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Lord Howe Island

Hybrid renewable energy project

A summary: Wind Turbine Environmental Report

This booklet provides a summary of the Environmental Report which assesses the environmental impacts of the proposed wind turbines as part of the hybrid renewable energy system on Lord Howe Island.

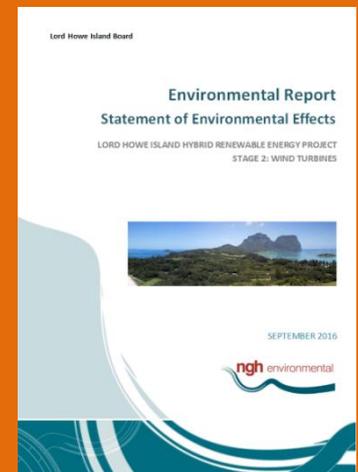
The Technical Feasibility Study produced in December 2015 found that to maximise the reduction in diesel fuel consumption a combination of wind and solar is needed, supported by a battery. The following configuration would provide the greatest diesel fuel savings within the available budget:

- **450 kW of solar panels (around 2,000 panels)**
- **400 kW / 400 kWh battery**
- **Two small to mid-sized 200 kW wind turbines.**

This preferred combination of renewable energy technology is expected to reduce the Island's diesel fuel consumption from 540,000 litres per year to around 180,000 litres per year, a 67% reduction.

This exceeds the ambitious target set in the Energy Supply Road Map (2012) which aimed for 63% of the Island's electricity to be generated from renewable sources by 2017.

The full Environmental Report is available on the Board website at www.lhib.nsw.gov.au on the 'Renewable Energy' page and at the Board's offices.



Project objectives

1. More environmentally sustainable electricity generation whilst maintaining high quality of supply.
2. Improve Island's self-sufficiency by reducing reliance on imported diesel and NSW Government funding used for electricity supply.
3. Protect World Heritage and tourism values by reducing environmental impacts of powerhouse and risk of fuel spills.
4. Seek lowest long term cost of energy production and reduce potential for 'diesel price shock' (increased energy costs if diesel fuel price escalates significantly).
5. Build on community support and provide pathway for other technologies (e.g. electric vehicles).
6. Ensure system can still be maintained and operated by the Board electricity generation team with minimal external input for regular operation and maintenance.
7. Showcase what is possible in a remote community when wind, solar and battery storage are integrated.

