Lancaster University Wind Turbine Project

Environmental Statement – Non Technical Summary

Volume 3

January 2010

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Preface

General Notes

Project Title: Lancaster University Wind Turbine Project

Report Title: Lancaster University Wind Turbine Project Environmental Statement Volume 3: Non- Technical Summary

Date of Issue: January 2010

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Copies of the Environmental Statement including the Non Technical Summary can also be obtained from Segen Ltd. by calling on 01524 590590 or emailing info@segen.co.uk or writing to the address above

The full Environmental Statement can be purchased for £150.00 per copy. Alternatively full sets of the documents are available free of charge as Adobe Acrobat files on CD-ROM.

Contents

ii. Table of Contents

iii Glossary

Abbreviation	Description
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
BAP	Biodiversity Action Plan
BBC	British Broadcasting Corporation
BREEAM	Building Research Establishment Environmental Assessment Method
BWEA	British Wind Energy Association
CAA	Civil Aviation Authority
CAD	Computer Aided Design
CBP	Community Benefits Package
CHP	Combined Heat and Power
CO_2	Carbon Dioxide
dB	Decibels
dB (A)	Decibel (Acoustically Adjusted)
DEFRA	Department of Food and Rural Affairs
EIA	Environmental Impact Assessment
ES	Environmental Statement
GDPO	General Development Procedure Order
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GVM	Groundwater Vulnerability Map
HAP	Habitat Action Plan
HER	Historic Environment Record
HECMP	Higher Education Carbon Management Programme
Hz	Hertz measurement of sound frequency
IEEM	Institute of Ecology and Environmental Management
IEMA	Institute of Environmental Management and Assessment
LCA	Lancashire Character Area
LDF	Local Development Framework
LRO	Lancashire Records Office
LVIA	Landscape and Visual Impact Assessment
m/s	Metres per second – measurement of wind speed
MoD	Ministry of Defence
MWh	Megawatt hours
NATA	New Approach to Appraisal
NATS	National Air Traffic Services
NCA	National Character Area
NCC	Nature Conservancy Council
NVCC	National Vegetation Classification Communities
NOx	Nitrogen Oxides
NPPG	National Planning Policy Guidelines
Ofcom	Office of Communications,
PPS	Planning Policy Statement
RAB	Renewables Advisory Board
RSNC	Royal Society for Nature Conservation
RSPB	Royal Society for the Protection of Birds
RSS	Regional Spatial Strategy
cSAC	Candidate Special Area of Conservation
pSAC	Proposed Special Area of Conservation
SAM	Scheduled Ancient Monument
SINC	Site of Importance for Nature Conservation
SO_2	Sulphur Dioxide
SPA	Special Protection Area
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
VP	Viewpoint
ZTV	Zone of Theoretical Visibility
ZVI	Zone of Visual Impact

Term	Definition
Above Ordnance Datum	Ordnance Survey Classification describing height above mean sea level
Ancient Woodland	Land continuously wooded since AD1600 in England
Anemometry Mast	A mast upon which equipment is mounted to ascertain the wind speed and directions
Blade Diameter	Twice the turbine blade length
Cumulative Effect	This is the result of more than one scheme being constructed and is the combined effect of all the developments, taken together. This may be in terms of their effect on landscape and visual amenity, bird populations, other wildlife, the local economy, tourism etc.
Climate Change	A process of changes to weather patterns and temperatures largely caused by the emission of certain 'greenhouse gases' from earth, principally associated with the burning of fossil fuels.
Carbon Dioxide	The main greenhouse gas formed by the combustion of all fossil fuels.
Compensation	The measures taken to offset or compensate for adverse effects that cannot be mitigated, or for which mitigation cannot entirely eliminate adverse effects.
Environmental Impact Assessment	The process used for describing, analysing and evaluating the range of environmental effects that are caused by a wind energy proposal.
Environmental Statement	The document supporting a planning application that sets out the findings of the Environmental Impact Assessment.
Greenhouse Gases	The six main gases contributing to climate change found in the upper atmosphere. They prevent some energy being re-transmitted into space. The gases include carbon dioxide CO_2, methane CH_4, nitrous oxides NOx, hydroflourocarbons, perfluorocarbons and sulphur oxides SO_2.
Hub Height	The height above ground level of the centre of the hub which the blades are attached
Kilowatt (kW): Kilowatt-hour (kWh)	A watt is an electrical unit of power A kilowatt is a thousand watts. One kilowatt-hour represents one hour of electricity consumption at a constant rate of 1kW.
Landscape	Human perception of the land conditioned by knowledge and identity with a place
Landscape Capacity	The degree to which a particular landscape character type or area is able to accommodate change without unacceptable adverse effects on its character. Capacity is likely to vary according to the type and nature of change being proposed.
Landscape Character	A distinct pattern or combination of elements that occurs consistently in a particular landscape.
Landscape Character Classification	The process of describing, classifying and analysing the character of landscape reflecting the distinct pattern or combination of elements that occurs consistently in a particular landscape
Landscape Sensitivity	The extent to which a landscape can accept change of a particular type and scale without unacceptable adverse effects on its character.
Landscape Value	The relative importance that stakeholders attach to a landscape for a verity of reasons including scenic quality, perceptual aspects such as wildness, remoteness or tranquillity that contribute to a sense of place, rarity, presence and influence of other conservation interests and special cultural associations.
Megawatt (MW): Megawatt-hour (MWh)	A watt is an electrical unit of power. A mega watt is a million watts. One megawatt-hour represents one hour of electricity consumption at a constant rate of 1MW.
Mitigation	Measures, including any process, activity or design to avoid, reduce or remedy adverse effects of a development proposal.
Nacelle	The housing unit at the top of the turbine tower, typically containing the generator and gearbox.
Photomontage	A photograph with the proposed windfarm digitally superimposed over the top of it, providing a computer generated image.
Swept Area	The swept area is the area of the circle delineated by the wind generator's rotating blades.
Tip Height	The maximum height of the wind turbine above ground level.
Wind Energy Development	Development consisting of one or more wind turbines, access tracks, ancillary buildings, substation, anemometer masts and supporting infrastructure.
Zone of Theoretical Visibility	A map showing theoretical visibility of a windfarm or other element to a wider landscape.
Zone of Visual Influence	The area within which a proposed development may have an influence or effect on visual amenity.

1. Introduction

This non-technical summary has been provided to accompany the Environmental Statement (ES), prepared by Segen Ltd. on behalf of Lancaster University to support their planning application for two wind turbines on land off Hazelrigg Lane.

This document provides a non-technical summary of the key issues of the ES, highlighting the findings and conclusions of the Environmental Impact Assessment (EIA).

An EIA has been undertaken to analyse the development in relation to the existing conditions and to ensure that all potential impacts have been identified and assessed. The EIA has examined the need for the development, the design of the development, and the associated impacts of the construction, operation and decommissioning of the turbines. The EIA has also identified appropriate mitigation measures which will need to be undertaken in order to minimise or eliminate these impacts.

1.1 Developer

The project developer is Lancaster University. The University is committed to the UK Government's targets of reducing carbon emissions by 20% by the year 2020 and 80% by 2050.

The University recognises that sustainability and the reduction of carbon emissions is an essential requirement for future growth and development. The University also appreciates the social, economic and environmental benefits that renewable energy installations can bring. Energy efficiency and carbon reduction are key University priorities.

