Intercontinental Hotel Sydney

Stage 1 DA – ESD Outline

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1. Executive Summary

This report is a preliminary outline of ESD options for the redevelopment and extension of the Intercontinental Hotel in Sydney. It is intended that this report will be workshopped with the design team and ultimately form part of the Stage 1 DA submission in response to the following requirement:

> **8. Ecologically Sustainable Development (ESD)**
>
> Identify how the development will incorporate best practice ESD principles in the design, construction and ongoing operation phases of the development.

The project is at an early stage of development and as a result most of the detailed design is unresolved. As a result, this report takes the format of an ESD brief with options, rather than a design review. It is intended that the options proposed in this report are subject to discussion before finalisation of the ESD DA submission.

A range of options have been identified for the project, covering façade, HVAC, electrical and hydraulic services. In many cases these have interactive effects, most notably in relation to chiller and boiler capacity. This is relevant as these are noted as being areas of significant consideration in the NDY services report.

We note also that in some cases the items in this report may lie on the margins of the currently proposed works.

2. ESD Recommendations – Energy/Water

2.1 Façade

The proposed refurbishment includes a replacement of the hotel tower façade as well as the construction of the new ball room area with extensive façade.

Recommendations

- ***Section J compliance.*** *All new façade elements must comply with NCC Section J; however, it is recommended that consideration is given to exceeding these requirements. A reasonable target would be for heating and cooling loads to be 20% lower than that of a Section J compliant façade. This is likely to involve a combination of low-e double glazing and external shading elements. Note also that this will ameliorate issues with window condensation from cooling towers as the external surface temperature of the window is likely to be above dew-point under most conditions.*
- ***Shading.*** *It is clear that one of the objectives of both the tower façade upgrade and the ballroom design is to provide improved visual amenity, particularly with respect to harbour views. It is recommended in this context that the best results will be achieved through the use of shaded glazing, as this can be used to minimise or eliminate direct solar gains which often result in curtains being drawn (thereby cancelling out any visual amenity benefits). There is potential for such shading to be integrated with PV elements, thereby obtaining a double benefit for the building.*
- ***Infiltration.*** *The hotel tower glazing upgrade is a significant opportunity to improve the infiltration performance of the building envelope. Infiltration is particularly important for hotel rooms. Which have generally lower internal loads and thus are more prone to heating demand. It is recommended that the façade upgrade carries an infiltration target and that measurement of façade performance is included in commissioning works. This also applies to the ballroom, although with lesser importance.*

2.2 Mechanical Services

The NDY report identifies opportunities for the centralisation of mechanical plant, and the upgrade of chillers and boilers. A number of unanswered questions remain in relation to capacity requirements. Cogeneration and tri-generation are raised as possibilities.

Recommendations – Central Plant

- ***General.*** *There is opportunity to enhance the design proposal through the use of a range of techniques that have the potential to lower loads.*

- ***Plant sizing.*** *It is noted that the façade upgrade, with consequent improvements to or beyond current Section J standards, will produce a significant change in heating and cooling loads. Other improvements, such as high efficiency lighting, may have further effects. Consideration of this will be important in the sizing of new and replacement boiler and chiller plant.*
- ***Chiller upgrade.*** *Chillers should be selected with a minimum IPLV of 9. Note other recommendations in this brief also suggest possibilities for the separation of one chiller to operate at high temperature and the use of chiller heat recovery for pool heating.*
- ***Boiler upgrade.*** *The new boiler should be a condensing boiler. This will permit lower load periods of operation to be served at significantly reduced heating hot water temperatures, with resultant improvements in distribution and combustion efficiency.*
- ***Steam boilers.*** *The deletion of the existing steam system is strongly recommended. Steam systems tend to be inefficient and the skills for their maintenance are becoming increasingly rare. Removal of centralised steam systems typically achieves significant energy savings.*
- ***Cooling tower upgrade.*** *Induced draft cooling towers are recommended as these generally have significantly lower fan energy than forced draft towers. Either way, a maximum fan power of 8W/kW heat rejected should be used. Cooling tower fans should be equipped with variable speed drives. Given the proposal to relocate the cooling towers to Level 10, and in the context that some concern has been expressed regarding condensation on guest room windows, it is noted that this issue should be able to be addressed by ensuring that there is sufficient mixing of ambient air with the cooling tower exhaust, most probably achieved by directing this exhaust airflow away from the building. As noted previously, the use of high performance glazing on guest rooms will also limit condensation issues.*
- ***Cogeneration/tri-generation.*** *We understand that this may have already been taken off the agenda. We note that increasing gas prices means that the economics of cogeneration and tri-generation has worsened significantly, and should be expected to continue in this vein for some time. In general, we note that such systems represent a relatively high maintenance risk and as a result need to have very strong economic benefits to be justifiable. It is likely that other investments of similar magnitude could generate better economic impacts for the operation of the hotel.*

