2-4: All values presented are dB(A);L_{Aeq} levels; 1: Intrusive goal from Table 2.

Note that the Preferred Tenderer Guarantees compare favourably (≤ 5 dB) with the original GTA as well as the assessment benchmark. This confirms that the original GTA levels remain appropriate and relevant when low frequency noise is not applicable as defined in Table 4.1 of the NSW Industrial Noise Policy.

Given the significant financial liabilities associated with not achieving the performance guarantee (in the form of achieving practical completion), the proposed guaranteed far field noise levels are considered reasonable and necessary to secure the project. Delta Electricity cannot proceed if the Preferred Tenderer's guaranteed far field noise levels are in excess of the GTA levels.

The application of the +5dB modifying correction factor, can only be confirmed after commissioning of the gas turbine(s). It is proposed that the modified GTA will only apply if a low frequency characteristic is evident in accordance with Table 4.1 of the NSW Industrial Noise Policy.

2.3 Proposed noise controls

The Preferred Tenderer has stated that all reasonable economical and technically feasible noise control options have been considered in the proposed design of the gas turbine facility. Refer to Appendix B for an overview of the proposed noise mitigation measures.

The proposed acoustic design of the proposal will be undertaken in accordance with the requirements specified within Chapter 7 of the NSW Industrial Noise Policy.

3. Proposed amendments to GTA

3.1 Amendment to Maximum Allowable Noise Contributions (Table 3 of the GTA)

Delta Electricity confirms that the current GTA's can be met (as per Table 2-3) and are guaranteed by the Preferred Tenderer where no low frequency correction is applicable.

Only in the event that a low frequency correction is applicable, Delta Electricity requests that the Preferred Tenderer's guaranteed noise levels with a low frequency correction (as per Table 2-4) be adopted.

This is summarised in Table 3-1 below.

Table 3-1: Requested amendments to maximum allowable noise contributions

| Receptor | Location | Maximum allowable noise contributions | |
|----------|----------------------------|---|--------------------------------------|
| | | without low frequency (existing GTA) | with low frequency (modified GTA) |
| P1 | Sunnylake Caravan Park | 35 | 40 |
| P2 | Macleay Drive | 41 | 45 |
| P3 | Woolana Avenue, Halekulani | 40 | 41 |
| P4 | Ulana Avenue, Budgewoi | 38 | 41 |
| P5 | Barega close, Buff Point | 35 | 39.5 |
| P6 | Barker Avenue, San Remo | 35 | 40 |
| P7 | Denman Street, Doyalson | 35 | 39.5 |

Notes to Table 3-1: All values presented a dB(A); L_{Aeq} levels presented.

3.2 Re-Wording of Clause 2.12 of GTA

Delta Electricity requests that Clause 2.12 be reworded as follows:

The Proponent shall design, construct, operate and maintain the project to ensure that the noise contributions from the project to the background acoustic environment do not exceed the maximum allowable noise contributions specified in Table 3, at those locations and during those periods indicated. The maximum allowable noise contributions apply under wind speeds up to 3ms^{-1} (measured at 10 metres above ground level), OR under temperature inversion conditions of up to $3^{\circ}\text{C}/100$ metres.

The proposed change in the wording is considered to be consistent with the requirements specified within Chapter 5 of the NSW Industrial Noise Policy.

4. Justification

PB considers that the proposed amendments to Clause 2.12 of the GTA can be justified on the basis of the following key conclusions:

- all tenderers have demonstrated compliance to the GTA with the requirements of Clause 2.12. However, compliance with Clause 2.13 (b) of the GTA was not achievable by any tenderer.
- in the event that the low frequency modifying correction factor as defined in the NSW Industrial Noise Policy is not applicable (i.e. no low frequency characteristic is measured), there would be no change to the current Maximum Allowable Noise Contributions contained within Table 3 of the GTA.
- the proposed adjusted Maximum Allowable Noise Contributions do not represent a significant increase in the current Maximum Allowable Noise Contributions (between 1 – 5 dB(A) only).
- the proposed adjusted Maximum Allowable Noise Contributions would be in close agreement with the assessment benchmarks (between ± 2 dB(A)). In all cases, the defined night-time Acceptable Noise Level recommended by the NSW Industrial Noise Policy was achieved within + 1 dB(A) of the recommended level.
- the proposed adjusted Maximum Allowable Noise Contributions with the low frequency correction (Table 4) represent best practice for commercially guaranteed limits.

The proposed change to the GTA in the event of low frequency characteristics have been recommended only after all reasonable economic and technically feasible noise control options have been considered.