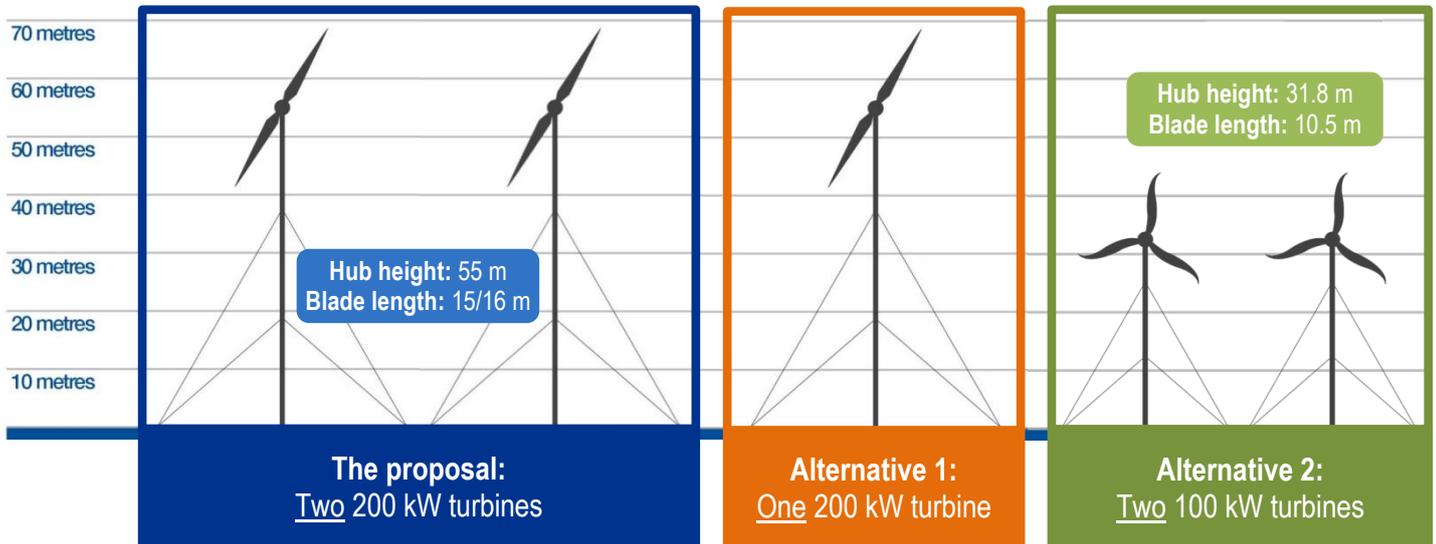
Design considerations

- No clearing of existing remnant native vegetation (except for access road).
- Minimise impact to highest value agricultural land.
- Avoid low lying areas prone to flooding.
- Minimise impact on biodiversity.
- Consider Airservices Australia assets.
- Connections between equipment to be mostly underground.
- Equipment sized to suit the Island's small 25 tonne crane.
- Consider ease of operation in remote location.
- Minimal disruption to existing electrical network during construction.

The proposal

The proposal is for **two 200 kW wind turbines**; however there are alternatives, as shown below.

The assessment in the Environmental Report focuses on the two 200 kW turbine proposal, but also considers the differences in impacts of two additional options. If the wind turbines are approved, the turbine model and number of turbines (one or two) would be selected following a competitive tender process, within the parameters stated in the conditions of approval.



Comparison of options

The table below compares the proposal with the alternative wind turbine options, as well as a solar only option and the status quo (the current situation of diesel generation and some private solar). The proposal (highlighted in blue in the table below) provides substantially better fuel savings than the alternatives. The costs indicated are 2015 budget estimates.

Option	Fuel savings (litres)	Fuel savings (%)	Diesel usage (hours)	Cost (AUD millions)
Diesel and 120 kW private solar (status quo)	32,118	6%	12,798	-
Solar only (550 kW)	192,512	36%	8,670	6.60
<u>One</u> 200 kW turbine	284,652	53%	7,065	8.28
<u>Two</u> 200 kW turbines	359,895	66%	5,000	9.21
<u>Two</u> 100 kW turbines	281,029	52%	7,185	7.55

Would the wind turbines be permanent?

The installation of the wind turbines would be easily reversible. The operational life of the hybrid renewable energy system is 20 years. After 20 years, components would either be refurbished to extend their operational life or removed and replaced with new technology in the same way the current diesel powerhouse is managed. If the wind turbines are removed and the site is no longer used then the paddock would be restored to its current condition.

Assessment of impacts

Based on the risk assessment, the environmental factors at greatest risk of impact (**high rated risks**) are biodiversity, visual and landscape character, world heritage and national heritage, and noise. **Moderate rated risks** are State and local heritage, social and economic values, and the cumulative impacts of the proposal.

The issues which have the potential to cause the most significant impact on the environment were identified using a risk assessment method consistent with Australian Standard AS/NZ ISO 14004:2004 (Environmental Management Systems) and AS/NZ ISO 13000:2009 (Risk Management).

Risk ratings from 1 to 5 were applied to each issue for the nature of the impact, the sensitivity of the environment and the likelihood that an impact would occur. When multiplied together, the overall risk rating can be categorised as low, moderate or high.

