

Guidance Notes for Wind Turbine Site Suitability



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The Crown and the Greater London Authority
October 2006

Published by

London Energy Partnership, c/o Greater London Authority, City Hall,
The Queen's Walk, London SE1 2AA

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ISBN

Cover picture:

Picture 1: LE Group

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Executive Summary

Scope

This document is part of the London Energy Partnership's (LEP) feasibility study into the potential for non-building integrated wind energy and biomass plants. The wind study includes:

- a) A feasibility study into the potential for non-building integrated wind in London
- b) The identification of sites that are suitable for wind turbines, illustrated on GIS maps, and production of a set of guidelines detailing what renders a site suitable for installing a wind turbine.

This document, *Guidance Notes for Wind Turbine Site Suitability* provides a set of guidance notes outlining the general principles of site suitability for both large and smaller (1-100kW) wind turbines within an urban environment. It also provides advice on how turbines, both large and smaller (1-100kW), can be developed as of community projects, including guidance on financing and working with appropriate developers. It provides a step-by-step approach to assessing a site's suitability for the development, any constraints that will limit its placement, and any potential issues that could be encountered, including those on a strategic scale. This document relates to all areas throughout the Greater London area and is not constrained to those sites identified as "wind opportunity areas".

Constraints

These comprehensive guidance notes can be used by potential wind applicants or by the LEP, Greater London Authority (GLA) and local planning authorities when planning and assessing strategic local wind development opportunities in their areas, as well as when assessing specific planning applications. However, given the rigorous tests and scrutiny that wind energy schemes undergo, it is not possible to provide an exhaustive assessment of all scenarios encountered by wind turbine proposals.

Therefore, it should be noted that any developers, landowners or stakeholders interested in pursuing such schemes may be required to undertake further assessments and investigations, especially for large-scale wind developments, before any official consent is forthcoming.

Outputs

The report outlines a series of guidance notes relating to the installation of large-scale and small-scale wind energy schemes. Further detailed guidance relating to wind energy development in general is set out in *Planning for Renewable Energy: A Companion Guide to Planning Policy Statement 22*, 2004.

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1 Introduction

This document represents a companion guide to the study commissioned by the London Energy Partnership to investigate the potential resource for siting large-scale and smaller, stand-alone wind turbines in the urban and urban fringe environment of Greater London.

Phase 1 of the aforementioned report seeks primarily to identify opportunities to develop wind energy in urban parts of London and provides an overview for those stakeholders and/or developers taking advantage of subsequent study phases. The Phase 1 report establishes that there are a range of opportunities for wind energy development within the study area, given the diversity of existing land uses and the varied topography of the area of search.

The Phase 2 study provides a more detailed investigation of the initial “opportunity” areas in order to select those sites most suitable for the pursuit of wind energy development. The result has been a portfolio of locations encompassing sites suitable for general wind farm opportunities, landmark sites, and innovative sites for utilising new technologies such as low wind speed turbines.

This companion guide to Phase 1 and Phase 2; *Guidance Notes for Wind Turbine Site Suitability*, presents an overview of the issues that need to be considered when identifying, characterising and progressing potential wind farm sites in the Greater London area. This guidance provides advice on the issues involved in site selection for both large and small-scale wind turbines. Whilst this information is included within the text of the Phase 1 and Phase 2 reports, it has been compiled within this separate document to provide a general guide for use by the LEP, GLA and local planning authorities when planning and assessing local wind development opportunities in their areas, in addition to assessing specific planning applications.

2 Guidance Notes for Large Scale Wind Development

2.1 Overview

This section provides a set of guidance notes that outline the general principles of site suitability for larger wind turbines (>100 kW) within an urban environment. It provides a step-by-step approach to assessing a site's suitability for the development of large-scale wind. Any constraints that will limit its placement are highlighted and any potential issues that could be encountered, including those on a strategic scale, are also addressed.

As with all forms of development, wind energy proposals face a variety of constraints which may either be reasonably surmounted or, conversely, severely limit the number of localities suitable for such a proposal. Such constraints should be addressed in the early stages of site selection to ensure the exclusion of less feasible locations for wind development and increase the possibility of achieving planning permission. The opportunities for siting a large-scale wind turbine in the London area are fairly constrained due to the lack of space available and the heavily urbanised environment.

Wind Energy Development is classed as Schedule II development under the provisions of the Town and Country Planning (Environmental Impact Assessment) Regulations 1999, to which it is the duty of the local planning authority to consider whether a formal planning application for the development would need to be supported with an Environmental Impact Assessment (EIA). The EIA procedure ensures that any likely significant environmental effects of development projects and their mitigation measures are identified and taken into account within the planning process. If a full EIA is not required, a Scoping Report produced by the local planning authority will identify the constraints recommended for address within the planning application.

This chapter provides guidance for locating large-scale wind turbines by describing the constraints faced by wind energy development and the methods by which they are addressed.

2.1.1 Wind resource

The United Kingdom possesses the greatest wind resource within Europe with the UK benefiting from 40% of Europe's total wind energy potential. Wind speeds specifically in the Greater London area average at $5.0-6.0\text{ms}^{-1}$ at 45m agl (above ground level). Wind turbines can produce energy over a range of wind speeds starting at circa $3 - 4 \text{ms}^{-1}$. However, it is generally accepted that wind speeds greater than 5.5ms^{-1} are economically viable for wind development.

As the Greater London area is heavily developed, on-site measurements are vital to ensure existing buildings have adequate wind speeds for economically viable wind development. London's wind resource is discussed in more detail in section 2.2.

2.1.2 Grid access

An initial grid connection assessment will be required, based on the installed capacities of the initial site layout(s). The assessment will involve the use of public domain data regarding the existing grid infrastructure and the current system load profile. The local Distribution Network Operators (DNO) are well placed to provide support in any subsequent discussions or negotiations. The grid assessment will

identify connection options together with their likely maximum allowable power export capacities, and estimated capital costs. If the nearest grid connection is some distance from the turbine then wooden pole lines or underground cables will be required to transmit the power. In such a case, the proposal may not be economically feasible; however, the electricity company will indicate whether the connection is technically and commercially viable. Any additional wooden pole lines required for the grid connection may add to both visual and potentially financial constraints.

2.1.3 Landscape and visual impact

It is important to identify all international and national nature conservation designations in the vicinity of the sites including RAMSAR Sites, Natura 2000 sites (Special Areas of Conservation (SACs) and Special Protected Areas (SPAs), World Heritage Sites, National Parks and Areas of Outstanding Natural Beauty (AONB), which receive the highest level of protection nationally.

Bromley is the only London borough that includes part of an AONB, the Kent Downs. There are no National Parks within the London search area. There are two RAMSAR sites in Greater London, Lee Valley in Essex and South West London Waterbodies, Surrey. There are a number of World Heritage Sites: Maritime Greenwich; Royal Botanic Gardens Kew; Tower of London; Westminster Palace, Westminster Abbey and Saint Margaret's Church.

Other national designations include Sites of Special Scientific Interest (SSSI), and National Nature Reserves. In addition, local nature conservation areas should be identified wherever the information is publicly available. These will usually be highlighted within Unitary Development Plans or Local Development Frameworks.

Following the identification of such designations, the extent to which the proposed site layouts could significantly impact on the designations is assessed including, in the cases of the ecological designations, any resident species and habitats. Opportunities to address any potential concerns at the site design stage will also be quantified.

All the information regarding environmental constraints will be available from the relevant local authority. Landscape and visual impact is considered one of the main environmental issues in determining wind development applications. PPS22 includes that planning permission should not be granted for renewable energy developments in designated areas unless there are strong overriding considerations and no alternative locations. It is unlikely that large-scale commercial wind development would be permitted in such areas, however, there is potential for small-scale wind turbines to be considered acceptable within designated areas such as AONBs.

2.1.4 Ecological impact

Developers are required to undertake an Environmental Impact Assessment (EIA) for all major wind projects. The EIA identifies any risks posed by the proposed development. Any protected species such as bats, badgers and great crested newts will be identified in the EIA and avoidance or mitigation measures will then be discussed.

