Wind Power Feasibility Study Sustainable Eastside

Dulas Ltd

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Wind Power Feasibility Study

For:	Sustainable Eastside
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Wind Power Feasibility Study, Sustainable Eastside

Draft Final Report

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1. Introduction and Scope of Work

Birmingham Eastside is a major regeneration initiative for 420 acres of Birmingham City Centre. The initiative seeks to develop an area of the city centre associated with poor urban planning and which has to date been somewhat divorced from the life of Birmingham's centre through the former presence of the Masshouse flyover (the "concrete collar"). The area in question is shown in Figure 1 below.

Figure 1: the Birmingham Eastside Regeneration area

It is the remit of the Sustainable Eastside team to assist in integrating the principles of sustainability into this particular urban regeneration initiative. Sustainable Eastside is a project jointly funded by the European Commission, Birmingham City Council, Advantage West Midlands, Environment Agency and East Birmingham North Solihull Regeneration zone. As well as economic objectives, the initiative is looking to demonstrate how regeneration can positively impact on the environment, particularly in terms of energy, transport, waste and biodiversity. Three key themes have been incorporated into the development of the Birmingham Eastside initiative: Learning, Technology and Heritage. The intention is that any new developers in the Eastside area should consider, and closely align their developments with, these themes.

There are no Renewable Energy or Sustainability targets defined for the Eastside redevelopment plan, although reference has been made within the final report to the vision of the Sustainable Action Group as detailed in their Eastside Sustainable Advisory Group funded report, Sustainable Eastside: A Vision for the Future (March 2002). Within this report, broad issues on renewable energy generation and energy efficiency are discussed, although no firm targets are presented. Similarly, there are no overt targets in the draft Unitary Development Plan for Birmingham for renewable energy generation. However, under *Design Principles for Sustainable Development* Policy 3.14E states the following:

> ***3.14E Development has a large impact on issues such as global warming, resource depletion and pollution. Developments, including new and refurbished buildings, should therefore be designed in a way which reduces such harmful impacsts and respects the principles of a sustainable environment. Applications for developments will assessed against the following principles:***
>
> ***…***

- ***The orientation, external and internal design of buildings, and use of landscaping, should maximise the use of natural heat and light, contribute to local biodiversity and minimise the use of non-renewable energy sources. The use of renewable energy sources will be actively encouraged. This should not, however, be at the expense of good urban design; ...***

This sole paragraph on renewable energy identifies only the potential for incorporating renewables into building design. There is no mention of stand-alone renewable energy projects such as large-scale ground based turbines or hydroelectric generation. Thus the policy does not encourage the development of large-scale renewable energy projects, but rather appropriate building design, which should not compromise "good urban design". The policy does not represent a strong commitment to renewable energy deployment.

The purpose of this Feasibility Study, in light of the above, is to answer the question: "Is wind power a practicable option within the Birmingham Eastside planned development?" Wind generation in the general Eastside location would provide, if technically, economically and environmentally feasible, not only a source of clean energy to the area but a highly visible commitment to renewable power and a landmark aspect of the overall regeneration initiative. Consequently, where a variety of parameters allow, wind turbines would constitute an element representing the sustainability principles of the overall project.

An inception meeting was held with BCC Eastside Team Sustainability Advisor, Steve Dewar, on 25th November 2003. The purpose of this meeting was to discuss aspects of the feasibility study, the regeneration initiative, and procure relevant information and data to inform the Wind Feasibility Study. As a result of this meeting, the topics for appraisal within this Feasibility Study were determined as those that are presented in the rest of the document.

2. Regulatory and Licensing Conformity

When making an application for the erection of a wind turbine, planning permission will usually be required from the local planning authority. Consents, authorisations and licences may be required for wind turbine construction and operation, and relevant regulatory authorities responsible for determining an application will have to be consulted and will appraise an application for planning consent. Among the regulatory requirements likely to be required are the following:

- **Town and Country Planning (General Development Order) Act 1990**: this Act determines that any new proposal must be applied for through the development control mechanism operated usually at the District or Unitary level.

- **Town and Country Planning (Environmental Impact Assessment (England and Wales)) Regulations 1999/DETR Circular 02/99**: these Regulations and Circular require an applicant to submit with a planning application an Environmental Statement for proposals over 5 MW or 5 turbines. Where applications are for less than 5 MW or 5 turbines, an environmental report will usually be required, subject to the requirements of the planning control authority.

  For turbines and projects that are significantly under this threshold, the planning application (under the Town and Country Planning (General Development Order) Act 1990) will need, at minimum, to be accompanied by basic information regarding the proposal, as agreed with the planning officer; it should be stressed that the nature and level of detail of this is largely at the discretion of the planning office involved. This information is likely to cover noise emissions, size of structure and associated works, but other information may be requested, particularly if the siting is in a sensitive area.

  Where an Environmental Statement is required, the following issues would normally need to be addressed:

  Landscape Classification:
  Account should be taken of any landscape designations including published landscape assessments that cover a particular area. Special consideration should be given to projects within National Parks, Heritage Coasts, Areas of Outstanding Natural Beauty, the Broads or Sites of Special Scientific Interest.

  Effects to Conservation Areas:
  There is one conservation area within Birmingham Eastside, which is the Digbeth Conservation area, near to Custard factory, Warwick Bar Canal Basin and Typhoo Wharf. Effects to the physical infrastructure of the conservation area and its setting should be assessed as part of any planning application.

  Visual Effects:
  After considering any landscape designations, the visibility of the proposed site and the potential visibility of the proposed development from fixed viewpoint receptors - such as country parks, villages, trails and public rights of way, urban area, etc – should be assessed. Cumulative visual impact with existing wind turbine sites should be considered.

Noise and general proximity to dwellings:
Wind turbines should not be located so close to domestic dwellings that they unreasonably affect the amenity of such properties through noise, shadow flicker, visual dominance or reflected light. There are clear guidelines for what constitute acceptable noise levels created by wind turbines. These are given in the ETSU document 'The Assessment and Rating of Noise from Wind Farms', which is likely to be formally incorporated in planning terms when Planning Policy Statement 22 (PPS22) (currently in draft version) is finalised and accepted. Generic guidance on all this point is presented in Section 7.

Ecology:
The site developer should take account of existing information relating to both ecological designations that cover a particular area and particular protected species that are found in the area either year round or seasonally. The planning body may require further ecological studies of the site area. Initial consultation on Eastside ecology is presented in Section 9. Any wind turbine proposition should take account particularly of the main Eastside wildlife corridors and the Black Redstart nesting areas.

Archaeological/Historical Heritage:
The existence of listed buildings, Conservation Areas and archaeological sites may have an influence on the acceptability of a particular site. Initial consultation on these issues is presented in Section 9.

Recreational Uses:
Any areas on or close to the site identified in development plans for recreational use should be considered. The turbines should be at least over-sail distance away from any Public Rights of Way, such as footpaths and bridleways.

Telecommunications:
Microwave, TV, radar or radio transmissions may be affected by the presence of wind turbines. Consultation can readily be conducted with the Radio Communications Authority (RCA) and the other private operators. With the exception of aviation interests, in most cases technical problems can normally be resolved by micro-siting. The details of telecoms consultation are given in Section 4.

Civil and Military Airports:
For all sites, correspondence with the aviation authorities should be conducted. At present, this may be initiated with the Civil Aviation Authority (CAA), National Air Traffic Services (NATS) and Defence Estates (DE) by means of a single proforma. Proposed sites within 30km of airports or radar installations should expect to be consulted. Other Ministry of Defence firing ranges, radar, or communications equipment should be identified for consideration. Responses from the aviation consultation are also given in Section 4.

Construction:
Description of the construction activities required for erection of the wind turbine, including outline construction methods, timetable, resource requirements, vehicle movements, wind farm infrastructure, operation and decommissioning.

Health and Safety:
Assessment of effects to public health and safety, as stated in Section 7 of this report.

Of these points the first three can be mitigated against with smaller machines or projects. Landscape designations and visual effects are clearly an issue in the UK, a country with a high population density, although one might think this could be less of an issue in an urban setting. In this respect smaller wind turbines have a definite advantage over larger machines and there may in future be scope for siting smaller turbines in otherwise restricted areas. Similarly, smaller turbines and smaller projects may have a lesser impact as regards noise emissions. These mitigations can have a very real effect in terms of the financial costs of the project pre-planning, as well as at the planning stage in terms of costs and the likelihood of success.

- **Construction (Design and Management) Regulations 1994:** These Regulations are intended to make improvements in the management of safety during construction work. They establish high standards in the management and control of construction activity from concept to commissioning, rather than imposing detailed engineering requirements. In particular, they emphasise the need to take account of health and safety aspects during initial planning to ensure that these considerations are built into the scheme.

- **Environment Agency Pollution Prevention Guidelines:** relevant guidelines that should be addressed in the construction of a wind turbine or wind farm are likely to be *General guide to the prevention of pollution PPG1, Above ground oil storage tanks PPG2, Disposal of sewage where no mains drainage is available PPG4, Works in, near or liable to affect watercourses PPG5, Working at construction and demolition sites PPG6, Safe storage and disposal of used oils PPG8 and Pollution incident response planning PPG12.*

- **Road Traffic Act 1988:** possible agreement with the Highways authority or Highways Agency may be required for the delivery of crane and turbine parts to site, particularly where alterations to the highway or street furniture are required. A section 278 agreement should be drawn up where such alterations are required.

3. Review of Current Plans and Proposals

Following an Inception meeting with Steve Dewar of the Eastside team it became apparent that the current plans and proposals for residential, commercial and industrial developments in the Eastside regeneration area are not confirmed. Plans and designs for the Eastside area have been drawn up but as yet there are firm consented proposals approved for development. The plans at present are therefore an 'ideal' picture of how the regeneration might take place.

In the absence of firm plans and proposals it is not yet possible to identify potentially available areas for wind turbine deployment. Therefore, the criteria cited in this Feasibility Study would have to provide the guiding principles for wind turbine deployment in the Eastside area and should be referenced in the event that proposals are firmed up. Clearly, major areas of infrastructure would need to be avoided and areas without encumbrance would be preferred to allow clean air flows and therefore maximum generation. This is likely to be focused on public open space or delineated areas for non-development within the overall regeneration, or the use of roof or building tops. But beyond this, no further specific guidance can be provided at this time.

It should, in addition, be noted that a public participation exercise has been completed and amendments have been incorporated into the plans and proposals, which should take the form of supplementary guidance later this year. The results of the EDM framework consultation exercise will be incorporated and it should be issued as SPG later in 2004.

4. Air Safeguarding and Electro-magnetic Interference consultations

This chapter describes any potential interference effects to electro-magnetic links or MOD, CAA or NATS interests within the Birmingham Eastside Area.

Microwave and other electromagnetic signals are transmitted throughout the country by a wide range of operators, including both statutory agencies and commercial companies. There is potential for interference to the transmission of these signals from any large structure, including wind turbines, which may be developed close to the signal path. Operators of communication systems have been approached to identify the nearest microwave or television links. Any adverse impacts can usually be avoided by re-siting wind turbines or re-routing the link. Similarly, if it is considered that local television reception may be affected this can also be avoided through technical solutions.

The Ministry of Defence (MOD), the Civil Aviation Authority (CAA) and National Air Traffic Services (NATS) must also be consulted in wind farm planning. This is to ensure that adverse impacts to primary radar systems, instrument landing systems or aircraft training areas will not be caused.

The purpose of these consultations is to determine whether objections could be expected from the organisations with a remit for Air-Safeguarding or with operational EMI (Electro-magnetic interference) links if a planning application for a wind turbine/wind cluster were submitted. Where EMI link operators highlight microwave, television or radio links that would be affected by the erection of wind turbines, the links need to be factored into the location of turbines and overall site layout.

The following organisations and operators have been consulted in order to establish the location and nature of microwave, rebroadcast and other telecommunications links in the vicinity of the area:

- Civil Aviation Authority (response received)
- National Air Traffic Services (response received*)*
- *Ministry of Defence*
- Birmingham International Airport (response received)
- *Radio Communications Agency*
- T-Mobile (response received)
- *Orange*
- Crown Castle International Ltd (response received)
- ITC/OFCOM (response received)
- Cable and wireless (response received)
- *BT Radio Solutions*
- *BBC Spectrum Planning (response received)*
- *NTL*
- *Vodaphone*
- Dept of Transport Navigation and communication branch (response received)
- *MLL Telecom Ltd*

Full contact details for the consultees listed above can be found in Appendix 1.

All of the bodies controlling communication links have been contacted. Only one of the EMI operators has raised issues regarding the effect on links from the proposed wind turbines in the

Birmingham Eastside area. Cable and Wireless have advised us that three of their links cross the Birmingham Eastside Area. These have end points given by the 10m NGR references:

- SP0700 8743 - SP0820 8590
- SP0700 8743 - SP1095 8307
- SP0646 8673 - SP1155 8408

They have requested that three lines by drawn between these points and that no turbine bases are within 150m of these lines, in order to give their fixed links a 100m safety zone from effects of wind turbines. These links are shown on Figure 2: Birmingham Eastside Constraints map for siting of wind power installations.

With respect to potential interference to terrestrial analogue and digital domestic television reception and BBC radio services, a formal response from BBC was received on 2ND February 2004. Domestic reception of terrestrial analogue television within the area is provided from broadcasters' transmitters at Sutton Coldfield (SK113003). The assessment carried out by the BBC showed that many thousands of Sutton Coldfield viewers in the surrounding areas could suffer interference as a result of a wind turbine(s) proposal. Provisionally, consultations with the relevant bodies should take place in the early phases of a development so that interference can be avoided through suitable location of the turbine(s). Where interferences to television reception are experienced, the responsibility will be on the developer of the site to rectify such problems. There are a number of technical fixes in the event that problems arise: installation of cable connections, provision of digital receptors, or implementing improved signal boosting at the requisite transmitters. Further studies would need to be undertaken by NTL or Crown Castle to ascertain the extent of the potential interference in the surrounding area. In addition, wind turbines are not expected to have a detrimental effect upon national or local BBC radio reception.