There are currently no universities in the UK which have an installed large scale wind development mainly due to their urban locations. Lancaster University's rural setting places it in a distinct position whereby the utilisation of wind power will make for a high yielding form of sustainable energy supply which will make a significant contribution towards the UK Government's targets for reducing carbon emissions.

1.2 Project Consultants

The EIA and ES has been produced by Segen Ltd. together with a team of specialist consultants and contractors who have the appropriate, knowledge (local where necessary), skills and technical understanding to complete the assessment to a high standard. The specialists employed to produce each section of the ES are shown in the table below. A more comprehensive version of this table can be found in Chapter 1 of the ES Volume 1

Environmental Assessment	**Environmental Consultant**
Landscape and Visual	Principle Assessment carried out by Neil Furber Principal Landscape Architect Stephenson Halliday & Maps and Photomontages provided by; Segen Ltd.
Shadow Flicker	Segen Ltd.
Electromagnetic Interference and Radar	Torsten Zöhl Lead Engineer Germany ATDI Ltd,
Ecology and Ornithology	Cameron S Crook Cameron S Crook & Associates Bio-Ecological Consultancy
Arboriculture Assessment	Roger Cartwright Landscape and Woodlands
Land Use	Segen ltd.

Traffic and Transport	AECOM & John Sumner Thomas Consulting Civil & Structural Engineers
Noise	Ian Bennett Acia Engineering Acoustics
Hydrology and Geology	Paul McQuillan BSc MSc AIEMA Principal Consultant Environment AECOM
Archaeology and Cultural Heritage	Emily Mercer Senior Project Manager Oxford Archaeology NORTH

1.3 Proposal

1.3.1 Site Description

The application site is situated to the east of the M6 adjacent to the University campus on agricultural land accessed from Hazelrigg Lane. The landscape around the site comprises rolling farmland with hills in the distance. To the north of the site is grazing land and a line of electricity pylons and cables. To the west is the M6 motorway and the main university campus beyond, separated from the site by a mature tree belt which extends into an area of mature woodland. To the east is the University field station which comprises grassland and research plots, a small building, and a number of atmosphere controlled greenhouses, permanent meteorological mast and a telecommunications mast. There is also an area of trees to the south east separating the site from the intermittent residential properties located on Hazelrigg Lane. To the south is additional agricultural land and the existing site access off Hazelrigg Lane.

The total ground area covered by the planning application is approximately 23 hectares. However the total land take up for development is much smaller comprising only part of the wider study area and land holding. The total land taken for the turbine foundations, site access track and crane pad hardstandings and blade swept area is approximately 1.5 hectares.

1.3.2 Site Layout

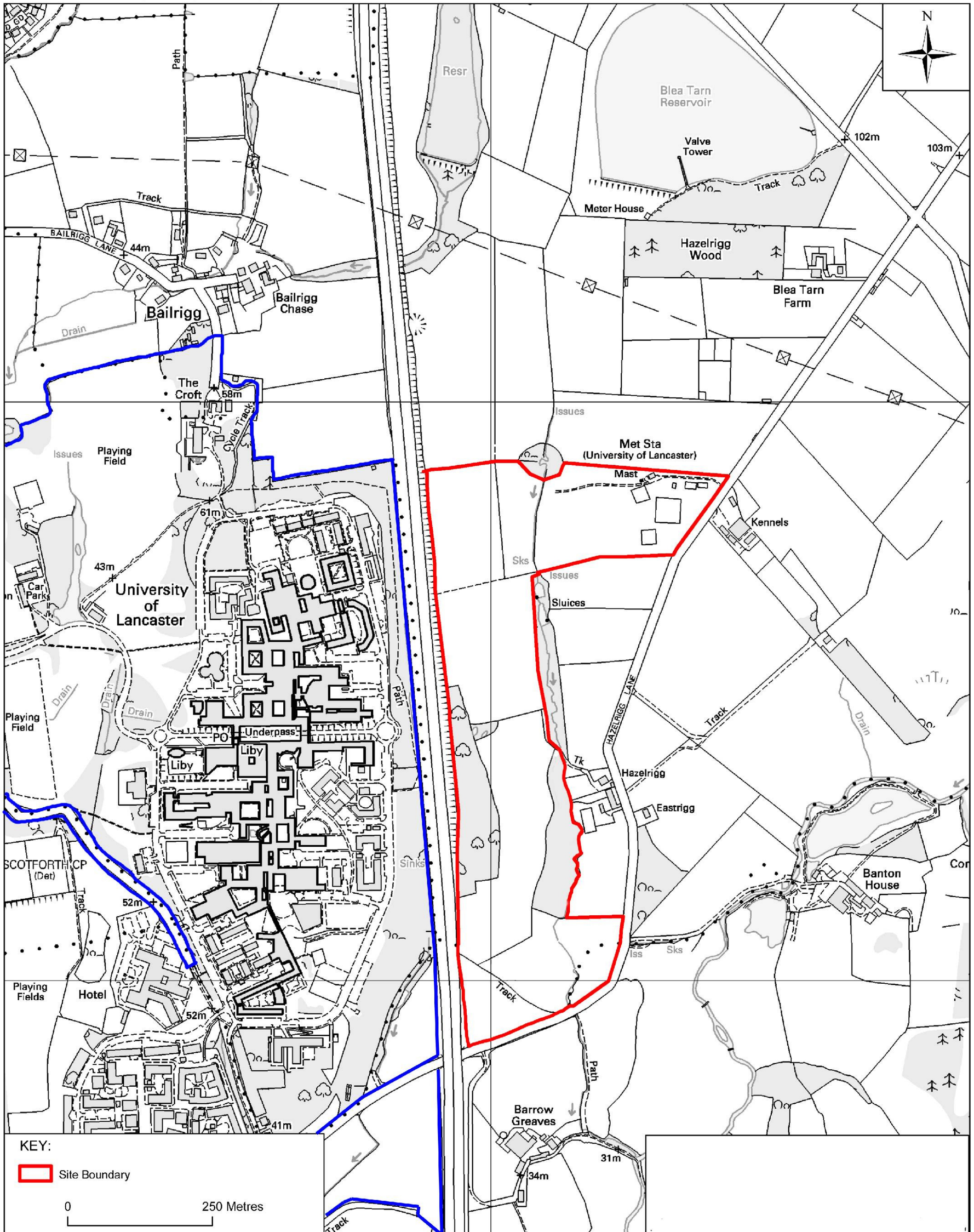
The layout of the wind turbines within the site has been designed taking into account a number of factors. The wind turbines have to be spaced sufficiently apart so as not to interfere with each other aerodynamically and they have been placed to capture the energy of the wind effectively, whilst minimising visual and environmental impacts.

Other considerations and constraints taken into account include set back and topple distances from roads and other public rights of way, potential impact on communications infrastructure, landscape and visual impacts, noise impact on nearby residential properties and the impact on site ecology. A detailed explanation of the steps taken in the design process before finalising the proposed turbine locations and scale is provided in Chapter 2 of the ES Volume 1.