Given the social worth of the development and the associated economic consequences of not proceeding, the requested amendment to the GTA noise limits in the event of a low frequency characteristic and suggested amendment to Clause 2.12 are considered consistent with the broad objectives and underpinning methodology of the NSW Government's Industrial Noise Policy.

Notwithstanding the above, the Preferred Tenderer has stated that the guaranteed noise levels are the best achievable in accordance with Best Available Technology Economically Achievable (BATEA) principles.

5. Concluding remarks

The proposed amendment to the Clause 2.12 and Clause 2.13 of the current GTA is considered a minor variation to the existing Minister's approval.

Where no low frequency noise characteristics are associated with site-related noise emissions, the current Maximum Allowable Noise Contributions (Table 3 of the GTA) would be maintained.

Where low frequency noise characteristics are associated with site-related noise emissions, however, the assessment presented in this report has demonstrated that no loss of local noise amenity or adverse noise intrusion will result following the adoption of the proposed Maximum Allowable Noise Contributions as per Table 2-4.

Further to the above, the proposed Maximum Allowable Noise Contributions (where low frequency noise characteristics are present) are generally consistent with the established assessment benchmark levels and are considered consistent with the objectives of the NSW Government's Industrial Noise Policy.

Post-commissioning validation measurements and regular environmental noise compliance monitoring will be carried out to ensure that the local ambient noise environs are maintained.

Appendix A

Background noise monitoring, noise catchments and nominated receiver point locations

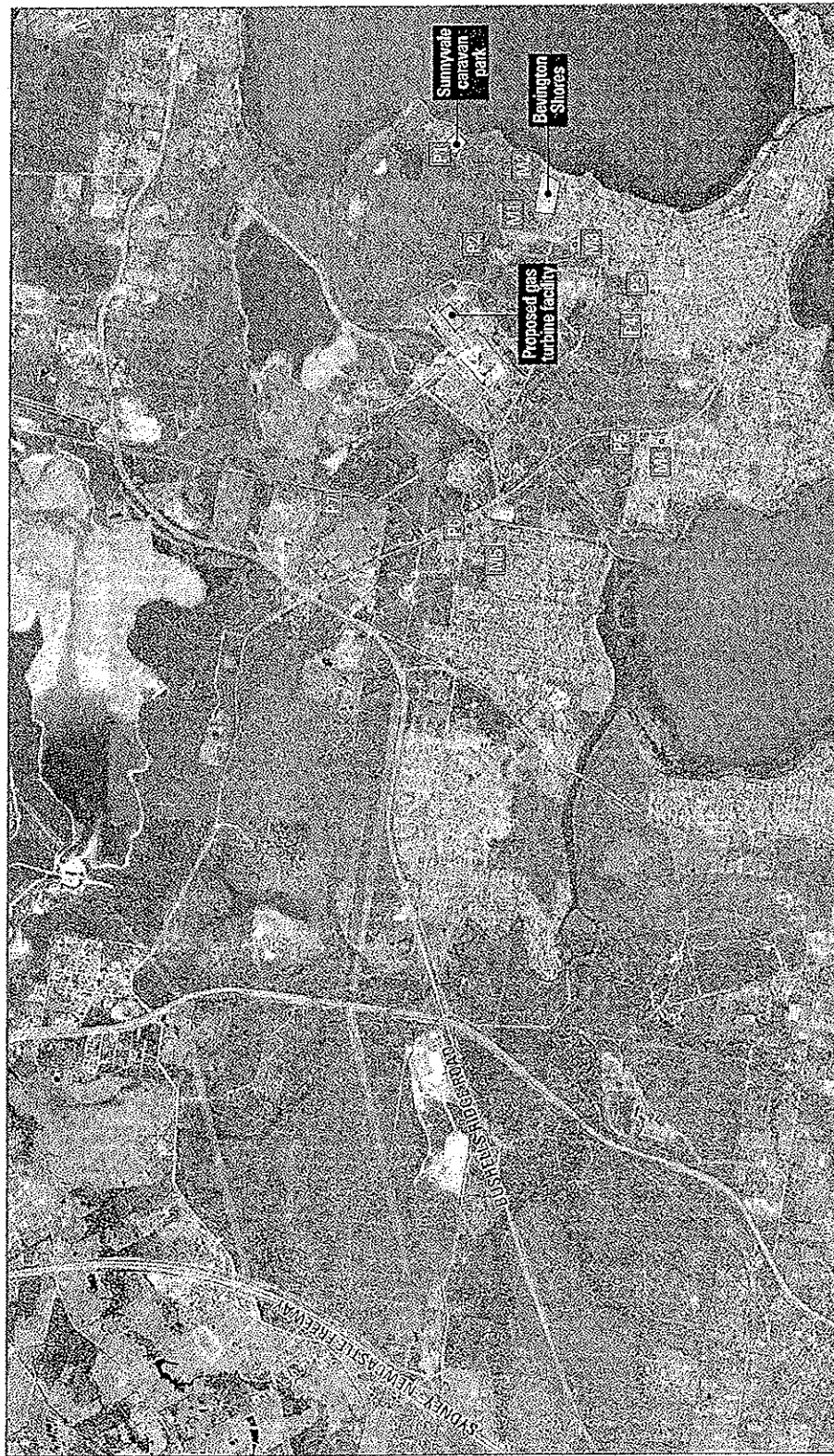
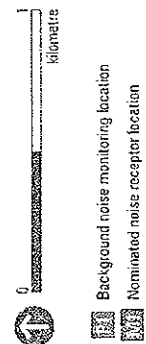