With respect to Air safeguarding, the MOD, CAA and NATS have been consulted. The CAA directorate observed that the site was within 30km of Birmingham Airport and requested we contact them for their observations. Birmingham International Airport has responded on comments relating to Aerodrome Safeguarding responsibilities relating to Birmingham Airport. Birmingham International airport have stated that the maximum permissible height of any turbine would be 242m Above Ordnance Datum (AOD). With a maximum turbine height of 80m and a site level of 105m AOD the overall height is 185m, which falls well below the maximum permissible height of 242m AOD. As long as this was the case, Birmingham International Airport would have no objection to the proposed wind development in terms of any physical impact upon the safe operation of the airport.

NATS has raised an objection to wind turbines in Birmingham Eastside. A copy of their response can be found in Appendix 2. In addition Birmingham International Airport have subsequently made an objection to wind turbines within Birmingham Eastside with regards to EMI effects, as the proposed wind turbines are in the line of site of Birmingham International Airport's primary radar and would consequently produce false returns, thereby endangering aircraft, which would require extended aircraft vectoring for inbound traffic.

The MOD have no objections to this proposal. All consultation responses can be found in Appendix 2 of this document.

5. Assessment of Local Wind Resource and Determination of a Generalised Wind Profile

As an urban environment, the nature of the wind regime in Eastside will be largely defined by the man-made structures surrounding and within the area, in combination with the more general wind climate for this part of the UK. The predominance of large buildings in the area will produce increased levels of turbulence in the wind and shifts in the dominant directional sectors in comparison with the more general wind climate for the region. As such, accurate short and long term wind speed predictions are probably only determinable through measurement at the point of interest.

However, a general indication of the long term average windspeeds can be obtained from the NOABL database. NOABL provides wind speed predictions at 10, 25 and 45 metres height based on 1km grid squares for the entire UK. The NOABL predicted wind speeds in m/s for the nearest grid square reference to Eastside (SP08, 87) and its surrounding neighbours are shown in the following table:

M/s @ 10m AGL			M/s @ 25m AGL			M/s @ 45m AGL		
4.8	4.6	4.6	5.5	5.4	5.4	6.1	6.0	6.0
4.9	4.7	4.7	5.6	5.4	5.5	6.2	6.1	6.1
5.0	4.9	4.9	5.8	5.7	5.7	6.4	6.3	6.3

Table 5.1: NOABL predicted windspeeds for Eastside centered on SP08, 87

To put these figures in perspective, most windfarm developers consider windspeeds of 6-6.2m/s at 45m to be economically viable or 5-5.2m/s at 25m hub height. The figures demonstrate that a useable wind resource is available in the area, subject to more detailed wind monitoring in the event that a wind turbine proposal is firmed up. Using the above figures, it would be possible to correlate wind speeds up to 60 metres to give an expected wind profile at this height, which is likely to be the highest acceptable limit for wind turbine dimensions.

In addition it was discovered that the University of Birmingham has short term and long term wind speed data for their campus. As such they have been approached, although it proved impossible within the time frame of this report to ascertain exactly where and what height their masts are and gain access to appropriate data. However, we do have a contact established (John Kings [J.KINGS@bham.ac.uk]) should the Eastside team desire to take this further (it was indicated that a charge would be made for the data).

Similarly, short and long term windspeed data may be available from Birmingham International Airport and the Metrological Office, should short term local wind measurement within Eastside be commissioned and a subsequent data source be required in order to make long term predictions based on the Measure-Correlate-Predict technique.

6. Grid Infrastructure in the Area

Introduction

Connection to the electrical transmission system requires that the generator concerned (in this case a wind turbine) can meet certain safety requirements (primarily the ability to sense a loss of power on the network in the generators locality and shut down accordingly) as well as being able to supply its maximum power onto the system without causing problems, such as excessive voltage rise. In order to meet these requirements any new generator of appreciable size (greater than say 10kW although this figure is variable) the generator will need to install hardware of have hardware installed for them by the District Network Operator (DNO) to appropriate specifications. The work and its associated cost is largely dictated by the DNO, although these can be contested if they are excessive.

Grid Connection

Electrical connection by any wind turbine or wind turbine installation up to 5MW to the distribution network is subject to the regulations contained in Engineering Recommendation G59/1 and Engineering Technical Report 113. The protection specified within these standards is the responsibility of the generator and is installed on the generator side of the connection to the distribution grid. It will generally account for fixed price costs independent of turbine size, although the detailed protection requirements will initially be specified by the DNO. DNO requirements can be contested if they seem extreme, however contesting costs time and money. Larger generating connections are likely to require more protection which will increase costs, but it is very dependant upon the nature / location of the site.

The connection cost that is quoted by the DNO is that of the physical connection to the existing distribution system. This cost is specified by the DNO based on the equipment installed on the DNO's side of the connection. This cost is dependent on variables such as distance to and strength of the local grid. At the same time demands placed on the generator are well known to vary from one DNO to another.

G59 demands adequate protection against islanding from the generator. This equipment (primarily relays and circuit breakers) is installed on the generator's low voltage (LV) side of the connection and represents fixed costs of around £10,000-20,000 for utility scale wind turbines (i.e. greater than 75kW). On the DNO's side of the connection the charges involved vary considerably depending on whether the capacity of the generator is above or below 200kVA as the equipment is installed on the high voltage or low voltage respectively. For LV connections (i.e. capacity below 200kVA) costs will be in the range of £10,000-15,000, while for HV connections, costs will be in the range of £10,000-100,000. Additionally, smaller charges may or may not initially be imposed by the DNO in the form of feasibility studies, before a connection offer is made.

Within the ranges of costs indicated above for grid connection, costs are usually lower the smaller rated power of the wind turbine(s). Additionally, smaller projects (less than 1-3MW) maybe able to connect in at the 11kV level, which also keeps hardware prices down.

Grid Code

With increasing wind penetration, grid and network operators, both in the UK and Europe, are demanding greater flexibility in the electrical characteristics of wind turbines. At present, the Grid Code, as maintained by National Grid Transco, is being rewritten such that significant wind developments will need to support the grid with respect to frequency and voltage stability. Until now wind turbines have not been able to provide such a role and have disconnected from the grid when non-standard conditions have occurred and so manufacturers have recently been forced to develop additional features in their turbines. As such smaller (and hence generally older) designs do not have these features. However, compliance with the new Grid Code will only be required for wind farms with a rated power of greater than 50MW, and these technical requirements are unlikely to impact on the applications in which smaller turbines are likely to be employed.

Grid connection in Birmingham Eastside

The network operator for the Birmingham Eastside area is Aquila Networks. We have contacted them to look at the possibility of connecting up to 2.6MW (two 1.3MW wind turbines). They have investigated the technical issues and have provided the following comments:

(1) There should be no cable rating problems for a scheme of this size.
(2) The voltage rise should be acceptable.
(3) There may be a problem with fault levels since the existing fault levels (during temporary parallels) are already very high. This applies to all the substations feeding the area around the centre of Birmingham. For this reason we (Aquila) would recommend that you keep the total wind turbine capacity below 1 MW.
(4) The nearest primary substation to the proposed site is Bordesley.
(5) A ball park cost of connection for a single wind turbine of the order of 1 MW in size is £50,000. The costs have been based on a connection into a local 11kV network. The costs include up to 250m of 11kV cable with a looped supply to the turbine substation.

A copy of the response can be found in Appendix 2.

7. Public Safety and Amenity

An assessment of effects to public safety and amenity has been undertaken on a generic basis in the absence of a firm proposal from which to make an assessment. Consequently, following are the public safety and amenity issues that should be addressed by any developer of wind turbines in the Eastside area. This section focuses particularly on driver distraction, noise, public access and safety, shadow flicker effects, reflected light and contaminants.

Driver distraction

Motorists today face many distractions; however, research carried out into driver distraction with respect to existing wind farms gave no reason to believe that the wind turbines would be an added distraction to motorists.

There are a number of wind farms in the UK in close proximity to major roads, including Lambrigg Wind Farm, 600m from the M6 in Cumbria; Carland Cross Wind Farm directly on the junction of the A30/A3076 roundabout near to Newquay; and Cold Northcott Wind Farm, which directly straddles the A395 at Launceston. In addition, the Dun Law wind farm directly straddles the A68 between the Edinburgh and Newcastle. There is, however, no evidence of accidents directly related to the wind farms. There is no evidence to date in the history of wind farm development of distraction impacts to vehicle drivers despite a large number of UK wind farms being clearly visible from major roads.

Noise

The DTI/ ETSU document 'The Assessment and Rating of Noise from Wind Farms'[i] gives clear guidance on the acceptable noise limits that can be produced by a wind turbine or wind farm in relation to inhabited properties within the vicinity of the development. These are given in both absolute terms and as a margin above background noise. For the Eastside area it is thought that the high levels of background noise present will mean that any wind turbine will have to meet the latter criteria during amenity hours and either the former or the latter during night time hours. These limits and terms are explained in the Executive Summary of the ETSU document, which can be found in Appendix 3, or as embedded below.

Additionally representative simulations of generic turbines with various source sound power levels (SWP) ranging from 94 – 100 dB(A) (representative of a wide range of turbine sizes from 75kW-1MW) have been conducted and the distances at which these turbines produce noise levels between 30 and 50dB$_{LA90}$ (at 10m/s windspeed) are shown below in Table 7.1.

Prediction	SWP	94dB(A)	96dB(A)	98dB(A)	100dB(A)
30 dB$_{LA90}$		20m	45m	70m	85m

40 dB_{LA90}	140m	180m	230m	285m
50 dB_{LA90}	430m	530m	640m	770m

Table 7.1: Predicted noise levels from variety of generic wind turbines of various sound power levels

These figures should be viewed in the light of the ETSU noise guidance with particular attention paid to the fact that for environments with higher background noise levels, the acceptable levels are set at a 5dBA margin above background noise levels (in an urban environment such as Eastside it is thought that noise levels of 50-60$dB_{LA90,\ 10min\ average}$ will be common).

Smaller turbines, such as those described in Section 13, will generally have lower noise emission levels than the larger machines. However, these turbines do not often provide source noise levels. The Proven 2.5kW machine produces 40dB(A) at 5m/s and 60dB(A) at 20m/s; it is thought that even smaller turbines, which have been designed for the urban environment, will be quieter than this.

Low Frequency Noise

Infrasound, or low frequency noise, is all around us, often generated by the wind, by transportation systems and by industry where it occurs. Unlike audible sound, which only becomes annoying when it is significantly above the perception threshold, infrasound may become annoying when it is only just above it. Criteria for infrasound limits are therefore set to account for the perception thresholds of the most sensitive 5-10% of the population; this has a threshold of 86 dB(G) (dB(G) is the infrasound frequency weighting). Measurements that we are aware of, made by the Hayes-McKenzie Acoustic Engineering Partnership, indicate that the infrasound components attributable to the blade passing frequency for a large (1MW) turbine are significantly below this level (by about 30 dB).

Public access and safety

Wind turbines are like most other engineering products such as cars or aircraft; they are designed to operate to high standards of safety. All site work for a wind turbine proposal would need to comply with the Construction (Design and Management) Regulations 1994 approved code of practice. Properly designed, constructed and maintained wind turbines are entirely safe and would not constitute a danger to the public or maintenance personnel. In addition, the wind turbine generators would be fully certified by an internationally recognised authority, and they would have a proven track record. A computer control system would monitor the turbines at all times to make sure they are operating safely and operators would be able to communicate with the control system remotely. If a fault were to develop, the particular turbine would automatically shut down and send an alarm to the maintenance engineer. In the event of a more serious fault the wind farm would be disconnected from the grid.

In very high winds (greater than 25 metres per second) the turbines would stop automatically. There would also be lightning protection. Vibration sensors would prevent the turbines from working should unusual events occur such as the build up of ice on the blades.

The overall risk to public safety is extremely low. The risk of anyone being hit by a fragment of a wind turbine is comparable to death by lightning (Taylor and Rand, 1991). A safeguarding distance from any footpath, road or public right of way to the turbine is equivalent to the height

to tip plus an additional 10 metres is usually incorporated into wind farm layout. As a minimum this distance needs to be equal to the oversail distance (1 blade length). Whether this would need to be adhered to in an urban environment is a question of choice for the planners and statutory consultees. In a rural environment, many of the LA's specify a separation distance of a single turbine height to a public right of way.

Further to the above, it should be a consideration of any wind turbine developer that protection against unauthorised access should be factored into the design of a proposal. Where possible, internal transformers should be placed within the turbine tower to avoid acts of vandalism.

Shadow Flicker

Wind turbines are large structures, which can cast long shadows when the sun is low in the sky. The large rotating blades cast moving shadows which can appear to flick on and off as the blades rotate.

Wind turbines can cause 'shadow flicker' under certain combinations. This happens when the sun passes behind a moving blade and casts a shadow on the window of a neighbouring property. For this to be a problem the sun needs to be low in the sky, whilst the wind turbine and property all need to be in line. Research by Clarke (1991) has demonstrated that shadow flicker only occurs inside buildings, when flicker appears through a narrow window opening, particularly if the window is the sole source of light. In line with current research, these effects have been shown to only occur at distances of up to, and no more than, 10 rotor diameters, and in Britain, for properties that lie in the directions from east through north to west of the turbines. In addition, it should be noted that potential disturbance from shadow flicker occurs at frequencies between 2.5Hz and 40Hz (or cycles per second). The blades of larger turbines of around 1MW have a rotational speed of between 13 and 19rpm, giving frequencies of less than 1Hz, well below the frequencies of concern. The blades of smaller machines have higher rotational speeds and these may fall into the frequency of concern indicated previously. Care would need to be taken when selecting and siting any smaller turbines and in these cases a separation distance of 10 rotor diameters should be kept from any residential properties.

