SUPPORTING STATEMENT
FOR THE ERECTION OF A SINGLE 11 kW GAIA WIND TURBINE.

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1. **INTRODUCTION**

Further to the online submission of an application for the erection of an 11kW Gaia-Wind turbine please accept the following information in support of the application together with the appropriate plans, specifications, illustrations and reports.

In line with current guidelines and policies determining micro-renewable projects we have taken the following into consideration:

We can confirm that a full site survey was carried out by Gaia-Wind, a fully accredited installer and supplier of Gaia-Wind turbines. The survey was carried out in order to ascertain the most viable and sustainable design and site layout with regard to suitable wind conditions for the turbine configuration, landscape framework, potential visual and noise impact upon neighbouring properties, road users and access to the site, electrical connection suitability and the general economic benefits of the chosen positioning of the turbines. The potential impact on the horizontal and vertical landscape was also taken into account in order for the turbine to be absorbed, through time, into its natural setting.
It is understood that the electricity produced by the 11kW Gaia-Wind turbine will be predominately for use within the premises with any surplus being sold back to the National Grid in order to generate an income that can be utilised to offset the capital cost of the equipment.

The result of the site survey has indicated that the installation of an 11kW Gaia-Wind turbine will not have a significant impact on the environment as a result of its nature, size or location.

2. **SITE DESCRIPTION**

The proposed site lies within predominately rural area, The proposed turbine is situated approximately 790m away from the village of Wallyford and 2.43km from the village of Whitecraig. The A6094 dual carriageway lies in the region of 385m to the west. The nearest residential property out with the applicants control lies in the region of 280m from the turbine which provides adequate separation to ensure that there is no noise impact to neighbouring properties. This separation will also ensure that there will be no adverse impact on the amenity of any neighbouring property with regard to loss of visual amenity. It is hoped that the local residents, in the wider locale, will view the installation as a proactive and positive effort to reduce carbon emissions and provide a source of renewable and sustainable energy locally.

3. **KEY CONSIDERATIONS**

A Gaia wind turbine is classed as a 'Small' wind turbine. Gaia turbines are generally utilised in producing energy for use within a property such as a rural house or farms. The energy consumption of such properties allow for their electricity needs to be met with the potential, in some cases, for any excess to be sold back to the National

Grid. The Gaia wind turbine operates in areas that are not 'prime wind' locations but are still economically viable and sustainable for the owner.
When selecting the site there are key considerations that should be taken into account, as follows:
Turbulent zones within the vicinity, created by obstacles such as buildings and trees, degrade the quality of wind which in turn will reduce the output of the turbine. In order to mitigate zones of turbulence it is important to have a turbine with sufficient tower height for the rotor to sit above the aforementioned zones. There should be preferably no, but certainly minimal, obstacles or obstructions in the direction of the prevailing wind which is predominately south west.

Wind speed tends to increase with height in most locations, a phenomenon known as wind shear. This variation in velocity with altitude is most dramatic near the surface. Further, the energy in wind is proportional to the cube of the wind speed. Consequently a small change in wind speed produces a much larger change in wind energy. For example: increasing the height of a turbine rotor, from 9m to 18m will increases the expected wind speeds by 10% and the expected power generated by 34%.

Wind energy capture is related to the area swept by the rotor e.g. a 6m radius rotor sweeps an area 4 times greater than a 3m rotor. Bigger rotors generate more power. This is important due to the Gaia wind turbine being utilised in areas that are not 'prime wind' locations in order to optimise the wind energy capture.

4. ROADS, PARKING & ACCESS

The proposed site of the Gaia-Wind turbine will require no new access roads or parking facility requirement. The turbine foundation is installed within a 2/3 day period with the Gaia-Turbine being erected on site, approximately three weeks after the pouring of the foundation taking a further 1 to 2 days, dependant on weather conditions. All refuse and materials are cleared on an ad hoc basis. The turbine is delivered in three sections in vans that require no more access to fields than current agricultural vehicles and as such no special arrangements require to be put in place.
Once in situ the turbine will require a yearly visit for servicing and as such there will be no impact on the current road use, access or volume of traffic.
There is no unacceptable detrimental effect on residential amenity, existing land use or road safety issues by reason of shadow flicker, noise or reflecting light.