With regard to ornithology, it is important that consultation takes place at the early stages between the developer and RSPB/English Nature. Some wind energy

proposals, including most larger schemes, may need to be the subject of a breeding bird survey, usually carried out between late March and early June, and a winter bird survey (November to February).

In areas which are potentially more sensitive, further survey work may be required to quantify bird flight activity across the site. Bird assessments performed as part of the EIA will highlight areas to avoid locating wind turbines, where such wind development would have an adverse impact on birds.

In the UK wind turbine developments have avoided adverse impacts on birds. The majority of nature organisations recognise the threat that climate change will have on wildlife and ecology and encourage their members to support measures to combat climate change, including renewable energy.

It is generally considered that most birds will avoid obstacles in their flight path. However, in areas where designations such as SPAs, SACs and SSSIs seek to protect specific bird species, there will be constraints on wind energy development as wind farms must not have an adverse impact on such areas, or the protected species they host.

2.1.5 Archaeology

To anticipate any unforeseeable archaeological constraints there is a need to identify and quantify the archaeological context of potential sites. This will only be necessary on those sites where archaeological levels are likely to remain in the vicinity of potential turbine locations. Site surveys prior to application are to be included in the EIA or Environmental Report. PPG16 on Archaeology and Planning advises on the procedures that should be followed in handling planning applications to ensure that archaeological remains are not needlessly damaged.

If nationally important remains and their settings will be affected by the proposed development they should normally be physically preserved. Initial desk-based research and a site walkover may be required. As part of the planning permission, it may be considered necessary to include a condition to ensure that an archaeologist holds a watching brief during the construction. If there are any findings during the watching brief development could be halted for a certain period and this could potentially cause disruption to the development and reduce the economic viability of the scheme.

2.1.6 Noise

Noise is an issue that tends to receive public concern; however, this concern is often related to perception rather than actual experience. Turbine technology has advanced over recent years and noise has been significantly reduced. Livestock frequently graze right up to turbine towers demonstrating that turbine noise is not a concern for cattle farming.

A buffer of approximately 400 metres is usually placed around residential areas to ensure that amenity would not be affected by noise. This also exceeds any requirement for 'topple distance' separation from residential areas. Very few urban environments are not exposed to noise from people, roads, railways and industrial processes etc. In many cases the noise produced by wind turbines will be masked by this background noise, even at distances considerably less than 400 metres. A noise assessment should accompany every planning application and EIA, and should consider:

- a) Noise sensitive receptors in the vicinity
- b) Predicted noise from the turbines
- c) Background noise assessment (including monitoring if necessary)
- d) Compatibility with relevant guidance
- e) Potential mitigation, if necessary.

Data in Table 1 is taken from PPS22 and demonstrates how the noise from wind turbines compares with other everyday noises:

Table 1: Noise generated by wind turbines compared with other every day activities (Source: PPS22)

Source/Activity	Indicative Noise Level dB(A)
Threshold of Pain	140
Jet aircraft at 250 m	105
Pneumatic drill at 7 m	95
Truck at 30 mph at 100 m	65
Busy general office	60
Car at 40 mph at 100 m	55
Wind farm at 350 m	35-45
Quiet bedroom	20
Rural night-time background	20-40
Threshold of hearing	0

The report ‘*The Assessment and Rating of Noise from Wind Farms*’ (ETSU-R-97), gives advice on noise limits from wind farms in order to protect wind farm neighbours, without placing unreasonable restrictions on wind farm development. The ETSU guidelines should be used by planning authorities when assessing noise from wind energy developments.

The ETSU report states that separate noise limits should apply for day and night-time as during the evening the emphasis is on preventing sleep disturbance. Noise from the wind farm should be limited to 5 dB(A) above background noise levels for both day- and night-time. A fixed limit of 43 dB(A) is recommended for night-time. This is based on a sleep disturbance criteria of 35 dB(A). Where the occupier of the property has a financial interest in the wind farm the noise limits for day and night can be increased to 45 dB(A).

The guidance advises that in low noise environments the day-time level of the wind farm noise should be limited to an absolute level within the range of 35-40 dB(A). The noise limit chosen within this range depends upon the number of dwellings in the neighbourhood of the wind farm, the effect of noise limits on the number of kWh generated, and the duration of the level of exposure.

In cases of single turbines or wind farms with very large separation distances between the turbines and the nearest properties, the guidance states that a simplified noise condition may be suitable. If the noise is limited to a LA90,10 min of 35 dB(A) up to wind speeds of 10ms⁻¹ at 10m height, then this condition alone would protect the amenity and a background noise survey would not be necessary.

In addition, the report '*Sounder City - The Mayor's Ambient Noise Strategy*¹', published in 2004, should also be considered when pursuing wind energy development in the Greater London area. This does not introduce specific new requirements related to noise impact from renewable energy sources, but it will be beneficial for all wind energy developments to have regard to this strategy.

2.1.7 Shadow flicker

Shadow flicker is an issue which gives concern to some residents near wind energy proposals. Shadow flicker occurs when a turbine is positioned between the sun and a potential receptor such as a dwelling, in a location where the rotating blades effectively block the view of the sun, casting a flickering shadow. It only occurs inside buildings where the flicker appears through a narrow opening such as a window or doorway. Such effects are strongest at sunrise and sunset.

It is generally accepted that shadow flicker does not occur at distances greater than the equivalent of ten times rotor diameter. In the case of smaller and second hand turbines (100kW - 500kW) it would be a distance of between 260 - 390m, and in the case of larger turbines (up to 3 MW) the distance would be up to 1.0 km. It is also acknowledged within Planning for Renewable Energy A Companion Guide to PPS22 that only properties within 130 degrees either side of north, relative to the turbines, can be affected at these latitudes in the UK as turbines do not cast long shadows on their southern sides. However, the occurrence is likely to be rare and infrequent and modern turbines can be programmed to be switched off at the times at which shadow flicker can occur.

2.1.8 Telecommunications

Wind turbines can interfere with radio signals and affect TV reception and telecommunications systems. The Office of Communications (Ofcom) is responsible for protecting radio systems against interference. Ofcom also provides information on telecommunications that may be affected by a proposed wind farm.

There are a number of solutions available that can mitigate any negative effects to telecommunications caused by wind turbines. Solutions include the installation of digital television or a local community re-broadcast facility. Interference of television reception can be solved relatively easily and at a low-cost.

Interference of fixed radio links can be more difficult to resolve, early identification of such issues can identify where problems are minor and can be mitigated.

2.1.9 Aeronautical concerns

Aviation and radar issues are considered major constraints to wind development in the UK. It is suggested that the UK has some of the strictest policies regarding aviation and radar. Early consultation with statutory consultees: the Civil Aviation Authority (CAA), Ministry of Defence (MOD) and the National Air Traffic Service (NATS) is important and it can often avoid problems at a later stage.

The MOD requests consultation on projects within 67 km of their airfields, where these are radar equipped. There are also statutory consultation requirements for any wind project within 10 km of any Secondary Surveillance Radar (SSR) facilities.

¹ <http://www.london.gov.uk/mayor/strategies/noise/downloads.jsp>

In general many aeronautical and radar issues can be resolved by site scoping and through technical solutions. Importantly, early consultation with the key stakeholders is essential at the initial stages.

2.2 Wind Resource in the Greater London Area

2.2.1 London's wind regime

This section describes the nature of the wind regime across London, examining how London is incorporated in the national picture, what localised effects are seen on the wind regime in London and the characteristics of the wind regime from available data sources.

2.2.2 The national picture

As a whole the UK wind regime has certain patterns of variability, demonstrated via the results of many years of measurement and observation, primarily using data collected from approximately 150 surface observing stations of the Meteorological Office. In general terms, notwithstanding local exceptions, the wind regime of the UK is driven predominantly by the Atlantic depressions, which typically follow a track between Scotland and Iceland, and which result in a prevailing south-westerly directionality.