Issue	Nature of impact	Sensitivity of environment	Likelihood of occurrence	Risk rating
Biodiversity	3	5	4	60
Noise	3	4	4	48
Visual and landscape character	3	4	4	48
World heritage	3	4	4	48
National heritage	3	4	4	48
State and local heritage	3	3	3	27
Social and economic values	3	4	2	24
Cumulative impacts	3	4	2	24
Aviation safety	2	3	2	12
Traffic and access	2	3	2	12
Tenure, land use and resources	2	3	2	12
Physical natural values	2	1	3	6
Waste	2	3	1	6

All environmental issues listed in the table above are assessed in the full Environmental Report. Biodiversity, visual and landscape character, noise and heritage are summarised in this booklet.

Specialist studies

As part of the environmental impact assessment, the following specialist studies have been completed by experts in each of the subject areas. The outputs can be viewed as part of the full Environmental Report.

- **Biodiversity Assessment** (Appendix B in full report) – specialist bird studies by Dr Stephen Ambrose of Ambrose Ecological Services; Flesh-footed Shearwater studies by Dr Lisa O'Neill and Nicholas Carlile; bat monitoring by Fly By Night Bat Surveys.
- **Landscape and Visual Impact Assessment** (Appendix C in full report) – by Moir Landscape Architecture.
- **Shadow Flicker Assessment** (Appendix D in full report) – by Fulcrum 3D.
- **Noise Impact Assessments** (Appendix E in full report) - by John Hutchison of Hutchison Weller (previously Jacobs), independently reviewed by Dr Renzo Tonin.
- **Aviation Impact Statement** (Appendix F in full report) – by The Airport Group (TAG).
- **Electromagnetic Study** (Appendix G in full report) – by IDS (Ingegneria Dei Sistemi).

Existing environment

Flora (plants): the site is home to exotic pasture grasses, clovers and weeds, with few native species. The small area of vegetation to be cleared during construction of the access road consists of Greybark-Blackbutt Closed Forest, a widespread but heavily cleared lowland community. The site is currently grazed by cattle. Other plant communities in the surrounding area, but not impacted by the project, include Kentia Palm Closed Sclerophyll Forest, Lowland Mixed Closed Forest and significant native vegetation mapped under the Local Environmental Plan.

Fauna (animals and birds): Typical of remote oceanic islands, birds are the dominant fauna on Lord Howe Island. The exotic grassland at the site has minimal habitat value. However, forest bird species regularly fly over the 40-100 metres between forest areas either side of the site, and seabirds use the air space above the site when crossing the Island and when leaving and returning to nests during the breeding season. The most commonly observed forest birds are the Welcome Swallow, Lord Howe Silvereye, Magpie-lark and White-throated Needletail. Seabirds commonly observed included the Flesh-footed Shearwater, Black-winged Petrel, Providence Petrel, Red-tailed Tropicbird, Sooty Tern and White Tern. Flesh-footed Shearwaters have a significant breeding ground to the immediate north-east of the site and were the subject of specific monitoring undertaken for the project. The Large Forest Bat forages for insects below the canopy in surrounding forests and over the site, and a dead Scalybark tree with a hollow provides a potential roosting habitat.

Impact assessment

The proposed wind turbines have the potential to affect biodiversity through forest habitat loss and fragmentation, and risk of blade strike impacts and tower/guy wire collisions for birds and bats. Impacts are not considered significant at a local scale.

Flora: Construction of the wind turbines would result in temporary disturbance to and permanent loss of exotic pasture with no conservation value. The small-scale clearing required for construction of the access road impacts a common vegetation community and already disturbed groundlayer so would not be significant. A small number of endemic species would also be removed but these are not uncommon locally and the loss of these plants would not significantly affect local populations.

