Department of Planning

Buronga Power Plant Project

Review of Electrical System and Greenhouse Gas Issues

ARUP

Department of Planning

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Arup
Arup Pty Ltd ABN 18 000 966 165

Arup
Level 10 201 Kent Street, Sydney NSW 2000
Tel +61 2 9320 9320 Fax +61 2 9320 9321
www.arup.com

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1 Introduction

An Environmental Assessment was submitted under Part 3a of the Environmental Planning and Assessment Act 1979 by International Power (Australia) Pty Ltd in August 2008, for a distillate fired peaking power plant at Buronga in south-western New South Wales. The project is currently being assessed by the Department of Planning (the Department). The associated submissions report was provided to the Department in November 2009.

The Department is currently assessing the proposal and to assist in the assessment, requested specific independent technical advice from Arup in terms of two key issues:

- Justification of the project in terms of electrical system needs
- Greenhouse gas emissions.

These key issues are evaluated in the following sections.

2 Electrical System Review

2.1 Background

2.1.1 Environmental Assessment

The project need and justification of the proposed Buronga Peaking Power plant was provided as part of the original Environmental Assessment (EA) by URS on behalf of the International Power (Australia) Pty Ltd (IPRA).

The following section is included in the Project Need and Justification chapter of the Environmental Assessment:

"In contrast to a base load plant which runs most of the time to meet "core" electricity demand, peaking plants start and run only at times of very high demand or when there are system problems such as a base load generator suddenly tripping off or a transmission line failure.

Consequently, peaking plants generally run only over short periods of time on any one day and for a relatively small proportion of time on an annual basis with a focus on high demand periods during winter and summer on a seasonal basis.

Peaking power plants improve the reliability and maintain the quality of electricity supply during peak periods. They also improve the security of supply, due to a faster start-up time, should a transmission system emergency (instability or shutdown) occur."

IPRA identified the following main points in the Project Needs & Justification section of the EA:

- *NSW is a net importer of electricity reliant, in summer peak demand periods, on hydro-generation … and excess generation capacity in Victoria*
- *annual NSW peak demand growth of 2.1 - 3.2% (summer) and 1.4 - 2.7% (winter)*
- *there is insufficient generation capability to meet peak load demand growth over the near and longer term*
- *TransGrid … identified high voltage constraint scenarios on its transmission system and on regional NSW interstate connectors*

The major benefits of constructing the Power Plant at the proposed Buronga site identified by IPRA include:

- *NEM and NEMMCO support at times of high inter-regional demand and/or constraints;*
- *Transmission network support to ensure reliability and quality of electricity supply;*
- *Security of local electricity supply at times of system (planned or accidental) shut-down;*
- *Significant mitigation of growing peak electricity demand within NSW; and*
- *Significant regional reinforcement in the event of extensive transmission system problems.*

The validity of the above statements is discussed in the Evaluation section of this report.

The Environmental Assessment also provided a summary of possible alternatives and concluded that the only viable alternative was the construction of an equivalent natural gas fuelled power plant at close proximity to existing sources of natural gas. This would place the proposed plant at either the Sydney to Moomba gas pipeline some 400km from Buronga or at Angaston the nearest source of natural gas some 325 km from Buronga. Both of these options would require the construction of a new transmission line to Buronga. Once

transmission losses from were taken into account the relative difference between the greenhouse gas intensity of a natural gas fired turbine at Angaston and a distillate fired turbine at Buronga, was found to be small (less than 5%).

2.1.2 Response from TransGrid

TransGrid provided a letter response to DoP dated 30 October 2008 stating that in their opinion the power plant was *not essential to the continued reliable operation of the transmission network in this area*. TransGrid noted that the power station *could be of assistance should there be extensive transmission network problems…as well as in the day to day functioning of the National Electricity Market (such as through supporting power flows to South Australia via Murraylink).* However, in TransGrid's opinion, the principal purpose of the plant would be to provide market-based peak load generation, which would be dispatched via the NEMMCO bidding/scheduling process.

2.1.3 Response from Department of Planning

The TransGrid letter response to DoP dated 30 October 2008, raised concern about the need for the plant from a regional demand perspective. While in principle DoP would have no objection to a project justified purely on economic grounds, it commented *"there is no critical need for the project to be located as proposed on the grounds of ensuring network reliability and security in south western NSW."*

The conclusion, amongst others, reached by the Department of Planning was that *"the project should be refused on the grounds of an absence of project justification/need and an unacceptable greenhouse gas impact…the marginal benefits of the project do not outweigh these negative aspects."*

2.1.4 Response from IPRA

Following receipt of the Department of Planning concerns, IPRA responded to the DoP on 27 March 2009. The major topics covered by the response were the Project Need & Justification, and the Greenhouse Gas Impacts. The Greenhouse Gas Impacts are dealt with in section 3 of this report.

The following are selected comments in the IPRA response which are appraised in the evaluation section of this report:

- *coincident summer peak demands and unstable generation or transmission system conditions across the interconnected regions leaves NSW exposed to having insufficient reserve capacity*
- *IPRA contends - as stated in its EA and supported by the market data - that there is a need for fast response peaking capacity at several locations in NSW. As far as IPRA is aware, none of the other proponents' proposals presently approved and under consideration by DOP is for this fast response type of plant.*
- *…it might be inferred that the DOP views NSW's participation in the NEM as being an issue outside the purview of criteria to be considered for generation projects proposed within NSW. IPRA suggests that such a view overlooks the fact that NSW is reliant upon imported energy Imported energy sustains NSW at many times of peak demand, unstable generation or unstable transmission system conditions across the interconnected regions. Even the Wentworth/Buronga area is supplied from Victoria. Therefore such a view would seem somewhat incongruous with the DOP having a vital interest in supporting generation being embedded within NSW.*
- *IPRA has never stated that Buronga would be exclusively focused on providing power to NSW as, within the NEM, no generator can make such a claim. Rather, any generator is subject to the despatch and overall management of NEMMCO within the interconnected market.*
- *IPRA contends that the TransGrid advice needs to be considered in the broader context of transmission and generation system operation in an "extraordinary"*

environment and the realities of energy flows within the interconnected market regions.