Typically, windspeeds are higher in the more exposed areas of the north and the west, closer to the centres of the tracking depressions. Consequently, lower windspeeds are observed in the central and eastern areas, and away from the coasts. As the predominant UK wind source lies in the west, the further east the winds travel, the more they are slowed by surface friction effects from the terrain. London, located in the south-east of the country, is therefore in the less windy area of the UK.

2.2.3 Local effects on the wind regime

Given the fact that London lies in a less windy part of the UK, this does not preclude localised effects modifying the wind regime to produce relatively higher and lower windspeeds within the region. There are a number of factors which will affect the nature of these localised variations.

2.2.3.1 Topography

Topography affects the natural flow of wind across the terrain. Measurements and mathematical modelling exercises have assessed the nature and magnitude of such effects. Typically, increases in altitude will create speed-ups of the windspeed near the surface and localised areas of higher windspeed will result. The precise nature of these speed-ups will vary according to the shape, extent and orientation of the terrain feature relative to the incident wind regime. The underlying topography of London is not particularly complex, and the variation in windspeed across the region is not therefore likely to be that great.

2.2.3.2 Roughness

Roughness is a term describing the magnitude of the vegetation or other features on the terrain, which will have a friction effect on the wind regime, slowing it down from the upstream conditions. The roughness is described in terms of a length which is proportional to the height of the feature (eg a tree, grass, blown sand or an urban area). The higher the roughness value, the greater the slowing effect. Urban areas,

as most of London would be classified, have a higher roughness value than open fields or moorland.

Windspeeds vary with height above the ground (shear profile). This is dependent on the roughness and, in the case of an urban area, can be quite complex as each building or group of buildings will create an effect on the boundary layer of the atmosphere (the level of the atmosphere closest to the surface).

2.2.3.3 Obstacles

The main characteristic of the urban wind environment is the presence of buildings which act as obstacles to the flow. Such obstacles can create local vortices which result in localised concentrations of flow and areas of calm, depending on the relative magnitude of the wind and the direction of the flow relative to the geometry of the building, or group of buildings. Obstacles can also be a source of additional turbulence in the wind.

Turbulence exists naturally and is defined as perturbations about the mean windspeed over a given time period. The effect of turbulence on wind turbines can be to create concentrations or imbalances in load patterns across a wind turbine rotor and on the tower structure. Over time, these effects can impact on the fatigue lifetime of the turbine. The presence of obstacles to the flow increases natural turbulence in the wind. Conversely, the higher the turbine relative to local obstacles, the less their effect will be. Using sensible siting practices, the location of turbines relative to buildings can be designed to minimise the turbulence effects caused by the buildings themselves.

2.2.4 Characteristics of the wind regime across London

There are a number of sources of data from which a representative picture of the wind regime of the London region can be determined. The Meteorological Office, whose sites in and around London provide a primary source of information, have a charging policy which precludes the use of their data in this study. Secondary sources of data include:

The UK Windspeed Database (“NOABL”): This national database of UK windspeeds is based on the use of a mass-consistent numerical model, NOABL, initiated using data from a large number of the Meteorological Office sites. The study was funded by ETSU under the DTI and has resulted in a database of windspeeds at 10m, 25m and 45m above ground for each 1km square across the UK. Whilst only to be regarded as indicative, the database nevertheless gives a reasonable picture, especially in areas of low terrain variability (such as London), of the likely long-term windspeed magnitude.

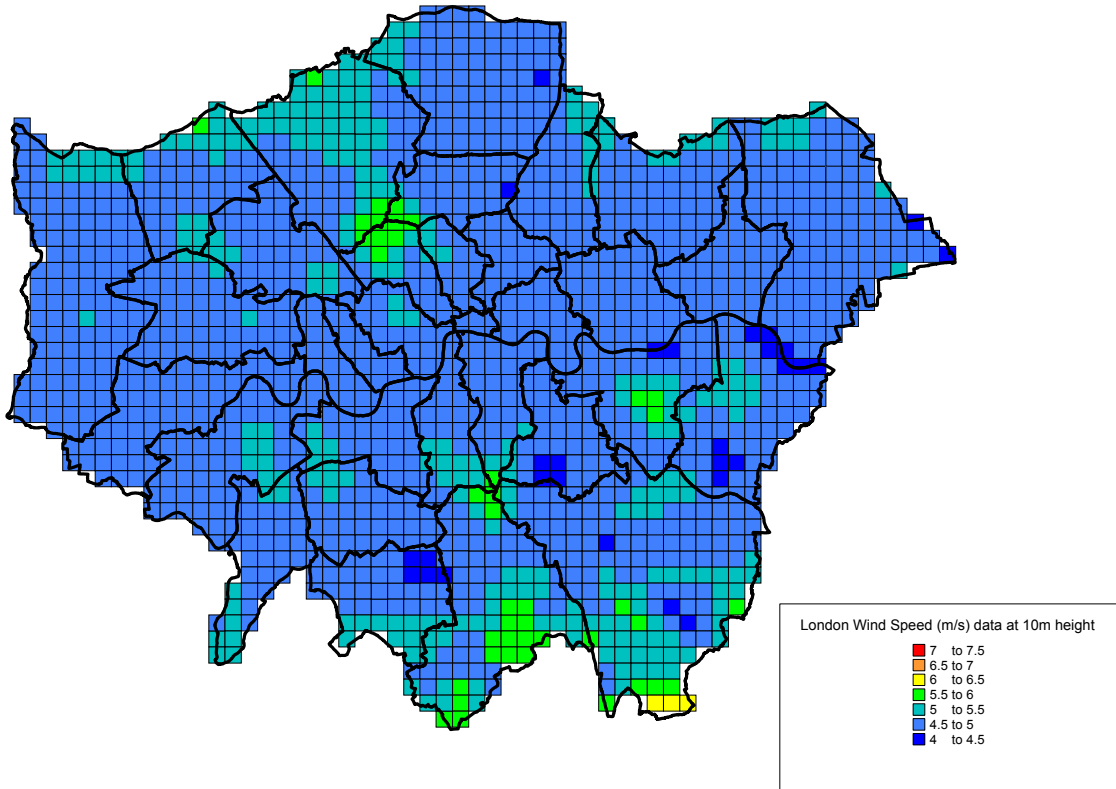
The European Wind Atlas (EWA) was created as the result of an EU funded program which used the numerical model WAsP, initiated by Met. Office data in the case of the UK, to provide a more detailed picture of the wind regime at a number of regionally-representative sites. One such site used was London Heathrow.

2.2.4.1 Magnitudes

NOABL windspeeds for the London region are shown graphically in Figure 11 and range in magnitude at 10m from 4-7.5ms⁻¹. The EWA summary data for Heathrow shows a mean windspeed based on data collected between 1973 and 1982 of 4.0ms⁻¹ at 10m agl. This is lower than the NOABL estimate and highlights the issue over how

the use of different data periods and modelling codes can affect results. The EWA summary is, at least, derived initially from observations at the site.

Figure 1: NOABL Wind Speeds for London



2.2.4.2 Directionality

NOABL data does not include a directional element. The EWA summary for Heathrow shows the typical UK wind rose with a predominant south-westerly component.

2.2.5 Summary

The wind regime across London is at the lower end of the range of windspeeds across the UK due to the predominant south-westerly nature of the national wind climate and the surface characteristics of the region.

The most significant element of the regime in terms of wind energy implementation will be the levels of turbulence induced by the presence of buildings acting as obstacles to the flow.

Several secondary sources of data exist which can serve to act as indicators of the likely magnitude of the wind regime across London.

2.3 Aeronautical Issues within the Greater London Area

There are a number of officially safeguarded aerodromes in and around London. These include Heathrow, Gatwick, Luton, London City, Stansted and Biggin Hill. All of these sites operate radar systems, with the exception of Biggin Hill and London

City. The radar systems at Heathrow, Gatwick and Stansted, supplemented by a NATs radar at Debden near to Saffron Walden, together provide the 'Thames' radar service, used by London City and Biggin Hill. In addition, a radar system is operated by RAF Northolt, and a meteorological radar is located at Chenies, west of Watford.