Fauna: Construction of the wind turbines would result in some habitat loss as a result of clearing for the access road, potential for interference to habitat utilisation due to construction noise and activity, and risks to wildlife from construction traffic. Birds which breed close to the site (Black-winged Petrel, Flesh-footed Shearwater and Lord Howe Island Woodhen) are at particular risk on the roads during breeding season. The assessment shows that the wind turbines would not significantly add to existing habitat fragmentation at the site. Disturbance from the works would be highly localised and largely outside the seabird nesting period so is not considered likely to significantly affect fauna over the medium-long term. Operational impacts include blade strike risks to birds and bats, potential collisions with guy wires and disruption from turbine lighting. Blade strike risks could threaten the safety of the local Flesh-footed Shearwater population, and infrequent but large aggregations of birds within the turbine airspace creates the risk of a mass bird strike. However, the seven-part tests of significance for threatened species concluded that the wind turbines would not result in significant impact, subject to the implementation of avoidance and mitigation measures. Blade strike can kill bats, but Large Forest Bat activity was recorded mostly near ground level at the site, with some activity up to 20 metres but none at 40 metres.



Flesh-footed Shearwater (photo: Jack Shick)

Management of impacts

Flora: Clearing required to construct the access road would be adequately offset by restoration of similar vegetation close to the site. Risks from weeds and diseases associated with the works are manageable using current best practice guidelines.

Fauna: One of the taller 200 kW turbines (alternative 1) is preferable over two (the proposal), and better than the smaller 100 kW turbines (alternative 2) for minimising impacts on birds and bats. Mitigation measures include shutting down turbines during the peak daily return period of Flesh-footed Shearwaters to the nesting and roosting colony i.e. from 15 minutes before dusk to 2 hours after dusk during their breeding season (15 September to 15 May). The hollow-bearing Scalybark tree should be retained, but if clearing is required this will be undertaken outside of Large Forest Bat breeding and winter hibernation periods. The forest area to be cleared should be searched for Lord Howe Placostylus individuals and shells prior to the works, and live snails relocated and additional habitat protection measures applied if found.

Once commissioned, an Adaptive Management Plan will trigger additional mitigation measures if impacts exceed expectations, based on mortality and injury impact monitoring and long-term monitoring of breeding success. An example of this is the regeneration of nearby Flesh-footed Shearwater nesting habitat to compensate for potential blade strike mortalities. As a last resort measure, a 30 minutes before dusk to 60 minutes after dawn shutdown throughout the breeding season would ensure the largely nocturnal Flesh-footed Shearwater would not be significantly impacted.

Existing environment

Scenic protection to maintain the spectacular natural beauty of Lord Howe Island (one of the two criteria for the Island's World Heritage listing) is a key strategy to protect World Heritage values. Four distinct landscape character units were identified in the Landscape and Visual Impact Assessment based on variations in geology, topography, land use and vegetation.

- Northern Permanent Park Preserve (very high visual quality rating) – views to the south are dominated by the steep, vegetated peaks of Mount Gower and Mount Lidgbird.
- Southern Permanent Park Preserve (very high visual quality rating) - expansive views from Goat House Cave (Mount Lidgbird) and Mount Gower, overlooking the valleys, hills, lowlands, beaches, sea-cliffs and settlement area.
- Settlement area (moderate-high visual quality rating) - residential, commercial and agricultural lands as well as key infrastructure including the airport.
- The lagoon (high visual quality rating).

Impact assessment

In general, wind turbines have the potential to create a contrast in the landscape as a result of their vertical scale and lack of visual integration. However, the proposed wind turbines are comparatively small in scale in the visual context of the Island, and would be a temporary element with little to no long term impact on the landscape.

21 viewpoints of potentially high visual impact were selected for the visual assessment, including views from a boat in the lagoon. For each viewpoint, the potential visual impact was analysed using a combination of 3D terrain modelling, topographic maps and on-site analysis. Photomontage images were produced with superimposed turbines to assist with the assessment of visual impact.

Photomontage showing indicative view of proposed wind turbines and solar panels from Kim's Lookout (zoomed and cropped)



The large scale of the rugged vegetated hills in the Permanent Park Preserves means these characteristic features would remain dominant visual elements of the landscape. Expansive views from the southern and northern hills and distance from the proposed wind turbines (the site is over 3.5 kilometres away from Goat House Cave), mean the turbines would be noticeable yet only a minor visual element in the overall landscape.