1.3.3 Location Plan and Site Layout Plans (following page)

A. 1 Location Plan

Segen



KEY:

Site Boundary

0 250 Metres

Client: LANCASTER UNIVERSITY	Title: A. 2 Site Plan	Design:	Drawn:
		Chk'd: ESC	App'd: SM
Project: LANCASTER UNIVERSITY WIND FARM		Date: December 2009	Scale at A3: 1:6,000
		Drawing Number:	A3

B. 10

INDICATIVE

INDICATIVE SITE BOUNDARY

TURBINE 1

TURBINE ROTOR SWEPT PATH AT 82mØ

EXISTING WOODED AREA AND PONDS

WOODED AREA, 3263m² TO BE CLEARED IN VICINITY OF TURBINE 2

TURBINE 2

TURBINE ROTOR SWEPT PATH AT 82mØ

SPOIL STORAGE

SITE COMPOUND

SOUTH ACCESS JUNCTION

KEY

	STATUTORY UNDERTAKERS PLANT
OV BT	- BRITISH TELECOM
GEO	-COMMUNICATIONS
GAS	-GAS
COM	PROPOSED CABLES FOR WIND
LUHV	FARM

Client: UNIVERSITY OF LANCASTER		Title: OVERALL SITE LAYOUT	
Project: LANCASTER UNIVERSITY WIND FARM	Design: SR	CAD: RR	
	Chk'd: SR	App'd: SDC	
	Date: 07/01/2010	Scale: 1:5000	

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No. 60102072-1-025-A3 Rev: A

A3

cm

DRG Path: F:\PROJECTS\Dev Planning - Penny Hill Wind Farm\60102072 - Lancaster Wind Farm (Edinburgh) - TEMPORARY FOLDER\Drawings\Layout\A3 Layouts\11-020-026_A 060110.dwg
Layout Tab: 60102072-025 A3 ● User: WAINWRIGHTJ Plot time: 13/01/2010 @ 4:41 PM

1.3.4 Turbine Specification

Lancaster University is seeking to install and operate two wind turbines with an output of 4.1MW. The precise turbines make and models have not been finalised as this is dependent upon the technology available at the time of install and statutory requirements for tendering. However, the EIA and the ES assumes a worst case scenario opting for a candidate turbine with the largest dimensions.

The two turbines will be three bladed, horizontal axis machines with a hub height of approximately 59m, a maximum blade length of approximately 41m and a maximum rotor diameter of approximately 82m. This gives a maximum ground to tip height of 101m. The turbine rotor and nacelle (generating hub of the turbine) will be mounted on a tapered steel tower, of a colour to be agreed with the Lancaster City Council. The turbines will be supported on reinforced concrete foundations. The foundation will be approximately 15m by 15m with an overall depth (underground) of 3m.

1.3.4.1 Rotor

Maximum Diameter	82m
Maximum Swept area	5281 m^2
Rotational speed, rotor	8.5-17.1 rpm
Direction of rotation	Clockwise
Rotor position	Up-wind

1.3.4.2 Blades

Length	41 m
Height	5 m
Type	GRP Sandwich construction
	manufactured in infusion-process

1.3.4.3 Tower

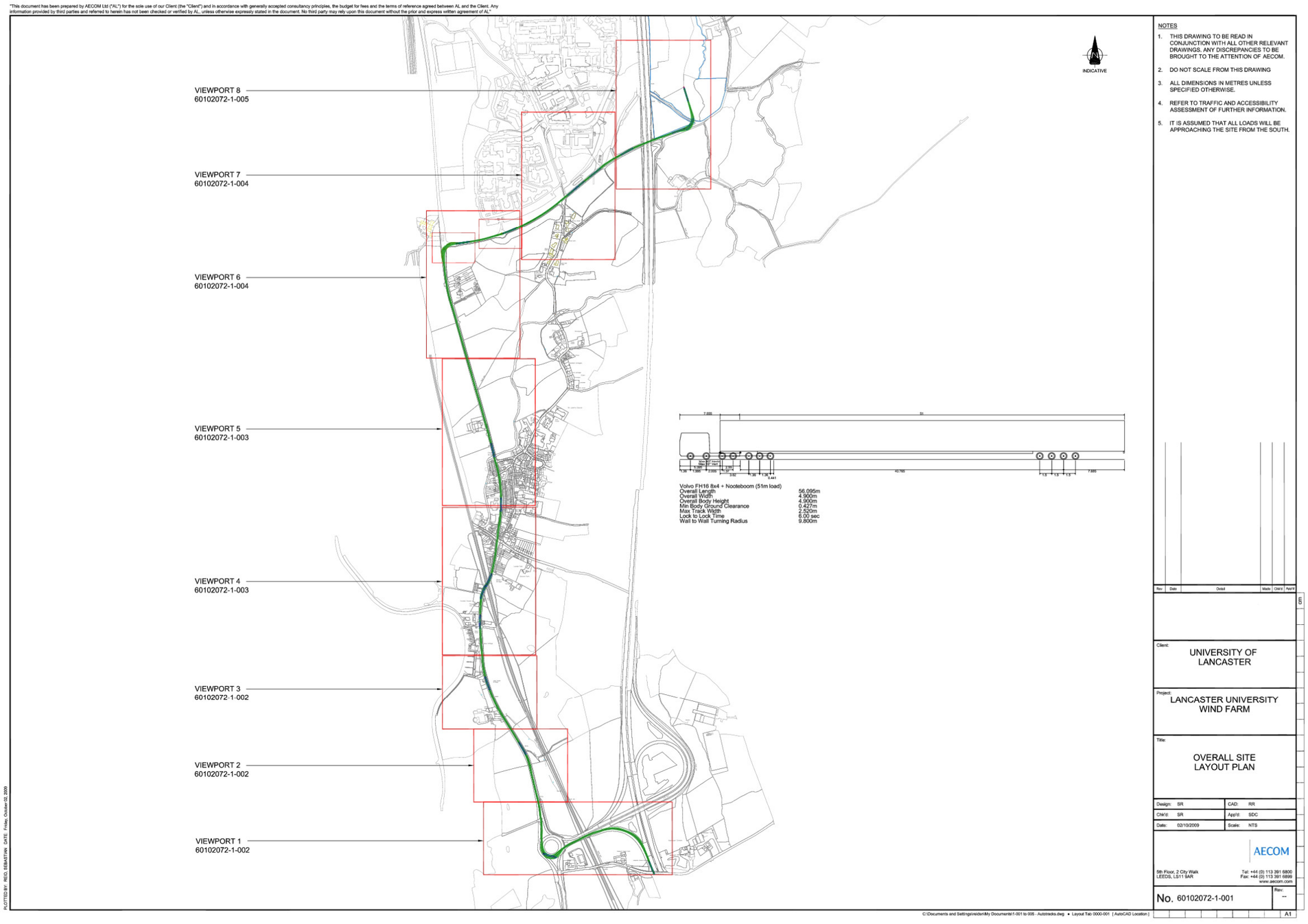
Type	Steel Tube
Hub Height	59m

1.3.5 Access Roads

The turbines will need to be transported from a port which is likely to be located on the east coast to the turbine site. This will involve the use of the major road network and the M6.