All these aerodromes represent a potentially significant constraint to wind energy development in and around London, particularly with regard to the radar equipped sites where turbines have the potential to have an unacceptable impact on the operation of the airports primary and secondary radar systems. With regard to primary radar problems can arise as wind turbines can be detected by the radar creating 'Clutter' on radar screens which may increase the workload of air traffic controllers. When sites consist of several turbines, and the rotors are turning, the resultant radar return can mimic that of a moving aircraft, further increasing the work of air traffic controllers. With regard to Secondary Surveillance Radar (SSR), these communicate directly with transponder equipped aircraft. Where turbines lie within 10km of a SSR, it is possible that rotating turbines could affect the communication between SSRs and aircraft, leading to the incorrect identification of the position of the latter. This, however, is not considered to be a problem at distances greater than 10km from a SSR.

This 10km exclusion zone also applies to the SSR at RAF Northolt and the Chenies Meteorological Office radar.

In summary, airports object to proposals within 10km of their secondary radar systems, and these objections would effectively prevent the development of turbines where they would be visible to airports and would affect the secondary radar.

With regard to primary radar, concerns are frequently raised with regard to proposals, which, it is felt, may be visible to the radar out to a radius of 30km. In reality, however, even where a wind proposal is potentially visible to a primary radar system within 30km of an aerodrome, this may only have an unacceptable impact on the radar service where it lies within an approach or departure route, or any other trafficked areas such as 'Stacking' areas. TNEI has significant experience of securing planning consent for wind proposals within 30km of aeronautical primary radar elsewhere in the UK, both where the proposals were predicted to be visible, but were not in operationally significant areas; and where it was successfully demonstrated that the proposal in question would not be visible to the radar in question. The CAA have closely monitored such negotiations and have, on occasion, intervened where they have felt that airports have behaved unreasonably.

With regard to such line-of-sight issues, it is safe to assume that turbine proposals which are not 'visible' to any aeronautical radar will not receive a sustainable aeronautical objection on radar grounds. Where proposals are potentially visible but are over 30km from a radar equipped airfield, a sustained objection on radar impact grounds is again unlikely. Sites within 30km of such an airfield, and as close as 10km, would not sustain an objection if it could be demonstrated that topography or buildings effectively obscure the proposal from the relevant radar, or it can be demonstrated that a proposal would not have an adverse impact on airport operation, even if it were visible.

The acceptance of potential wind energy developments to the Ministry of Defence (MOD), Civil Aviation Authority (CAA) and National Air Traffic Services (NATS) is a

very significant factor in their potential deliverability as sites with outstanding objections from these bodies fail to obtain planning consent, almost without exception. As a result, developers tend to undertake formal consultation at the earliest opportunity. Such consultation takes the form of a standard proforma in which wind energy developers list the exact locations, dimensions, construction details and output of all proposed turbines. Completed proforma are submitted to the MOD who consult with their various departments, as well as the CAA and NATs. Where a site falls within 30km of a safeguarded aerodrome, the CAA generally devolves safeguarding responsibility to the aerodrome(s) in question.

NATs and the CAA do, however, object to wind energy proposals, which they feel could adversely impact en-route aeronautical radar coverage. Although this is, again, unlikely, further clarification should always be sought through the normal consultation route, should specific sites be progressed.

With regard to London City Airport, specific safeguarding advice is set out in the *London Borough of Newham Supplementary Planning Guidance Note: London City Airport Safeguarding*². The purpose of the guidance note is to inform those who are considering applying for planning permission of the potential implications if a proposed development is located within a “safeguarded” area around the airport.

London City Airport has several physical safeguarded surfaces extending from either side of the runway, as well as complex surfaces associated with each end of its runways. The most critical surfaces extend from ground level from either side of the runway (which runs from east to west) in an upward sloping direction. Wind turbines should not be placed on the path of these critical surfaces. In general terms, new developments within the safeguarded area will not be permitted where they breach protected surfaces; however, there are already a number of existing tall buildings which breach these limiting surfaces.

The safeguarding issues surrounding London City Airport are complex and where it has been determined that a planning application for a proposed development may have an effect on navigation or other aeronautical systems, it will be necessary to conduct simulation or other types of simulation modelling of the effects of the development to be conducted.

² <http://www.newham.gov.uk/NR/rdonlyres/DDCBDF78-DF87-48DA-BD60-AF77F8043679/0/LondonCityAirport.pdf>

3 Guidance Notes for Small Scale Wind Energy

3.1 Overview

This section provides a set of guidance notes that set out the general principles of site suitability for smaller wind turbines (1-100 kW) within an urban environment. It outlines the benefits and suggests areas of opportunity for small-scale wind development. It provides a step-by-step approach to assessing a site's suitability for the development of small-scale wind. Any constraints that will limit its placement are highlighted and any potential issues that could be encountered, including those on a strategic scale, are also addressed. In addition this section considers how these schemes can be developed and taken forward, for example in terms of community projects.

These guidance notes could be used by potential small-scale wind applicants or by the LEP, GLA and local planning authorities when planning and assessing local wind development opportunities in their areas, as well as when assessing specific planning applications. These guidance criteria apply to non-building integrated/ stand-alone wind turbines of less than circa 100 kW in capacity.

3.2 The Benefits of Small Scale Wind Generators

Small-scale wind energy has an important role to play in reaching the government's 2050 renewable energy targets. In appropriate locations and at the right scale, wind energy is currently one of the most economic and rapid ways of reducing CO₂ emissions. In combination with improved energy efficiency, microgeneration will go a long way towards cutting CO₂ emissions and reducing the overall demand for energy. All of these are required to meet the government's 2050 targets of cutting CO₂ emissions by 60%. Small-scale projects will also be an indispensable factor in creating sustainable communities and will be an effective method in aiding communities in generating their own electricity.

Specifically relating to the Mayor's Energy Strategy, small-scale wind development within the Greater London area will contribute greatly to the 665GWh of electricity production target by renewable sources by 2010. The Mayor's targets specifically include the proposal of 500 small wind generators associated with public and private sector buildings.

Most benefits will be derived from the direct offsetting of on-site energy demands via on-site generation, thus significantly reducing building running costs. This method is generally very effective for businesses and is substantially more cost-effective than selling electricity back to the grid provider. It works particularly well if the energy generation from the turbine and the energy demands of the site are similar or closely matched. However, selling surplus electricity back to the grid provider is possible. Alternatively, for much smaller sites, where there is little or intermittent energy consumption, the energy generated from the wind turbine can be stored within a battery and extracted as and when required. This is particularly useful for sites remote from an electricity connection point, such as lighting a school playing field.

Local generation of energy for local consumption is also seen as particularly beneficial by the public, who quite often feel aggrieved by the presence of large wind turbines which are perceived to supply non-local markets. Small-scale turbines

also have the added benefit that they are not as visually intrusive as the larger turbines, and can often be accommodated into existing industrial or urbanised environments.

Figure 2: Small scale wind turbine at a primary school in Telford



Finally a recent report by the Sustainable Development Commission "*Seeing the Light*"³ (October 2005) illustrated how on-site energy generation has the remarkable effect of increasing on-site energy efficiency and reducing energy demand within homes and schools by raising awareness of energy consumption. Installation of small-scale renewables thus effectively 'kills two birds with one stone', reducing demand for electricity by encouraging energy efficiency, as well as contributing towards renewable generation targets. This valuable consequence should serve to provide a further driver and encouragement for the implementation of small-scale wind energy within Greater London area and its surrounds.

3.3 Opportunities for Small scale Wind Development in London

The requirements for siting a small wind turbine are fairly easily met due to the range and sizes of turbines currently available. However, they will be particularly dependant upon:

- Good wind speeds $>4.5\text{ms}^{-1}$
- The presence of an open space between circa 81-2025 m^2 in extent
- Lack of physical obstructions to the wind
- The requirement for on-site electricity.