Dense vegetation surrounding the settlement areas will limit views to the turbines, with the highest visual impact from cleared areas close to the north and east of the turbines. Turbines are likely to be a dominant feature when viewed from close proximity. The settlement area landscape is modified by development and the turbines are a similar scale to the existing Airservices Australia towers. The airstrip is a major modification to the landscape and when viewed in conjunction, the turbines would be comparatively small in scale. It is likely the turbines would be visible from Old Settlement Beach and Ned's Beach. Views of the proposed turbines from residences along Lagoon Road to the south are screened by topography. Turbine blades would be visible beyond the vegetated ridgeline viewed from south of Transit Hill, however existing airport infrastructure would be visible at the same time. A comparative assessment of the three turbine options found that the visual effect does not vary greatly between the options. The smaller 100 kW turbines would have a slightly lower visual impact than the taller 200 kW turbines, but the difference would be close range and localised with no real difference from high vantage points.

Management of impacts

With mitigation measures and ongoing consultation with the community, visual impacts could be reduced to an acceptable level at residences and tourism accommodation. Controls should be placed on navigational lighting and blades treated with non-reflective coating to reduce reflection at night. Turbine design should consider uniformity in colour and rotational speed, and use simple muted colours and non-reflective materials to reduce distant visibility and avoid drawing the eye. The NSW Draft Guidelines recommend that turbines should be off-white or grey in colour. Planting trees around the site would not provide screening due to the height of the turbines; however specific views from individual properties could be managed through localised planting. Screen planting layout should avoid screening views of the broader landscape and use native species that are typical to the area.

Noise guidelines

In earlier stages of the project, the *Draft NSW Planning Guidelines for Wind Farms* (2011) were used to measure and assess potential noise impacts from the wind turbines, but in August 2016 the new NSW draft wind farm planning framework was released. The new framework includes the adoption of the *South Australian EPA Wind Farms - Environmental Noise Guidelines* (2009), which prescribe a noise limit of 35dB(A) or the background noise plus 5dB(A), whichever is the greater (this is the same criteria as the Draft 2011 Guidelines). Noise criteria must be established for separate daytime (7am to 10pm) and night-time (10pm to 7am) periods. In the framework, wind farm proponents are not required to conduct a health impact assessment or measure infrasound. This is because of the National Health and Medical Research Centre's (NHMRC) current position that there is no evidence supporting a link between wind turbines and adverse human health outcomes. However, based on community concerns and advice from Dr Renzo Tonin (the independent noise expert), the Board carried out infrasound assessment at Coral Bay in Western Australia, where three similar wind turbines to those proposed for the Island have been operating since 2007.

Background noise

Background noise is the ambient noise environment, made up of sounds from the ocean, wind, traffic, birds and devices like refrigerators. Intermittent noise events such as planes or dogs barking are not considered part of the background noise unless they are present for at least 90% of the time. Generally speaking, noise from wind turbines increases as the wind speed increases, but so does the background noise. As part of the extensive technical noise assessments undertaken by Hutchison Weller, background noise measurements and meteorological monitoring was carried out at four locations on the Island, over four weeks in January/February 2015 and again in August 2015 to account for seasonal variations in insect activity and prevailing winds. Background noise was recorded for turbine operating wind speeds; between 4 and 13 m/s. As a guide, average wind speed recorded at the monitoring mast is 7.7 m/s (or 15 knots) at hub height. **Measurements show that existing background noise on the Island is high due to natural noise sources; including wind in palm trees, surf on the reef and beaches, and insects in summer months. This means that noise from the turbines would be effectively masked.**

Impact assessment

Noise levels for the proposed wind turbines are predicted to be below criteria in the guidelines, for all areas of the Island at all times. While the turbines may be heard at some locations, the most stringent criteria (e.g. the night period) would be met and the risk of adverse impacts to the community and amenity of the Island is low.