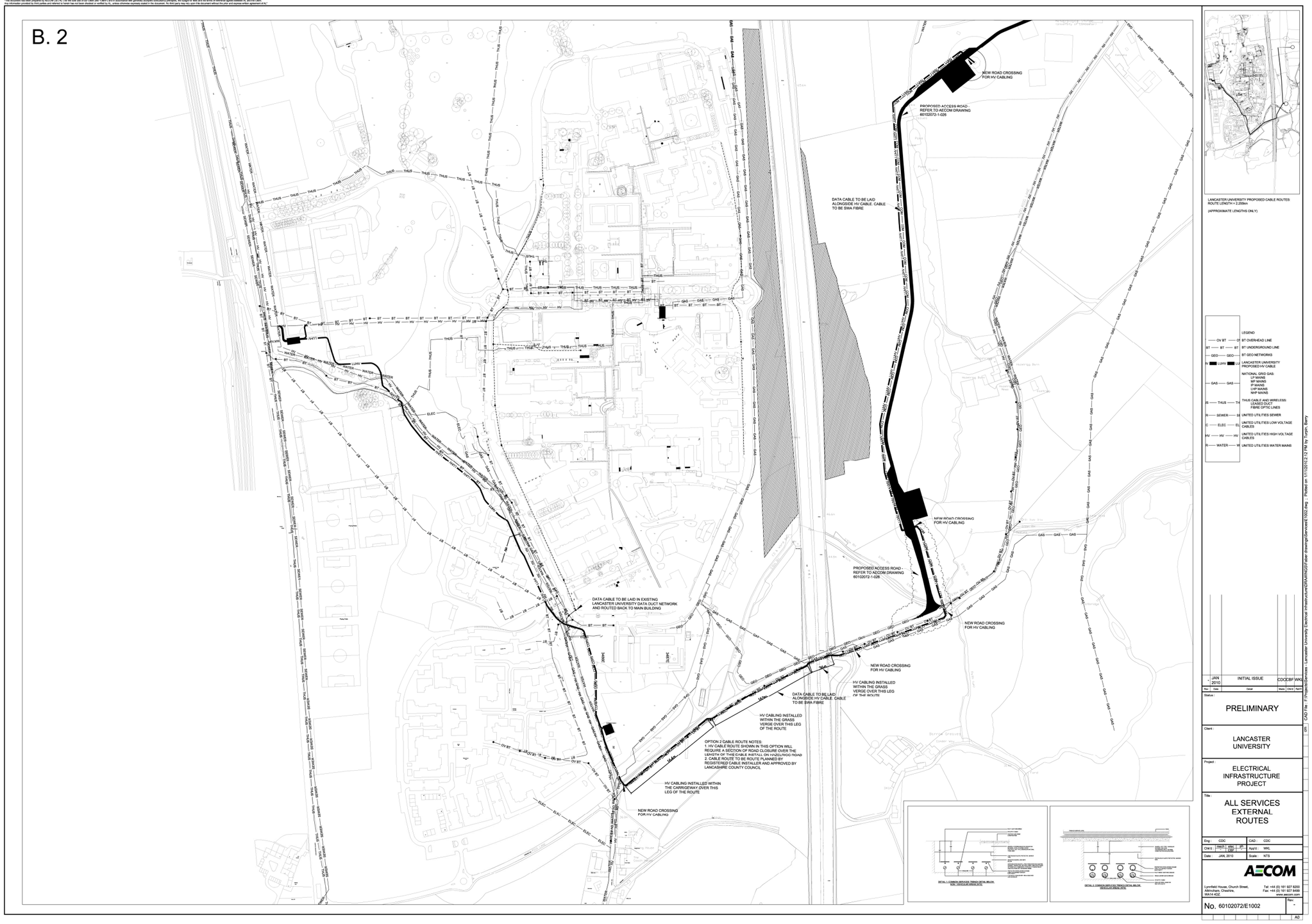
The site is located between junctions 33 and 34 of the M6 and the most suitable route to it will be from Junction 33 and the A6 through Galgate until the junction at Hazelrigg Lane, turning right and continuing through the University roundabout, east to the site. The large abnormal loads will require police or private escort from the Motorway to the site and will involve the temporary removal of some street lights and signs etc.

The main entrance to the site will require some alterations, including temporary improvements to verges and visibility splays, to enable long vehicles to get in and out. An an on-site access track leading to and between the turbines will be laid using a construction method which provides a hard base for vehicles to travel on but allows grass to grow on the tracks and hardstandings.



1.3.6 Cable Route

Underground electrical cables and a temporary construction compound are required as part of the development. There is no requirement for any standalone control building on site as the transformer unit and switch gear equipment will be housed within the base of the turbine towers, thus reducing visual impact. The wind turbines need to be connected to the main university supply cable and this will be done via a cable running from the transformer unit in the base of the towers to an existing electricity substation on the main University Campus. The map below shows the cable route which will be buried below ground and comply with all regulations.



1.3.7 Construction

Construction would take place over a period of 5 months subject to the final details of the scheme, weather and ground conditions, with a further month for testing and commissioning. The project would consist of the following stages some of which may overlap or be carried out concurrently.

- Construction of site construction compound
- Construction of access roads and crane hardstandings
- Construction of reinforced concrete tower bases
- Laying of the on-site cabling
- Delivery, erection and installation of turbine towers, nacelles and blades
- Landscaping work for mitigation measures
- Commissioning of the turbines
- Site reinstatement.

1.3.8 Operation

Each turbine has a computer controller that regulates every aspect of the turbine's performance. Routine inspection visits would take place to ensure that the turbines are operating at their maximum efficiency and regular servicing would take place twice per year with a main service at twelve monthly intervals and a minor service at six months.

1.3.9 Decommissioning

At the end of the 25-year planned life of the wind turbines they will either be removed and the site reinstated or a new planning application may be submitted to retain or modify them.

The decommissioning period is estimated to be around five months, and will involve the removal of above-ground structures and the reinstatement of the agricultural land use.

2. Planning Policy Context

The Lancaster University wind turbine project is set against the context of international, national, regional and local planning policy as described in detail in Chapter 3 of the ES Volume 1.

2.1 Climate Change Legislation

The British Government has taken the threat climate change poses very seriously and considers it to be one of the biggest challenges currently facing the country. Over the last few years several frameworks and groups have been formed and much policy and guidance has emerged, largely directed at the planning profession, which the government sees as an important facilitator in tackling climate change.

The Climate Change Act 2008 was put in place to set a legally binding target for the UK to reduce carbon dioxide levels to 80% less than 1990 levels by the year 2050. The Planning Act 2008 and The Energy Act 2008 encourage the adoption of renewable energy with a variety of measures to assist with their delivery and implementation.

The UK Government has also set a target of 10% of all electricity to be generated by renewable sources by 2010, rising to 15% by 2015 and 20% by 2020. In 2009, the UK was generating approximately 5.5% of its electricity from renewables and with less than 1 year to go until the first target, the UK has a great deal to do to achieve it.

2.2 National Planning Policy

In preparing the detailed EIA the scheme design was guided by all relevant national planning policies, regional spatial strategies and local plans. Relevant national planning policies consulted for this proposal include:

- PPS1: Delivering Sustainable Development;
- PPS1 Supplement: Planning and Climate Change;
- PPS7: Sustainable Development in Rural Areas;
- PPG8: Telecommunications;
- PPS9: Biodiversity and Geological Conservation;
- PSS 11: Regional Guidance
- PPS 12: Local Spatial Strategies
- PPG15: Planning and the Historic Environment;
- PPG16: Archaeology and Planning;
- PPG17: Planning for Open Space, Sport and Recreation;
- PPS23: Planning and Pollution Control;
- PPS25: Development and Flood Risk;

- PPG 24: Planning and Noise.
- PPS22: Renewable Energy;
- A Companion Guide to PPS22 Renewable Energy;

2.3 Regional and Local Planning Policy

The relevant Regional and Local Plans for the development area are;

NW RSS – North West Regional Spatial Strategy (adopted July 2008)
LDCS – Lancaster District Core Strategy (adopted 2008)
LDLP – Lancaster District Local Plan (adopted 2006)

The tables below set out the relevant regional and local planning policies which have been taken into account whilst preparing the planning application for this development.

