

Stockton-on-Tees  
Borough Council

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**Stockton Renewables  
Study**

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Wind Study

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October 2009

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This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party

Job number 125435-21

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# 1 Introduction

## 1.1 Overview

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Arup was commissioned by Stockton-on-Tees Borough Council (SBC) in late December 2008 to undertake a high level desk based review of the borough to gain an understanding of the extent of land which is potentially unconstrained for commercial scale wind energy development within the borough. This review only considers commercial scale wind energy development not micro scale or urban wind energy development.

Within this report the term commercial scale wind energy development, or similar terms, has been used to refer to grid connected development of three or more wind turbines of at least 100m to blade tip. The term scale refers to number of turbines within a development, although no fixed numbers are given, not height of turbines.

The review involves two core tasks which were discussed and agreed with SBC:

- a constraints mapping exercise for the whole of Stockton-on-Tees; and
- a basic estimate of the theoretical maximum energy generation capacity from onshore wind within Stockton-on-Tees.

## 1.2 Report Content and Structure

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Following this introduction, the report is structured as follows:

- Section 2 provides an outline of International, National, Regional and Local Policy relating to renewable energy generation in particular onshore wind energy.
- Section 3 sets out the broad methodology used within this study.
- Section 4 considers the technical and environmental constraints to commercial scale onshore wind energy generation within the borough.
- Section 5 considers the potential maximum theoretical levels of renewable energy generation from commercial scale onshore wind within Stockton-on-Tees.
- Section 6 contains the conclusions arising from this research.

## 2 Energy Policy

### 2.1 Overview of International and European Policy

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The Kyoto Protocol is an international agreement, linked to the United Nations Framework Convention on Climate Change<sup>1</sup>, setting binding targets for the reduction of greenhouse gas emissions. The United Nations Framework Convention on Climate Change is an international environmental treaty which entered into force on 21<sup>st</sup> March 1994 aimed at stabilising greenhouse gas concentrations in the atmosphere. No mandatory limits on greenhouse gas emissions for individual nations were set within the treaty; however it included provisions for updates, called "protocols" that would set emission limits. The principal update is the Kyoto Protocol.

The Kyoto Protocol was adopted in December 1997 and entered into force on 16<sup>th</sup> February 2005. Over 180 countries have ratified the Protocol to date. The European Union agreeing to a cut in the amount of greenhouse gases emitted, on average, by 8% from 1990 levels with the UK aiming to reduce a basket of greenhouse gases to 12.5% below 1990 levels by 2008-12.

On 10th January 2007, European Commission proposed a comprehensive package of measures to establish a new Energy Policy for Europe<sup>2</sup> that proposed a unilateral reduction of at least 20% in greenhouse gas emissions from all primary energy sources by 2020 and reduction of 50% in carbon emissions from primary energy sources by 2050, compared to 1990 levels. This was largely endorsed by the European Council in March 2007 in a comprehensive Energy Action Plan<sup>3</sup> for the period 2007-2009. The Action Plan endorses a *"binding target of a 20 % share of renewable energies in overall EU energy consumption by 2020"* and *"stresses the need to increase energy efficiency in the EU so as to achieve the objective of saving 20 % of the EU's energy consumption compared to projections for 2020."*

In November 2008, the Commission adopted the 2nd Strategic Energy Review<sup>4</sup>, the EU Energy and Solidarity Action Plan, which addresses in particular the challenges of promoting the internal and external infrastructure essential for the EU's energy security. Within the Strategic Energy Review a five-point EU Energy Security and Solidarity Action Plan is proposed – the fifth point of which requires *"making the best use of the EU's indigenous energy resources."* The Strategic Energy Review states that *"the EU's greatest potential source of indigenous energy is renewable energy."*

The European Commission's proposals on renewable energy have culminated in the publication of the European Directive on Renewable Energy in June 2009<sup>5</sup>. The Directive requires the establishment of *"mandatory national targets consistent with a 20 % share of energy from renewable sources and a 10 % share of energy from renewable sources in transport in Community energy consumption by 2020"*, setting the United Kingdom a target of achieving 15% of all energy from renewable sources by 2020, from a baseline of 1.3% in 2005.

### 2.2 Overview of National Policy

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The energy policy of the United Kingdom is set out in a series of national policy documents which outline the energy needs of the UK and the mechanisms for delivering them through national, regional and local land use planning. While renewable energy sources have not historically played a major role in UK energy production, the Government is now strongly

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<sup>1</sup> United Nations Framework Convention on Climate Change. United Nations 1992. Fccc/Informal/84 Ge.05-62220 (E) 200705

<sup>2</sup> Communication from the Commission to the European Council and the European Parliament: Energy Policy for Europe.