Recommendations – HVAC Systems

- ***Ballroom HVAC.*** *The energy use of the Ballroom will be dominated by the management of outside air provision. This is likely to require heat recovery or CO_2 control as a minimum under Section J compliance; It is noted that heat recovery will produce a lower maintenance solution for this application that is likely to be more appropriate for the hotel environment. Beyond this, and with significant impact on cooling loads, consideration should be given to the use of a dewpoint cooler on the outside air supply. This provides indirect evaporative cooling to close to dew point temperatures (with no humidity addition to the airstream) and could save significant energy use, with some additional impact on cooling loads.*
- ***Guest room HVAC.*** *It is not known whether any upgrade of guest room HVAC is intended, although it is noted that existing fan coils will be somewhat overcapacity post the façade upgrade, which may produce some controllability issues. Consideration should be given to the feasibility of providing a dedicated dehumidification coil (or desiccant wheel) to the outside air supply in order to precondition the outside air provision to the rooms. This potentially could enable the room fan coils to be operated using a high temperature chilled water circuit (alterations to risers are likely to be needed) with lower losses and lower maintenance (no in-room condensate drainage issues) than the current system. If a DX or desiccant wheel dehumidifier are used this will reduce the chiller load. Use of heat recovery around a dedicated chilled water preconditioning coil will also reduce chiller loads. The greatest performance benefits would be achieved is a chiller is operated at high temperature to service this load, rather than using standard chilled water mixed up to the higher operating temperature.*
- ***Guest room HVAC.*** *If guest room upgrades are being undertaken, consideration should be given to the addition of shut-off dampers to eliminate outside air supply in periods of non-occupancy.*
- ***BMS.*** *As a new BMS is being allowed for, this should meet the requirements for points coverage and screen presentation outlined in the appendices of AIRAH DA 28.*
- ***Guest room controllers.*** *As a new BMS is being installed, allowance should also be made to upgrade room controllers to be fully integrated with the BMS. New controllers should be integrated with the guest room management system so that air-conditioning mode can be altered upon check in; it should also include occupancy sensing and facility for set-back.*
- ***Fans and pumps.*** *All larger, continuously operating fans and pumps should be selected to be at least 70% efficient at design point.*
- ***Motors.*** *All electric motors should be "high efficiency" as defined under AS1359.*

Recommendations – Swimming Pool

- ***Swimming pool heating.*** *Consideration should be given to the use of chiller heat recovery for swimming pool heating. This is particularly feasible given the low temperature requirement for a swimming pool and the reasonably close proximity of the new pool location and the plant room. Heat recovery should be sized for routine loads, rather than for the load under pool filling conditions. Note that a high temperature chiller combined with heat recovery would achieve particularly attractive performance outcomes.*
- ***Swimming pool HVAC.*** *As noted by NDY, a dedicated heat recovery unit should be used for this purpose. Fully integrated design of this should consider whether the use of some dehumidification to the inlet air would permit overall air volumes to be reduced.*

Recommendations – System Management

- ***Automatic Fault Diagnosis System.*** *It is recommended that consideration is given to the installation of an automated fault diagnosis (AFD) system for the hotel. AFD systems, such as the CopperTree system of which Energy Action is a licensee, continuously monitor data points from the BMS and other control systems in order to detect equipment and control faults. In a complex building such as a hotel, an AFD system will produce multiple benefits, including improved commissioning outcomes, better energy efficiency and improved guest comfort.*

2.3 Electrical Services

The design has not progressed sufficiently to identify specific design relevant to energy efficiency at this point. The following recommendations are therefore general in nature.

Recommendations

- ***Lighting.*** *Fully LED lighting should be used. Design targets for illumination power density should be 65% of Section J DTS, without consideration of controls.*
- ***Lighting controls.*** *Lighting should be controlled using occupancy sensors with a manual on/auto-off configuration. In public areas occupancy sensors should stage down the lighting via dimming. Lighting control zones should be no larger than 100m² in multi-use spaces. Note that a specific response to lighting control during bump-in and bump-out for functions will need to be designed, as this is a frequent cause of inefficiency in hotel lighting operation. Back of house lighting control should be set to be reasonably aggressive, as again default mode in these areas ends to be continuous operation.*

- ***Metering.*** *In order to provide monitoring of the energy use, it is recommended that sub-metering is installed to allow identification of major end-uses, specifically chillers, pumps, fans, boilers, lifts, lighting and equipment loads. It is noted that separation of HVAC, lifts, lighting and equipment is a Section J requirement for new works; ideally this should be extended and in greater depth of resolution across as much of the site as possible. In order to be useful, this will need to be combined with a carefully designed metering interface so that aggregates of meters can be monitored in a manner that provides useful information to the hotel's engineering department. It is noted that such a system may also be integrated with a re-charge system that enables operating units within the hotel to be charged for energy they use. This has potential as a behavioural modification measure for "difficult" efficiency areas, such as food preparation.*

2.4 Hydraulic Services

Limited information is available in relation to proposed upgrades to hydraulic services at this stage.