Turbines between 1-100 kW (considered here) can be of varying heights ranging from circa 6.5m to 45m to tip, and thus it should be possible to accommodate a small turbine in even the most constrained of urban environments. The level of noise that a turbine emits will vary with size, however smaller turbines generally have lower noise source levels and thus can fit into urban surroundings more easily than larger specifications. The range of turbines available entails that it should be possible to select an appropriate turbine, because noise pollution is not an issue in most urban locations, and the proximity of nearby dwellings should not be a problem, although caution should of course be exercised in installing even small turbines in potentially turbulent conditions close to bedroom windows.

Small scale wind projects might therefore be suitable for development within small open areas in the following contexts:

- Schools, colleges & universities
- Small industrial sites & estates
- Supermarkets and superstores
- Hospitals
- Households (depending on space)

³ <http://www.sd-commission.org.uk/publications/downloads/Micro-generationreport.pdf>

- Council buildings and depots
- Community areas and schemes
- Car parks
- Sports grounds and stadiums
- Recreation areas eg playing fields, leisure centres and environment centres.

Figure 3: Small scale wind turbine at a Primary School in Lanarkshire⁴



One factor to bear in mind is that the viability of the smaller schemes is often heavily cost reliant. Ideally, each site should therefore be matched to extract maximum generation from the available wind resource but at minimal cost. Grants from the DTI are available to help with the installation of small turbines (see Section 4.4 Stage 7), however, projects of this nature might also be appropriate for joint initiatives with large retailers, utilities, land owners or developers who would help to spread the costs.

3.4 Guidance on Developing a Small Scale Wind Turbine Site

Following the decision to install renewable energy on an urban/brownfield site, it is necessary to identify whether the site is actually suitable for a wind turbine, and if so, selecting the best location for it. The following section provides a step by step approach to assessing a site's suitability for the development of a small-scale wind turbine and the processes that are required for its planning application, approval and installation.

3.4.1 Step 1 - Selecting a suitable site

3.4.1.1 The initial broad site selection

As stated in Section 3.3 above, most sites will be suitable for the development of a small stand alone wind turbine of some size providing the spot is windy enough. The constraints applicable to larger turbines will not necessarily apply to the installation of small-scale ones. The main requirements for a small turbine site are:

- **Wind speed** - Small turbines require lower wind speeds than those necessary for larger commercial turbines, but as a general indication a project is liable to be economic if the actual wind speed exceeds 4.5 ms^{-1} (Energy Saving Trust, 2004). The DTI website has modelled generic wind speed for every 1km^2 of the UK. Figure 11 of the Phase 1 report suggests that these broad wind speeds are achieved over the majority of the Greater London area, however site-specific locations may diverge from this.
- **Land availability** - The size of area available will often influence the turbine tip height and capacity. An open area between 42m^2 to 2025m^2 in size without the restriction of other tall obstacles, will be able to accommodate the recommended fall over distance (topple distance) for turbines of 1kW-100kW. NB. Topple distance from buildings is at the owners' discretion.

⁴ Courtesy of North Lanarkshire Council

- **Away from housing** - Preferably a lack of residential buildings within 100-200 m of the site (unless very small scale turbines <50kW are being considered, although by limiting turbine size this should not be an issue).
- **Electrical requirement** - A relatively high utilisation of on-site electrical energy and thus an ability to reduce on-site costs is most beneficial unless justified/aided by a subsidy scheme. This is due to the fact that, at the time of publication, the cost of buying electricity from the grid is greater than the cost received when selling back to the grid provider.

Other issues that should be considered at the broad site selection stage are:

- **Designations** - Ensure that there are no important environmental or landscape designations on the site or immediately adjacent to it.
- **Planning policies** - Ensure there are no national/regional/local planning issues to constrain development.
- **Aeronautical concerns** - Ensure a distance greater than 10 km from local airfields with Secondary Surveillance Radar (SSR). However, smaller turbine models available are likely to guarantee that such issues are unlikely to be of significance, or are easily overcome.

The first two issues are somewhat flexible depending on the scale of the turbine to be installed. Very small turbines may be acceptable on nature conservation sites and even in landscape designations. For example, the manufacturer, Proven have successfully installed turbines in SSSIs, AONBs, Natural Heritage Sites, National Parks and other sensitive locations⁵.

3.4.1.2 More detailed site selection factors

All issues identified above can be recognised at a broad/strategic scale. Once a number of potential small-scale wind areas have been identified the following site-specific factors should also be considered to refine the search areas:

- **No obstructions** - A lack of tall physical obstructions in the direction of the prevailing wind. Tall obstructions, such as a large building, could disturb the wind flow to the turbine. As such, the turbine may experience high levels of turbulence. This could reduce efficiency and have an impact on turbine design lifetimes. The potential turbine site should ideally be a distance of five times the height of the obstacle from the turbine location. For instance, if a 10m building could obstruct the wind flow to the turbine, the turbine must ideally be situated 50m (10m x 5) from the building.
- **Minimal presence of Radcom links** - The presence of radio and microwave links can pose a serious limitation to turbine development. Information on the path of all radio-communication links within 1km of a site can be obtained from Ofcom. The presence of links through a site will not necessarily negate it, but will need careful consideration during the final site design. Link providers could object to any wind energy development that provided interference with radiocommunication links.
- **Local support** - support from the local community is often crucial to the success of a proposal, although energy generation for local use is generally fairly well supported.

⁵ Information from Proven website, accessed November 2005
www.provenenergy.co.uk/index.php?option=com_content&task=view&id=16&Itemid=31.

3.4.2 Step 2 - Choose the type of electrical connection

Once a suitable site has been located, there are still a number of decisions to make before deciding on a particular turbine type. There are two broad wind generator categories: stand-alone turbines, which store electricity in a battery, or Grid connected systems. The choice of turbine type will depend on the specific site under consideration.

- **Stand-alone systems** - Traditionally, small wind turbines have been used to generate electricity often in remote areas, where it is expensive or not physically possible to connect to a mains power supply. The wind turbines are used to charge batteries (eg car batteries) in order to run small electrical applications (eg on rural farms, island communities, boats and caravans). Larger turbines can also be used to power an entire building, for instance a stand-alone 6kW turbine could supply 2-3 house-sized buildings or a large house that is not grid connected. However, as the wind is intermittent, there is also a requirement for a back up generator to provide cover on non-windy days eg diesel generator. The wind generated electricity is stored in a battery and then converted into AC current suitable for a house via an inverter. Excess electricity can also be stored in the battery and drawn on when the wind is not blowing.
- **Grid-connected systems** - An alternative is to directly connect the output of the wind turbine to the existing mains electricity supply. A grid-connected wind turbine can be a particularly good proposition if the on-site consumption of electricity is high. The energy produced by the turbine can then be used to reduce the energy taken from the grid. In addition, any excess generation can be sold back to the grid by claiming and trading Renewables Obligation Certificates (ROCs). The variable nature of the electricity generated from small wind turbines means that not all generation is likely to be used immediately on a site at all times. It is therefore inevitable that some electricity will need to be fed back to the distribution network or entirely lost.

Due to the fact that the value of avoided electricity purchases is generally significantly higher than the value that can be obtained from exporting power to the grid, offsetting on-site production is the most cost-effective use of a small-scale wind turbine. This is particularly relevant if the potential site relates to business consumption of electricity, as such on-site generation then qualifies for exemption from the Climate Change Levy. However, exporting electricity requires liaison with the local network distribution operator, as when a wind turbine is connected to the mains supply, it has to be approved by the Distribution Network Operator (DNO). They will insist on the connection being to a high technical standard and thus the cost of incorporating power import and export metering and approved electrical protection equipment can be high. The DNO may also limit the size of the wind turbine that may be connected in a particular area depending on the loading of the electrical distribution system in the vicinity. For small wind turbines, the cost of grid connection can be a substantial part of the total project cost.

3.4.3 Step 3 - Locating the turbine in the best spot

There are a number of factors to consider when deciding the final location of a small-scale turbine, however the extent to which these are considered will depend on the specific site. In some cases there may be no flexibility in the choice of location. In those circumstances the presence of radio-communication links and the available wind speed and direction will be the limiting factors.