2.3.1 Regional Policy

Policy	Plan
DP1: Spatial Principles	NW RSS
DP2: Promote Sustainable Communities	NW RSS
DP3: Promote Sustainable Economic Development	NW RSS
DP7: Promote Environmental Quality	NW RSS
DP9: Reduce Emissions and Adapt to Climate Change	NW RSS
RDF2: Rural Areas	NW RSS
EM1: Integrated Enhancement and Protection of the Region's Environmental Assets	NW RSS
EM15: A Framework for Sustainable Energy in the North West	NW RSS
EM17: Renewable Energy	NW RSS
EM18: Decentralised Energy Supply	NW RSS
W1: Strengthening the Regional Economy	NW RSS

2.3.2 Local Policy

Policy	Plan
SC1: Sustainable Development	LDCS
SC3: Rural Communities	LDCS
SC5: Achieving Quality in Design	LDCS
SC7: Development and Risk of Flooding	LDCS
ER1: Higher and Further Education	LDCS
ER7: Renewable Energy	LDCS
E1: Environmental Capital	LDCS
E3: Development the Forest of Bowland AONB	LDLP
E4: Development within the area identified as countryside	LDLP
E7: Development that would affect an existing water course	LDLP
E8: Development within areas of ground water vulnerability	LDLP
E12: Impacts on wildlife protected species and habitats	LDLP
E13: Development affecting woodland	LDLP
E22: Wind Turbines	LDLP
E35: Views into and across conservation areas	LDLP
E44: Archaeological considerations and safeguarding	LDLP
E45: Protecting sites of archaeological interest	LDLP
E46: Archaeological Assessments	LDLP

2.3.3 Lancaster University Carbon Reduction Targets

Lancaster University's Energy and Carbon Management Plan sets out the University's principal strategy to manage and reduce carbon emissions in future years.[1] The plan has been developed as part of the 08/09 Higher Education Carbon Management Programme (HECMP) process in which Lancaster University has participated. The purpose of the HECMP is to assist the University in understanding and reducing its carbon emissions. A large number of carbon and energy saving projects have been identified and prioritised as part of the HECMP process. In addition, the University has produced a Sustainable Energy Strategy[2] which forms part of its Infrastructure Masterplan. It details how the University plans to transform its electricity and heat generation systems on site over the coming years.

The key elements of the Strategy are as follows:

- Replacement of the existing Combined Heat and Power (CHP) gas turbine (which has reached the end of its life) with one or two new high efficiency CHP gas engines (to be provided in 2010).
- Replacement of the four original 1960's heat boilers with up to four high efficiency gas fired boilers (to be provided in 2010).
- Provision for the installation of a high efficiency wood-fired biomass boiler.
- An in depth study by an independent energy consultant to assess the feasibility of the installation of renewable generation technologies, which has identified that the installation of two large scale wind turbines at the campus would be the most effective and efficient renewable energy installations.
- Upgrading and improving the efficiency of the University's central heat distribution system.

The total electricity consumption of Lancaster University in the year 2008/2009 was 32.3 GWh (32,300Mwh). For the year 2009/2010 a target of a 5% absolute reduction in consumption has been set.

Total utilities carbon emissions from the University in the year 2008/2009 amounted to 27,450 tonnes. The emissions include those from electricity, gas and water use, waste disposal and recycling, procurement, maintenance and small projects. Planned works including infrastructure improvements and renewable installations will significantly improve the efficiency of the heat and electricity generation plant and will result in a major reduction in carbon emissions[7].

The primary function of the wind turbines is to harness wind energy to create a "clean" and sustainable source of electricity to replace part of the University's grid supplied electricity. This will in turn reduce the release of carbon emissions.

The installed capacity of the development will be 4.1MW which will generate an electrical output of approximately 10,755 MWh per annum which would in turn prevent the release of approximately;

- CO_2: 5750 tonnes per annum
- SO_2: 100 tonnes per annum
- NO_x: 32 tonnes per annum

The installed capacity of the development will generate an electrical output of approximately 10,775 MWh per annum which represents a 33% of the overall electricity consumption and in turn would result in a 21% reduction to annual utilities carbon emissions at Lancaster University.

[1] Lancaster University, 2009, Energy and Carbon Management Plan.
[2] Lancaster University, 2007, Sustainable Energy Strategy, Lancaster University Master Plan, 2007-2017

3. Environmental and Technical Assessments

3.1 Socio-Economics, Land Use and Tourism

Chapter 4 of the ES Volume 1 considers the effect of the development on the local economy of Lancaster, on local tourist attractions and recreation facilities and on land use within 0.5km of the development site.

The assessment has been based on a detailed desk study and consultations with a range of organisations including Lancaster City Council, the Bridleways Association, Lancashire County Council Public Rights of Way Office, the Ramblers Association, the Forest of Bowland AONB Board and Natural England.

For the purposes of this assessment, in terms of socio-economic factors significant effects are classed as occurring if the proposal were to result in any fundamental or material changes in population, structure of the local community, or local economic activity during the different construction, operation or decommissioning phases. In terms of land use significant effects are classed as occurring if the development were to result in a fundamental change in the predominant land use of the site.

The chapter concludes that socio-economic effects will occur at a local and regional level and are deemed to be minor and short term and not significant in terms of the EIA regulations.

The development of the proposed Lancaster University Wind Turbines will bring financial investment to the local area. Investment will be both direct, through opportunities for local and regional companies, and for construction and through the supply chain, and indirect for the financial savings it offers to Lancaster University enabling further growth and sustaining its position as a key investor and employer in Lancaster.

Through continuous further funding for community projects throughout the 25 year lifetime of the wind turbine project, it will also contribute positively towards improvements in the social-economic profile of the surrounding villages.

It is anticipated that there would be no negative impacts on local businesses or households in the local communities as a result of the development.

No public rights of way will be directly impacted by the turbine development. The effects on tourism and recreation are dependent upon the attitude of the viewer. Studies undertaken by a range of professional bodies have shown that the majority of the public are in favour of generating energy from renewable sources and although local people can be concerned about wind turbine proposals in their area, these fears are generally allayed when the equipment becomes operational.

The loss of improved and semi-improved grassland is assessed as negligible and not significant in the context of the similar available land locally. The field station facilities will be replaced on site and the area of woodland removed will be replaced with suitable planting and through the introduction of a habitat management plan which will improve biodiversity on the site.

3.2 Ecology

Chapter 5 of the ES Volume 1 considers the affect of the development on ecological. To determine possible impacts desktop surveys and a series of ecological surveys, site appraisals and impact assessments were carried out at the site including the Lancaster University Metrological & Field Station, with the following aims:

- To establish the presence or absence of protected species and evaluate the overall nature conservation status of the site
- To assess the likely impact of proposed works to develop the site upon any protected species that may occur on or adjacent to the area of land concerned, and the integrity of nature conservation interest of any other sites of ecological or nature conservation importance within the vicinity
- To provide outline mitigation and habitat aftercare proposals, as appropriate

Consultation was also undertaken with Natural England, the RSPB and the Lancashire County Ecology Department whose advice and recommendation have been incorporated into the design process.