2.2 Evaluation

The National Electricity Rules state that:

> *"all Registered Participants should have the opportunity to form a connection to a network and have access to the network services provided by the networks forming part of the national grid."*

The National Electricity Grid generally operates based on an open-access arrangement. Should a generator satisfy all technical obligations outlined in the National Electricity Rules and by the responsible TNSP (Transmission Network Service Provider), in this case TransGrid, they are permitted to connect to the national grid.

2.2.1 NSW Peak Electricity Demand Support

The latest Statement of Opportunities released by NEMMCO (2008) indicates a projected average annual growth rate of 2.3% for the NSW 10-year Summer Peak Demand Growth. The same report also projects a shortfall in generation capacity reserve in NSW of 283MW in 2014/2015. Both of the aforementioned figures are noted by IPRA in their Response letter. However, it is not clear how the growth in Summer Peak Demand will be impacted by other government policies such as Renewable Energy Targets, Demand Side Management, and the Carbon Pollution Reduction Scheme.

Hence to ensure continuation of electricity supply within NSW from 2014/2015 onwards, additional generation capacity will need to be installed. As the summer peak demand occurs for a relatively small period of time, this demand will typically met by Peaking Plants, such as the one proposed by IPRA at Buronga.

Due to the nature of peak demand, generators supplying the peak load will typically need to start and ramp up/down on relatively short notice. IPRA note in their response that of the 7767MW of generation in NSW subject to approval/approved, only 3% has a fast response time (<30mins). Arup agrees with IPRA's assertion that wind power (comprising 38% of approved/subject to approval generation projects in NSW) is unreliable for the purposes of mitigating the effects of summer peak electricity demand.

The DoP stated in their assessment that *"Additional generation is preferable at the major load growth centres…, and the proposed location of the Buronga project means that transmission losses would result with little, if any, generation benefit at these load centres."* The electricity generated by a plant located in south western NSW would, in normal operation, support local load before benefiting loads in other far away areas. This would remove the burden of this local load from the greater NSW generation pool, reducing the amount of power required to be delivered to south western NSW, and the associated transmission losses. For example, the ~50MW (figure provided by TransGrid 28/4/2009) currently supplied to Broken Hill would be fed from the Buronga generator, removing all associated transmission losses to get the 50MW to the Buronga Terminal Station before on forwarding to Broken Hill. This outcome eliminates the transmission losses in transporting power from a conventional generator located in the east of the state.

Arup agrees with TransGrid's opinion the principal purpose of the plant would be to provide market-based peak load generation, which would be dispatched via the NEMMCO bidding/scheduling process.

Arup also notes IPRA's response to TransGrid's statement that *"such a power station could be of assistance should there be extensive transmission network problems (beyond those considered by TransGrid when planning and developing its transmission system)."*

IPRA make the following point – *"the Buronga project has been proposed to cater for precisely those occasions when there are extensive network or interconnected NEM*

problems. That is why its projected operational regime is cited as being between 5% and 10% pa" An example of 'interconnected NEM problems' is the recent Victorian Bushfires.

TransGrid's above comment (when read in conjunction with the comment *"it is not essential to the continued reliable operation of the transmission network in the area"*) can simply be interpreted as 'we do not need it for transmission network purposes, but that's not to say it wouldn't be useful'.

Additional Peak generation will be required in NSW in the near to medium future. The proposed Buronga Distillate Power Plant is a suitable type of generation for this purpose.

2.2.2 NEM Inter-regional Support

The national electricity grid is an interconnected electricity grid covering the Australian Capital Territory and the states of Queensland, New South Wales, Victoria, Tasmania and South Australia.

Decisions made by the Department of Planning should take into consideration the impacts and benefits that any proposed power plant would have on the national grid, including regions/states other than NSW.

The location at Buronga is one of three interconnection points between NSW and Victoria. A 220kV transmission line connects across the border to a terminal station at Red Cliffs, Victoria. The Red Cliffs Terminal Station connects into the Victorian part of the national grid, and into South Australia via the Murraylink Interconnector. As such, either Buronga Terminal Station or Red Cliffs Terminal Station is a suitable location to site a plant to support loads in the three states, as well as the local area.

The following table shows the predicted generation shortfalls for the regions nearest to the Buronga site, and the overall forecast shortfall for the NEM.

Region	**Year Additional Generation Required**	**Reserve Generation Capacity Deficit**
NSW	2014/2015	283 MW
Victoria/SA	2008/2009	168 MW
Queensland	2013/2014	267 MW
Tasmania	2010/2011	8 MW
National	**2013/2014**	**~650 MW**

All figures from NEMMCO Statement of Opportunities 2008

It can be seen from the table above that each region of the NEM is forecast to experience a reserve deficit (additional capacity required to meet the minimum reserve level in each region) within the next 5 years. N.B. this deficit could be exacerbated by possible early retirement of coal fired power plants, particularly in Victoria, due to the introduction of the CPRS.

The assistance that a plant at Buronga could offer the NEM and other states is highlighted in TransGrid's letter – "…*such a power station could be of assistance … in the day to day functioning of the National Electricity Market (such as through supporting power flows to South Australia via Murraylink)"*

Arup have contacted VENCorp (Victorian Energy Networks Corporation – operator of the Victorian section of the electricity grid), in order to establish their position on the proposed plant and network need. Margarida Pimentel (Manager – Connection & Procurement) of VENCorp indicated "VENCorp monitors the impact of all transmission network constraints and will initiate an augmentation to relieve a constraint where this passes the Regulatory Test. Constraints on Victorian import associated with high demand in south west NSW do

not presently justify network augmentation." No comment was made on any possible benefits or detriments the proposed plant may have on the Victorian network.

Arup also spoke to David Bones, a planner for NEMMCO, to understand NEMMCO's position on the proposed plant. They noted that their involvement commences once an 'Application to Connect' has been made. At the planning stage, their involvement is typically limited to the negotiation of performance standards to ensure the requirements of Chapter 5 of the National Electricity Rules are met. Once a plant is registered and connected to the NEM, the size, type, and location of the plant will be factored into NEMMCO's scheduling of generation of that plant. The plant will then also be considered when NEMMCO revises their annual Statement Of Opportunities. Any generation and/or ancillary services that the plant can provide become part of the National Electricity Market and this generation/service will be traded according to market rules and needs.

Clearly, from IPRA's perspective, the provision of a power station at Buronga is a response to NEMMCO's Statement of Opportunities, and the advice from NEMMCO confirms that the power station would be utilised by the NEM, once all connection obligations had been satisfied. The relative benefits of the power station's existence are not considered by NEMMCO, where market forces and bidding arrangements dictate dispatch outcomes.