Figure 1 Background noise monitoring and nominated noise receptor locations



Appendix B

Overview of noise controls
proposed by the Preferred Tenderer

B1 Introduction

The Preferred Tenderer has provided feedback on the noise mitigation measures that will be considered during the detailed design of the facility.

The main noise source for the open cycle gas turbine power plant is the exhaust stack mouth, for which high standard acoustical damping measures has been proposed. The impact of all other noise sources is expected to be about 10 dB below the overall level required at the receptor points.

A summary of key identified options for mitigation of noise from the identified key site sources, and their anticipated acoustic benefit, is provided below. The Preferred Tenderer has stated that the proposed controls currently apply the limits of technical and economic reasonableness.

B2 Gas turbines/generator enclosure

The gas turbine units, including the generators, air intake manifolds and exhaust diffusers, will be designed with an acoustical enclosure for the project. The Preferred Tenderer has indicated that a project-specific low noise version enclosure will be used.

The standard enclosure for GT13E2 turbines is designed to reach a surface sound pressure level of 85 dB(A), with an enclosure of approximately 1,000 m² and a resultant expected sound power level of 115 dB(A). The low noise enclosure for the project will be designed with a expected sound power level of only 97 dB(A). Sandwich panels with inner absorption will be designed for all elements. Interfaces/openings of the ventilation will be equipped with silencers.

The Preferred Tenderer has stated that an expected noise source reduction of approximately 18 dB(A) may be achieved as a result of these control measures.

B3 Flue gas system – exhaust duct and elbow

For the exhaust duct, the standard design used for GT13E2 turbines is thermal insulation, which also serves as acoustical protection. This approach has historically resulted in a sound pressure level of 85 dB(A) at 1 m. The Preferred Tenderer has stated that an improved design and acoustic insulation in the exhaust duct will be adopted.

The components with the highest impact on far field noise would be the rectangular sections of the exhaust system at the elbow of the exhaust stack. The Preferred Tenderer's detailed design will include additional acoustical screens around the elbow as per Figure 1 below.

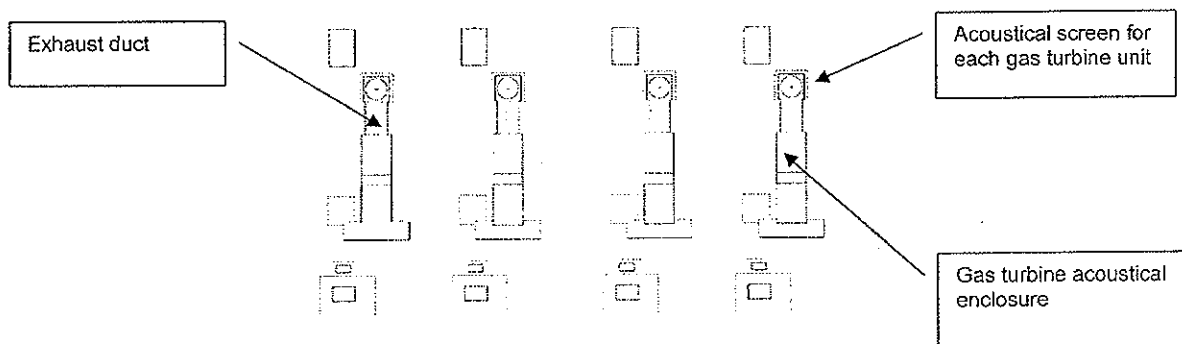


Figure 1: Schematic of gas turbine acoustical screens

B4 Flue gas system – stack

The stack mouth is the primary noise source at each of the nearest potentially effected receiver to the project.