The part of the site proposed for wind turbine location comprises an extensive area of agricultural land dominated by improved grassland currently used for grazing. The site is partly bounded by mature broadleaved woodland and hedgerows to the east and west with individual fields separated by a combination of both intact and defunct hedges, post and wire fences and drainage ditches. There are occasional individual trees across the site with a notable copse of mixed broadleaved and coniferous mature trees to the north. There is a small stream to the south and another along the northern part of the western boundary to the agricultural land. The stream also passes through the woodland to the east of the site. Three small on-site ponds occur, each of which is located within woodland. To the north-east of the agricultural land is the existing Lancaster University Field Station which comprises grassland, experimental plots, hard standing, a large telephone mast and associated equipment, glasshouses, and buildings and equipment associated with the Meteorological Station. One turbine is to be located to the south of the existing agricultural land, a second within the existing Field Station.

Detailed inventories of the species found at site are provided in Chapter 5 of the ES Volume 1 and Appendix E Volume 2. The ecological surveys, which have taken account of plants, trees, badgers, bats, water voles, bird (breeding and overwintering) amphibians and reptiles have confirmed that with the exception of breeding birds and bats, no protected or otherwise important species were recorded during any of the surveys.

Bats forage alongside trees and scrub at the margins of the site and navigate along linear features such as lines of trees. No bat roost sites have been found in any of the larger trees or site buildings. There is potential for bird breeding at site particularly within mature trees and shrubs and on closely adjacent sites. The site is little used by overwintering birds and survey work undertaken up to January 2010 indicates that there are no significant migration routes over the site and no important birds using the site in the vicinity of proposed turbine locations.

Although conscientious efforts will be made to retain as much vegetation as possible at site, in order to accommodate the wind turbines it will be necessary to remove 606m of hedgerow and approximately 0.36 hectares of woodland. It will also be necessary to culvert two short section of the watercourse, the first near the base of turbine two, at the southern end of the site, and the second at the water crossing to the north of the site. To minimise adverse impact no vegetation will be removed during breeding season (February to July inclusive) unless checked for breeding birds by an ecologist. Furthermore checks will be undertaken to ensure that no bat roosts have established in any trees planned for removal nearer to time of development. To compensate for the loss of habitat a mitigation strategy is to be provided comprising of replacement woodland planting and a wetland habitat, basic details of the habitat mitigation plan are contained in Appendix F Section F7 of ES Volume 2. Full details of the habitat mitigation strategy will be supplied as an addendum to this Chapter 5 following submission of the ES. Both Natural England and the Lancashire County Ecologist have agreed that this addendum can be provided following completion of the site Bird Overwintering Study in February.

Following implementation of mitigation measures outline above, there will be residual impacts upon bats, breeding birds and overwintering birds. The magnitude of impact cannot be fully quantified as future behaviour of birds and bats cannot be reliably predicted. However, the removal of habitat which is used by the respective species concerned coupled with the creation of new, optimal habitat will minimise the risk by encouraging the species concerned to use other parts of the site. Monitoring of the active wind turbines, once installed, will provide data as to effectiveness of mitigation and allow for additional measures to be implemented should they be required.

3.3 Landscape

Chapter 6 of the ES Volume 1 identifies and quantifies the likely significant effects of the wind turbines on the existing landscape and visual amenity within 30km of the development site.

Landscape impacts and visual impacts are separate, but related. Landscape impacts are changes in the fabric, character and quality of the landscape. Visual impacts relate solely to changes in available views of the landscape, and the effects that those changes have on people. Landscape and visual impacts do not necessarily coincide. Impacts can be beneficial as well as adverse.

There are three main objectives to the Landscape and Visual Impact Assessment.

- Firstly to identify the effects of the development on the visual amenity of the area. This includes views from nearby properties and settlements and any areas of public access.
- Secondly to identify the effects of the development on the landscape character of the area. This involves the identification of the landscape characteristics of the site and its surrounds at a national, regional and local level, and an assessment of how the development will change the fabric, character and quality of the landscape.
- Thirdly to identify any cumulative effects the development has on visual amenity. A cumulative appraisal takes account of any wind farm developments within a 10km radius which are either in operation, under construction, have planning permission, or which are due to be submitted to local planning authorities for planning permission in the near future.

The landscape and visual impact assessment revealed the following;

3.3.1 Landscape Effects

The turbines are located within two areas of landscape character namely the Langthwaite Ridge (7c) and Cockerham-Galgate-Carnforth 12a landscape areas. There would be no significant direct effects on these landscapes as a result of the wind turbine development. However due to their proximity to the site and associated ZTV coverage there would be significant indirect effects in relation to the Langthwaite Ridge (7c) and Cockerham-Galgate-Carnforth (12a) landscapes.

In respect of other neighbouring landscapes, significant landscapes effects would apply to areas within approx 5km to West Bowland (5i), Bowland Gritstone Fringes (4d), Central Bowland Fells (2b), and High Bowland Plateau (1b) although the composite effects for each of these would not be significant.

The indirect landscape effects in relation to the Forest of Bowland AONB would be similar to effects on some of the landscapes with significant effects associated to areas within 5km and with overall composite effects being Moderate.

3.3.2 Visual Effects

Significant effects would apply to some receptors within the settlements at Bailrigg and Galgate subject to intervening screening levels. In terms of roads significant visual effects would apply to short sections of the M6 and A6 routes where the wind turbines could be viewed at close range, although the overall visual effects in relation to these routes and others within the study area would not be significant.

In terms of recreational routes and footpaths significant effects would apply to parts of Lancashire Coastal Way, National Cycle Route 6 and Regional Route 90 at locations within 5km, although the overall effects on these routes would not be significant.

3.3.3 Cumulative Landscape and Visual Effects

The cumulative impacts of five other existing, consented and proposed wind turbine developments were appraised in relation to the Lancaster University proposal. Significant cumulative effects would potentially apply to residents on the western edge of Quernmore on Wyresdale Road and scattered dwellings between the village and Littledale Road to the north east as a result of the addition of the Lancaster proposals. The Lancaster scheme would reinforce the sequential cumulative effects already experienced from the M6 resulting in significant effects.

Assuming the prior presence of all schemes (the current worst case scenario), cumulative effects are predicted to occur from a limited section of the Lancashire Coastal Way/National Cycle Route 6 in the vicinity of Stodday where the addition of the Lancaster proposals in combination with the Heysham scheme could potentially result in significant cumulative effects for a limited section of the route. Sequential cumulative effects would also occur as a result of the Lancaster proposals from the Regional Cycle Route 90 between Caton village and the M6.

Landscape and visual effects whether regarded as positive or adverse can be reversed, and following decommissioning there would be no residual effects. The wind turbine proposal should therefore be regarded as a long term reversible addition to the landscape, preserving the choice for future generations as to whether or not to recover what might be regarded as the landscape fabric of today, or continue with clean renewable energy generation.

3.4 Archaeology and Cultural Heritage

Chapter 7 of the ES Volume 1 quantifies the impact of the development on the historic environment looking specifically at archaeology. Although no listed buildings or scheduled monuments are directly affected by the development, the visual impact of the proposal on important listed buildings and scheduled monuments within the surrounding landscape is considered.

A desk-based assessment addresses the direct and indirect impacts of the proposed development on the historic environment. The study reviewed relevant databases, as well as published, documentary, map and aerial photographic sources and was supplemented by a site visit.