Additional Peak generation will be required in the National Grid in the near to medium future. The proposed Buronga Distillate Power Plant is a suitable type of generation for this purpose, and would be utilised by NEMMCO if available.

2.2.3 Transmission Line Augmentation Works

Arup had a discussion with Gordon Burbidge (Acting Manager/Network Planning) of TransGrid regarding the proposed Buronga plant on 28 April 2009. Mr Burbidge was the author of TransGrid's letter response to the Department of Planning, dated 30 October 2008. TransGrid has no technical objections to the proposed generation plant at Buronga, provided it meets the required technical access standards. TransGrid did emphasise that the proposed plant should not jeopardise the operation of the transmission network, and should not contribute unacceptable levels of harmonic resonance to the transmission network. TransGrid also commented that any proposed plant should be compatible with the existing transmission network, taking into account the transmission line capacity limits. TransGrid reiterated that there was no urgent need for new generation in the Buronga area. As noted in section 2.2.2, initial discussions with VENCorp have not identified any discrepancy with TransGrid's position.

A key objective of the Buronga Plant proposal is to provide significant regional reinforcement in the event of extensive transmission system problems. It should therefore be noted that an upgrade of the transmission line from Darlington to Buronga has been identified by TransGrid as a potential project to resolve a "*problem associated with transmission losses and power flows between NSW and Victoria*" and could in principle reduce the likelihood of extensive transmission network problems. The project involves upgrade of the current 220 kV system to 275 kV through the use of new transformers at Darlington Point and Buronga, new shunt reactors, new switchgear and minor works. The project was included in TransGrid's 2009–2014 revenue proposal submitted to the Australian Electricity Regulator (AER).

In their revenue proposal, TransGrid proposed that the upgrade is to be undertaken as a "contingent project". Under the National Electricity Law (NEL) and the National Electricity Rules (NER), contingent projects require that a trigger event which is reasonably specific or capable of verification is identified. Contingent revenue can then be assigned to the project when or if the trigger event occurs. In their response to DoP, IPRA quotes the independent review of the TransGrid revenue proposal undertaken by Parsons Brinckerhoff in 2008, which specifically states that no trigger event had been identified as indicated by the following quote " *does not meet the requirements of the NER in that it is not reasonably specific or capable of objective verification*". (IPRA, 2009) However, although available at

the time the IPRA response was prepared, there was no mention that subsequent information had been provided by TransGrid to the AER and that a draft decision had been made with respect to the project. In October 2008, the draft decision was released stating that the project was to be allocated $51 million as a contingent project with the trigger event (deemed to be reasonably specific and capable of objective verification) being: *"the NSW Government directing TransGrid to upgrade these transmission lines to improve its greenhouse gas emissions"* (AER, 2008)

This review has not established whether the transmission line upgrade will eliminate the network shortcomings indentified by IPRA justifying the Buronga project. Secondly, it is unlikely that building the Buronga Plant would obviate the need for the Darlington Point to Buronga Transmission line upgrade. As previously stated, the trigger for this project is the NSW Government directing TransGrid to upgrade these transmission lines to improve its greenhouse gas emissions. While the transmission line upgrade would increase capacity to/from the region, the stated trigger event may occur, regardless of any works undertaken in Buronga.

Power generation in the Buronga area may defer some expenditure to upgrade the Darlington Point to Buronga transmission line; however the stated trigger event for this upgrade is independent of local generation construction.

2.2.4 Network Ancillary Services Support

Arup agrees that the proposed Buronga plant could provide system Ancillary Services support opportunities.

IPRA makes the following point in their response to the DoP:
"TransGrid has not in this advice (nor in previous discussions with IPRA) ruled out entering into commercial arrangements for the provision of Ancillary Services for voltage and/or frequency control. Albeit now somewhat dated, the last direct comment made to IPRA in this regard was "... come and talk to us if you build these peaking stations." "

However, it should be noted that no comment that these services are required, nor any commitment to use them, has been made by TransGrid, nor NEMMCO.

The proposed Buronga plant could provide system Ancillary Services support opportunities, however these are not required at this point in time.

2.2.5 Summary

Overall, it is apparent that there is no substantive technical reason to support or reject the proposed Buronga Power Station. The introduction of new generation capacity at Buronga has potential to positively support the operation of the NEM at times of transmission network stress, however, this is not expected to be the case for most operational periods.

This conclusion is supported by IPRA in indicating that the proposed Buronga Plant would only operate for 5-10% of the year, in support of either peak-load conditions or transmission network instability.

Both of these circumstances are dictated by events elsewhere which have nothing to do with the plant itself (i.e. circumstances such as a summer heatwave, bushfires, or generator failure elsewhere).

It is IPRA's assessment from their own modelling that the likelihood of these 'extreme' events is sufficient for IPRA to invest in a new peak load generator. This response to the NEMMCO Statement of Opportunities is fulfilling the intent for producing the Statement of Opportunities. The risk of achieving adequate operation time for the plant to be economically viable is all with IPRA.

From a technical perspective, provided the proposed plant satisfies the NER and TransGrid connection requirements, there is no reason to object to the proposal.

3 Greenhouse gas review

3.1 Background

3.1.1 Environmental Assessment

A greenhouse gas assessment was prepared as part of the original Environmental Assessment (EA) by URS on behalf of the International Power (Australia) Pty Ltd (IPRA) and included as Appendix A to the Air quality Impact Assessment for Proposed Buronga Peaking Power Plant (URS, 2008). The greenhouse gas assessment was nominated as a key assessment requirements in the Director Generals' requirements for the assessment, specifically that

> "*The Environmental Assessment must include a comprehensive greenhouse gas assessment, incorporating a quantitative model showing the tonnages of greenhouse gas produced (tCO_2-e) both directly and indirectly from the project as tonnes per unit of production basis. These tonnages must be compared against best practice emissions for the activity and alternative electricity generation technologies and fuels. Annual tonnages must also be compared against the total annual NSW emissions to demonstrate the impact of the proposal on NSW emission targets. If a greenhouse gas offset is proposed, full detail of this offset(s) must be included. The assessment must also include an evaluation of the feasibility of measures proposed to reduce emissions with assessment provided regarding the effectiveness and reliability of each measure*."