- **Wind** - Just because a site has a reasonably high average wind speed, according to the DTI database, it does not mean that the available wind speed will be high. The predicted wind speed at a site is dependant on a number of factors such as: height above ground level; wind fetch; local topography which can shade an area from the wind; and wind turbulence and vortices, which can be caused by the presence of adjacent buildings, trees or landforms. The first step is to assess the expected wind speed on the site. The windier the site, the more cost effective the development will be. Sites with lower wind speeds will require an economic cost/benefit appraisal to establish their viability. The power output will also depend on the range and reliability of the wind. This can be measured using a wind monitoring mast (anemometer). However, for a small site measuring, on-site wind via an anemometer is rarely cost effective, but taking a few readings using a hand held anemometer at different times of the day and different months may help to confirm the validity of the site and decide on the most effective location. Please note: a turbine manufacturer may be able to help assess the wind speed.
- **Wind direction** - The turbine should be exposed to the prevailing winds. In the UK these mainly come from the south-west.
- **Radiocommunications** - The presence of microwave, and radio-communication links across a site can also pose a serious restriction on turbine placement. In the first instance Ofcom (the industry regulator) should be consulted to determine the presence and path of any links. Ofcom will provide a list of links and their operators, who should be contacted to ensure that the turbine does not cause a deterioration in the link's signal. Once contacted, if a link operator objects to the proposal, then micro-siting is the best option. Ofcom guidance states that there should be a separation distance of (two fresnal zones +1x rotor radius+50m) between the path of a link and the turbine, although link operators prefer a distance of 250m unless the link has been accurately measured by a professional. It may be necessary to employ a specialist to investigate the correct path of the link and to consult with the necessary people. In some cases, and with very small turbines, it may be possible to negotiate a smaller separation distance with the link operator but this is likely to occur on a site-by-site basis and will be dependant on the individual operator. Micro-siting of the turbine is the only really viable option, as relocating of links can often be very costly ie in excess £50,000.

In other more flexible cases, it would be beneficial to consider the following issues prior to choosing the final turbine location.

- **Obstacles** - Trees, buildings, hills and obstacles slow down the wind, so it is best to site the turbine as far away from these as possible. Ideally there should be a clear, smooth fetch to the prevailing wind, eg over open water, smooth ground or on a smooth hill.
- **Turbulence and roughness** - Excessive turbulence over varying ground heights and vegetation may slow down the wind speed and cause wind eddies and turbulence. Wind turbulence can cause turbine fatigue and shorten the lifespan of the turbine.

- **Height** - A turbine should be placed as high as possible as wind increases with height above ground level. The turbine should ideally be well clear of obstructions, but this should still be safe and practicable. Easy access will be required for turbine erection, and foundations for the tower may be needed depending on the size and tower type. It is also important to ensure that the wind turbine can be easily lowered for inspection and maintenance.
- **Safe location** - Exposed or moving parts would never be <3m from any point where people or livestock may stand or have access. Due regard should be taken of rights of way and the likely presence of any children.
- **Topple distance** - A turbine should be placed at least topple distance plus 10% away from electricity grid lines, railways, local road and highways, footpaths and bridle-ways in line with the Government guidance "*Planning for Renewable Energy - A Companion Guide to PPS22*", even though there is minimal risk of tower failure. The turbine should not be placed any closer than this unless written concession has been granted by the relevant London borough planning authority. In respect of buildings, the same topple distance should apply (110%) although it is really up to the discretion of the building owner. Where a turbine is placed near to a building used by or open to the public, for example a supermarket, it may be prudent to observe the former conservative distance, however a private owner may wish to waive this requirement.
- **Distance from grid connection** - If the turbine is to be connected to the electricity distribution network then distance to the grid connection point should be minimised as the costs of underground cabling can be substantial. Please note that for grid connected systems, in order to receive payment on exported electricity via ROCs the installation of an export meter may be required, and this should be discussed with the nominated electricity supplier.
- **Swept area** - In modern commercial turbines the rotor blades are able to rotate 360° around the turbine tower. The area that the rotor blades can cover is called the 'rotor swept area'. Using information collected from a turbine anemometer (a wind monitoring mast on the turbine), the rotor blades of a commercial wind turbine can therefore be rotated to face the prevailing wind direction. This is done at five minute intervals. In order to minimise objections it is preferable if the rotor swept area is contained within the land ownership of the applicant. If this is not the case, then permission and consent should be sought from the adjacent landowner before a planning application is made. Smaller turbines (as in a few kW) do not have anemometers on the turbines but then rotor swept area is rarely a problem as the diameter of the rotor blades is smaller.
- **Ground conditions** - Ground conditions can affect the choice of turbine specification and the buildability of a project. Very soft ground or solid rock should be avoided when considering small-scale wind as these conditions generally increase the cost of installation.
- **Access** - Easy access to the site is also preferable for turbine delivery, maintenance and decommissioning, depending on the size of turbine.

Transport of the equipment to more remote areas eg middle of playing fields or public parks needs to be practicable as the removal of obstructions to gain access to the site could incur additional costs.

- **TV Interference** - In relation to TV signals, the BBC website is able to indicate how many houses are likely to be affected by TV interference. Again the only answer is to micro-site the turbine away from the link or for the developer to pay for the installation of digital receiving equipment into the affected properties. As a word of caution, some TV links serve thousands of customers, so it should be confirmed how many properties may be affected before opting for this as a solution to the problem.

3.4.4 Step 4 - Site design summary

The ideal location for a wind turbine is on a smooth rounded and exposed hill top or rise, many meters from any trees, buildings or obstructions, especially avoiding any obstacles that are in the path of the prevailing wind. Realistically it should also be close to the grid connection, otherwise the cost of any underground cabling may be excessive.

3.4.5 Step 5 - Turbine specification

Turbine specification and rated capacity should be determined by the individual circumstances at a site. The available wind speed and rotor blade dimensions are the two most important factors affecting the turbine power output and thus the viability of a scheme.

Power output is related to the cube of the wind speed. Thus higher wind speeds can make vast improvements in power output. Maximisation of the wind speed on a site is therefore essential. Wind also increases with height, so the higher the turbine the greater the power output. Other things such as turbulence and obstructions may limit wind availability and thus it makes sense to locate a turbine away from obstacles in order to maximise the power output.

The power available is also dependant on the rotor swept area (as in turbine specification); power = the square of the rotor diameter. So increasing the diameter by 20% can increase the power by 44%.

To maximise energy savings and minimise costs, the turbine specification should ideally be matched to the wind potential of the site and the on-site energy demands, taking energy losses and non generating time into account. Using the estimated wind speed it should be possible to calculate the likely power output for a range of turbine sizes. The potential turbine size can then be up or downscaled to get the desired results. A turbine installer should be able to advise on the best turbine option. For information on companies that build and install small wind systems, visit the British Wind Energy Association's (BWEA) directory of "Small System Suppliers"⁶.

The noise source levels of the turbine will be particularly relevant if it is a residential area with properties within 100-200m of the site. In these cases, noise predictions will help determine the maximum turbine specification suitable to the site.

⁶ <http://www.bwea.com/members/category.asp?search=10>

Finally, the size of a turbine may be restricted by planning constraints. In urban locations these would mainly be due to noise and visual impact. However this is unlikely to be a significant barrier for very small-scale (non-commercial) turbines. In either case it would be beneficial to seek the views of the planning authority at an early stage in case their views may affect the final turbine choice.

3.4.6 Step 6 - Planning permission

The location and scale of a turbine will determine whether it needs planning permission or not. In general, those wind turbines with rotor diameters of >2m (ie >circa 500W) will require planning consent. However, if a turbine installed purely for agricultural purposes, then planning consent may not be necessary, although the local planning office should still be informed.

It is advisable to contact the local planning authority in the early stages of a small-scale wind project. They will be able to help with identifying any planning led constraints to development such as policies, noise or visual impact as discussed above. They will also be able to direct the developer to the latest planning policies and guidance.