For the purposes of this assessment key impacts have been identified as those that would potentially lead to a change to the archaeological or historical site significantly outside the existing range of environmental baseline conditions.

A Bronze Age axe find spot was located within the study area, and there is further evidence for Bronze Age activity in the wider area. The supposed route of a Roman road crosses the study area, and a Romano-British settlement site is located to the west of the study area. Medieval activity in the area appears to have been largely agricultural with a field system and area of ridge and furrow identified in the study area. A further area of medieval/post-medieval ridge and furrow was also identified, as well as the township boundary between Scotforth to the north and Ellel to the south. The date of this boundary is unknown, but it could be medieval. Post-medieval sites include relict boundaries and tracks, former pits and ponds, a ditch and bank a cropmark, and a former woodland enclosure bank. Within the study area there is also a modern unspecified cropmark, an undated earthwork, and an undated former watercourse.

Five of the sites identified by this assessment could be impacted by the groundworks during the construction of the wind turbines, however, most of these are considered to be of *low importance* and no specific further work to mitigate the impact of the proposed scheme on these has been recommended. Only the possible route of a Roman road is considered to be of *medium importance*. The route of the road through this area is unknown and therefore the potential impact of the proposed development remains uncertain. In addition, the proximity of the Romano-British settlement site excavated in 2003 to the proposed development area, suggests that there is some potential for further Romano-British archaeological remains to be uncovered. In light of this, a programme of archaeological works is proposed, which, in the first instance will consist of a geophysical (surface level 'metal detector type') survey of the area. This may be followed by a programme of targeted trial trenching, the methodology for which work would be agreed in advance with Lancashire County Archaeological Services.

The indirect impact of the installation of the wind turbines has also been considered. Two Grade II Listed Buildings within the study area and 28 other statutorily protected sites (Scheduled Monuments, Grades I and II* Listed Buildings, Registered Historic Parks and 17 Conservation Areas within a 10km radius of the proposed site have been assessed in terms of the visual impact on their settings. Of the 30 sites considered, 24 may be visually impacted by the proposed scheme and of the 17 Conservation Areas, 15 may be visually impacted. These sites are all considered to be of *high importance*, but as the impact of the proposed scheme on them would be indirect and temporary, the magnitude of impact has been considered to be *small*.

3.5 Shadow Flicker and Light Reflection

Chapter 8 of the ES Volume 1 describes and assesses the potential nuisance that may be caused by shadow flicker effects (shadows cast by the rotating turbine blades). It also addresses the matter of potential Light Reflection which has been identified by the Local Planning Authority in their Scoping Response.

Planning for Renewable Energy, A Companion Guide to PPS22 has been considered in carrying out this assessment. The Companion Guide document was published by the Office for the Deputy Prime Minister in 2004 to provide additional information to assist in the implementation of Planning Policy Statement 22: Renewable Energy (PPS22). The Guide provides additional technical information on a range of renewable energy technologies, including onshore wind power, which is universally applicable.

The companion guide describes the conditions under which flicker may occur and states that the effect diminishes with distance and that "flicker effects have been proven to occur only within ten rotor diameters of a turbine. It also confirms that effects only occur within 130 degrees either side of north relative to the turbines".

Shadow flicker effects can happen when a certain combination of conditions coincide in specific locations at particular times of the day and year. Factors determining the occurrence and/or perception of shadow flicker nuisance at a property etc. include:

- Time of day and year
- Weather conditions – clear and sunny
- Wind direction
- Position of the Sun e.g. when the sun is low in the sky, directly behind a turbine and in line with the property
- Height of the turbine and rotor diameter.
- Distance of the turbine from the property – shadow flicker effect diminishes with distance. At distances greater than ten times the rotor diameter the effect is unlikely to occur[3]
- Type and frequency of use of the affected space within the receptor.
- Size of window apertures and type of curtain or blind fitted (vertical blinds will exacerbate the effect)
- Duration of shadow flicker effects

- Presence of mitigating factors such as screening effects from vegetation near windows

Computer modelling has been carried out for the proposed wind turbines and this has identified a number of potentially sensitive locations which may experience shadow flicker. Although the number of affected days and the duration of such effects would be limited, the possibility of nuisance arising may not be entirely ruled out.

It is generally accepted that a maximum of 30 minutes per day; 30 hours per year; or 30 days per year: whichever is greatest is an acceptable level of shadow flicker impact. These figures are derived from guidelines applicable in Germany. In the UK there is a lack of specific regulations regarding shadow flicker therefore it is up to each individual authority planning authority to assess the impact on a site specific, case by case basis.

For the purposes of this assessment significance effects are categorised to occur where expected shadow flicker results exceed a maximum of 30 minutes per day; 30 hours per year; or 30 days per year: whichever is greatest.

Figures in Chapter 8 of the ES Volume 1 identifies the potential worst case scenario and shows that expected shadow flicker effects fall below the 30 hours per year threshold indicating that special measures should be uneccessary. However if the local planning authority consider controls necessary, mitigation of any adverse effect can be provided in the form of a control system which automatically shuts down the wind turbines at times when shadow flicker will occur.

To prevent light reflection generally turbine blades are coloured a light grey anti-reflective coating which efficiently reduces the effects of reflection.

3.6 Noise and Vibration

Chapter 9 of the ES Volume 1 considers the potential noise and vibration affects associated with the proposal. An assessment of noise resulting from the construction, operation and decommissioning phases of the turbines has been carried out.

The avoidance of excessive noise during construction and decommissioning will be managed through the use of best practice to ensure that effects are minimised as far as is reasonably practicable.

The existing background noise in the vicinity of the proposed wind turbines has been assessed and the level of noise likely to occur at local residential properties as a result of the operation of the proposed turbines has been calculated. From this, the environmental implications have been considered.

The results are assessed against the guidelines available for wind energy developments, including PPG24 and PPS22. Particular attention is paid to the ETSU-R-97 report The Assessment and Rating of Noise from Wind Farms and the latest onshore wind energy planning conditions guidance note (Renewables Advisory Board and the Department for Business, Enterprise and Regulatory Reform, BERR).

For the purposes of this assessment significant effects are deemed to occur if operational noise levels breach the threshold 5 dB above prevailing background noise levels as specified in ETSU- R -97.

For a given wind speed the noise levels created by the turbines predicted at the properties nearest to the proposed wind turbines are below the current daytime background levels. Noise from the turbines will remain within the limit of 35dB, or 5dB above the prevailing background levels, whichever is the greater. The night-time limit of 43dB, or 5dB above prevailing background noise levels, will also be met. This chapter of the ES therefore concludes that there are no significant effects by reason of noise predicted.

3.7 Radar and Electromagnetic Interference

Chapter 10 of the ES Volume 1 describes and analyses the impact of the two proposed wind turbines on air traffic control radar and telecommunication systems.

For the purposes of this assessment significant impacts on radar are identified as those that could lead to the turbines being identified at one or more radar stations. Significant impacts on existing telecommunications and infrastructure links are categorised as those which would prevent normal operation of the links.

The chapter concludes that the turbines will have no significant effect on existing telecommunication or existing infrastructure.

There is only one microwave link, managed by BT, which is potentially affected by one of the turbines but BT have confirmed that they have no objection to the currently proposed turbine locations.