The greenhouse gas assessment included an analysis of emissions from the 150 MW power plant for the 'typical' and theoretical maximum operation of the facility. The analysis included direct emissions (Scope 1) from combustion of the distillate on site and indirect emissions (Scope 3) from the upstream extraction production and transportation of the fuel in accordance using emission factors published in the National Greenhouse Accounting (NGA) Factors. The yearly emissions for the theoretical maximum scenario were then compared to the total emissions for NSW and the NSW stationary energy sector representing 0.02 and 0.04% of current emissions respectively. The assessment also provided an assessment of the emission intensity of the plant expressed as greenhouse gas emissions per unit of electricity sent out for both the theoretical maximum and typical scenario

The assessment also provided a summary of viable alternatives and concluded that the only viable alternative was the construction of an equivalent natural gas fuelled power plant at existing sources of natural gas. These would be either the Sydney to Moomba gas pipeline some 400km from the Buronga or at Angaston the nearest source of natural gas some 325 km from Buronga with both options requiring the constructions of a new transmission line to Buronga. Once transmission losses from were taken into account the relative difference between the greenhouse gas intensity of the two options was found to be small (less than 5%).

3.1.2 Response from DECC

Following exhibition of the EA, the NSW Department of Environment and Climate Change provided a formal response to the Department of Planning (DECC, 2008). Specific to the greenhouse gas assessment, DECC's position was essentially that comparison to the NSW emission inventory was not relevant and that the critical factor was whether the plant represents "best practice emissions for the activity and alternative electricity generation technologies and fuels". DECC acknowledged that two viable options to provide network support for the South West of NSW were presented in the EA that is:

- the plant as proposed; and
- a natural gas fired power plant at the nearest available location (Angaston) with a transmission upgrade.

DECC were satisfied that the relative difference in emission intensity per unit of electricity delivered to Buronga between these two options was small. DECC therefore concluded that the greenhouse gas impact of the proposed plant was acceptable.

A further response was provided to DoP by DECC in an email from Joe Woodward on 30 January 2009, addressing whether the project could be declined on greenhouse grounds or made conditional on the purchase of offsets. DECC's response hinged on the Commonwealth Government's proposed Carbon Pollution Reduction Scheme (CPRS) for which the enabling legislation is yet to pass through the Senate. Once implemented the Scheme will cover the majority of emissions in NSW (including any emissions from the proposed power plant) such that nominated reduction targets are achieved on a national level through a market based mechanism. DECC concluded that "*whilst the CPRS cannot currently legally be taken into consideration, if it is accepted that the CPRS will commence in 2010 and that the targets are credible, then there is no reason on greenhouse grounds to decline the consent*. DECC also commented that "*intervention* [with the CPRS by State regulation] *will theoretically work against the likelihood of achieving a least-cost outcome unless a separate market failure exists*".

3.1.3 Response from TransGrid

TransGrid also provided a letter response to DoP dated 30 October 2008 stating that in their opinion the power plant was *not essential to the continued reliable operation of the transmission network in this area*. TransGrid noted that the power station *could be of assistance should there be extensive transmission network problems network problems (beyond those considered by Transgrid when planning and developing its transmission system*). However, in TransGrid's opinion the principal purpose of the plant would be to provide market-based generation.

3.1.4 Response from Department of Planning

The TransGrid letter response to DoP dated 30 October 2008, raised concern about the need for the plant from a regional demand perspective. While in principle DoP would have no objection to a project justified purely on economic grounds, the TransGrid response raised concern that if the plant was not required to maintain reliable level of service and if the environmental impacts of the plant were deemed to be significant then the approval should not be granted in accordance with the objectives of the *NSW Environmental Planning and Assessment Act,* 1979. The key environmental impact of the project in this regard was taken to be the greenhouse gas emissions, specifically that the project would result in an increase in the emission intensity of grid electricity in NSW and would therefore be inconsistent with the State Plan. In an email dated 9 March 2009, DoP provided IPRA with an opportunity to further comment with respect to these concerns specifically as to "*whether the project is fundamentally necessary and justified on the grounds of electricity supply such as to justify its development at a location which would necessitate the utilisation of a fuel source (i.e. distillate) that would promote the generation of higher than average greenhouse gas emissions within the NSW energy sector*". DoP nominated the NSW Category B Generator Pool Coefficient 2008 calculated for the purposes of administration of the NSW Greenhouse Gas Abatement Scheme (GGAS) as the appropriate value to represent average greenhouse emission intensity of the electricity generated in NSW.

With regard to the role of the planning system in assessing greenhouse gases in the context of the CPRS as raised by DECC, DoP further stated that even if it is accepted that the CPRS is implemented, it should still be questioned '*whether it is justifiable to allow a greenhouse gas impact to be introduced in the first place, regardless of whether it could be regulated and offset through a separate mechanism*".

3.1.5 Response from IPRA

Following receipt of the Department of Planning concerns, URS on behalf of IPRA, revised its greenhouse gas assessment specifically to provide comparison with the NSW Category B Generator pool coefficient (URS 2009). URS noted that it is inappropriate to compare the

pool coefficient with the greenhouse gas intensity values calculated in the original assessment due to methodological differences. In its revised assessment, URS recalculated the greenhouse gas intensity for both the typical and theoretical maximum scenarios in accordance with the Greenhouse Gas Benchmark Compliances Rules and Generation Rules and found the emission intensity for both scenarios to be lower than the pool co-efficient.

URS further commented that the NSW Annual pool value is a more appropriate parameter for comparison as a measure of whether a generator will cause the emissions intensity of the state's emission intensity to worsen or improve. This is because the coefficient is a rolling average of five year of annual pool values with the annual pool values representing the emission intensity of NSW Category B Generators in any given year. The rolling average is used in the administration of the GGAS Scheme to reduce price volatility due to the yearly fluctuations of the average emission intensity of the NSW grid.

URS found that the emission intensity of the proposed plant is lower than both the most recent pool coefficient (2008) and annual pool value (2007) and therefore concluded that "*had the proposed power station been operational during this year, it would have acted to reduce the annual pool value and subsequently the pool coefficient*".

3.2 Approach

For the purposes of this review it is assumed that the plant is justified at the proposed locations for the purposes stated by IPRA specifically:

- to provide peak power generation fro the National Electricity Market; and
- to provide regional network support for the South West of NSW.