3.4.6.1 Planning policies

Overall, national planning policies support the development of small-scale wind energy. The Government has already taken steps to facilitate micro-generation through national planning policies eg PPS22. Whilst some authorities have adopted their own supplementary policies, such as the London Borough of Merton, PPS22 sets out a clear national policy framework on renewable energy for planning authorities in England to ensure that the Government's renewable energy targets are met. Under PPS22, regional and local planning authorities should recognise the full range of renewable energy sources, their differing characteristics, location requirements and the potential for exploiting them, subject to appropriate environmental safeguards. Small-scale developments can also be permitted within areas such as National Parks, AONB and Heritage Coasts provided that there is no serious environmental detriment to the area concerned. PPS22 introduces a new policy area for small systems by encouraging local planning authorities to require that new developments should supply a percentage of their energy needs from onsite renewable energy sources.

3.4.6.2 Other planning considerations

Other deciding factors in the determination of a planning application often include environmental considerations, access to the site, noise and visual effect. Local public opinion can also be an influential factor and so early public consultation or involvement of neighbours and surrounding communities is advisable.

Any important issues that need consideration as part of the planning application will be identified during discussions with the council. The official route is to undertake a screening and scoping exercise as outlined in The Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999. This exercise determines whether there are likely to be any 'significant effects' from the proposal and whether there is a need for a full EIA (see also DETR Circular 02/99 Annex Energy Industry A15). In the case of a single small-scale wind application, the results of the screening request are likely to state that 'no significant effects' are expected and thus no EIA is required, although some issues should be described more fully in a report to accompany the planning application.

The issues and depth of detail to be covered in any report/information to be submitted in support of the planning application will be outlined by the scoping response from the council.

The constraints for larger turbines, discussed in the LEP Wind Study Phase 1 report, will not necessarily always apply to smaller turbines. Issues which may/or may not need covering in the supporting information/environmental report (depending on the scale of the turbine) are listed below:

- a) Site location, scale and plan
- b) Drawings and schematics
- c) New site infrastructure required - eg information on the equipment, location, design, installation requirements, access
- d) Other similar installations in the area
- e) Relevant planning policies
- f) Birds, fauna and ecology
- g) Hydrology
- h) Archaeology
- i) Radcoms
- j) Visual impact and residential amenity
 - Shadow flicker
 - Noise - Information on noise source levels, noise predictions and background measurements if requested
- k) Access
- l) Health and safety eg ice throw, topple distance and blade shear
- m) Grid connection and electrical requirements eg output cables, connection points and building, sub-station requirements, turbine metering, battery connection or grid, inverters
- n) Construction requirements eg foundations or anchor points, turbine specification
- o) Operational requirements
- p) Decommissioning
- q) Site improvement/Mitigation
- r) Predicted timescales.

Some of these issues are more important and inflexible than others (ie hard or soft constraints to planning permission) but ignoring or avoiding looking into any of these aspects at an early stage could lead to the refusal of planning permission or more likely, a more costly development with longer lead-in time. Given that small-scale wind developments are likely to be financially constrained, it is therefore advisable to address each of these issues early on.

The requirement to submit a planning application and often an environmental report in support of the application and the ability of all applicants to be able to understand and fulfil this raises a number of strategic issues. These will need to be addressed before the deployment of widespread micro-wind projects or the publicisation of any drive towards small-scale wind energy in Greater London area. This issue is briefly addressed in Section 4.6.

3.4.7 Step 7 - Contacts

For technical and electrical information, applicants should follow the guidance in *Installing small wind-powered electricity generating systems. Guidance for*

*Installers and specifiers.*⁷ Manufacturers and installers will also be able to provide relevant documentation describing turbine specification, operation, maintenance and the previous requirements of other similar turbine installations.

In terms of environmental and planning issues the following groups will be able to provide information and advice:

- Ecology - English Nature, RSPB, local raptor groups, local wildlife trusts, local nature groups
- Hydrology - The Environment Agency
- Radcoms - Ofcom at first and then individual link operators as supplied by Ofcom. It may be beneficial/necessary to employ a specialist to investigate the link path and to consult with the relevant operators
- TV - The BBC website provides information on the number of houses likely to be affected by reduced TV signal as a result of a wind turbine. However, the automated assessment does not take height and dimensions of a turbine into account, so if high results are being produced it would be beneficial to talk to the local contact to confirm the scale of likely impact
- Turbine suppliers - Turbine specification and dimensions, construction and access requirements, rated output
- Grid Issues - Turbine suppliers and DNO's
- Fall Over - Highways Agency, rail provider and DNO
- Archaeology - Council County/Regional Archaeologist & English Heritage
- Noise - Turbine manufacturer (for noise source levels), Council Environmental Health Officer
- Planning Policies - Local planning authority.

Other sources of information and advice can be found on the following websites:

- DTI (Department of Trade and Industry/Renewables)⁸
- Clear Skies⁹
- BWEA (British Wind Energy Association)¹⁰
- EST (The Energy Saving Trust)¹¹
- Yes 2 Wind¹², which has a list of installers and community investors.

And from the following Advice Services:

- The Energy Saving Trust's Renewable Energy Advice Centres¹³
- The Countryside Agency's Community Renewables Initiative¹⁴
- Scottish Communities & Household Renewables Initiative¹⁵
- Action Renewables¹⁶
- Local support networks
- Project support companies
- Proven turbines provide site advice and support.

⁷ Energy Saving Trust, Energy Efficiency Best Practice in Housing (p 6 onwards) - <http://www.est.org.uk/uploads/documents/housingbuildings/ce72.pdf>

⁸ www.dti.gov.uk/renewables

⁹ Addendum: Clear Skies was replaced in April 2006 by the DTI's Low Carbon Buildings Programme. Further information can be found at www.lowcarbonbuildings.org.uk.

¹⁰ www.bwea.com

¹¹ www.est.org.uk

¹² www.yes2wind.com

¹³ www.est.org.uk/myhome/localadvice

¹⁴ www.countryside.gov.uk/LAR/Landscape/CRI/index.asp

¹⁵ www.est.org.uk/schri

¹⁶ www.actionrenewables.org

3.4.8 Step 8 - Turbine installation and funding

The cost of purchase and installation of a small-scale wind project will often be one of the prohibitive factors preventing the widespread uptake of this technology. In order to make a development justifiable, the revenue or energy savings derived from the available wind turbine should thus exceed the installation and running costs over the lifetime of the turbine. This is particularly crucial for a small-scale site, which will probably be running on marginal costs. With smaller schemes, the fixed costs, such as grid connection and installation also take up a greater proportion of the overall costs and thus minimising these costs by appropriate siting is essential.

3.4.8.1 Funding

Sources of funding for small scale renewable projects including wind have historically come from the DTI grant system Clear Skies and the Energy Saving Trust.

However in April 2006, The Low Carbon Buildings Programme (LCBP) will supersede Clear Skies. Although Clear Skies managed to help the micro-industries move forward it was not able to stimulate markets enough to make a significant impact on prices. The LCBP will start on the 1st April 2006 for a period of six years. It will combine practical advice with capital grants. There will be two streams of funding; Stream 1 for the individual and community projects; and Stream 2 for the larger scale developments. It is not yet clear how 'large' these developments will have to be. The criteria for the selection of projects will be competitive but the criteria have not yet been set.

3.4.8.2 Installation

Once a source of funding has been secured and planning consent achieved, the turbine manufacturer will be able to advise on installation requirements. Please note that if a turbine is to be grid connected, then it is necessary to inform the DNO and get approval for the grid connection.

3.5 Developing Community Projects

Current examples of ways to develop community wind projects can be found in Scotland and Wales where the Scottish Community & Household Renewables Initiative and Bay Wind (in Wales as a particular example) have dedicated groups of people who provide technical advice and help with funding and project management. Help with the project management side particularly enables community involvement in the design of the wind farm.