Reflected light

With respect to reflected light, the colour of the turbine towers, blades and nacelle would be subject to agreement with the planning authority. However, agreeing to paint the turbines a light-grey (RAL 7035) colour with a minimum-reflective, semi-matt finish coating which would ensure that the potential to reflect light is minimised.

Contaminants

It is recognised that the risk of contaminants coming into contact with the land and entering the water table is highest during the construction period. Control of Substances Hazardous to Health Regulations (COSHH) (2002) would be complied with at all times and with appropriate procedures the risk of contamination will be minimised. Should a decision be made to pursue wind energy in Birmingham Eastside, a full Method Statement, including management of on-site potential contaminants, would need to be agreed with Birmingham County Council prior to construction

During construction, the contractors would be limited only to storing sufficient diesel fuel for the plant on site. Drainage within the site compound, where construction vehicles would park and where any diesel fuel would be stored, would be directed to an oil interceptor to prevent pollution if any spillage occurs. Storage of diesel fuels and oils would be within a bunded area in accordance with Environment Agency Pollution Prevention Guidelines: Above Ground Oil Storage Tanks (PPG 02) and CIRIA/Environment Agency Joint Guidelines: Concrete Bunds for Oil Storage Tanks. In the event of a spillage, the procedures recommended in PPG 21: Pollution Incident Response Planning would be adopted. Fuller details on the proposed incorporation of this pollution prevention guidance would be provided in a detailed Method Statement to be agreed with relevant authorities in the event that planning consent is awarded.

For the long-term operation of the wind farm, the key potential contaminants are identified as follows:

Concrete

The foundation concrete specified is of high strength structural grade, which is not prone to significant leaching of alkalis. The concrete delivery vehicles should not be washed out on site after pouring.

Lubricants

Proper draining and containment should be employed during routine servicing to prevent spillage of lubricants or hydraulic fluid.

Coolants

The transformers to be used in the development should be either sealed units containing non-toxic cooling oil or dry resin transformers. The oil units are similar to those used elsewhere and leakages are negligible. There should be no long-term storage of lubricants or other petrochemical products on site. Instead, Operation and Maintenance personnel should bring these onto site, and waste coolants will be removed from site after routine maintenance and replacement and disposed of in an environmental acceptable manner.

Controlled use and proper disposal of any potential contaminants should be undertaken in accordance with the Environment Agency guidelines outlined in section 2 of this Study.

8. Visual Elements

Wind turbines are a relatively recent addition to our environment and there is no doubting that they present significant vertical elements in any landscape. It is in the nature of wind turbines to be visually seen as they attempt to harness the power of the wind for the generation of electricity. There is general no consensus of opinion on the threshold height above which significant changes in the view will have an unacceptable effect on visual amenity. This varies from person to person, with those in favour of wind energy development in their local area likely to accept much greater changes to their visual amenity than those who do not find wind turbines aesthetically pleasing. Consequently it is very difficult to achieve complete unanimity of opinion in developing a wind applications and there are always likely to be objectors to new wind turbine proposals.

For an individual, this threshold of acceptability can be different, depending on the location and size of the installation. For example, some consider small groups of turbines preferable to larger groups, even though a much greater number of installations would be required to achieve an equivalent energy output. Some prefer to see turbines in rural locations away from centres of population, whilst others consider installations in industrial or urban settings, or in countryside close to urban centres, more appropriate for this type of development, even though a much greater number of residents will see them.

Furthermore, peoples' opinions on wind energy can also vary over time, as the result of changes in their understanding of the technology or their increasing familiarity with a particular scene. Public attitude surveys have consistently concluded that the majority of people do not think that they are going to like a wind farm when one is proposed in their locality, but consider the development acceptable once it is constructed. In some of these surveys, residents living near wind farms have also suggested that they would be happy to see extensions or additional wind farms in their locality.

In the context of the Eastside development initiative, large scale wind turbines would present significant elements in the urban environment, whilst smaller scale building top or integrated turbines would be visible to a large amount of people within view of them. Factors that should be considered in the location of wind turbines include:

- Location of turbines in areas that do not provide an overwhelming visual intrusion to residential properties
- Protection of the lines of sight identified in the draft Eastside Design and Movement Framework (September 2003)
- Sensitive location of turbines in or near to the Digbeth conservation area, to preserve the setting of the built heritage

These three factors will strongly determine the location of turbines in the Eastside area, though it is important for any prospective developer to consult with the relevant statutory authorities, perhaps armed with photomontages of a proposal, on further locational criteria that may to be addressed in the siting of any turbines.

The three guiding themes of the Eastside initiative – technology, heritage and learning – should be considered by wind turbine developers. The technological aspect will give a strong supporting case for developers as wind turbines are a relatively recent innovation and thereby display modern, more sustainable forms of energy generation. Protection of the natural and

cultural heritage is important for locating wind turbines and should be factored into turbine development and implementation. Lastly, there are substantial opportunities for developers to facilitate learning among the populace on renewable energy generation, which would be a positive aspect of any proposal to site wind turbines in the Eastside area.

As vertical elements on rooftops or incorporated into building design, wind turbines should present an acceptable form as long as they conform to building design criteria; and done correctly can actually enhance the visual impact with wind sculptures etc., reflecting good urban design principles. In the case of larger turbines, more detailed siting criteria should be addressed before making applications for planning consent as there are more constraints, in the form of the design and movement framework and conservation areas, that need to be addressed. However, some scope for the deployment of a large-scale wind turbine in the city centre remains.

9. Environmental and Heritage Issues

The following consultees have been approached for information and guidance in the course of the preparation of this feasibility study:

- English Nature North Mercia Team
- English Heritage West Midlands
- Royal Society for the Protection of Birds, Central England Office
- Environment Agency
- Birmingham and Black Country Wildlife Trust

In addition the following people at Birmingham City Council have been consulted:

- Birmingham City Council Senior Archaeologist
- Rob Wells, Development Control
- Mike Taylor, Strategic Planning
- Dave Ward, Local planning officer
- Steven King, Conservation officer
- Bill Arnold, Energy Section Team Leader
- Dave Clark, Renewables Officer
- Phil Preece, Head of Health and Safety
- Rosemary Coyne, Sustainability Advisor, Open Spaces
- Andrew Jellyman (Acoustics) – forwarded to Chris Hodson
- Graham Mitchell, Disabled Access
- Alan Bishop, Development Manager, Eastside
- Emrys Jones, Chief Planning Officer
- Doug Hyde, Transportation

We are still awaiting the majority of the responses from Birmingham County Council consultees.

A summary of the key responses received are detailed below:

- English Nature, RSPB and the Wildlife Trust all generally supportive of wind energy in Birmingham Eastside. RSPB stated that in their view the highly urbanized nature of the area makes it unlikely that there would be any major conflicts between wind energy developments and biodiversity in the area. English Nature supports the development of RE schemes (including wind power) where these have appropriate standards of environmental protection, will not damage wildlife and natural features, and contribute to achieving sustainability as well as emissions reduction targets
- There are no legally designated sites within 2km of SP0886.
- Eastside contains several wildlife corridors, which are rich in bird biodiversity, and 5 key corridors converge in the area. There are 20 bird species identified in area that are on the rare or at risk register, of which 10-15 species are in the new development area. Amongst these is the Black Redstart, which is known to breed in Eastside. RSPB raised concerns about rooftop turbines being erected close to Black Redstart breeding sites at a time of year when this scheduled 1, amber-listed species could be disturbed. An Eastside biodiversity study has been carried out on behalf of Sustainable Eastside which contains the data detailed above.

- The Environment agency are charged with encouraging and supporting sustainable development, which includes sustainable use of energy, therefore they welcome the proposal looking at wind power as an alternative source of energy. Within the Birmingham Eastside development area the agency has identified the following constraints which fall within the Agency's remit; the underlying Major aquifer including source protection zones, the River Rea, possible contaminated ground and made ground. Further details of regarding these constraints can be found in Appendix 2.
- English Heritage would generally support sustainable development where it is compatible with the proper protection and enhancement of the historic environment. They raised the issue of wind turbines up to 90 metres high in Eastside clearly being a challenging one in terms of historic environment and urban design and added that visual and other environmental issues would be just as serious in the inner city as in rural contexts. They would not, therefore, object in principle to the use of wind power in Eastside but they would wish to reserve their position in respect of the siting and design of any plant associated with it. Whilst English Heritage commented on the scale of large turbines proximate to historic buildings, the Renewables Officer (Dave Clark) of Birmingham County Council indicated that a single large wind turbine would give a higher profile for the region and suggested millennium point as a possible location.
- Eco-record holds details on nature conservation in area and a biodiversity audit has been produced on behalf of the Eastside Sustainability team. The biodiversity findings can be made available from Rosemary Coyne/ Ros O'Donovan.

All consultation responses received can be found in Appendix 2 of this report.

10. Transport and Access Arrangements

A map based desk top survey has identified that there are unlikely to be any significant constraints to large turbine delivery to the area due to the excellent road links that surround and enter the Eastside area. These include the M6, A38(M) A45, A47 and A4540.

At an early stage of developing a wind turbine proposal, consultations with the relevant Highways authority and the Highways Agency should take place, solely in regard to larger scale turbines and their delivery to site. It is possible that an agreement under Section 38/278 of the Road Traffic Act 1988 may be required to execute any works that fall within the highway boundary.

Attention should also be paid to abnormal loads, in the case of larger turbines, in respect of three issues: weight, speed, and physical size. For wind turbine construction, a large crane and lorries delivering long turbine components would be classed as abnormal loads. The main erection crane may weigh in the region of 90 tonnes and have a lifting capacity of 400 to 500 tonnes. Usually, whilst travelling to site on public highways, a crane would be de-rigged and its axle weights would be within that permissible by current legislation (maximum 12 tonnes per axle). While road speeds of such cranes do not normally necessitate police or other escorts, the developer would consult with the Highways authority and police to determine whether or not escorts would be necessary.

A transport assessment that determines whether wind turbine blades can be delivered to site without significant highways impacts should be undertaken by a developer, in the case of larger turbines. It is likely that the temporary removal of street furniture may be required, and possibly alterations to road infrastructure. Again, this should be agreed with the relevant Highways authority.

11. Planning Policy Guidance Appraisal

This Section examines the relevant UK national and regional planning policy in the form of Planning Policy Guidance notes and Regional Planning Guidance, specifically in relation to renewable energy. However, often other forms of guidance have a strong bearing on the development of renewable energy projects and so a broad overview of such guidance is made available here. This section starts with an overview of international objectives to combat global warming and climate change. This is not strictly planning policy guidance, but provides a context for understanding the main drivers in developing planning policy guidance.

The International Need for Renewable Energy

Climate change and global warming are common challenges facing the international community, and both nations and individuals are encouraged to act as part of the solution. One of most challenging dilemmas facing us as we move into the 21st Century is how to address and overcome the issues of climate change and global warming. The Inter-Governmental Panel on Climate Change (IPCC) found that:

> "*… if we continue as we are, global mean temperature would increase by 0.3% per decade (within a range of 0.2 to 0.4 degrees); this is greater than the world has ever seen over the past 10,000 years. Global mean temperature over the next century would become higher than at any time over the last 150,000 years; sea level would rise by 6cm per decade (within a range of 3-10cm per decade) over the next century, 3 to 6 times the rate seen over the last 100 years*" [1].

The Department of Environment, Transport and the Regions has re-emphasised these concerns in a recent publication concerning climate change where it states that:

> "*Global warming is no longer a theory. Since the 1970s, the world has warmed by about 0.15°C per decade, and 1998 was the warmest year on record. In England, four of the five warmest years in the 340-year record occurred in the last decade. These are startling statistics. The clear message from the scientific community is that this warming is due, at least in part, to the increasing concentrations of greenhouse gases in the atmosphere."*

On 21 January 2001, the IPCC issued a Summary for Policymakers, which describes the current state of understanding of the climate system and provides estimates of its projected future evolution and their uncertainties. This report indicates that the average global surface temperature is projected to increase by 1.4 to 5.8°C, between 0.4 and 2.3°C higher than previously predicted. Whilst there has been substantial debate about the cause of climate changes that have occurred during the last part of the 20th Century, more refined modelling techniques confirm that recent climate changes, especially over the last few decades, are almost entirely caused by human activity, particularly in the emission of long-lived greenhouse gases such as CO_2 arising from the burning of fossil fuels.

One of the most challenging dilemmas facing the global community in the 21st Century, therefore, is how to address and overcome the issues of climate change and global warming. CO_2 levels are now at the highest for at least the last several millennia and scientific opinion

[1] *This Common Inheritance: Britain's Environmental Strategy*; Government's White Paper; HMSO; ISBN 0-10-112002-8; September 1990.

attributes the cause primarily to the man-made burning of fossil fuels. The results are expected to be: the heating up of the earth's atmosphere and the resulting changes to global weather patterns; sea level increases and the loss of land and resources; the loss of biodiversity due to habitat changes; and potentially severe environmental health problems for mankind.

The international response to the threat of global warming and climate change hinges largely on the legally binding Kyoto Protocol commitment to reduce atmospheric emissions of various pollutants, including greenhouse and acid rain producing gases. The Kyoto Protocol was entered into by 174 countries, including the UK, in 1997. The Protocol assigned signatory Parties legally binding carbon reduction targets, which, as stated by Michael Meacher, Minister of State for the Environment, in the DETR publication "Climate Change Impacts in the UK" (1998), mean that:

> *"The European Union will have a legally binding target to cut emissions by 8% against 1990 levels, of which the UK will have a share. In addition we have a domestic aim to cut our emissions by 20%."*

Consequently, the UK government is committed to reducing greenhouse emissions by 12.5% by 2010 under the Kyoto Protocol and has issued a manifesto to reduce carbon dioxide by 20% by 2010. However, even greater reductions have been suggested by the Intergovernmental Panel on Climate Change, and the Royal Commission on Environmental Pollution recently proposed a 60% reduction in carbon dioxide emissions for the UK by 2050[2].