5. DRAINAGE & FLOOD RISK

The site location is not located within a designated flood risk area and the site specific survey ascertained that there are no drainage or flood risk issues to be taken into account.

6. LANDSCAPING/OPEN SPACE/BIODIVERSITY

The siting of the turbine, as previously stated, has been assessed by a full site survey taking into account the local topography of the surrounding area. In order to

minimise visual effect and reduce the loss of amenity the turbine has been sited where the least disturbance can be established, whilst taking into account overhead power cables and viable and sustainable connections to the grid and in order for the turbine to be viewed in conjunction with the farm buildings.
No existing hedgerows, walls, trees or fence lines will be disturbed in the establishment of the turbines.
There will be no loss of trees or other important landscape features or valuable habitats and species.
The available evidence suggests that the Gaia-Wind turbine does not pose a significant hazard for birds.
There will be no unacceptable impacts on the quantity or quality of groundwater or surface water resources during construction, operation and decommissioning.

7. **ENVIRONMENTAL IMPACT ASSESSMENT**

In accordance with the Environmental Impact Assessment (Scotland) Regulations 1999 (as amended) wind turbines fall within Schedule 2 development and can require an Environmental Impact Assessment where they exceeds one of the two applicable thresholds and criteria set out below:
The development involves the installation of more than 2 turbines.
The hub height of any turbine or height of any other structure exceeds 15m.
However, DETR Circular 02/99, Environmental Impact Assessment (EIA), makes it clear that EIA is more likely to be required for commercial developments of five or more turbines, or more than 5 MW of new generating capacity, given that there is likely to be significant effects on the environment.
Taking this into account we were of the opinion that a full EIA is unlikely to be required in this case.

8. **LANDSCAPE IMPACT ASSESSMENT**

The proposal is for a single, small 11kw Gaia wind turbine where the wind turbine is located at 18.m above ground level and mounted on a free-standing tower with a 5m² concrete base. Due to the size and scale of the installation it is assessed that there will be no unacceptable impacts on the environment and local amenity.
The land on which the turbine is located is agricultural and the turbine is there to enhance the use of the area by providing a clean, renewable energy source .

The turbine design has been selected in order to minimise the visual impact of the installation and to permit it to blend in to the existing topography and landscape. Additionally the scale of the installation (18.m tall to hub) is sympathetic to the location.
It has been noted that a neighbouring property, Faaside Castle has a turbine installed to generate electricity. It is not felt that this turbine will cause any impact on the existing turbine or cause an unacceptable level of cumulative impact in the area.

9. **NOISE LEVELS & FLICKER**

An 11kW Gaia-Wind Turbine is amongst the quietest of small wind turbines available

on the market at the present time. We have submitted, in support of the application a noise report for your reference and have taken an illustration, as shown below, that the Gaia-Wind Turbine, located approximately 280 metres from the nearest residential property would have a noise level of 28 dB(A) at a standard 8m/s.

Distance from proposed Turbine Site to nearest Residential Neighbour: 280m

Distance	Gaia Wind turbine noise levels at standard 8 m/s wind speed
280m	28dB(A)
175m	35dB(A) Single turbine