In addition to government grant schemes, financing may also be achieved through joint ventures with large retailers, utilities, land owners or developers. Developers who have expressed an interest in getting involved in microgeneration and who have been identified by the DTI include Shell, EDF Energy, Scottish and Southern Energy and Scottish Power. Some developers in particular have an interest in small sites and the possibility of installing second-hand turbines at lower costs. This would also enable communities to get help with the financing and compilation of supporting information and environmental reports (see Section 3.4, Step 7 above). A list of community investors can be found on the Yes2Wind website (www.yes2wind.com).

Case Studies: The current Clear Skies programme provides three examples of the successful installation of a wind turbine at community sites such as: Beaumont Primary School, Hadleigh, Suffolk; Nidderdale High School and Community College, near Harrogate and the BTCV Skelton Grange Environment Centre, Leeds. See appendix for more information.

3.6 Barriers to the Widespread deployment of Small Scale Wind Turbines

Even though the first commercial wind turbines in the UK were erected in 1991, small-scale wind turbines and other micro-renewables are still at an early stage in their evolution. Consequently, the market, strategies and mechanisms to support its widespread deployment are not yet effectively in place. Hence, a number of constraints or barriers often act to prevent the widespread uptake of small-scale wind installations. These are outlined below:

- **Costs** - The cost of micro-turbines is still very high and can act as a barrier to their uptake eg a 6 kW wind turbine which could supply 2-3 households, would cost about £20-27 K to install. Although it would generate about 10,000 kWh/yr (based on an average 6 kWp system). This would take about 29-39 years to payback using current electricity prices. These costs can be quite prohibitive to small companies and especially individual households.
- **Information constraints** - The following information constraints together transpire to reduce the incentive for people to purchase small-scale turbines: inadequate promotion and provision of information to potential customers, lack of information on how to set about installing a turbine; lack of a widely understood accreditation system for products and installers; and consequently a lack of local installers.
- **Technical constraints** - the lack of a comprehensive approach to dealing with the issues surrounding the connection of micro-generators to the grid network reduces the uptake of micro-generators.
- **Lack of support strategy** - There is a need for a support strategy from the government for the installation of micro-renewable energy systems. This should deliver appropriate support in a structured manner.
- **Grid connection Issues** - The variable nature of the electrical generation from small-scale turbines means that electricity export to the grid is a favourable way of reducing the pay-back period of the project. However, when connecting to the distribution grid, installations with an output of more than 16A/ph (c. 4kW) currently have to comply with technical standards designed for generators of up to 5MW in size. Compliance is costly and is also likely to require feasibility studies. Consequently these costs could well be a significant hindrance to would be micro-installers.
- **Electricity Export Payment**- Until recently it has been relatively difficult for micro-generators to access ROCs which enable them to sell back excess electricity to the grid in exchange for income. This has the favourable effect of reducing project pay-back times significantly. However, the Renewables Obligation was revised in 2004, so that any generators with a declared net capacity of 50kW or less can now claim ROCs on an annual or monthly basis.

- **Funding** - Funding for the purchase and installation of small-scale renewables has historically come from the DTI grant funded system Clear Skies. This is due to be replaced in April 2006 by a two-stream fund called the LCBP. It remains to be seen whether this system is more successful than Clear Skies and will be sufficient to stimulate the micro-renewables markets, bring down costs and deliver the numbers and level of projects desired.

4 Conclusion

This document provides a comprehensive set of guidance notes that could be used by potential wind applicants or by the LEP, GLA and local planning authorities, both in London and across the UK, when planning and assessing local wind development opportunities in their areas, as well as when assessing specific planning applications. However, given the rigorous tests and scrutiny that wind energy schemes undergo, it is not possible to provide an exhaustive assessment of all scenarios encountered by wind turbine proposals.

Therefore, any developers, landowners or stakeholders interested in pursuing such schemes must understand that a series of comprehensive assessments and investigations, particularly regarding large-scale wind developments, may be required before any official consent is forthcoming.

Subject to wind resource, smaller stand-alone grid-connected wind turbines should not carry with them the same range of concerns as larger commercial machines and ornithological impacts, aeronautical impacts and conflicts with adjacent land uses will normally be negligible, subject to sensible siting. The constraints to the development of small-scale turbines are more likely to be a lack of information regarding technologies, coupled with funding issues. These issues will need to be addressed if the Mayor's target of 500 small wind generators is to be met. Therefore, in a situation where the key constraints rule out the development of larger scale wind energy developments, this may not affect the potential to install smaller scale wind turbines.

5 Glossary

Anemometer - a device for measuring the velocity (speed) of wind.

Climate Change Levy - Introduced on April 1 2001, this levy is a charge placed on all non-domestic energy bills using all 'traditional' energy sources (non-renewable). The funds raised are collected by HM Revenue and Customs.

Distribution Network Operator (DNO) - electricity distribution operators. These are the organisations that give authorisation for distributed generators to be connected to the electricity network.

Export Meter - measure how much electricity is transferred from the generator into the national grid.

Fresnel Zone - In radio communications this is one of a (theoretically infinite) number of a concentric ellipsoids of revolution which define volumes in the radiation pattern of a (usually) circular aperture. Fresnel zones result from diffraction by the circular aperture. The concept of Fresnel zones may also be used to analyse interference by obstacles near the path of a radio beam.

Ice throw - This refers to ice shed from the turbine blade either during movement or start-up.

Inverter - A circuit for converting direct current (DC) to alternating current (AC). Simple inverters consist of an oscillator driving a transistor that is used to interrupt the incoming direct current to create a square wave. This is then fed through a transformer to produce the required output voltage.

Micro-siting - Slight amendments to the turbine siting to avoid constraints that arise in the local vicinity, such as movement of turbine 10m to avoid a radio communication link.

Renewable Obligation Certificate (ROC) - The Obligation requires electricity companies to source an increasing proportion of their supply from renewable technologies to reach the 10% goal by 2010. Renewable Obligation Certificates (ROCs) will be awarded to accredited generators of eligible renewable electricity produced within the UK - solar energy (including photovoltaics), hydro, wave power, tidal energy, geothermal energy, biofuels (including energy crops) and on-and offshore wind. Companies that are unable or unwilling to source the required amounts have the option of 'buying out' their Obligation. The 'buy out' price is initially set at £30/MWh (US\$43/MWh), and will be adjusted annually in line with the retail price index. Monies raised from companies 'buying out' in this way will be redistributed to companies that have met their Obligation, in proportion to the number of ROCs they presented in that year. This will act as a further market stimulation.¹⁷

¹⁷ Renewable Energy World: www.sref.co.uk/sref%20renewables%20obligation.pdf

Rotor Swept Area - The area covered by the diameter of the turbine rotor blades

Topple Distance - Distance from the base of the turbine tower to the blade tip

Turbine Fatigue - Wind turbines are subject to fluctuating winds. Components which are subject to repeated bending, such as rotor blades, may eventually develop cracks which ultimately may make the component break. This is turbine fatigue. Therefore, during the design process calculations are made on how the different components will vibrate, both individually and jointly. It is also important to calculate the forces involved in bending or stretching of each component.

Vortice - A spinning turbulent flow (or any spiral whirling motion) with closed streamlines. The shape of media or mass rotating rapidly around a centre forms a vortex. It is a flow involving rotation about an axis (not always oriented vertically though; sometimes possessing a horizontal axis).

Wind Fetch - The distance over which wind blows.

This project has been funded specifically by the Department of Trade and Industry and the Greater London Authority. The DTI, GLA, London Development Agency, Energy Saving Trust and Argent Group Plc provide core funding for the London Energy Partnership.

Working as an independent body, the London Energy Partnership uses the power of partnership to enable London to respond to the challenges of climate change, security of energy supply and fuel poverty. The London Energy Partnership steering group members and observers include representatives from Argent Group Plc, Business Councils for Sustainable Energy UK, Carbon Trust, EDF Energy, Energy Saving Trust, RBC Capital Markets, Greater London Authority, Government Office for London, London Borough's Energy Group, London Climate Change Agency, London Development Agency, London Sustainability Exchange, Renewable Energy Association, London South Bank University and Thames Gateway London Partnership.