Any possible problems associated with broadcast services (TV and radio) will be resolved by providing signal from 2 transmitters, as described in Chapter 10. In the unlikely event of signal degradation below the minimum signal level in an area, simple mitigation options can be provided to resolve this.

There are several aviation issues caused by the two turbines. Both turbines will be seen from each identified radar station (BAE Warton, Blackpool Airport, St. Annes and Great Dunn Fell) and there are no on site mitigation options available for any of the turbines. Consultation has been undertaken with the MOD, CAA and NATS. The MOD has expressed concerns regarding impact on aviation radar. A detailed assessment of the proposal by NATS is currently being undertaken. Until agreement can be reached with NATs and the MOD the impact on aviation radar must be classed as significant.

3.8 Hydrology, Geology, Hydrogeology and Soils

Chapter 11 of the ES Volume 1 presents an assessment of the likely impacts of the proposed development on hydrology, hydrogeology, geology and soils, describing and evaluating the potential effects and noting any potential constraints.

There are no statutory designations within or immediately adjacent to the survey area. The drainage from the site flows into the River Conder at a point which is 6.5km upstream from the confluence of the River Conder and the River Lune. There are no notified Regionally Important Geological and Geomorphological Sites within 1km of the site. The Environment Agency Groundwater Vulnerability Map shows that the solid geology of the site is classified as a Minor Aquifer. This is a formation that does not have a high primary permeability. Although these aquifers do not produce large quantities of water for abstraction they are important both for local supplies and in supplying base flow to rivers. The site is not within a currently defined Groundwater Source Protection and there are no Groundwater Source Protection Zones within the vicinity of the site.

A Flood Risk Assessment has been undertaken and shows that the site is located entirely within Flood Zone 1, therefore, all of the proposed wind turbines and associated infrastructure will be located in an appropriate flood zone, with the lowest probability of flooding.

A Pollution Prevention Plan (PPP) will set out measures to be employed to avoid or mitigate against potential impacts for all phases of the development, and will also include an Incident Plan to be followed, should pollution occur. Method statements will also be applied, which will follow the principles laid out in relevant Environment Agency Pollution Prevention Guidelines (PPGs).

Hydrology and geology protection measures will be incorporated into the project design including arrangements for the suitable storage of excavated soils and construction materials. The greatest potential risk is from concrete or concrete run off, entering the watercourse during construction and special measures will be taken to avoid this. Given these measures there would be no significant effect on the hydrological, hydro geological or geological resource.

3.9 Traffic, Transport and Highway Impact

Chapter 12 of the ES Volume 1 considers the potential distraction to drivers on the M6 and other roads, construction traffic and the delivery of turbine components to site. The chapter also describes and details the proposed design for the access junction and the internal tracks to the crane pads and turbine bases. It also considers the highway impacts of the proposal once operational and provides an assessment of the traffic generation for the site based on the three phases of the project's life: construction, operation and maintenance and decommissioning.

The turbines accord with setback guidance provided by the Highways Agency and County Highways Department and will be sufficiently visible to drivers as they approach them. It is concluded that they will not be an unreasonable distraction and are unlikely to be a contributing factor to accidents.

When the Contractor begins work there will be an increase in heavy and light goods vehicle traffic as the construction plant and site equipment is delivered. This is likely to occur within a very short timeframe and will be timed to happen outside peak periods. Due to the temporary nature and phasing of construction activity the overall impact is considered to be insignificant.

When the turbine components are transported to and from site there will be disruption in the vicinity of the site access as the loads cross the carriageway under escort. Again this disturbance will be temporary in nature with abnormal movements occurring in a single or a couple of short periods to minimise the impact on the local road network.

The removal of waste materials and the importing of new materials for the construction and decommissioning of the access, access tracks, crane pads and assembly areas will use bulk transportation lorries which will be timed to make deliveries and removals outside peak hours in order to minimise the impact on the local road network.

The management of vehicles will be detailed in a Traffic Management Plan which will detail the methodology to be used to schedule the vehicles and to prevent the site from having an overly negative impact on the local and strategic road network. This will ensure that the impact of all site traffic is minimised.

3.10 Miscellaneous Issues

Chapter 13 of the ES Volume 1 describes and assesses the potential impact of the proposed turbines on air quality, health and safety and waste management.

For the purposes of this assessment significant impacts on air quality are categorised as those which would result in a fundamental or material change to air quality. Significant impacts on health and safety are categorised to occur where fundamental deviations in recognised health and safety procedures.

It is concluded that the turbines will have a significant positive effect on air quality through the saving of greenhouse gases and other polluting emissions. During the course of every year of their 25 year operational life, the wind turbines will avoid approximately 5743 tonnes of CO_2 from entering the atmosphere.

Any health and safety risks will be addressed through normal construction and operational procedures and the safe design of the turbines. All relevant legislation will be adhered to during all stages of development.

The wind turbine development will be built, operated and maintained to high standards of safety. Sensors and protection equipment will be fitted to turbines and operational procedures followed to mitigate any safety risks associated with extreme weather. As such there will be no significant effects in relation to health and safety.

4. Community Consultation and Community Benefits

Chapter 14 of the Environmental Statement describes and explains the consultation which has taken place with the local communities prior to the application being submitted to Lancaster City Council. It sets out the details the community benefits package which Lancaster University is offering to the local community.

4.1 Community Consultation

Consultation with householders, communities, Parish Councils and local authorities, in the surrounding area has take place throughout the design stages.

Initial pre-design community consultation involved the following steps;

- Detailed discussions with Lancaster University's public consultation researchers
- Community Plan and Stakeholder Identification
- Initial discussions on community benefits
- Parish, County and District Councillor Briefing
- Letter to nearby householders in Bailrigg, Ellel and Galgate
- Initial Press Release
- Question and Answer Summary
- Local and National Press Publicity
- Wind Development webpage www.lancs.ac.uk/windturbines
- Lancaster University Newsletter Articles
- Radio Announcements
- Update for Times Newspaper

Following this proposals were presented at public exhibitions in December 2009, in convenient locations in the local wards and parishes, to provide an opportunity for individuals and local communities to view and make comment on the proposal. The feedback from these exhibitions then helped to inform the final design. Public exhibitions were held.

The majority of people attending the consultation events were interested in the proposal and many had positive comments on the scheme in general and the community benefits in particular. Individual concerns and questions were raised and conscientious efforts have been made to respond directly to these.

4.2 Community Benefits

The Lancaster University wind turbines would generate clean, green, electricity predominantly for use on the University Campus. The proposal would also benefit the wider community through its contribution to Lancashire's targets for renewable electricity generated by onshore wind turbines. The University recognises that this development will have an effect on the local community through alteration of "their" landscape. In response to this and in accordance with guidelines produced by the Renewables Advisory Board (RAB) in May 2007, the University proposes to provide a Community Benefits Package (CBP) to support the wind turbine development.

The aim of the CBP is to provide benefit for the community as a whole, rather than individuals. Having reviewed the best practice advice, the public consultation feedback and taking into account the scale of the development, the University has decided that the most appropriate way to administer the CBP is through the provision of a Community Fund which would include an initial lump sum payment followed by an annual payment of £2,000 per MW of installed generating capacity for the lifetime of the project (around 25 years). This fund would be administered by a Steering Group of elected local representatives, plus a university representative to act as an impartial advisor. They would allocate the funds to local environmental and eco-friendly projects as they deemed appropriate.