Recommendations

- ***Fixtures and fittings.*** *New fixtures and fittings should be rated at 5 stars or better for toilets, taps (other than baths and cleaners' sinks), showers and urinals.*
- ***Gas Metering.*** *Gas sub-metering should be installed to separate gas use between domestic hot water and space heating. Gas sub-metering should be electronically integrated with the electrical metering system and provide time-of-use information on consumption.*
- ***Water Metering.*** *Water sub-metering should be installed to separate water use between guest rooms (cold/hot water), kitchens (cold/hot water) and mechanical services. Total incoming water should also be monitored. Water sub-metering should be electronically integrated with the electrical metering system and provide time-of-use information on consumption.*
- ***Domestic hot water.*** *New domestic hot water heaters should use either high efficiency heat pumps or condensing boilers.*

2.5 Lifts

Some lift upgrades are proposed.

Recommendations

- ***Drive types.*** *Variable voltage, variable frequency drives with regeneration achieve significant energy savings over other lift drive types.*
- ***Car weights.*** *Second-order energy savings can be achieved by the use of lightweight finishes in lift cars (i.e. metal rather than tile).*

2.6 On-site energy generation

The site has relatively unimpeded north and east frontage.

Recommendations

- ***Roof-top PV.*** *Consideration should be given to the use of the ballroom roof for PV cells. There may also be potential to extend this over parts of Transport House, and on the hotel tower roof.*
- ***Building Integrated PV.*** *Consideration should be given to the incorporation of PV into shading elements for the ballroom, should such be provided.*

3. ESD Recommendations – Other ESD

3.1 Broad-scale Environmental Rating

The project does not have any target rating under any recognised environmental rating system. In the international accommodation market, good credentials in this area are increasingly an expectation. The main alternatives would be the US Green Building Council LEED rating, which has the benefit of appeal to an international audience, and the Australian Green Building Council Green Star rating, which has the benefit of local relevance and service provider availability. The latter is the preferred option, as the local relevance and service provider availability are important, and Green Star does already have a respected international profile.

Recommendation

- ***Green Star Design and As Built rating.*** *It is recommended that the hotel seeks an accredited Green Star Design and As Built rating of not less than 5 stars for the upgrade works. Should this not be feasible, then it is recommended that this rating tool is used as a menu from which to generate maximum environmental quality in the development with particular reference to indoor environment quality (daylighting, materials selection, indoor air quality) and as a guideline for project environmental management, energy efficiency and water efficiency.*

3.2 NABERS Hotels Rating

Although uptake of the NABERS Hotels rating is weaker than for the NABERS Office rating system, the Intercontinental has had a reasonable history of using the NABERS ratings to benchmark its performance, and the hotel engineer was involved in the original development of NABERS Hotels. NABERS is currently working on the development of rules for a Commitment Agreement for NABERS Hotels, where by new builds and extensive refurbishments can commit to a post-construction NABERS rating and in the process have permission to use the targeted post-construction rating in public materials before it is measured.

It is noted that the City Of Sydney has made requirements in relation to post-construction NABERS outcomes for non-office buildings as part of DA consents, and so a requirement of this nature may be placed on this project.

Recommendation

- ***NABERS Hotel Commitment Agreement.*** *It is recommended that the development considers the possibility of signing a NABERS Commitment Agreement (if available – this is still under development for hotels at the time of writing) for a suitable rating target (typically 4.5 or 5 stars NABERS) provided that the ramifications of this performance target for the project have been fully considered.*

4. ESD Recommendations – Process

The use of a well-defined and measureable process for managing ESD issues throughout design, construction and operation is essential to achieve a successful outcome.

Recommendations

- ***General ESD process.*** *The management of ESD should include definition of a clear ESD brief with measureable requirements. Typically this will be a combination of energy targets, water targets and assessable activity, material or equipment measures. This report is the commencement of this process. Compliance with the ESD brief should be reviewed at preliminary design, detailed design, during construction, during commissioning and in post-construction monitoring.*
- ***Energy and water efficiency.*** *As a subset of the general ESD process, it is recommended that:*
  - *Specific energy and water targets are developed for the end-outcomes. For energy, this should involve the completion of a calibrated computer simulation that identifies project total energy consumption post-construction using a baseline simulation that has been calibrated to current building performance. For water, an empirical model of water use will need to be developed based on available site data, with calculations made for project performance improvements.*
  - *The preliminary and detailed designs should be checked for compliance with proposed energy and water targets using the calibrated simulation as a baseline.*
  - *Post construction, the calibrated simulation model should be used to generate sub-system performance targets for sub-metered systems. Performance as measured using the sub-metering system should be checked monthly against the performance targets to enable issue identification and rectification.*
- ***Commissioning.*** *Commissioning should be overseen by an Independent Commissioning Agent. The ICA's role must commence at the early stages of design to ensure that process and technical requirements for the commissioning process are built into the design. The ICA then is responsible for ensuring that the commissioning process is sufficient to ensure that the proposed design delivers the intended performance in terms of comfort, amenity and efficiency. Note that the ICA would typically be engaged to the building owner and is not novated to the builder, thereby maintaining independence.*