Commission of The European Communities. COM(2007) 1 final. Brussels, 10.1.2007

<sup>3</sup> Presidency Conclusions of the Brussels European Council (8/9 March 2007). Commission of The European Communities. 7224/1/07 REV 1. Brussels, 2 May 2007.

<sup>4</sup> EU Energy Security and Solidarity Action Plan: 2<sup>nd</sup> Strategic Energy Review. MEMO/08/703. Brussels, 13 November 2008.

<sup>5</sup> Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC. 05.06.2009

encouraging the generation of energy from renewable sources and the reduction of the emission of gases that contribute to climate change.

Key national policy documents on renewable energy including onshore wind energy generation include:

- Renewables Obligation Order (2002)<sup>6</sup>
- Planning Policy Statement 22 (PPS22): Renewable Energy (2004)<sup>7</sup>
- Planning Policy Statement 1 (PPS1): Delivering Sustainable Development (2005)<sup>8</sup> including Planning Policy Statement: Planning and Climate Change Supplement to Planning Policy Statement 1 (2007)<sup>9</sup>
- The Energy Challenge: Energy Review A Report (July 2006)<sup>10</sup>
- Climate Change Act (November 2008)<sup>11</sup>
- Meeting the Energy Challenge: A White Paper on Energy (May 2007)<sup>12</sup>
- Draft Renewable Energy Strategy (June 2008)<sup>13</sup>

Together these documents provide general policy support for, and endorsement of, the development of renewable energy technologies including onshore wind energy development throughout England.

#### 2.2.1 Planning Policy Statement 1 : Delivering Sustainable Development

Planning Policy Statement 1 (PPS1) Delivering Sustainable Development, adopted in 2005, replaces Planning Policy Guidance Note 1: General Policies and Principles, PPS1 sets out the Government's vision for planning and the key policies and principles, which should underpin the planning system. A key principle of PPS1 which should be applied to ensure that development plans and decisions taken on planning applications contribute to the delivery of sustainable development requires that:

*“Regional planning bodies and local planning authorities should ensure that development plans contribute to global sustainability by addressing the causes and potential impacts of climate change – through policies which reduce energy use, reduce emissions (for example, by encouraging patterns of development which reduce the need to travel by private car, or reduce the impact of moving freight), promote the development of renewable energy resources, and take climate change impacts into account in the location and design of development.”*

Planning Policy Statement: Planning and Climate Change - Supplement to Planning Policy Statement 1 was adopted in December 2007 and outlines how planning should contribute to reducing emissions and stabilising climate change and take into account the unavoidable consequences. A key objective of the supplement to PPS1 is that *“regional planning bodies and all planning authorities should prepare, and manage the delivery of, spatial strategies that:*

*– make a full contribution to delivering the Government's Climate Change Programme and energy policies, and in doing so contribute to global sustainability”*

The Planning and Climate Change supplement to PPS 1 also states that planning authorities should:

<sup>6</sup> <http://www.opsi.gov.uk/si/si2002/20020914.htm>

<sup>7</sup> <http://www.communities.gov.uk/publications/planningandbuilding/pps22>

<sup>8</sup> <http://www.communities.gov.uk/publications/planningandbuilding/planningpolicystatement1>

<sup>9</sup> <http://www.communities.gov.uk/publications/planningandbuilding/ppsclimatechange>

<sup>10</sup> <http://www.berr.gov.uk/energy/review/page31995.html>

<sup>11</sup> [http://www.opsi.gov.uk/acts/acts2008/ukpga\\_20080027\\_en\\_1.htm](http://www.opsi.gov.uk/acts/acts2008/ukpga_20080027_en_1.htm)

<sup>12</sup> <http://www.berr.gov.uk/energy/whitepaper/page39534.html>

<sup>13</sup> [http://www.decc.gov.uk/en/content/cms/consultations/cons\\_res/cons\\_res.aspx](http://www.decc.gov.uk/en/content/cms/consultations/cons_res/cons_res.aspx)

*“– not require applicants for energy development to demonstrate either the overall need for renewable energy and its distribution, nor question the energy justification for why a proposal for such development must be sited in a particular location;*

*– ensure any local approach to protecting landscape and townscape is consistent with PPS22 and does not preclude the supply of any type of renewable energy other than in the most exceptional circumstances”*

### 2.2.2 Planning Policy Statement 22: Renewable Energy

Planning Policy Statement 22 (PPS22) Renewable Energy, and Planning for Renewable Energy: A Companion Guide to PPS22 outline the Government’s planning policy framework for renewable energy. PPS22 replaces Planning Policy Guidance Note 22 providing an update of the policies and principles contained therein. However, PPS22 places greater emphasis meeting national and international targets for the reduction of greenhouse gas emissions. In addition, PPS22 includes sections requiring the use of regional targets for renewable energy, removing buffer zones, and emphasising the need for clear, criterion based policies for use in Regional Spatial Strategies and development plans.