Considering the above, the scope of the greenhouse gas review is limited to the following issues:

- the technical adequacy and completeness of the Proponent's greenhouse gas assessment by consideration of:
    - the calculation methodology for greenhouse gas emissions;
    - the scope of greenhouse gas emissions included in the assessment;
- the acceptability of the project's greenhouse gas impacts in the context of relevant Government policy and best practice standards by consideration of:
    - whether the plant as proposed represents "best practice emissions for the activity and alternative electricity generation technologies and fuels";
    - the project's impact on the emission intensity of electricity generation in NSW; and
    - relevant Government policy including the Carbon Pollution Reduction Scheme.

The evaluation of these issues is presented in Section 3.3 below.

3.3 Evaluation

3.3.1 Calculation Methodology

Greenhouse gas emissions were calculated in terms of direct emissions from combustion of distillate (Scope 1) and upstream emissions (Scope 3) from extraction, production and transportation of fuels. For the original assessment, emissions were calculated using methods and factors provided in the NGA workbook. The workbook provides default emission factors for combustion of fossil fuels where real emissions data is not available. This methodology is considered appropriate for comparison between technologies and for comparison with state wide emission inventory.

For the revised greenhouse assessment, the calculation methodology was varied to allow for comparison with the benchmarks published under the NSW Greenhouse Gas Abatement Scheme. This resulted in a reduced emission intensity compared to the original assessment due to the incorporation of a transmission scaling factor and consideration of Scope 1 emissions only. This is considered an appropriate methodology for comparison with the NSW pool coefficient and Annual pool values.

The calculation methodologies adopted in both assessments are technically adequate and considered suitable for the stated purposes.

3.3.2 Scope of Emissions

The emissions included in the original and revised greenhouse gas assessments cover both the direct emissions occurring from combustion of the distillate at the plant (Scope 1) and the emissions from the extraction, production and transportation of the fuel (Scope 3). This is considered appropriate and enables a comparison between different technologies and fuel types based on full fuel cycle emissions. However the Scope 3 factors used in the assessment represent an average value for extraction, production and transportation of diesel fuel and do not take into account the higher than average emissions likely to be associated with transportation of the fuel over large distances to the plant site. This concern over emissions associated with large trucking distances was also raised by the Department of Planning during the meeting held with Arup.

The original environmental assessment states that the fuel will be sourced "locally". However, the ultimate source of the fuel will likely be the nearest refinery (Exxon Mobil Refinery Altona or Shell Refinery Geelong) in excess of 500km from the site. Arup has estimated the emissions from transportation of this fuel over this distance to be approximately 22 to tCO_2-e per year for the typical scenario and 97 to tCO_2-e per year for the theoretical maximum scenario[1]. This represents approximately 0.1% of the total emissions and is therefore not considered significant. The exclusion of project specific Scope 3 transport emissions is therefore considered immaterial omission to the results and assessment conclusion.

The scope of emissions included in the assessment is considered technically adequate and complete for the stated purposes

3.3.3 Emission Scenarios

Both the original environmental assessment and the revised greenhouse gas assessment provide an analysis of total emissions and emission intensity for:

- a 'theoretical maximum' scenario resulting from running each turbine at full load, at all times during the licensed 10% of the year; and
- a "typical" scenario where each turbine is operational for around 3% of the year, and operates at a range of loads2

The turbines operate at greatest fuel efficiency at full load meaning that emission intensity is lowest at the theoretical maximum and increases as load decreases under the range of loads in the typical scenario. The typical scenario therefore represents the worst case scenario for comparison of emission intensities (albeit not necessarily so for total emissions).

It should be noted that the typical scenario represents just one possible load profile for the plant which in practice would fluctuate depending on market demand for peak power. No detailed information is provided about the assumed load profile for the typical scenario and therefore the emissions intensity can be considered as indicative only. While this is not

[1] Based on an emission intensity of 60.2 g per tonne-km (DCC, 2005)
[2] The assessment states that this is based on "IPRA's South Australian peaking plant experience and assessment of the NSW 2006 and 2007 peak demand going forward"

relevant for the comparative analysis between technologies adopting the same load profile, it becomes relevant for comparison against a set benchmark such as the pool coefficient. Some sensitivity analyses around these values would have assisted in quantifying the uncertainty.

The emission intensity for the "typical" scenario has a high degree of uncertainty and is likely to be indicative only of the average emission intensity of the plant and under different load profiles, the emission intensity may actually be worse than the typical.

The original greenhouse gas assessment acknowledges the uncertainty stating that "*The impact of the proposal on this target* [the NSW greenhouse gas reduction target] *is difficult to depict with confidence given the uncertainties in operating duty and operating load.*"

3.3.4 Best practice emissions

The original greenhouse gas assessment included a comparative analysis of the proposed plant to meet the Director General's Requirement to demonstrate "*best practice emissions for the activity and alternative electricity generation technologies and fuels*". The comparative assessment accordingly identified a range of alternative energy generation technologies and fuels and assessed each of these for their ability to meet the project needs (i.e. supply rapid deployment of power during peak periods and transmission network support). A review of this analysis is presented below.

Natural gas turbine located 400km from the proposed site

The analysis of alternatives concluded that the only commercially viable alternative is a natural gas plant located some 400km away at the closest point of the Sydney to Moomba gas pipeline. This alternative would also require the construction of a new transmission line to Buronga which is outside of the control of the proponent and therefore represents a hypothetical alternative only. The analysis suggests that when transmission losses are taken into account the relative difference between the emission intensity of the distillate and gas plants is not material.

This would likely hold true for power delivered to Buronga in extraordinary circumstances. However, the purpose of the plant is not only to deliver power to Buronga in extraordinary circumstances, but also to provide peak power generation for the National Electricity Market. Either plant (a distillate plant in Buronga or a natural gas plant 400km away) could dispatch peak power to any location within the grid. Therefore, significant transmission losses are likely to be associated with both options. The greenhouse gas assessment assigns transmission losses to the gas plant only and assumes that the transmission losses from the Buronga plant will be negligible. This may not represent a fair comparison as transmission losses will occur for the Buronga plant for peak power supplied to the grid which is not consumed in Buronga. When transmission losses are taken into account the relative difference between the emission intensity of the plants would likely be greater than stated in the greenhouse gas assessment.

The difference in emission intensities during operation between the hypothetical gas fuelled and distillate fuelled plants is likely to have been understated by the greenhouse gas assessment when transmission losses for both plants are fully factored in.