In the latter part of the 20th century and in the initial stages of the 21st century, there have been major developments in national policies, guidelines and instruments for the promotion of a more sustainable energy supply. The UK Government's energy policy now clearly promotes renewable sources of electricity generation as integral to addressing the causes of climate change. The policy is for renewables to make a steadily increasing contribution to secure, diverse and sustainable energy supplies so that, as electricity consumption increases, the existing generating capacity is retired and a more sustainable energy generating infrastructure is put in place to offset the burning of fossil fuels. In 1992, the House of Commons Energy Select Committee[3] stated that:

> *"Increasing the use of renewable energy sources will help to reduce environmental damage from acid rain, and to meet legally binding targets for emission of carbon dioxide and other 'greenhouse gases', to which the government is committed. They will increase the regional and national diversity, and overall security, of energy supplies."*

Planning Policy Guidance: General Policy and Principles 1997 (PPG1)

One of the stated Primary Principles of PPG1 is in support of Sustainable Development, which it defines at paragraph 4 as "*...development that meets the needs of the present without compromising the ability of future generations to meet their own needs*."

Paragraph 5 advises that a sustainable planning framework should, among other things, "*provide for the nation's needs …….while respecting environmental objectives*".

[2] Royal Commission on Environmental Pollution (2000) "Energy – the changing climate"

[3] The House of Commons Energy Select Committee (1992)

Planning Policy Guidance Note 22, Renewable Energy, 1993 (PPG22)

This guidance note provides the primary source of Government guidance on the issue of renewable energy. Paragraph 3 states that "*Renewable energy sources offer the hope of increasing diversity and security of supply, and of reducing harmful emissions to the environment.*"

Paragraphs 5 to 14 set out the background to the Government's support for renewable energy. In particular, paragraph 8 states that it is Government policy "*… to stimulate the exploitation and development of renewable energy sources wherever they have prospects of being economically attractive and environmentally acceptable.*" Whilst this still provides the basis of national policy on renewable energy, government commitments and targets have changed substantially since 1993, hence the delivery of new planning policy guidance in the form of Planning Policy Supplementary 22 which is reviewed later in this section.

PPG22 provides an Annex on wind energy in which paragraph 3 sets out the distinctive features of wind turbines which should be taken into account in planning and development control. These are:

- *the need to site machines in open exposed locations often in rural areas which may also be in attractive landscapes;*
- *the nature of noise emissions from turbines;*
- *the movement of blades; and*
- *considerations relating to safety and electro-magnetic interference.*

Paragraph 11 of the Annex notes that the land area used for turbines is very small and that on agricultural land use can continue right up to the foundations.

Paragraphs 30 to 33 concern safety and advise that the "*minimum desirable distance between wind turbines and occupied buildings calculated on the basis of expected noise levels and visual impact will always be greater than that necessary to meet safety requirements*". The advice emphasises that there has been no example of injury to a member of the public, only to operational staff who have failed to observe manufacturers' operators' instructions. It also states that blade failure is a most unlikely event. With regard to icing, paragraph 33 notes that the build-up of ice on turbine blades is unlikely to present problems on the majority of sites.

Paragraph 37 recognises that properly erected wind turbines are stable structures but that "…*it may be advisable to achieve a set-back from roads and railways of at least the height of the turbine proposed, so as to achieve maximum safety.*" However, the advice also notes that drivers can be distracted by unfamiliar or moving objects and suggests a cautious approach to the siting of turbines near busy roads which carry tourist traffic and have a bad accident record. In reality, there is no evidence of distraction to drivers as a result of wind turbine operation and this is unlikely to be an issue for a wind turbine developer.

Paragraph 38 considers "shadow flicker" and recognises that in certain circumstances resulting from a combination of geographical position, time of day and year, a shadow may be cast over neighbouring properties. It notes, however, that "*it only occurs inside buildings where the flicker appears through a narrow opening*."

Paragraphs 39 to 51 concern noise. Paragraph 39 states that "*Well designed wind turbines are generally quiet in operation*". The advice examines the noise standards in existence in 1993

and paragraph 44 notes that British Standard 4142 *"… is intended to assess noise for industrial premises or fixed installations in mixed residential and industrial areas".* Paragraph 44 goes on to say that "*…Using BS4142 to assess wind turbine noise may be inappropriate for several reasons…*" BS4142 is not intended for use in largely rural areas and specifically precludes situations where background levels fall below 30dB(A). The Standard also recommends that noise measurements should not be taken in "*… extreme weather conditions such as high wind speeds greater than 5 metres per second average…*" Paragraph 7 notes that the wind turbines do not start to operate until wind speeds have reached about 5m/s.

Paragraphs 52 to 56 provide guidance on electro-magnetic interference and discuss the effect of turbines on television reception. It is advised that wind turbines should not cause any significant problems of electro-magnetic interference provided that they are carefully sited. Paragraph 53 also notes that any structure can cause interference with electro-magnetic transmissions. Paragraph 55 indicates that, while the general public may be concerned about interference with television reception, experience has shown that this can generally be alleviated by the installation or modification of a local repeater station. In respect of this guidance, Birmingham will no longer be approving further booster or repeating stations and therefore any wind turbine developer should be aware of this constraint and embark on early and detailed consultations.

Paragraphs 59 to 69 consider landscape issues. It is noted that "*… wind turbine generators will be proposed in the uplands, on the coast and other particularly exposed regions, where the highest mean wind speeds are found, …*" Paragraph 59 goes on to say that "*…. Local planning authorities must always weigh the desirability of exploiting a clean, renewable energy resource against the visual impact on the landscape of wind turbines.*" Paragraph 63 indicates that wind turbines "*… do present a distinctive vertical feature and have the characteristic of movement not normally present in man-made structures, …*" and paragraph 64 goes on to say "*… wind turbine generators must be assessed with their particular and unusual characteristics clearly in mind. The acceptability of wind turbine generators will be determined to a considerable extent by the form and pattern of the landscape within and adjoining a particular site.*"

Paragraph 69 concludes that "*Wind turbines should be sited in sympathy with existing landscape features such as hedges and roads, and with contours. …*" and that "*…. The most desirable layout in any given case will be a compromise between the quality of the wind resource, the characteristics of the land form and existing features of the landscape.*"

Ecology is briefly discussed in Paragraph 70 in which it notes that advice on the inter-relationship between nature conservation and development control is given in the PPG on Nature Conservation (PPG9, discussed below). It advises that applications for wind turbines in areas designated for nature conservation should be rigorously examined. However, it is noted that "*… the risk of collision between moving turbine blades and birds is minimal both for migrating birds and for local habitats.*"

With respect to archaeology, the reader is referred to PPG16, which is considered below.

It is very important to note that PPG22 has been reviewed and the new PPS22 has been published for consultation purposes. In view of the substantial changes that have taken place in the renewables industry, especially with respect to wind energy, during the ten years since the publication of PPG22, it is considered that PPS22, even in its draft form, will be a very important material consideration in determining applications for renewable energy projects.

Planning Policy Guidance: Nature Conservation; (PPG9) 1994
Paragraph 3 states: "*One of the essential tasks for …local authorities, and all public agencies concerned with the use of land and natural resources is to make adequate provision for development and economic growth whilst ensuring effective conservation of wildlife and natural features ….*"

Paragraph 4 goes on to say that the "*… protection of wildlife is not an objective which applies only in SSSIs; it depends on the wise use and management of the nation's land resources as a whole.*" The Government looks to local authorities to "*… take account of nature conservation interests wherever relevant to local decisions.*"

With specific reference to nature conservation and development control, paragraph 27 advises that planning authorities "*… should not refuse permission if development can be subject to conditions that will prevent damaging impact on wildlife habitats or important physical features, or if other material factors are sufficient to override nature conservation considerations.*"

Paragraphs 44 to 48 consider the provision of the Wildlife and Countryside Act 1981 in which certain plant and animal species, including all wild birds, are protected. PPG9 advises that the presence of a protected species is a material consideration when assessing a development proposal which would be likely to result in harm to the species or its habitat

Planning Policy Guidance: Planning and Noise (PPG24); 1994
This Guidance makes no specific reference to noise from wind turbines. However, in general terms, it seeks to minimise the adverse effects of noise and advises on the considerations to be taken into account for both noise-sensitive development and for activities which will generate noise.

Paragraph 2 states that noise can be a material consideration in determining planning applications and advises that it is important that *"… new development involving noisy activities should, if possible, be sited away from noise-sensitive land uses.*" This paragraph suggests that noise-sensitive development includes housing, hospitals and schools.

Paragraphs 10 and 11 consider noisy development and indicate that noise which contains a distinguishable continuous tone will require special consideration.

Planning and the Historic Environment (PPG15); 1994
Paragraph 1.3 re-iterates the government's commitment to the concept of sustainable development and notes that this has particular relevance to the preservation of the historic environment which is considered to be irreplaceable. However, the advice goes on to say that "*…the historic environment of England is all-pervasive, and it cannot in practice be preserved unchanged. We must ensure that the means are available to identify what is special in the historic environment; to define through the development plan system its capacity for change ...*"

The setting of Listed Buildings is considered in paragraphs 2.16 and 2.17 and advise that the planning authority should have regard to the desirability of preserving the setting of a building. The setting is often an essential part of a building's character, especially if a garden or grounds have been laid out to complement its design and function, and they can be robbed of their interest if they become separated from their surroundings by, for example, new traffic routes.

Paragraph 2.17 advises that the setting of a building should not be interpreted too narrowly. Whilst it would generally mean land which is ancillary to the building it may often include land some distance away. However, it gives examples of this approach in describing listed buildings in a street; the setting should include the adjoining buildings. In cases where the listed building forms an important visual element in a street, the whole street may be considered to be part of its setting. It is clear that the advice gives the impression that setting is generally regarded as being relatively close to the building concerned.

Paragraph 2.24 advises that the effect of proposed development on registered Historic Parks and Gardens and their settings are also material to the determination of a planning application.

Section 4 of this PPG deals with conservation areas and paragraph 4.1 advises that one of the purpose of designating conservation areas is to provide a basis for policies designed to preserve or enhance all the aspects of character and appearance that define an area's special interest. Paragraph 4.5 goes on to say that local planning authorities should make a judgement as to the character or appearance of any particular area of special architectural or historic interest which it is desirable to preserve or enhance. An authority's justification for designation, as reflected in its assessment of an area's special interest and its character and appearance, is a factor which must be taken into account in determining applications or appeals. Indeed, there should be a clear relationship between the local plan and detailed assessment documents, making clear that development proposals will be judged for their effect on the character and appearance of the area as identified in the assessment documents. However, paragraph 4.14 also indicates that development outside of conservation areas which would affect its setting, or views into or out of such areas, should also be a material consideration. One of the specific themes of the Eastside project is to preserve the heritage of the area and therefore effects to the historic built environment are a material consideration in any application for a wind turbine.

Planning Policy Guidance: Archaeology and Planning (PPG16); 1990

Part A of this guidance notes that archaeological remains are irreplaceable and Paragraph 6 advises that "*… care must be taken to ensure that archaeological remains are not needlessly or thoughtlessly destroyed.*" Paragraph 8 goes on to state that "*… Where nationally important archaeological remains, whether scheduled or not, and their settings, are affected by proposed development there should be a presumption in favour of their physical preservation.*" Paragraph 27 explains this to mean that "*… proposals which would involve significant alteration or cause damage, or would have a significant impact on the setting of visible remains.*"

Part B, paragraphs 19 to 22, advises on field evaluations and early consultation with the Council. Paragraphs 25, 29 and 30 indicate that where planning authorities decide that the physical preservation of archaeological remains *in situ* is not justified, they may impose conditions or enter into agreements to ensure that any potential remains are adequately recorded, either as a 'watching brief' during the construction period, or prior to any works commencing.

Planning Policy Guidance: Regional Planning 2000 (PPG11)

The guidance provides advice on the preparation, scope and content of Regional Planning Guidance (RPG). It states that the main purpose of RPG is to provide a regional spatial strategy within which local development plans can be prepared. RPG is also intended to provide a regional planning framework to inform and facilitate other strategies and programmes such as the regional transport strategies and the economic strategies of the Regional Development Agencies.

Regional Planning Guidance for the West Midlands (RPG11)

This guidance follows the principles laid down in PPG11 above in that it seeks to provide a spatial framework for other strategies for development in the region. The RPG, recently updated, is closely related to the Regional Sustainable Development Framework which "…*contains high-level statements of the regional vision for achieving sustainable development and sets priorities expressed through regional objectives, indicators and targets*." Whilst the RSDF concerns the broader aspects of sustainable communities, the RPG provides the land use planning framework within which this can be implemented, both through its influence on the development plan process and the determination of individual proposals.

Paragraph 8.98 states that the Region should contribute as far as possible towards the achievement of National energy targets, including 10% of UK electricity consumption met from renewable resources by 2010. Technical studies into the regional potential for renewable energy generation have identified that up to 15% of Regional energy needs could be met through a portfolio of renewable energy technologies. Energy from wind is identified as a major contributor, both in terms of multi-turbine developments and smaller installations, such as could be installed for the Eastside project, supplying power to housing and business premises. The guidance goes on to state in paragraph 8.101 that "*If National energy targets are to be met, it is important that development plans incorporate policies to ensure that the energy generation potential from all … sources is realised.*"

The principal policy in RPG11 is Policy EN2: Energy Generation and this is reproduced below:

Development plans should include measures to:

a. ***encourage proposals for the use of renewable energy resources, including biomass, onshore wind power, active solar systems, small scale hydro-electricity schemes and energy from waste combustion and landfill gas, subject to them being in scale and character with their surroundings;***
b. ***identify the locational and environmental criteria that will be applied to determining the acceptability of such proposals, with supplementary design guidance as necessary. Plans should consider the desirability of generation sites close to or within areas of demand, to minimise the need for new overhead transmission lines, particularly in areas where the environment has been accorded special statutory status, or in areas close to residential properties;***
c. ***[relates to fossil fuel power stations]***

The RPG goes on to state that energy developments impact on a number of other policies in the Guidance, particularly those relating the Quality of the Environment. The Guidance explains that these policies should be adhered to but it should not be assumed that there will always be adverse effects as appropriate developments can accommodate wider concerns. An analysis of the Quality of the Environment policies has not been undertaken here as it is more appropriate to consider Unitary Development Plans, Structure Plans and Local Plans where more site specific developments are likely to go into planning.