Audible noise: Wind moving across the blade is the dominant noise source for most modern turbines. In May 2016, predicted noise levels were modelled for the proposed 200 kW turbines (using a low noise model with insulated machinery and a non-insulated model for comparison) and the alternative 100 kW turbine option. For the 200 kW low noise turbine, the highest predicted noise levels were to the north of the turbines, with levels of up to 45 dB(A) for hub height wind speeds of 12 m/s (about 23 knots) and above. In areas to the north and west of the turbines, noise levels were in the bottom range at night time when wind speeds are less than 6 m/s (about 11.5 knots) - at higher wind speeds, the turbines may be audible around 50% of the time. In the centre of the settlement area, the turbines are likely to be heard for around 10% of the time during summer and winter months when wind speeds are below 6m/s at hub height. Above 6 m/s at hub height, the turbines would be heard around 50% of the time. In areas to the south, it is unlikely that the turbines would be heard at all under any weather conditions.

Infrasound: infrasound measurements of the Coral Bay turbines were used to analyse infrasound. The Coral Bay assessment found that while the operating turbines generated a small amount of infrasound, it was negligible in comparison with infrasound generated by natural sources such as wind and ocean waves. All measured infrasound was less than the most stringent thresholds of human perception, meaning that infrasound was neither audible nor physiologically perceptible.

Management of impacts

Once commissioned, operational noise monitoring would confirm actual turbine noise levels and compliance with the criteria. Noise management options in the Adaptive Management Plan should include identifying conditions and times that lead to undue impacts; sector management (turning off one or both turbines during specific wind directions/strengths or times); and consulting with the manufacturer to identify noise control options. The State Government will continue to monitor relevant contemporary scientific research outcomes, including any advice from the National Wind Farm Commissioner and Independent Scientific Committee.

Please note: the noise impact assessment in the Environmental Report (Appendix E and Section 6.2.3) supersedes the two previous noise reports dated April 2015 and February 2016, and the noise fact sheets distributed to the community at these times.



Existing environment

World and National Heritage: The Lord Howe Island Group was listed as a UNESCO World Heritage property in 1982 and is protected under the Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act. Lord Howe Island, the Admiralty Islands, Mutton Bird Island, Blackburn Island, Gower Island, Balls Pyramid and 145,000 hectares of surrounding marine environment and offshore islets are listed under two World Heritage criteria:

1. 'Superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance' (including exceptional diversity of spectacular and scenic landscapes within a small land area; and outstanding underwater vistas).
2. 'Important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation' (including the Lord Howe Island Woodhen - an example of successful in-situ recovery of a species from the brink of extinction; the Lord Howe Island Phasmid which survives on Balls Pyramid; the only breeding island for Flesh-footed Shearwaters on the east coast of Australia and a globally significant breeding site for this species; the threatened endemic Lord Howe Placostylus and many other endemic species of marine fish, invertebrates, corals and algae).

The Lord Howe Island Group World Heritage Property was added to the National Heritage List in 2007 in recognition of its national heritage significance for Australia's natural and cultural history.

State and local heritage: Lord Howe Island has several heritage sites which reflect the Island's history of discovery and Island life in the 20th century. The Lord Howe Island Group is included on the State Heritage Register as a 'Landscape – cultural' item under the NSW historic themes of cultural landscape, exploration, government and administration, and leisure. 20 local heritage items are listed in Schedule 2 of the Local Environmental Plan (LEP) and the Community-based Heritage Study (2012) recommends an additional 11 items for listing. The two closest listed items to the site are:

- Palmhaven (Garton house) – local historical significance due to strong associations with the Whiting family and well-designed and crafted bungalow typical of its time.
- Pinetrees family cemetery - high aesthetic values, strong associations with several of the Island's early settler families, and unique monument decoration and plantings.

Impact assessment

The proposed wind turbines would not significantly affect the World, National, State or local heritage values of the Island. The key scenic, aesthetic, biodiversity, cultural and historical values underpinning these listings would not be removed or degraded by the proposal.