Alternative Technologies

Analysis of other technologies was included in the original environmental assessment. Renewable technologies including solar and wind were dismissed. The reasons given were due to the potential 24 hour requirement for peak power and network support and that wind and solar output is affected by adverse (inclement, overcast or dust) weather conditions. Whilst it is accepted that neither solar or wind are currently able to provide 24 hour network support, it should be noted that the maximum solar power plant output occurs during hot sunny days which often coincide with high electricity demand on the grid for air conditioning

systems. A solar plant is currently proposed for Mildura (some 2 km from Buronga) to provide this very support.

Energy storage technologies are also developing such that in the future solar energy will likely be able to be stored and dispatched to grid as required as a rapid deploying peaking power plant. The first commercial application of the molten salt storage system is proposed for a 15MW solar thermal power plant in Spain known as Solar Tres.

Other Fuels

Similarly other fuels, with lower greenhouse emissions were also dismissed due to their unproven or unknown properties for use in a peaking power plant of the capacity proposed.

It is not proposed by Arup, that renewable technologies or fuels can or cannot currently meet the project objectives. However, alternative technologies may have been too readily dismissed by the assessment without consideration of recent developments in this field.

Transmission system upgrade

A key objective of the proposal is to provide significant regional reinforcement in the event of extensive transmission system problems. It should therefore be noted that an upgrade of the transmission line from Darlington to Buronga has been identified by TransGrid as a potential project to resolve a "*problem associated with transmission losses and power flows between NSW and Victoria*" and could in principle reduce the likelihood of extensive transmission network problems. The project involves upgrade of the current 220 kV system to 275 kV through the use of new transformers at Darlington Point and Buronga, new shunt reactors, new switchgear and minor works. The project was included in TransGrid's. 2009–2014 revenue proposal submitted to the Australian Electricity Regulator (AER)[3].

In their revenue proposal, TransGrid proposed that the upgrade is to be undertaken as "contingent project". Under the National Electricity Law (NEL) and the National Electricity Rules (NER), contingent projects require that a trigger event which is reasonably specific or capable of verification is identified. Contingent revenue can then be assigned to the project when or if the trigger event occurs. In their response to DoP, IPRA quotes the independent review of the TransGrid revenue proposal undertaken by Parsons Brinckerhoff in 2008, specifically that no trigger event had been identified that " *does not meet the requirements of the NER in that it is not reasonably specific or capable of objective verification*". (IPRA, 2009) However, although available at the time the IPRA response was prepared, there was no mention that subsequent information had been provided by TransGrid to the AER and that a draft decision had been made with respect to the project. In October 2008, the draft decision was released stating that the project was to be allocated $51 million as a contingent project with the trigger event (deemed to be reasonably specific and capable of objective verification) being: *"the NSW Government directing TransGrid to upgrade these transmission lines to improve its greenhouse gas emissions"* (AER, 2008)

This review has not established whether the transmission line upgrade will completely meet the objectives of the project. Should this be shown, then it would no doubt represent the best practice emissions solution to the regional problem and would actually reduce total emissions as well as emission intensity and cost less than the proposed distillate project.

An upgrade of the Darlington Point – Balranald – Buronga transmission system may at least partially meet the project needs and would represent best practice emissions by reducing the total emissions and overall emission intensity of electricity consumption in NSW.

[3] The AER is responsible for the economic regulation of electricity transmission services provided by transmission network service providers (including TransGrid) in the National Electricity Market (NEM) under the National Electricity Law (NEL) and the National Electricity Rules (NER).

3.3.5 Impact on the emission intensity of electricity generation in NSW

DoP in its email to IPRA dated 9 March 2009 suggested that if there was no justification for the plant in its proposed location, then it should not increase the emission intensity of electricity generation in NSW. DoP nominated the NSW Category B Generator Pool Coefficient (the pool coefficient) as the appropriate parameter for comparison.

As correctly stated by URS in the revised greenhouse gas assessment, the pool coefficient is used for the purpose of calculating New South Wales Greenhouse Abatement Certificates (NGACs) and provides an indicator of the average emission intensity of the electricity sourced from the electricity grid in NSW.

The pool coefficient is in fact the weighted average of the emission intensities of existing Category B generators. The Category B generators are represented by 8 existing steam/coal type power plants, one existing gas turbine power plant (fired on distillate fuel) and thirteen existing hydro electric plants. Any new generators that have come on line or that will come on line since the inception of the Scheme are not deemed to be Category B Generators and therefore do not contribute to the pool coefficient. This implies that the new distillate power plant could not reduce the pool coefficient as it would not be considered a Category B generator. Instead, it would be considered a Category D generator and would be eligible for generating NSW Greenhouse Abatement Certificates if it operated at emission intensity less than the pool coefficient.

Therefore the URS statement that had the distillate power plant been in operation in 2007 it would have acted to reduce the pool coefficient is incorrect. Instead, based on the URS calculations for the typical scenario (which is considered to have a high degree of uncertainty), the emission intensity of the distillate power plant is less than the Category B Generator Pool Coefficient. In this sense, if the distillate power plant had been in operation in 2007, it may have actually been eligible to generate NGACs.

Whilst the pool coefficient represents an indicator of the average emissions intensity of the electricity dispatched to the NSW electricity grid, it does not accurately represent the emission intensity of all generators. In fact it becomes increasingly unrepresentative of the emission intensity as new generators come on line. In future, as additional low carbon and renewable energy generators are constructed in response to market mechanisms, the average emission intensity of the NSW grid will likely fall below the pool coefficient[4] (Treasury, 2008). Further, the pool coefficient does not represent the emission intensity of peaking power plants and therefore direct comparison for the purposes of determining a peaking power plant's impact on the average intensity of the NSW grid is inappropriate.

Comparison with the pool coefficient does not allow determination as to whether the plant will increase or decrease the emission intensity of the NSW grid.

The emission intensity of the marginal peaking power plant would be the most appropriate parameter for comparison as in reality the distillate power plant will displace this generator within the NEM. The impact of the distillate plant on the emission intensity of electricity generation in NSW can only be determined by comparison with the emission intensity of the marginal peaking power plant. Peaking power plants in NSW currently include gas fired turbines, hydro-electricity or other distillate fuelled turbines. The identification of the likely marginal plant is a complex exercise and can depend on a number of factors at any one point in time. Therefore, the relative difference between the emission intensity of the distillate peaking plant and the marginal peaking plant has not been determined.