For the stack body, upstream of the silencer, acoustical insulation will be included as opposed to traditional thermal insulation only. Within the exhaust system an exhaust silencer will be installed.

The Preferred Tenderer has stated that a standard GT13E2 exhaust silencer achieves a sound power level at the stack mouth of 112 dB(A). The acoustic grade of the exhaust system designed for the project is expected to achieve a sound power level at the stack mouth of 96 dB(A). The Preferred Tenderer has stated that this is the best achievable noise level in the market for open cycle combustion turbines in power generation applications.

The Preferred Tenderer has stated that a noise source reduction of approximately 16 dB(A) is expected to be achieved with this control measure.

The silencer will dampen noise generated by the gas turbine compressor and combustor and the noise emission will be dominated by flow noise, which cannot be avoided during operation of the gas turbine.

The Preferred Tenderer has stated that the design of the GT13E2 exhaust system will be 'state of the art' from an acoustical perspective.

B5 Air inlet system – air intake cross section

The proposed air intake system will be equipped with multi-stage noise attenuation, rather than, the standard design used for GT13E2 turbines, which comprises, a single-stage silencer only. As with the exhaust system, the flow noise becomes the dominating component. The typical combustion turbine compressor noise (blade passing frequency) will be attenuated by the silencer / air-inlet filter design. Another noise source for the air intake system is the anti-icing equipment, for which anti-icing nozzles are installed with integrated silencers. The velocity from the anti-icing nozzles would be at the lower limit of the noise generated by the air intake system.

For the air intake duct, multi-layer insulation will be used. Design of the system will minimise structure-born noise passing from the internal to the external surfaces.

B6 GT coolers

The Preferred Tenderer has stated that the sound power level of the GT cooler is expected sound power level of 95 dB(A) per GT unit. The GT13E2 standard design for this component is a expected sound power level of 107 dB(A). The low noise cooler proposed represents the quietest cooler available on the market.

The Preferred Tenderer has stated that a noise source reduction of approximately 12 dB(A) is expected to be achieved with this control measure.

B7 Closed cooling water pumps

The closed cooling water pumps will be of a low noise type or alternatively designed with acoustical enclosures. The Preferred Tenderer proposes to provide a design with a expected sound power level of 84 dB(A).

B8 Transformers

A standard transformer for the proposed gas turbine has a sound power level of approximately 104 dB(A). For the transformers proposed for this project, The Preferred Tenderer proposes to provide a design with a expected sound power level of 96 dB(A). Lower values are not possible based on the nature of the noise source. In addition, The Preferred Tenderer will include acoustical screens to be installed in three directions as per Figure 2 below.

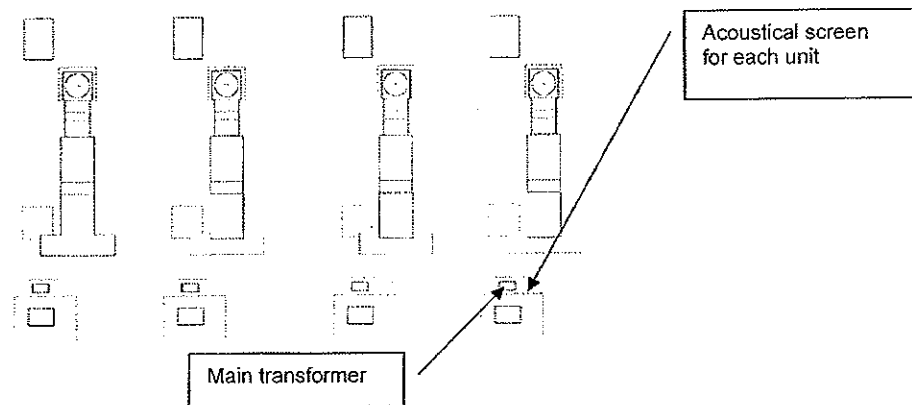


Figure 2: Schematic of transformer acoustical screens

The Preferred Tenderer has stated that a noise source reduction of approximately 8 dB(A) is expected to be achieved as a result of this control measure.

B9 Clarification Note

This information has been provided by the Preferred Tenderer to assist Delta Electricity's understanding of how the Preferred Tenderer expects to meet the guaranteed noise levels. For the avoidance of doubt, the noise guarantees are limited to those stipulated in the contract. The details provided herein are for information only and cannot be considered as guarantees.