World and National Heritage: The proposed wind turbines are not considered likely to significantly affect the World Heritage values of the Lord Howe Island Group property or compromise the World Heritage listing. In fact, a number of offsetting benefits would be provided in terms of vegetation restoration, and reduced air pollution, carbon emissions and risk of diesel spillages. The assessment of World Heritage impacts is relevant for National Heritage too; therefore the proposed wind turbines are also unlikely to significantly affect the National Heritage values. The proposal would not diminish the research or education opportunities available in the study area. The turbines may be audible from some locations in the settlement at certain times, but noise emissions would meet current amenity guidelines and are not expected to significantly affect the aesthetic values of the Island.

State and local heritage: The World Heritage and National Heritage assessments are also relevant for the State-significant State Heritage Register listing. The proposed wind turbines are outside the curtilage of the Schedule 2 listed heritage items and would not adversely affect their historical significance or associative values. There is potential for Palmhaven and Pinetrees family cemetery to be affected by noise and visual impacts, but based on the specialist studies and assessments against relevant heritage criteria, the proposal is not considered likely to adversely affect these local heritage values.

Management of impacts

Environmental safeguards and mitigation measures identified for minimising noise and visual impacts would also apply for the protection of heritage values at the World, National, State and local heritage scale. An adaptive approach should be applied to account for any unforeseen impacts to heritage values.



Pinetrees family cemetery (photo: Chris Betteridge)

Planning approval process

The solar panels, battery and control system elements of the project are going ahead, as the Development Application was approved by the Board in late 2015. The tender period to select the supplier for this element of the project is now closed and quotes are currently being reviewed to select the best option for the Island. Work on the ground to install the solar panels, battery and control system is expected to start in the first half of 2017.

Subject to approval, the wind turbines would be installed in mid-2017. The hybrid system will be fully operational in late 2017. Whilst the proposed wind turbines would maximise the reduction in diesel fuel consumption for the Island and are a key component of the hybrid renewable energy system, no decisions have been made.

Three levels of approval are required before the wind turbines could be constructed.

Local Government

The proposal is permissible with consent under the Lord Howe Island Local Environmental Plan (LEP) 2010. An Environmental Report meeting the requirements of Clause 42 and Schedule 3 of the LEP is required for consideration by the Board (the consent authority).

State Government

A Statement of Environmental Effects (SEE) is required to enable assessment and approval under Part 4 of the Environmental Planning and Assessment (EP&A) Act 1979. The SEE must meet the requirements of Section 111(1) of the Act and Clause 228 of the EP&A Regulation.

Commonwealth Government

The proposal has potential to affect a World Heritage property and a listed National Heritage property (the Lord Howe Island Group). The proposal will be referred to the Commonwealth Government to determine the controlled action status and assessment and approval requirements under the Environment Protection and Biodiversity Conservation (EPBC) Act 1999.

The Environmental Report meets the requirements under the Lord Howe Island LEP (Local Government approval) and the EP&A Act (State Government approval). A separate referral to the Environment Minister has been prepared for Commonwealth Government approval.

Have your say

Whether you are for or against the proposal, or somewhere in the middle, we want to know where the Lord Howe Island community stands on the wind turbines.

Provide your feedback to the Board:

The Development Application for the wind turbines (which includes the Environmental Report) will be on public exhibition for 28 days from **Friday 16 September to Friday 14 October 2016**.

Send your completed submission form or written feedback to:

- Manager Environment and Community Services, PO Box 5, Lord Howe Island NSW 2898
- or email administration@lhib.nsw.gov.au.

Copies of the full Environmental Report are available on the Board's website (www.lhib.nsw.gov.au on the 'Renewable Energy' page) and on display at the Board's Administration Office during normal business hours.

Provide your feedback to the Commonwealth Government:

Additionally, there will be an opportunity to provide submissions directly to the Commonwealth Department of the Environment during the 10 day public comment period for the EPBC referral. Dates and details of how to make a submission to the Commonwealth Government will be available at epbcnotices.environment.gov.au.