This was acknowledged in the original greenhouse gas assessment which stated that "*the impact of the proposal on this target* [the NSW greenhouse gas emission reduction target] *is*

[4] Treasury modelling of the CPRS and Renewable Energy Target predicted that the average emission intensity of grid based electricity within Australia will fall by between 13% and 21% depending on the final design of the CRPS, It should be noted that the GGAS will conclude at the onset of the Commonwealth Government's CPRS

difficult to depict with confidence given the uncertainties in: …. The style of plant this is displaced by the proposal (other styles of plant may be more carbon intensive or have less efficient means of accommodating peak demand)" (URS, 2008).

While this is true, it is considered likely that the style of plant displaced by the proposed distillate power plant will likely be other distillate fuelled plants, natural gas fuelled plants or hydro electricity. The style of plant displaced will therefore more likely be *less* carbon intensive than the distillate and therefore more likely result in an overall increase in emission intensity of the grid than a decrease.

Despite this, given that the project will only be operating for 3% of the year and that it can not be determined with certainty which peaking power plant will be displaced, it is unlikely that it will have a significant impact on the average NSW grid emission intensity in real terms

The proposed plant when dispatched to support the NEM, will more likely increase emission intensity of electricity generation than decrease. The actual increase is uncertain and not able to be estimated for the purpose of this review but is unlikely to be significant with respect to the annual average NSW grid emission intensity in real terms.

3.3.6 Relevant Government Policies

The original greenhouse gas assessment includes a summary of International and Australian Greenhouse Gas Policy issues. However there is limited discussion of the acceptability of the project's emissions in the context of these policies. The exception to this is the impact of the proposal of the NSW greenhouse gas emission reduction target for 2025 as specified in the NSW 2005 Greenhouse Plan. The assessment states that due to uncertainties (raised in Section and Section above) the impact of the proposal n the target is difficult to depict with confidence.

A summary of the proposal in the context of the most relevant Government policies is below.

NSW Greenhouse Gas Abatement Scheme

As outlined above, the project would be classified as a Category D generator and captured under the NSW Greenhouse Gas Abatement Scheme and as such would be subject to a market based mechanism for emission reductions once operating. Due to the structure of the Scheme, It is likely that the project will be eligible to generate NGACs. However, GGAS has been criticised for its ineffectiveness in delivering real abatement by allowing business as usual activities to generate NGACs in assuming "*that a new generator displaces another generator with an emissions intensity equal to the NSW pool coefficient*" (Passey, 2008). This design feature means that "*relatively efficient coal and all gas-fired generation anywhere in the NEM commissioned after January 2002 will be able to create NGACs from its entire output*". (MacGill 2006).

It would therefore seem inconsistent with broader policy objectives to 'encourage' this by permitting a development that can create NGACs because of the structure of the market based system when in reality it means that it will be competing with and potentially displacing existing 'cleaner, greener' peaking generation (i.e. gas and hydro electric).

Consideration of the proposed plant in the context of the NSW Greenhouse Gas Abatement Scheme may not be appropriate given issues with the Scheme design and application to peaking power plants.

NSW 2005 Greenhouse Plan and NSW State Plan

The NSW Greenhouse Plan announced a greenhouse gas reduction target for NSW of 60% reduction by 2050 and a return to 2000 levels by 2025. The NSW State Plan released in 2006, reiterated this commitment as well as a renewable energy target of 10% of electricity consumed by 2010 and 15% by 2015.

The NSW Greenhouse Plan further provides strategies to reach the target including "*encouraging new forms of energy that have low emissions*" stating that if successful "*the*

emission intensity of electricity will decrease". Energy generation which reduces the emission intensity of electricity generation in NSW is therefore considered to be consistent with the plan.

Both the NSW Greenhouse Plan and State Plan contain targets relating to reducing the emission intensity of the electricity grid. Energy generation which reduces the emission intensity of electricity generation in NSW is therefore considered to be consistent with the State Plan.

CPRS

DECC and DoP have expressed different opinions as to the role of the planning system in addressing greenhouse gas emissions for sources which will be covered by the Commonwealth Government's CPRS as expressed by DoP in its email dated 9 March 2009. Whilst the level of intervention is essentially a political decision, in Arup's view there is sufficient justification to warrant the consideration of greenhouse gas emissions covered by the CPRS in the environmental assessment process.

Firstly, the Commonwealth Government's White Paper (DCC, 2008) discusses the use of appropriate complementary legislative measures once the CPRS is implemented. Specifically the White Paper discusses a framework underpinned by a set of principles agreed by the Council of Australian Governments (COAG) for jurisdictions to review and streamline their existing climate change emission reduction measures, with the aim of achieving a coherent and streamlined set of climate change measures. Specifically the framework identifies that:

> *"Complementary measures may be targeted to manage the impacts of the Scheme on particular sectors of the economy (for example to address equity or regional development concerns). Where this is the case, in line with regulatory best practice, the non-abatement objective should be clearly identified and it should be established that the measure is the best method of attaining the objective".*

In this respect the Buronga project may represent a regional development concern with a non-abatement objective to provide reliable electricity supply to Buronga. Therefore ensuring that the proposed plant is the best method of attaining the regional development objective is considered complementary to the CPRS. This is consistent with DECC's requirement for the project to demonstrate "*best practice emissions*".

Intervention with the CPRS may be appropriate within the decision making context to address regional development concerns such as energy security where non-abatement objectives are exist.

The COAG framework also identifies relevant market failures which are not addressed by the CPRS or may not be addressed in its transitional phase. These take the form of non-price barriers which might prevent participants from fully responding to the carbon price signal. The COAG framework states that "*Government has a role in developing measures to correct non–price-based market failures*". Relevant non-price issues include the following:

- Information barriers.
- Split incentives.

In Arup's view, complementary measures are required to ensure that none of these market failures are present in the decision making context. In the context of the Buronga project, this could be in ensuring that sufficient information gathering exercise has been undertaken such that information barriers do not exist in identifying alternatives. Information barriers could exist especially with regards to new technology, which may be commercially ready but not known or understood by the proponent. Split incentives may also be present especially in the case of the transmission system upgrade where there are split financial incentives

between the generators and transmission network service providers to improve the efficiency of the transmission system with the generators receiving the majority of the financial benefit[5].(Garnaut, 2008) \

Intervention with the CPRS may be appropriate within the decision making context to address market failures including information barriers and split incentives which may prevent the carbon price signal from achieving lowest cost abatement.