Planning Policy Statement 22 – Renewable Energy (Consultation draft)

The Office of the Deputy Prime Minister recently issued a consultation draft of Planning Policy Statement 22 on renewable energy which will, when published in its final form, replace the current PPG22 reviewed above.

As stated in the introduction to the Consultation Paper on PPS22, the new Planning Policy Statements are intended to provide shorter and more focused statements of national planning policies. PPS22 is no exception to this and, although much of the guidance within it reflects the advice contained within the current PPG22, paragraph 5 of the introduction states that its policies are firmly based on the recent Energy White Paper. The introduction also notes that most of the contextual and non-planning material in PPG22 would not be appropriate to the new form of the PPS. However, whilst this has been omitted from PPS22 it is the government's intention that a companion guide to PPS22 will be published which will contain general technical advice on different renewable technologies together with examples of good practice in terms of both development plan policy and the development of projects.

As with the PPG series, PPS22 will be material to individual planning applications. Indeed, even in its draft form, it will be a material consideration in current planning applications for renewable energy development, although less weight should be attached to it. Nonetheless, since much of PPS22's policy is already based on the existing guidance and, more importantly, on the Energy White Paper the principal aims and objectives will remain unchanged.

PPS22 certainly lives up to the aim of being more focused and sets out the Government's fundamental energy policy objectives perhaps more clearly than any other Government Statement. These objectives are the Government's target to generate 10% of UK electricity from renewable resources by 2010, the aspiration to attain 20% by 2020 with still more renewable energy needed beyond that date in order to achieve 60% cuts carbon dioxide emissions by 2050.

PPS22 also states that:

"*Positive planning which facilitates renewable energy developments can contribute to all four elements of the Government's sustainable development strategy:*

- *Social progress which recognises the needs of everyone – by contributing to the nation's energy needs, ensuring all homes are adequately and affordably heated, and providing new sources of energy in remote areas;*
- *The effective protection of the environment – by reductions in greenhouse gases and thereby reducing the potential for the environment to be affected by climate change;*
- *Prudent use of natural resources – by reducing the nation's reliance on ever diminishing supplies of fossil fuels; and,*
- *Maintenance of high and stable levels of economic growth and employment – through the creation of jobs directly related to renewable energy developments, but also in the development of new technologies. In rural areas, renewable energy projects have the potential to lay an increasingly important role in the diversification of rural economies.*

The PPS then sets out the National Planning Policies and main points of these are noted as follows:

- *It should be possible to locate renewable energy developments throughout England where these are viable and environmental and other impacts can be addressed satisfactorily;*
- *RPG and development plans should contain policies which promote and encourage renewable energy developments. Policies which rule out or place constraints on particular technologies should not be included in these documents;*

- *The wider environmental and economic benefits of all proposals are material considerations and should be given significant weight in determining applications for planning permission;*
- *Planning authorities and other bodies should foster community involvement in renewable energy projects and promote knowledge of and greater acceptance by the public of appropriately located developments;*
- *Developers should engage in active consultation and discussion with local communities at an early stage in the planning process*

Paragraphs 2 to 5 of the Statement go on to discuss regional targets and states that these should be expressed as a minimum amount of renewable energy generated within a region and should be set as targets for 2010 and 2020. These should be reviewed regularly and, if they are met, revised upwards. More importantly, the fact that a target has been met should not be used as a reason for refusing planning permission for further renewable energy projects. In developing Regional targets, the fact that substantial offshore renewable energy resources could be exploited should not be used to set lower targets for onshore projects.

The remainder of PPS22 focuses on locational and other considerations to be taken into account. With respect to International designations such as SPAs, SACs and RAMSAR sites, renewable energy proposals would only be acceptable if they do not adversely affect the integrity of these designations or, there are reasons of overriding public interest.

Projects within National Parks, Areas of Outstanding Natural Beauty, Heritage Coasts, Sites of Special Scientific Interest and National Nature Reserves will be granted planning permission where they can demonstrate that the objectives of the designation would not be compromised by the development and that any significant effects are outweighed by the benefits. Paragraph 10 goes on to say that small scale developments should be permitted in nationally designated landscapes provided that there is no serious harm to the area concerned.

Paragraph 12 clarifies the position of "buffer zones" and states that these should not be created around international or national designations and, in so doing, apply restrictive policies on renewable energy in those areas. It goes on to say that, in themselves, local landscape and nature conservation designations should not be used to refuse planning permission for renewable energy developments.

With regard to visual effects, PPS22 advises that "*Policies in plans should concentrate on the mitigation of visual effects (e.g. on siting, layout, landscaping, design and colour schemes), rather than trying to provide specific criteria against which potential harm is assessed.*" With respect to wind turbines, local authorities should "*…recognise that the impact of turbines on the landscape will vary according to the size and number of turbines and the type of landscape involved.*"

Other matters specifically related to wind turbines include noise, where it states that the method of assessment for this issue is set out in the "The Assessment and Rating of Noise from Windfarms". Finally the Statement advises that development plans should not include policies relating to the impact of wind turbines on aviation interests including radar and aircraft or on the separation distances from roads, powerlines or railways, but it is for the developer to resolve these issues prior to planning applications being submitted.

The Draft Planning Policy Statement plainly sets out the Government's policies with respect to achieving 2010, 2020 and 2050 targets on the implementation of renewable energy developments. It provides much needed clarity on issues relating to development within, and more importantly, on the fringes of nationally and internationally designated areas and advises that local landscape and nature conservation designations should not be used in themselves to refuse planning permission for renewable energy developments.

Overall, PPS22 will serve as an important driver in ensuring that the Government's targets and aspirations set out in the Energy White Paper will be delivered through the land use planning system. In this respect, it provides a very important material consideration in the determination of any planning application for renewable energy development.

Unitary Development Plan – Birmingham City Council

Birmingham City Council first Unitary Development Plan, published in 1993, contained no reference to renewable energy. The Plan is now under review and BCC has published draft Alterations to the Plan to roll it forward to the year 2011. The first Public Deposit was made in May 2001, and contains a policy on energy. Proposed Alteration 3/43 relates to energy and states the reason for change in this policy as striving to incorporate policies to minimise energy consumption and carbon dioxide emission in new developments. The policy is stated as follows:

> ***Energy***
>
> **3.79 The City Council is aiming to minimise energy consumption and carbon dioxide emissions within Birmingham, and will require development which minimises or reduces energy consumption and carbon dioxide emissions, thereby reducing the City's impact on global warming, resource depletion and pollution. This will be addressed in a number of ways, including:-**
>
> - **locating the most intensive forms of development within the City Centre or other centres and along public transport corridors (see Chapter 2)**
> - **mixed use development**
> - **modes of transport which reduce the impact of travel on energy resources (see Chapter 6)**
> - **layout design which reduces the need for travel (see paragraph 3.14E)**
> - **layout design which takes account of possible future combined heat and power schemes**
> - **building design which reduces energy consumption by maximising natural heat and light and using renewable energy (see paragraph 3.14E).**

Clearly, this policy has no stated aims on the matter of renewable energy and so no guidance is available at the local level. Consequently, where proposals for renewable energy projects are taken forward as part of the Birmingham Eastside project, advice from planning officers and relevant statutory undertakers should be sought, along with reference to the guidance cited in RPG11.

However, further to the above, some guidance is given in *Design Principles for Sustainable Development,* Policy 3.14E:

> ***3.14E Development has a large impact on issues such as global warming, resource depletion and pollution. Developments, including new and refurbished buildings, should therefore be designed in a way which reduces such harmful impacsts and respects the principles of a sustainable environment. Applications for developments will assessed against the following principles:***
>
> ***…***
>
> - ***The orientation, external and internal design of buildings, and use of landscaping, should maximise the use of natural heat and light, contribute to local biodiversity and minimise the use of non-renewable energy sources. The use of renewable energy sources will be actively encouraged. This should not, however, be at the expense of good urban design; …***

This paragraph identifies only the potential for incorporating renewables into building design. There is no mention of stand alone renewable energy projects such as large scale ground based turbines or hydro-electric generation. Thus the policy does not encourage the development of large scale renewable energy projects, but rather appropriate building design renewable opportunities which should not compromise "good urban design". The policy does not represent a strong commitment to renewable energy deployment.

Appraisal of Planning Policy Guidance on Renewable Energy in relation to the Eastside project

National and Regional guidance on renewable energy is developing fast and effectively for the formulation of development plans at the local level, largely as a response to the need for clean energy production under the UK's climate change objectives. This is testified through the revised PPG22 guidance, PPS22, and the policies directing development plan formulation contained within RPG11. However, such guidance has not filtered down to the local level and Birmingham City Council does not have any policies relating to renewable energy *per se* in its proposed Alterations to the Unitary Development Plan, except in respect of Design Principles for Sustainable Development. Consequently whilst there is clear and effective guidance at National and Regional Level, there is a policy vacuum at the local level, which does not support the development of renewable energy projects.

However, this should not be construed as a barrier to renewable energy development for the Eastside project. Full consultation with relevant planning officers and statutory consultees should provide sufficient guidance as to whether a renewable energy proposal would be acceptable in land use planning terms, and what information should be provided to accompany a planning application. The drivers of National and Regional guidance should be sufficient to provide a framework to which a developer of renewable energy in the Eastside area can plan a project. In addition, further guidance from the British Wind Energy Association, Countryside Agency, RSPB, English Heritage should be referenced so that a suitable project can be developed and implemented.

12. Literature Review

Relevant Government legislation and guidance in respect of renewable energy are well recognised by Dulas Ltd through its long term involvement in the renewable energy field. Such legislation and guidance includes the following:

- *Renewable Energy in the UK: The Way Forward*, Energy Paper Number 55, Department of Energy, 1988
- *New and Renewable Energy: Future Prospects in the UK*, Energy Paper Number 62, Department of Energy, 1994
- *New & Renewable Energy, Prospects for the 21st Century*; Department of Trade and Industry; March1999
- *The Energy Review* – Cabinet Office Performance and Innovation Unit, February 2002
- *New and Renewable Energy prospects for the 21st century: The Renewable Obligation Statutory Consultation*, Department of Trade and Industry, August 2001
- *Energy White Paper, Our Energy Future – Creating a low carbon economy,* Department of Trade and Industry, February 2003
- *Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999*
- *Planning Policy Guidance 22: Renewable Energy* 1993
- *Planning Policy Supplementary 22: Renewable Energy (*consultation draft 2003*)*

In addition to the above, relevant policies relating to renewable energy within the Birmingham City Council Unitary Development Plan (1993 version and the consultative draft to 2011) will be reviewed and incorporated into the final report as guidance to developers, along with regional guidance on renewable energy in the form of Regional Planning Guidance for the West Midlands. The review of the relevant policies in such guidance will include policies relating to environmental and landscape protection, cultural heritage and conservation areas.

13. Presentation of Case Studies and CBA Scenarios

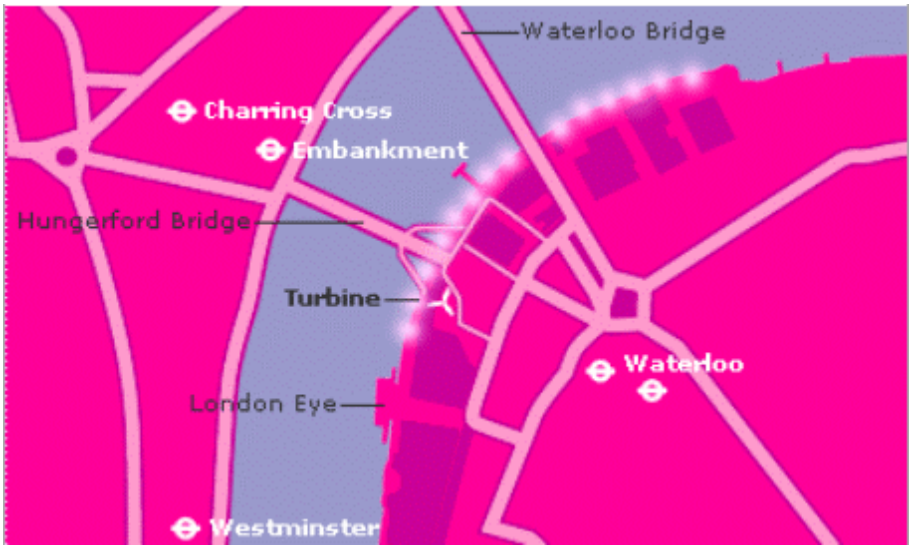
Following the investigation of the feasibility of the area for wind turbine deployment, a small number of reference scenarios are presented based on the potential for wind development, the expected capital and operational costs, and projections of expected revenues. This aspect includes potential environmental savings in terms of greenhouse and acid rain gases. An estimation of the number of households that will be supplied by the scenarios is presented. Additionally, a small number of comparable UK case studies are identified and presented.

Case studies – Large wind turbines

South Bank, London – Electric storm: 225Kw Vestas wind turbine

A 45-meter tall wind turbine has been erected in central London, as part of a temporary installation along London's South Bank, called the Shell Electric Storm. The turbine is designed to generate sufficient power such that there is a net zero energy consumption by the whole installation, which runs for 4 months as a free attraction each night from dusk to 11pm. This comprises lighting reminiscent of "the Northern Lights", with the addition of mist and sound effects, and rather than being pre-programmed, the effects are driven by various environmental readings continuously made at the site. The project is also backed by the DTI, as part of a campaign to encourage renewable energy.