There are no low frequency noise issues with the proposed turbine and we have enclosed for your reference a copy of a noise assessment report specific to a Gaia-Wind Turbine.
There is no interference with electrical equipment including telecoms, radio or TV equipment.
There is no radiation and no electromagnetic fields to affect any equipment in the vicinity.
There will be no interference with authorised aircraft activity.
There will be no electromagnetic disturbance to any existing transmitting or receiving systems.
ETSU-R-97 is a Noise Assessment and Rating advice note for Wind Turbine Developments. This Guidance Note recommends that in most the fixed noise limit for night time is 43DB (A) is acceptable. This limit is derived from 35DB (A) sleep disturbance criteria referred to in Planning Policy Guidance Note 24. An allowance of 10DB (A) is made for attenuation through an open window (free-field to internal) and 2dB subtracted to account for us of LA90 10min rather than 23 LAeq 10 min. They also recommend noise emission of the turbine in relation to a neighbour's outdoor sitting area in the open countryside should be no higher than 43 -45 dB (A) at any noise sensitive properties.
It must be noted that ETSU-R-97 advocates that considerations should be given to increasing the permissible margin above background where the occupier of the site has some financial involvement in the wind turbines meaning that it can be acceptable to have higher noise readings where the applicant's property is the primary affected residence. The noise data in the table above gives indicative noise levels at various distances from the Gaia base of the turbine. The data is derived from independent measurements made at a site in Denmark.

SHADOW FLICKER

Shadow flicker can cause a problem to nearby properties early in the morning or late in evening. It is caused by the rotating blades interrupting the light from sun when the turbine is between the property and the sun. This occurs early in the morning to the west of the turbine and late in the evening to the east of turbine. The effect is likely to be worse on sunny days in winter than in summer, as in summer the sun is much higher for longer and therefore the shadow is more local to the actual turbine.
It is generally accepted that some degree of shadow flicker is acceptable, but that limits should be imposed to restrict the number of hours per year for which any one property is affected. There are no specific rules on this, but a 30 hour per year

maximum has been suggested as reasonable in Germany and this seems to be generally accepted.
Expected shadow flicker is difficult to predict, however, some general rules and guidance can be applied. Assuming an 18m tower and 13m diameter blades at the latitude of London, the following guidelines may be used to ensure a low risk of adverse affects.
No property with a window facing the turbine should be within 36m of the turbine location from due east, through north, to due west.

Care should be taken to ensure that any property within 72m at a direction from 120 degrees west to 120 degrees east of the turbine location does not have a light sensitive outlook towards the turbine. E.g. a west facing conservatory or patio where the occupant might be expected to sit out on a sunny evening.
Properties greater than 85m away are unlikely to be seriously affected, since the duration of any shadow flicker will be reduced, and its severity will be lower since the shadows from the blades will become more diffuse.
In this case the separation distances between the turbine and all neighbouring residential properties are well in excess of the recommendations above.

10. **WIND TURBINE TECHNICAL SPECIFICATIONS**

Hub Height	18.3m
Yaw System	Free Yaw
Cut-In wind speed	3.5 m/s
Rated wind speed	25 m/s
Nacelle Weight	900 kg
Operating Temperature	-20 - 50 deg C
Rotor	
Diameter	13.0m
Blade Material	Glass Fibre Reinforced Polyester (GRP)
Nominal Speed	56 rpm
Weight	200kg
Power Regulation	Stall regulated
Air Brake	Tip brakes, centripetal activation
Generator	
Type	3-phase induction generator, 400 V, 50hZ, Marine Grade
Nominal Power	11 Kw
Weight	138 kg
Gear	
Transmission Ratio	1 : 18

Lubrication	Centrifugal
Weight	143 kg
Mechanical Brake	
System	Calliper Brake Disc
Location	High-Speed Shaft
Tower	
Height	18.0 m
Weight	Tubular Tower - 2200 kg

11. **WIND TURBINE DESIGN**

Towers	Constructed from Galvanised Steel. Lattice or Tubular design. Lattice design merges into background such as trees and hills. Tubular design compliments modern structures Both designs are ideal for rural, agricultural farm and domestic settings.
Rotor	Slow turning at nominal speed of 56 rpm (independent of wind speed). Light grey, reflection free fibreglass blades.
Colour	Pale Gray Galvanised 12 - An analysis of different colours (grey, galvanised, green, brown and black) was carried out in order to derive the least obtrusive when set in several backgrounds such as rural , farms, agricultural or domestic settings.