There is a further argument that the planning system has an important role to play in regulating new sources of emissions in the context of a CPRS. This view was expressed by several submissions to the 10 year review of the Environment Protection and Biodiversity Conservation Act 1999 in relation to the proposed greenhouse trigger for Commonwealth assessment of projects (ANEDO, 2009, McGrath, 2008). These submissions argue that for long lived infrastructure assets in particular, the planning phase represents a once off opportunity to provide least cost abatement by embedding best practice technology from the outset and avoiding future expenditure on retrofits. ANEDO in particular submits that "*the CPRS is not a panacea. It alone will not be sufficient to address climate change and must be complemented by supplementary measures …. It is crucial that new projects, such as power plants and coal mines, are assessed against best practice technology*" In the case of Buronga, the role of the planning system in this sense would be to ensure that the least emission intensive solution is implemented so that it does not become surpassed in the future where an elevated carbon price dictates that an alternative solution is implemented.

Interestingly, industry submissions to the EPBC Act review argued that there is no need for greenhouse gas assessment within the planning system where regulated by the CPRS (Santos 2008, Woodside, 2008, APPEA 2008). DECC also notes this industry perspective in the email from Joe Woodward on 30 January 2009.

Finally, whilst the CPRS will result in a set level emission reductions across the national economy, a state planning system that does not adequately consider greenhouse gas emissions of new developments may increase the carbon intensity of a state's economy. This may occur where differences between planning systems result in new carbon sources being concentrated in one state such that it incurs a disproportionate share of the cost of abatement. This would result by carbon permits being freed up from emission reductions occurring in other states and sold to cover the new emissions from carbon sources concentrated in one state resulting in a net economic flow out of the carbon intensive state.

Whilst the CPRS will in theory ensure that national emission targets are reached, it will not ensure that individual state targets are met. If one state attracts more emission intensive development than another through differences in planning regimes, it may result in the emission intensive state incurring a disproportionate share of the cost of abatement.

However, the relevancy of the CPRS for the Buronga project can only be considered if accepted that the CPRS will commence in 2010. As noted by DECC in an email from Joe Woodward on 30 January 2009, "*the CPRS cannot currently be taken into consideration because the enabling legislation has not yet been passed by the Commonwealth Parliament*".

3.3.7 Summary

Whilst the methodology and scope of greenhouse gas calculations are adequate for the purposes of the assessment, there is still a high degree of uncertainty regarding the likely actual average greenhouse gas emission intensity of the operational plant. Notwithstanding, if the 'typical' emission intensity is taken to be representative of the plant's

[5] Even with the CPRS, the transmission network providers will not be liable for carbon emissions as the point of obligation for all electricity generation (including transmission losses) to be on the electricity generators themselves.

average operating emission intensity, then the plant will likely have an emission intensity less than the current pool coefficient calculated for the purposes of NSW Greenhouse Gas Abatement Scheme. As such the plant may actually be eligible to create NGACs if the Scheme is still operating upon the commencement of operation of the plant.

The pool coefficient may however, not be an appropriate benchmark to determine whether the plant will result in a net increase or decrease in the emission intensity of the NSW electricity grid. Of more relevance is the emission intensity of the marginal peak power plant likely to be displaced by the proposed distillate power plant. The marginal fast response peaking power plant is unable to be identified with any certainty but is likely to be represented by the existing fast response peaking power plants connected to the grid (being gas or other distillate turbines or hydro electric power). These power plants are likely to be of lower or, at worst, of equal emission intensity than the distillate fuelled plant such a net increase in the emission intensity of the NSW grid is more likely to occur as a result of the project than a decrease. Despite this, given that the project will only be operating for 3% of the year and that it can not be determined with certainty which peaking power plant will be displaced by the project, it is considered unlikely that it will have a significant impact on the average NSW grid emission intensity in real terms

The environmental assessment identified only one viable alternative to the distillate fuelled plant. This was deemed to be an equivalent gas turbine plant located on the Moomba to Sydney gas pipeline or closest source of natural gas some 400km from Buronga. The assessment concluded that this plant was likely to have equal emission intensity when transmission losses were taken into account. This is likely to be true for power supplied to Buronga for both plants in extraordinary operational circumstances at which the project is targeted. However, for at least part of the time the Buronga plant will be supplying peak power to the National Electricity Market and will therefore have associated transmission losses such that the relative difference between the emission intensity of these two options is likely to be greater than reported in the greenhouse gas assessment.

Other renewable energy alternatives are discussed and dismissed due to lack of proven technology or viability for supplying peak power. However there is a no discussion on the developments within these industries and the potential future prospects to supply peak power including biofuels and biomass and solar power coupled with energy storage technologies.

Finally the alternative of a transmission system upgrade has not been comprehensively explored as a viable alternative to achieve the project objectives by the environmental assessment. The upgrade of the transmission system to Buronga has been nominated as a contingent project in the AER draft decision for the allocation of TransGrid's revenue for 2009 to 2014. Interestingly the trigger event for the project has been identified as the NSW Government directing TransGrid to reduce greenhouse gas emissions which has not been highlighted by IPRA. If the transmission system upgrade is able to meet the project objectives, then it no doubt represents the best practice emissions alternative as it would reduce emission intensity of the NSW grid by reducing transmission losses.

The impact of the greenhouse gas emissions from the project is therefore more likely to increase than decrease the average emission intensity of the NSW grid. The impact is not likely to be significant and regardless will be caught under the CPRS (if implemented) such that its emissions may be "offset" by reductions occurring elsewhere within the national economy. Notwithstanding, to be consistent with the NSW Greenhouse Plan, new energy generation should not increase the emission intensity of electricity in NSW unless it is the lowest emission option available to ensure the reliability and security of the energy supply.

If the project *is not* justified for local energy reliability or security reasons then there are likely to be peaking power generation alternatives which are both commercially viable and less emission intensive which could be located elsewhere on the grid. If the project *is* justified at the specific location for local energy reliability or security reasons, then there are

also likely to be alternatives which are less emission intensive. However it should be noted that these alternatives require expenditure on new or upgraded transmission infrastructure. Such expenditure is subject to the NER and NEL and is outside of the proponent's control.

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