The installation runs along the South Bank of the Thames, between the London Eye, past Hungerford Bridge, and Waterloo Bridge and beyond. The wind turbine itself is installed in the South Bank coach park by Hungerford Bridge.



The wind turbine is a 225kW V27 model, made by Danish turbine manufacturer Vestas. It has a hub height of 31 metres, a 3-bladed rotor diameter of 27 metres and a total height to blade tip of 45 metres. It is likely that this turbine has been installed and run previously as part of a windfarm and has been provided to this project second hand. The foundation design involves piles of 27 metres depth in an area with complicated ground conditions in the centre of a busy major city.

Timeplan

19th May 2003	(revised) Planning Application submitted to Lambeth Council
25th June 2003	Lambeth Council consults London Mayor's office on the planning application
16th July 2003	Mayor's office considers report on the project, and asks for more details
13th August 2003	Lambeth Council ready to grant planning permission for project
27th August 2003	Mayor's office ratifies planning decision
16th October 2003	Start of excavation for wind turbine foundations
12th November 2003	Wind turbine blades lifted into place
18th November 2003	Switch On, by Patricia Hewitt, Secretary of State for Trade and Industry
1st December 2003	1st Day of Advent - special display
25th December 2003	Christmas Day - special display
31st December 2003	New Year's Eve - special display
14th February 2004	St Valentine's Day - special display
Mid February 2004	Installation comes to an end
16th March 2004	Expiry of planning permission

See also

- Shell Electric Storm (http://www.shellelectricstorm.com/) official site
- Planning decision from the Mayor of London

(http://www.london.gov.uk/mayor/planning_decisions/2003/aug_27_03.jsp#hungerford2708)

- Lambeth Council planning decision

(http://www.lambeth.gov.uk/intradoc/groups/public/documents/report/021053.pdf#xml=http://www.lambeth.gov.uk/intradoc-c)

Ford, Dagenham, Essex: Planning permission for 3 wind turbines

Mayor of London, Ken Livingstone, has given the final go ahead for Ecotricity to build London's First wind park at Ford's Dagenham plant. The Mayor's decision endorses planning approval granted by Havering and Barking & Dagenham Councils' Planning Committees.

When complete the 3 turbines will provide 100% of the electricity requirements of Ford's new Clean Room Assembly Hall that is being built to expand production of high-tech diesel engines at the Dagenham engine plant. This is equivalent to enough electricity to power over 3,000 homes (around 10 million units per annum). This will mean that all Ford's diesel engines assembled at the plant will have been produced using wind power.

Located only 16km (10 miles) from the City of London, the development will create a major new Thames-side landmark for the capital and will make a key contribution to the renewable energy targets outlined in the Mayor of London's draft energy strategy - preventing the emission of up to 10,000 tonnes of carbon dioxide every year.

One of the turbines will feature a 65m high public viewing platform, accessible via a stairwell located inside the turbine tower. Providing a unique opportunity to experience wind power from the heart of the machine, visitors will enjoy views that rival the London Eye. The platform is to form part of the new visitors' centre that Ford is planning at Dagenham.

Cassop School – Atlantic Orient 50Kw wind turbine

Community projects are sometimes small and usually try to maintain any flow of benefits or resources as locally as possible. In 1999, a 50Kw wind turbine was installed at Cassop primary school in County Durham. The turbine was installed by Winsund. The school selected the turbine to match the load of the school ovens, thereby being capable of offsetting the school's peak electricity demand. When the ovens aren't being used, the surplus electricity is sold on to the grid. The "community" in this situation brings together the school, the local authority and the local electricity supply company who helped to develop the scheme. Winsund of Hugh Jennings Ltd was the local renewable energy contractor providing the specialist knowledge and turnkey installation.

Swaffham, Ecotec Centre: 1.5MW wind turbine with viewing platform

Installed - 1999
Rotor diameter - 66m
Capacity - 1.5MW
Hub height - 67m
Turbines - 1
Carbon dioxide (CO2) savings - 3,161 tonnes
Generation kWh - 3.7 million
Sulphur dioxide (SO2) savings - 37 tonnes

Equivalent homes - 1,121
Nitrogen oxide (NOX) savings - 11 tonnes

Swaffham One is the UK's first multi-megawatt wind turbine and one of a new generation of direct drive, variable speed wind turbines, brought to the UK by Ecotricity. The turbine was installed at the Ecotech Centre in Swaffham, Norfolk in October 1999 and officially opened by the Environment Minister, Michael Meacher. It produces enough electricity for around 3,000 people - over a third of the population of Swaffham. The Ecotech Centre is an environmental education centre and Swaffham One includes a viewing platform, which has already been visited by over 50,000 people. The unique public viewing platform, designed by Foster & Partners, is situated just below the hub and can be reached by climbing a 300-step spiral staircase inside the tower.

Case Studies - Urban wind turbines

Large wind turbines have become an increasingly familiar sight within the landscape, often situated in wind farms in remote areas, and away from the towns. Yet, another opportunity is opening up with the appearance of small wind turbines that are suited to the urban environment. Blending elegantly into the built environment, designed specifically for the

demanding wind profiles common in built-up areas, they offer another chance to benefit from the power of the wind. A large number of small wind turbines are available commercially but the requirements for use in built-up areas are much tighter than for use elsewhere.

Examples of wind turbines suitable for installation in urban locations can be found at the following web-sites:

- Alternative Energie Systeme GmbH
- Ampair Natural Energy
- Bergey WindPower
- Bornay Windturbines
- Lagerwey the Windmaster
- Marlec Engineering Co Ltd
- MG PLAST Windenergy Technology
- Proven World Friendly Energy
- Prowin professional windmills
- Seateach
- Shield Ltd
- Windmission
- Windside Production Ltd
- Urban Turbines

Ecofys, Delft University of Technology, and Energy Research Centre of the Netherlands (ECN) have formed a group working on these research issues and new concepts, resulting in a series of Urban Turbines®, innovative wind turbines for built up areas. They are working on wind turbines for placement on buildings, near buildings and integrated in street furniture. Two turbines are currently under development specifically designed for urban locations:

Hera®

The Neoga® is a Vertical Axis Urban Turbine, designed as a landmark for sustainable energy. It consists of a Darrieus type of turbine combined with Savonius blades for start-up. The VAT design is not sensitive to changes in wind direction or speed, which is perfect for application in difficult wind situations, commonly found in urban situations. According to the manufacturer, the advantages of the Neoga are:

- The Neoga® withstands the turbulent winds.
- The vertical axis makes the Neoga® independent to the often changing wind direction.
- The Neoga® does have a high annual energy production, at relatively low wind speeds
- The Neoga® has an attractive and distinctive design
- The vertical set-up makes it easy for installation and service
- Assembly on site, no need for crane

Hera®

The Hera® is a 'hidden' Urban Turbine, which combines a wind turbine with the possibility to display commercial messages (i.e. company logo). The Hera® does use a diffuser for enhanced wind speed resulting in higher energy production at low wind speeds, at the same time reducing negative acoustical and optical effects. According to the manufacturer, the main advantages of the Hera® are:

- Reduced visual noise
- High energy output

- Offers space for company logo or commercial messages

An excellent paper by Mike Blanch of RAL can be found in Appendix 4, which details the status of urban wind turbines.

CREST, Loughborough University: 2Kw Proven wind turbine

An Example of a small demonstration purpose wind turbine can be found at the Centre for Renewable Energy Systems Technology (CREST) at Loughborough University. The Proven WT2200 wind turbine is sited next to the AMREL building on a 13m un-guyed tower. The Proven has a three-bladed 3.5m-diameter downwind rotor with passive pitch power regulation, which has a direct-drive permanent magnet generator. The rated power is 2.2kW at a wind speed of 10m/s. The turbine is located approximately 5m from the nearest building. Further details can be found at:

http://www.lboro.ac.uk/departments/el/research/crest/Resources/windturbine.htm

Summary and Economic Viability of Wind Turbine Options

Financing projects

Developers usually seek to establish wind farms or other renewable energy projects as separate businesses in the form of a company limited by shares, which owns a bundle of rights comprising, in the case of a wind farm:

- Wind turbine(s)
- Lease of property on which wind turbines can stand;
- Power Purchase Agreement (PPA);
- Planning Permission;
- Turnkey Construction Agreement; and
- Ongoing Operation and Maintenance Agreement or Service and Warranty Agreements.

For a developer seeking to finance the construction of a wind farm, it will be looking to generate a mixture of equity capital and debt. Larger companies will provide the equity share capital from their own resources and look to banks for debt.

On a small renewable energy project, it may be possible for the project to raise all the capital required (both equity and debt) from the community. On a larger multimillion-pound project the community might be expected only to raise a percentage of the share capital that the developer requires as equity share capital for the project.

For smaller projects of single machines or clusters of small machines debt finance can be raised from banks. Both Triodos Bank (www.triodos.co.uk) and the Co-operative Bank are particularly interested in renewables and have experience in financing small projects. Equity for small projects, particularly community based can be raised through the Renewable Energy Investment Club (www.reic.co.uk). Baywind (www.baywind.co.uk) are also involved in raising finance for wind projects through its shareholders.

Financial Forecasting

The economics of small to medium wind turbines are not as favourable as for their larger counterparts (indeed, the fall in the cost of wind generated electricity is at least in part due to

the larger turbine sizes available today and the greater hub heights that can be utilised). This is primarily due to the near fixed nature of many of the infrastructure costs involved and the reduced specific cost of turbines in relation to their power rating as rated power increases. In relation to the former point, which encompasses items such as civil engineering costs and grid connection fees amongst others, this section will show not only how these expenses are disproportionate for smaller turbines and smaller projects, but will also explore ways in which these costs may be reduced by nature of the development.

With regard to the latter point, financial analysis is conducted for two cases; the first being for new machines and the second being for second-hand, refurbished machines. The following assumptions have been applied throughout:

Capital costs	Annual costs
Land costs – 5% of costs	Admin =5% turnover + £500 FSA/accountant
Planning costs - £500	Business rates=£5810/MW
EIA and design - £5000 (75Kw) to £7500 for 600/Kw	Turbine maintenance and consumables =1p/kWh
Spares budget - £5 - 25,000 dependent on size	**Insurance - £10/kW installed**
Grid connect based on figures presented in section 6	Landowner rent=3% of annual revenue
Construction costs – £35-75,000 dependent on size	

The interest rate was set at 7%.

Rate of inflation was set at 2%.

Plant output (kWh)=

8760(hrs/yr) x capacity factor x Rated output of turbine (kW) x availability

where the availability has been set as:

95% for second hand machine and;
98% for a new machine.

The capital cost of both the larger new and second hand machines has been based on the prices provided by the manufacturers and suppliers previously contacted in respect of other work.

Small building integrated wind turbines

The 1.5Kw Swift wind turbine, Renewable Devices, Scotland costs £10,000 pre-prototype. £7000 to councils and £1500 post 2005. Clear Skies approved. This turbine is currently undergoing certification by ENTEC.

Contact: Dr. Charlie Silverton, Edinburgh – 0131 535 3301 or see
http://www.renewabledevices.com/swift.htm

Renewable Devices has developed the SWIFT rooftop wind energy system, a silent building mountable wind turbine. The turbine has been designed as renewable heating system to augment an existing hot water system. The rated power of the wind turbine is 1.5Kw and the annual predicted power supplied is 4200kWh/year. The turbine has a 20-year product life with low maintenance and the design enables use in turbulent wind airflows. The silent mast mounting technology claims to eliminate unwanted vibration to buildings. The rooftop Wind Energy System incorporates safety features, which, it is claimed, exceed all the British, European and North American safety standards for wind energy systems of this class. The turbine safety systems complies with International Standard IEC 1400-2, for the safety of wind turbines, and, if required it can generate electricity in line with Electricity Association Requirement G59 for power quality. The electronic controller has been designed and tested for EMI suppression and is LVD directive and EMC directive compliant.

The manufacturers state that their rooftop Wind Energy System has been designed to be environmentally sustainable. The product produces more energy in its lifetime than is incorporated in the materials and processes used to manufacture. On average, a single rooftop system installed in the UK will save 2.81 Tonnes CO2 per annum (calculated using CEDRL RETScreen® International)

Water heating is currently responsible for 23.7% of domestic energy consumption in the UK, and for 4.1% of UK CO2 emissions. The rooftop Wind Energy System contributes to emissions reduction in line with recent government energy policy stating that UK carbon dioxide emissions be reduced by 60% by 2050. The Swift is especially suitable for sustainable housing developments where it can be integrated into a hybrid RE design.

Winddam building integrated wind turbine -£3000/Kw installed
Contact: Judy Travithick and Derek Miles

Wind Dam based in Newton Abbott has been awarded a Smart award to develop a prototype building integrated wind turbine. The work has been sponsored by Dartmoor National Park and BT. The wind turbine uses the inherent strength of the building to intercept and collect wind energy. The building has a number of pressure points on its surface that are linked to an internally mounted turbine so that there are no visible conventional turbine and no rotation. The system can be incorporated into a large number of building types and has considerable retrofit potential (Miles, 2001). A 1kW prototype machine has been installed on Plymouth College of Further education in Cornwall. They are in the process of designing a second generation prototype and BT are looking to install it on one of their telephone exchanges in Cornwall. http://news.bbc.co.uk/1/hi/england/cornwall/3361369.stm

The turbines comprise a caged vertical axis wind turbine designed to be very quiet with no vibration problems. They are looking to manufacture turbines with a rated power of 5-50Kw with anticipated costs of approximately £3000/kW installed. They anticipate having a production model available in 9-12 month and have a value engineer starting work in 1 month. They are currently seeking manufacturing partners.

A full synopsis on Urban wind power: Integrated wind energy providing details of the wind dam system can be found in Appendix 4.

Wind Save small tower mounted wind turbines www.windsave.com
Wind Save has developed a wind-powered generator that uses low to medium wind speeds to create electricity. The Wind Save system is designed to mount on to almost any roof or wall. The generator feeds electricity directly into the property on the consumer side of the meter.