12. **SAFETY FEATURES**

The Gaia-Wind turbine has a number of safety features to ensure that the rotor speed and power generation are kept under control in all wind conditions. These exist as passive features built into the design or are actively initiated by the control system.
There are three levels of protection:
First level – passive:
The aerodynamic design of the blades introduces a gradual stalling effect as wind speeds rise above 12 m/s. This limits power output.

If for any reason the turbine is disconnected from the grid, a spring operated mechanical brake is released and the rotor is stopped.

Second Level – controller initiated:
At wind speeds above 25 m/s (56 mph) the controller activates a mechanical brake. This stops the rotor turning. The brake is not released until wind speed drops consistently below 25 m/s.

The controller will also activate the brake if an excessive vibration is detected, if the generator overheats or if there is a grid electrical fault.

A manual override button on the controller can also be used to activate the braking mechanism

Third level – passive:
In the extremely unlikely event that the first and second level safety mechanisms are insufficient or fail, centrifugally activated aerodynamic brakes, concealed in the rotor tips, release, spoiling the rotor aerodynamics and its subsequent ability to rotate.

13. **IMPACT ON THE CHARACTER OF THE LANDSCAPE**

Due to the siting and scale of this installation, the wind turbine would have only a very minimal visual impact on landscape that would be mitigated by the positive effects the turbine would have on the environment, such as a reduction in CO2 emissions by an annual saving of over 19 tonnes of CO2, which will lead to a reduction in global warming, helping to sustain the integrity of the landscape in the longer term. It will also enable the applicants to reduce their energy bills and to increase their self-sufficiency in terms of electricity production.
The chosen turbine scale and design, will help to breakdown the mass of this installation and will reduce its visibility over a distance. The turbine has no tail fin and only two blades as opposed to the usual three, which makes the turbine head less visually obtrusive. Also the pale grey colour of the turbine will help the structure blend with the landscape as it matches the sky by mirroring the stormy colours and white clouds. The design of the Gaia turbine is such that it has a constant blade rotational speed of 56 rpm whatever the wind conditions as opposed to other similar scale models which can have a revolution speed of up to 300 rpm, this means that the visual disturbance of the Gaia turbine is also significantly less than other models. Although the turbine may be visible from some viewpoints it is hoped that it will be viewed as a positive and proactive approach to achieving sustainable, renewable energy sources. When considering landscape impact NPPG6 places a strong emphasis on the encouragement of site specific small-scale development and stress that the provision of clean sources of sustainable energy can override perceived landscape harm. Small-scale projects can provide a valuable cumulative contribution to overall output of renewable energy locally and nationally.
The turbines will provide a clean source of sustainable energy for use on the property thus reducing reliance on traditional ‘carbon heavy’ energy sources by the property owner. Additionally it will benefit them via a modest long term income from the proposed Feed in Tariff Scheme, which was introduced in April 2010 as part of the 2008 Energy Act.

In conclusion as outlined above the proposed wind turbine will not cause unacceptable harm to the visual amenity of the locality nor will it have a detrimental effect on the character of the area.

14. **ECOLOGY & NATURE**

As highlighted through NPPG6, the greatest threat to all living species is climate change resulting from carbon emissions. Whilst there is little data available on the risk to wildlife by small wind turbines and the Gaia-Wind small turbine specifically, it is too easy to impose requirements appropriate to industrial scale machines.

The land immediately surrounding the application site for the proposed turbine is rural / agricultural. From the initial site survey no features of wildlife interest have been identified in the immediate vicinity of the site of the wind turbine and there are no adjacent sites that are designated as having any local, regional, national or international ecological interest.

The British Wind Energy Association Website (http://www.bwea.com) States "Experience and careful monitoring by independent experts shows that birds are unlikely to be damaged by the moving blades of micro wind generators. The Royal Society for the Protection of Birds, whose view is that "Climate change is the most significant, long- term threat to biodiversity worldwide. To help meet this threat, the RSPB also strongly supports moves to increase energy efficiency, reduce energy demand and supply more of our energy needs from renewable sources, including wind power, provided they do not harm birds or their habitats." Studies of birds increasingly show that the risk from wind turbines to most species is very low, far greater risk exists from overhead cables and moving cars.