Costs: £980 for an 850w wind turbine (1.8m rotor diameter)
£780 for 1 333w turbine (1.4m rotor diameter)

Cost includes installation. Looking towards being clear-skies accredited and should be commercially available in short -term.

Proven 15kW wind turbine (grid connected)
Proven is a small (10 strong) engineering company based in Ayrshire, Scotland specialising in Renewable Energy technologies (wind, hydro and solar) for small scale applications. Within this remit Proven manufacture and sell a range of small turbines (2.2, 6 and 15kW) of their own design. These turbines are designed for stand-alone, off-grid use, but are also sold with inverters for grid-connected applications. The Proven turbine range is known to be particularly rugged and is the small turbine of choice for harsh wind conditions. Proven are currently in the process of installing a roof-mounted 2.2kW wind turbine on a building at the Thames Valley University. Details of the Proven turbine range, along with prices and contact details can be found in Appendix 4.

Large grid connected wind turbine

As part of this feasibility study we have looked at the economic viability and outline financial costings for two wind turbines; a second-hand 225Kw Vestas wind turbine and a new 1MW machine. There are an increasing number of second hand wind turbine suppliers, offering wind

turbines from 30Kw up to 750Kw. Most originate from Denmark and have been replaced in order to re-power sites with larger, more modern machines.

Economic viability of a second hand 225kW wind turbine

Financial forecasts have been made for a second hand 225Kw machine based on a total capital cost of £116,650, a PPA price of 5.5p/kWh and a grid connection cost of £20,000 and a capacity factor of 20%. The total cost of construction is detailed below:

Capital Costs of Construction		**Units**	**Comments**
Land Cost	7500	£	5% of costs
Planning Cost	500	£	
Plant and Equipment Cost	31500	£	45000 euro greentech
Building Cost	30000	£	
spares	15000	£	Figures from SKM as spares budget for major component failure
Legal Cost	4000	£	
Insurance Cost	750	£	
Environmental Statement and design	7500	£	
Connection Costs	20000	£	
Other Project Start-up Costs		£	
Total Capital Cost of Construction	**116750**	**£**	**Total cost of construction including all land and civils, plant and equipment costs.**

The economic viability of the project is detailed below:

vestas 225kW machine			
Undiscounted			
Payback Period	**11.87**	Yrs	The number of years it takes an investment to generate sufficient cash to recover the original capital outlay in full. Usually determined on an undiscounted basis.
Discounted Investment Analysis			
Net Present Value (NPV)	**-1044**	£	This calculates the Present Value of future cash flows, (discounted at the rate of interest), and deducts the Present Value of capital expenditure. A positive NPV suggests that it would be worthwhile for a company to invest in the project, for it will earn a return in excess of it's financing costs.
Economic Internal Rate of Return	**6.9%**		The discount rate which brings the NPV to 0. If the calculated internal rate of return is greater than the discount rate (interest rate), then the project is worthwhile. The greater the difference between the two, the more profitable the project.
Financial Internal Rate of Return	**6.9%**		The Financial Internal Rate of Return is similar to the above, but it is calculated after the consideration of financial costs, (ie the cost of interest). This therefore gives the return to the investor when applying for external funding.
NPV Ratio	**-0.009**		Ratio of the NPV to the initial capital outlay. Should be used to compare different project proposals.
Benefit-Cost Ratio	**1.0**		Compares the present value of benefits to the present value of costs. If the benefit to cost ratio is greater than, or equal to 1, then the benefits outweigh the costs.

This size of wind turbine is just financially tenable by in an urban wind speed site with reduced infrastructure costs and a good power purchase price. Even so, machines rated at less than 100kW struggle in single turbine projects.

Second-hand machines are able to provide much greater return due to their lower capital costs and machines greater than 300kW are financially viable in the base case presented within this section. Gaining grant funding, a better PPA price or improving energy production by placing the turbine on a greater wind speed site all make machines greater than 100kW financially viable. Reducing infrastructure costs by using an urban site makes 225kW viable and increasing the project size to 2 or 3 turbines makes even a low wind speed site just about viable.

Economic viability of a new 1MW wind turbine

Financial forecasts have been made for a new 1MW machine based on a total capital cost of £700,000, a PPA price of 5.5p/kWh and a grid connection cost of £50,000 and a capacity factor of 20%. The total annual costs are estimated to be £40,000.

Generic 1MW machine			
Undiscounted			
Payback Period	**13.04**	Yrs	The number of years it takes an investment to generate sufficient cash to recover the original capital outlay in full. Usually determined on an undiscounted basis.
Discounted Investment Analysis			
Net Present Value (NPV)	**-52596**	£	This calculates the Present Value of future cash flows, (discounted at the rate of interest), and deducts the Present Value of capital expenditure. A positive NPV suggests that it would be worthwhile for a company to invest in the project, for it will earn a return in excess of it's financing costs.
Economic Internal Rate of Return	**6.2%**		The discount rate which brings the NPV to 0. If the calculated internal rate of return is greater than the discount rate (interest rate), then the project is worthwhile. The greater the difference between the two, the more profitable the project.
Financial Internal Rate of Return	**6.2%**		The Financial Internal Rate of Return is similar to the above, but it is calculated after the consideration of financial costs, (ie the cost of interest). This therefore gives the return to the investor when applying for external funding.
NPV Ratio	**-0.075**		Ratio of the NPV to the initial capital outlay. Should be used to compare different project proposals.
Benefit-Cost Ratio	**1.1**		Compares the present value of benefits to the present value of costs. If the benefit to cost ratio is greater than, or equal to 1, then the benefits outweigh the costs.

The economic viability of the project is detailed below:

This scale of machine is marginally viable and would require a good PPA price and low infrastructure costs to be viable. The economics could be improved if grant funding could be gained.

14. Locational Wind Turbine Design Constraints and Solutions

One of the key outputs of the feasibility study was to identify potential constraints to wind deployment in the Eastside area, and any technical solutions to overcome such constraints. In pursuance of this, consultations have been carried out with a large number of statutory consultees. In addition a review of relevant planning policies and guidance has also taken place.

The results of these consultations have identified the following key design constraints:

- **Planning:** correspondence from Doug Lee, local planning officer for Birmingham City Council, exhibits that the council does not believe larger scale turbines up to 90 metres to tip would be possible in the city centre and that only suitably designed small turbines on building rooftops would be appropriate. However, proposals in the Eastside area should be taken forward on a case by case basis. Where a developer believes a wind turbine would not compromise planning guidance nor the constraints given below, consultations with the planning department should take place at an early juncture to discuss the potential of locating a turbine in the Eastside area. Special attention should be given to the protection of the Digbeth conservation area and its setting.

- **Turbine height:** A maximum turbine height above Ordnance Datum of 242m has been specified by Birmingham Airport and Birmingham City Council's Tall Buildings Policy. Development beneath the outer horizontal surface must not exceed 150m in height above the lowest threshold at the airport, which is 92m AOD. The height limit for turbines in Eastside is 92m.

- **Grid connection and maximum turbine capacity:** The network Aquila Networks recommend that the total wind turbine capacity is kept below 1 MW. The nearest primary substation to the proposed site is Bordesley.

- **EMI exclusion zone:** Turbines should not be placed within 150m of the following three links:
  - SP0700 8743 – SP0820 8590
  - SP0700 8743 - SP1095 8307
  - SP0646 8673 - SP1155 8408

- In addition NATS have objected to the deployment of large wind turbines in Birmingham Eastside and Birmingham airport has objected on the grounds EMI and the affects of any wind turbine on the line of sight of Birmingham International's Airport **primary radar**, which would consequently produce false returns, thereby endangering aircraft, which would require extended aircraft vectoring for inbound aircraft.

- BBC has stated that **television reception** may be affected for Sutton Coldfield transmitter viewers in the surrounding area. Further studies would need to be undertaken to ascertain the extent of the potential interference to domestic television reception.

- **Biodiversity:** Up to 20 rare or at risk species have been identified in the Birmingham Eastside area including the black redstart. Results of the biodiversity study currently being undertaken of behalf of Sustainable Eastside would need to be taken into account if wind turbines were to be deployed in the area.

- **Noise:** Noise should be assessed in relation to the ETSU R-97 document previously referred to in Section 7, with particular regard to existing background noise levels in the area of interest.

- **Safety distance:** A safeguarding distance from any footpath, road or public right of way to the turbine is equivalent to the height to tip plus an additional 10 metres is usually incorporated into wind farm layout. As a minimum this distance needs to be equal to the oversail distance (1 blade length).

In addition the following advice should be taken into account when selecting a turbine and designing the site:

- **Shadow flicker:** These effects have been shown to only occur at distances of up to, and no more than, 10 rotor diameters, and in Britain, for properties that lie in the directions from east through north to west of the turbines. In addition, it should be noted that potential disturbance from shadow flicker occurs at frequencies between 2.5Hz and 40Hz (or cycles per second). The blades of larger turbines of around 1MW have a rotational speed of between 13 and 19rpm, giving frequencies of less than 1Hz, well below the frequencies of concern. The blades of smaller machines have higher rotational speeds and these may fall into the frequency of concern indicated previously. Care needs to be taken in selecting turbine to avoid shadow flicker effects.

- **Reflected light:** Any wind turbines selected for deployment in the Birmingham Eastside area should be painted a semi-matt light grey colour in order to minimise reflected light

15. Recommendations and Conclusions

Generally the response to the consultation on the feasibility of wind energy in Birmingham Eastside has been very positive, particularly with respect to the statutory consultees. The results of the feasibility study indicate that wind energy deployment could be viable if the NATS objection can be resolved, as long as the key design constraints identified in Section 14 of this report are adhered to. The results of the ongoing biodiversity audit would need to be taken into account in any wind energy project designs.

Consultation responses have indicated that the maximum size for wind energy deployment be a maximum of 1MW (unless further grid studies are undertaken) and that the maximum height of the turbine above Ordnance Datum be 242m AOD. This equates to a maximum height of 92m for any wind turbine located within Eastside.

Examples of wind turbines in urban environments exist, including a 225kW wind turbine on the banks of the Thames at Southbank in London (Shell electric storm) and research is ongoing into integrating wind turbines into buildings, with some products currently available for sale

There are a number of possible scenarios for integrating wind energy into Birmingham Eastside:

- Single medium sized wind turbine up to 600Kw rated capacity and 60m to blade tip[4]
- Individual, stand-alone grid-connected wind turbines up to 15kW rated capacity
- Building integrated wind turbines up to 50Kw rated capacity
- Individual small-scale wind turbines for water heating and electricity generation purposes up to 2kW rated capacity

In order for any of these options to be pursued, steps would need to be taken to integrate wind energy into the Eastside development plans. It is thought that with respect to the larger turbines the land take and subsequent revenue loss from prime city centre real estate. Building integrated wind turbines would ideally need to be incorporated into the initial building design stages by the architects, although roof-mounted turbines should be available as an add-on to an existing building.

Scenarios for Birmingham Eastside

In order for any of the options detailed above to be pursued, steps would need to be taken to integrate wind energy into the Eastside development plans. It is thought that with respect to the larger turbines the land take and subsequent revenue loss from prime city centre real estate areas for medium scale wind turbines will be hard to come by. Building integrated wind turbines would ideally need to be incorporated into the initial building design stages by the architects, although roof-mounted turbines should be available as an add-on to an existing building. The following sections provide some possible scenarios for where wind energy could be integrated into Birmingham Eastside, subject to addressing the locational design constraints:

[4] Subject to further consultation with NATS and Birmingham International Airport

Medium scale urban wind turbine
This scale of project could be developed as a community-owned venture by the people of Birmingham with electricity purchased by Birmingham City Council. Typical installation costs for this scale of project using a second hand 225Kw wind turbine would be in the region of £120,000 and the payback period would be in the region of 12 years. There is an area adjacent to Moor Street station that would be suitable for this type of development, which could include a visitor attraction. This scale of turbine may also be suitable for millennium point.

Individual, stand-alone grid connected wind turbine
Individual stand-alone grid connected wind turbines could be integrated into developments in Birmingham Eastside to supply electricity to existing or proposed industrial or educational buildings. An individual turbine ranging from 2Kw to 75Kw could be installed within the grounds Matthew Bolton College or Aston Science Park or individual building mounted turbine(s) at Typhoo Wharf proposed residential and social housing development.

Building integrated wind turbine <50kW
Building integrated wind turbines could be including in buildings currently under development in Birmingham Eastside, including City Park Gate, New Matthew Bolton College or Aston Science Park. Companies including Wind Dam and Ecofys are currently designing building integrated wind turbines, up to 50Kw.

Individual domestic-scale roof-mounted wind turbines up to 2Kw
Individual roof-mounted wind turbines could be retro-fitted to existing buildings in the Birmingham Eastside area, including the McLaren building, Typhoo Wharf, the Custard factory media and arts Centre or Curzon Gateway.

Appendices

Appendix 1: List of Consultees

Appendix 2: Consultation Responses

Appendix 3: Executive Summary of ETSU R-97 noise guidance

Appendix 4: Wind Turbine manufacturer's promotional literature, case studies and papers

Appendix 5: Sources of Capital Grant Assistance

UK WIDE GRANT SCHEMES

1. ALTENER II,
   Mike Brooke, DTI, Victoria Street, London SW1T 0ET (020 7281 2647)
   mike.brook@dti.gov.uk
   Grants up to £500,000. Likely benefactors, those developing or promoting renewable energy. A European partner is required.

2. Biffaward,
   The Kiln, Waterside, Mather Road, Newark, Nottinghamshire, NC24 1WT.
   Enrolled environmental bodies, has environmental policy, can complete the project, has a third party willing to contribute. The project must: have ENTRUST approval, be on the built environment, natural environment, R&D, Education, OR waste minimalisation. Does not fund: Core costs, land purchase, events, feasibility studies, clubs, cycle paths. Up to £150,000

3. CEMR (European Sustainable Cities Awards)
   Ms Anne Van Oost, 22 Rue dArlon, B-1050 Brussels (Tel : 0032 2 511 09 49) e-mail: avanoost@ccre.org To raise awareness in the local community of sustainable development action and the implementation of LA21 , encourage participation and modify behaviors.

4. EcoPower,
   Nadine Dooley, Eastern Energy, 5th Floor Suffolk House, Civic Drive, Ipswich, Suffolk (01473 554530 / 553566) nadine.dooley@eastern.co.uk Applications invited for small projects of educational benefit to the wider community.

5. Entrust
   5th Floor, Acre House, 2 Town Square, Sale, Cheshire M33 7WZ,
   http://www.entrust.org.uk Landfill Tax is levied on waste received at licensed landfill sites in the UK. Landfill site operators can claim tax credits in respect of contributions made to enrolled environmental bodies for approved purposes. They can claim 90% of contributions made, up to a maximum of 20% of their tax liability. Third party funding is sometimes available to assist in making contributions. Environmental bodies must be non-profit making organisations and must register with Entrust in order to be able to receive contributions. Further details are available from Entrust at the above address.

6. Esmee Fairbairn Charitable Trust
   7 Cowley Street, London SW1P 3NB. Grants towards the promotion of sustainable development. Main priorities include the preservation of the countryside and wildlife, and reconciling the needs of the environment and the economy. Grants range from £1,000 - £500,000. Please obtain Guidelines (send an A4 SAE) before submitting an application.

7. EU LIFE Fund : Ms V Sherwood, Zone 5/G9, Ashdown House, 123 Victoria Street, London SW1E 6DE, or DGX1.B.2., European Commission , 200 rue de la Loi, B - 1049, Brussels. http://europa.eu.int/comm/life/home.htm Grants from the European Commission's Environmental Action Programme provide 30-50% of costs for innovative environmental projects by industry and local authorities over 3-5 years, with a total cost of £300,000-£3 million.

8. European Social Fund
   DG-V, Unit B/1, Article 6 ESF Projects, Rue de la Loi 200, B 1049 Brussels OR European Social Fund Unit, Department for Education and Employment, 1 Caxton House, Tothill Street, London, SW1H 9NA.
   http://europa.eu.int/comm/employment_social/esf2000/index-en.htm Contributes to the running costs of vocational training, guidance and counselling, job creation measures and projects to stimulate employment in particular regions. These must have an element of public sector support. Supports innovative projects developing local employment and forms of work organisation, and to community developmentt.

9. Groundwork Millennium Awards,
   The Cattle Market, Nottingham Road, Mansfield, Notts NG18 1BJ (01623 626555) Awards for local volunteers and community groups who are working to improve their local environment. Applications are assessed twice a year. Email gma@groundwork.org.uk

10. Groundwork
    National Office 85-87 Cornwall Street, Birmingham B3 3BY. Works in partnership with community groups, local authorities and the private sector to bring about physical, social and economic improvements in deprived areas through school programmes, youth activities, training for the long - term unemployed, derelict land reclamation and helping business improve its environmental performance. Applications

11. The International Council for Local Environmental Initiatives,
    Mrs Karen Bachanan, EschholzstraBe 86, D- 79115, Freiburg (Tel : 0049 761 368 920). E-mail : iclei_Europe@compuserve.com

12. National Grid Community 21 Awards.
    National Grid sponsors projects run by local authorities in partnership with local community groups including businesses, schools and voluntary groups. Applications must be made by the local authority. 01727 850761

13. NERC Small Research Grants, Polaris House, North Star Avenue, Swindon, Wiltshire SN2 1EU (01793 411500) A competition for curiosity-motivated basic strategic or applied research between £2000 – £35,000 www.nerc.ac.uk/awards/rgscheme.htm

14. New Opportunities Fund
    Heron House, 322 High Holborn, London WC1V 7PW. Tel 0845 0000 120 Fax 020 7211 1750 Web site www.nof.org.uk Green Spaces and Sustainable Communities Initiative has four main strands (i) recreational green space and playing fields projects, which make better use of green space; (ii) space for children's play projects, which create or improve outside space for children's play; making green spaces more accessible for communities projects which help communities access, use and enjoy green space and the countryside, including projects which tackle social exclusion; and (iv) small sustainable community based projects that contribute to sustainable development in social, economic and environmental terms. The scheme covers England, Scotland, Wales and Northern Ireland. Other NOF initiatives which may be able to support sustainable development projects are Community Access to Life Long Learning and Healthy Living Centres.

15. Clearskies
    Provides capital grant and feasibility study assistance for individual householders and community groups. http://www.clear-skies.org/index.aspx

16. Scottish Power Green Energy Trust contact Gordon McGregor, Tel: 0145683041. E-mail gordon.mcgregor@scottishpower.plc.uk . The Trust invites applications for grants of up to £12,500. 50% of the total project costs must be funded from other sources. Applications are assessed by an independent committee which meets at least three times a year.

17. Shell Better Britain Campaign (SBBC) runs a small grants scheme for projects that benefit the environment and community. Projects must be run by local community, Make a positive difference to the local environment, Consider wider environmental issues and Help bring the community closer together. SBBC have launched a new bursary - called Interactive Connect - to help foster connections between groups involved in community based sustainable development. The new fund will pay for fares and reasonable costs to help groups link up through site visits, project exchanges and conferences. Grants of up to £150 are available - check the case studies produced by SBBC to see if there are projects similar to your Celebrating our Communities project that it would be helpful for you to visit. Shell Better Britain Campaign Small Grants Scheme: King Edward House, 135a New Street Birmingham B2 4QJ. Tel: 0121 2485900. E-mail: enquiries@sbbc.co.uk Website: www.sbbc.co.uk

18. Structural Funds,
    English regional Government Offices www.local- regions.detr.gov.uk/go/goindex.htm

19. Transco Grassroots
has been designed to support registered charities, community groups and schools working to "protect, preserve and improve their own environments for the long
term benefits of their community". This year they are offering a total of £200,000 to be awarded to projects – a big increase on last year. The majority of awards will range from a few hundred pounds to £5,000. There will be ten awards of between £5,000 and £10,000 and a handful between £10,000 and £15,000. Contact: Transco

20. WWF
wwf-uk, Panda house, Weyside Park, Godalming, GU7 1XR. Grants from £1,000 to £50,000 to projects that contribute to WWF UK's programme comprising specific target areas Living Seas, Forests, Wetlands, Species and Habitats of Special Concern, Future Landscapes, Climate Change, Toxics, Sustainable Resource Use.

ENGLAND ONLY

21. The Energy Saving Trust
21 Dartmouth Street, London SW1H 9BP "Schoolenergy" scheme provides rebates up to 50%, up to £3,500, for energy efficiency measures. Contact CREATE: 01942 322 271 for details

22. Environmental Action Fund
Victoria Akeredolu, Zone 6/G9, Ashdown House, 123 Victoria Street, London SW1E 6DE. Telephone 020 7944 6654, fax 020 7944 6559, e-mail victoria.akeredolu@defra.gsi.gov.uk The EAF helps voluntary groups in England to carry forward the Government's environmental policies. Grants of between £10,000 and £75,000 can be made. Applications are solicited annually in the summer.

23. The Single Regeneration Budget (SRB)
Carole Dawson, 4/G5, Eland House, Bressenden Place, London SW1E 5DU or see web site www.regeneration.detr.gov.uk/srb/ The SRB provides resources, through annual bidding rounds, to support regeneration initiatives, including environmental projects, in England carried out by local regeneration partnerships. There are over 750 schemes under Rounds 1-5 which range from £250k to over £20million SRB grant – within these schemes there will be a large number of holistic projects. Partnerships for these schemes will provide information on local environmental projects. Names and addresses of SRB partnerships are available from the local Regional Development Agency or Government Office for London.

SOURCES OF ADVICE ON FUNDING AND ORGANISATION OF PROJECTS

24. Consult your local Council For Voluntary Services.
They can advise on the development and management of voluntary organisations (getting charitable registration etc) and of other relevant groups in your area. They can advise on how to phrase and target fund raising applications and also offer information and training sessions on fund-raising from trusts, central government and Europe. The National Association of Councils for Voluntary Service (0114 278 6636) or http://www.nacvs.org.uk can help you find your local branch.

25. THE COUNCIL FOR ENVIRONMENTAL EDUCATION
offers guidance on funding for education projects on their website at http://www.cee.org.uk/resources/grants.html

26. Directory of Environmental Consultants,
available from Environmental Data Services, Finsbury Business Centre, 40 Bowling Green Lane, London, EC1R 0NE. Lists some 300 environmental consultants.

27. Directory of Grant Making Trusts,
available from Charities Aid Foundation, 48 Pembury Road, Tonbridge, Kent, TN9 2JD on paper and CD-ROM. Other sector specific guides are also available.

28. Directory of Social Change, 24 Stephenson Way, London, NW1 2DP publishes a range of useful publications including 'A Guide to Funding from Government Departments and Agencies' (£18.95),'The

Complete Fund-raising Handbook' (£14.95), 'The Complete Guide to Business & Strategic Planning' (10.95), 'Environmental Funding Guide' (1998 edition £16.95), 'Essential Volunteer Management' (£14.95), and 'Tried and Tested Ideas for Raising Money Locally' (£9.95).

29. Energy Efficiency Hotline
    0345 277 200 run by the Energy Saving Trust, 21 Dartmouth Street, London SW1H 9BP. Environment and Energy Helpline Tel. 0800 585 794. Not specifically aimed at the voluntary sector but includes information on the Government's Energy Efficiency Best Practice Programme covering wide range of sectors.

30. Environmental Trainers Network
    c/o BTCV, Enterprises, Red House, Hill Lane, Great Barr, Birmingham, B43 6LZ. Organises courses on many aspects of managing and funding environmental projects.

31. FunderFinder
    65 Raglan Road, Leeds LS2 9DZ is a regularly updated software package for grant seekers which is available on subscription or to consult at your local council for voluntary services, where there will be a member of staff trained in its use. The National Association of Councils for Voluntary Service (0114 278 6636) or http://www.nacvs.org.uk can help you find your local branch.

32. FundRaising UK Limited
    host a helpful website linking to many ;potential sources of grant and information about them. It can be found at http://www.fundraising.co.uk/grants.html

33. Guide To Funding sources For Renewable Energy Projects In Schools & Colleges
    (ETSU Ref K/BD/00224/REP) ETSU, AEA Technology Environment, Harwell Didcot, Oxfordshire OX11 0RA (01235 432571)

34. Guide to Good Practice in Managing Environmental Projects
    is a 30 page guide to devising, funding and managing environmental projects. It uses case studies funded by the Department of the Environment's Environmental Action Fund and Local Projects Fund which have supported environmental projects in England with over £4 million in 1996/97. Copies of the guide are available free of charge from Unless otherwise stated these free environmental publications are available from DEFRA Publications, Admail 6000, London, SW1A 2XX. Tel: 08459 556000 Fax: 020 8957 5012 Email: defra@iforcegroup.com, quoting reference 96EP134.

35. Managing Without Profit by Mike Hudson
    Penguin 1995 gives advice on managing medium to large third sector organisations.

36. NCVO,
    Regents Wharf, 8 All Saints Street, London, N1 9RL publish advice including Grants from Europe: How to get money and influence policy and Finding Funds, general information for voluntary groups.

37. Scottish Council for Voluntary Organisations
    18 Claremont Crescent, Edinburgh, EH7 4QD issue various publications including Directory of Scottish Grant Making Trusts and Directory of Environmental Consultants in Scotland.

38. Shell Better Britain Campaign
    Victoria Works, 21a Graham Street, Birmingham B1 3JR. Annual magazine Innovations provides advice on setting up and funding projects. Website http://www.sbbc.co.uk

39. Sustainable Development Net
    have information on sources of grant in the UK at http://www.sustainabledevelopment.net/page316243.htm Who's Who in the Environment available from the Environment Council, 212 High Holborn, London WC1V 7VW is a database of groups who can provide advice in specialised areas such as rural action, sustainable building and environmental education.

GENERAL GUIDANCE ON MAKING APPLICATIONS

- Ensure you obtain and read the full application details for the organisation to which you are applying and, if there is one, apply on their application form filled out according to the instructions. Contact them if there is anything you are not clear about.

- Check your work is within the current terms of the funding regime. Don't assume that your eligibility rolls forward from year to year. Some funding bodies prefer to support new and others existing organisations. Some have geographical limits, or only support certain kinds of project or those benefiting specific communities.

- Remember that some funding organisations will only support capital (e.g. buildings) and others revenue (e.g. salaries) expenditure. Make sure you know what you can apply for.

- Some bodies require matching funding, and government grants usually prohibit this coming from other government sources. This may mean that receiving some grants can render a group ineligible to receive certain others. Matching funding in kind may be prohibited or limited.

- Study any criteria mentioned against which applications will be assessed and ensure that your application clearly shows how you meet each of them.

- Make clear what you want the money for, how you know there is a need for the work and who will benefit.

- Check all your figures. A mistake of one digit in your telephone number might prevent a potential funder ringing you back, while a misplaced decimal point could prevent your budget balancing - which does not impress assessors.

- Check that you have enclosed with your application all supporting documentation that has been requested, but do not include irrelevant material that has not been requested.

- Keep copies of whatever you send, including the completed application form. It may be lost in the post. Have it handy in case the grant awarding body contacts you for further information or clarification.

- Be prepared for an assessment visit. Many funding organisations send assessors to examine schemes in person.

- Check you are ready to use the funding. Some groups make applications before their project is fully developed and ready to start.

- Seek feedback on your failed applications. Find out how you could have made a better or more appropriate case. However, remember that not all grant-makers have the resources to give feedback.

- Make sure that you fully document the way you use the money that you receive and that you keep all receipts. Some funding organisations will impose special audit requirements as a condition of making grant. If you are unable to meet these then you should not accept the grant.

Appendix 6: Draft Brochure