Guidance published by the BWEA 2001 in conjunction with English Nature, RSPB and WWWF-UK indicates that bats species in the UK are unlikely to come in to contact with blades during their normal movements. Risk to bats and other flying species are reduced by the design of the turbines, compared to other small turbines, as the rotors are slow moving at a constant 56 rpm. Bats have been observed to avoid rotors on large wind turbines with echo-location, though are not able to detect the low pressure areas behind the rotor resulting in lung damage, or Barotrauma. With small wind turbines the risk of Barotrauma is low due to the shorter extent of low pressure behind the rotor, approximately 15cm compared with 3-4m with large wind turbines. No bat casualties or other casualties have been observed from a turbine positioned 25m from a bat foraging route. There is no published evidence of turbines of this size interfering with echolocation calls or causing injuries as a result of atmospheric pressure drop at wind turbine blades, these problems are more commonly associated with large megawatt generators or wind farms and not micro generators as proposed in this location.

Many nature conservation bodies now support the use of small scale renewables installation including domestic turbines, for example the National Trust " believe there is great potential in developing renewable energy, for both electricity and heat, at a more local and small scale, in households, businesses and communities." http://www.nationaltrust.org.uk/main/w-microgen-policy_from_practice.pdf and English Nature also "support the development of renewable energy schemes (including wind, biomass and energy from waste projects) where these have appropriate standards for environmental protection, will not damage wildlife and natural features, and will contribute to achieving sustainability as well as emissions reduction targets."

Taking the above into account the proposed construction and operation of the wind turbine can be carried out without having any adverse impact on existing ecological

or hydrological features or assets of value as such the proposal does not conflict with local or national planning policy concerning this matter.

15. **AVIATION**

Following discussions throughout 2001 by the DTI-led 'Working Group for Wind Energy, Defence and Civil Aviation Interests', a consultation proforma has been agreed between the BWEA and key Aviation issue consultees such as the MOD, NATS and CAA. Details
Because of their physical size, in particular their height, wind farms can have an effect on the aviation domain. Additionally, rotating wind turbine blades may have an impact on certain aviation operations, particularly those involving radar. The aviation community has procedures in place which are designed to assess the potential effect of developments such as wind farms on its activities, and, where necessary, to identify mitigating measures.
An analysis of the surrounding area would seem to indicate that there are no MOD or civil aviation facilities in the immediate vicinity and therefore it is unlikely that this proposal would be of concern to them. The turbine height is well below the lowest point at which any MOD flights are permitted to fly, under the low fly regulations and therefore this should also not represent any concerns to them.

16. **DECOMMISIONING**

It has been determined that the life span of the Gaia-Wind turbine is in the region of 20 -25 years if regularly serviced and maintained. If the turbine is still operational then further permission will be applied for to continue in the generation of electricity. If, however the turbine is no longer in commission it can be easily removed from the site and the area of land reinstated.

17. CONCLUSION

This proposal is for a single, small, 11kW Gaia wind turbine which will be used to generate renewable energy and reduce CO2 emissions by over 19 tonnes per year. The production of electricity will assist the owners to achieve a viable and sustainable source of power. The location of the turbine has been chosen to ensure that it has the least visual impact possible on the surrounding area, while being able to capture the benefits of the prevailing wind. The turbine is relatively small in scale when viewed in context with the surrounding area. It is therefore felt that this is an appropriate location for the turbine and that any small impacts this development may have would be greatly outweighed by the economic and environmental benefits detailed above.

We trust that the above information will assist you in determining the application. Should you require any further information or assistance please do not hesitate to contact this office.
We reserve the right to augment the application, if necessary, should any unforeseen development occur that affects the application to its detriment.

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