PPS22 sets out clear principles that regional planning bodies and local planning authorities should adhere to in their approach to planning for renewable energy including that:

*“– Regional spatial strategies and local development documents should contain policies designed to promote and encourage, rather than restrict, the development of renewable energy resources. ...*

*– At the local level, planning authorities should set out the criteria that will be applied in assessing applications for planning permission for renewable energy projects. Planning policies that rule out or place constraints on the development of all, or specific types of, renewable energy technologies should not be included in regional spatial strategies or local development documents without sufficient reasoned justification. ...*

*– The wider environmental and economic benefits of all proposals for renewable energy projects, whatever their scale, are material considerations that should be given significant weight in determining whether proposals should be granted planning permission. ....”*

The Companion Guide to PPS22 provides practical advice and good practice guidance on the preparation and implementation of policy, and includes a Technical Annex which provides specific advice on the range of renewable energy technologies that are covered by PPS22. Chapter 4: Planning Policy Issues: Local Level. The Companion Guide *“outlines how local planning authorities could prepare criteria-based policies for inclusion in their local development frameworks, encourage the take-up of integrated generation and increase community involvement at this level of plan-making.”*

### 2.3 Regional Policy

The North East of England Plan Regional Spatial Strategy to 2021(RSS)<sup>14</sup>, which replaces the previous Regional Planning Guidance for the North East (RPG1), was published on 15<sup>th</sup> July 2008. The RSS provides the regional level planning framework for the North East of England setting out the broad development strategy for the region for the period up to 2021.

Within the RSS three key policies relate to renewable energy and onshore wind energy development: Policy 39: Renewable Energy Generation, Policy 40: Planning For Renewables and Policy 41: Onshore Wind Energy Development.

Policy 39: Renewable Energy Generation states

*“Strategies, plans and programmes, and planning proposals should:*

- a) *Facilitate the generation of at least 10% of the Region’s consumption of electricity from renewable sources within the Region by 2010 (454 MW minimum installed capacity);*

<sup>14</sup> The North East of England Plan Regional Spatial Strategy to 2021 published by Government Office North East (July 2008)

- b) *Aspire to further increase renewable electricity generation to achieve 20% of regional consumption by 2020;*
- c) *Facilitate the achievement of the following minimum sub regional targets to 2010:*

<i>Northumberland</i>	<i>212MW</i>
<i>Durham</i>	<i>82MW</i>
<i>Tyne &amp; Wear</i>	<i>22MW</i>
<i>Tees Valley</i>	<i>138MW</i>
	<b><i>454MW</i></b>

Policy 40: Planning For Renewables states

*“Strategies, plans and programmes should support and encourage renewable energy proposals and identify renewable resource areas. In assessing proposals for renewable energy development significant weight should be given to the wider environmental, economic and social benefits arising from higher levels of renewable energy, and the following criteria should be considered:*

- a) anticipated effects resulting from development construction and operation such as air quality, atmospheric emissions, noise, odour, water pollution and the disposal of waste;*
- b) acceptability of the location and the scale of the proposal and its visual impact in relation to the character and sensitivity of the surrounding landscape;*
- c) effect on the region’s World Heritage Sites and other national and internationally designated heritage sites or landscape areas, including the impact of proposals close to their boundaries;*
- d) effect of development on nature conservation sites and features, biodiversity and geodiversity, including internationally designated and other sites of nature conservation importance, and potential effects on settings, habitats, species and the water supply and hydrology of such sites;*
- e) maintenance of the openness of the Region’s Green Belt;*
- f) accessibility by road and public transport;*
- g) effect on agriculture and other land based industries;*
- h) visual impact of new grid connection lines;*
- i) cumulative impact of the development in relation to other similar developments; ,,,”*

A number of “*broad areas of least constraint for wind farm development*” are identified and listed in Policy 41. These areas are identified with “*W*” symbols on maps contained within the RSS. Two scales of “*W*” symbols are included on the RSS maps indicating broad areas of least constraint for:

- small scale wind energy development (labelled as Urban/Urban Fringe resource are in the legend for the key diagram) which is broadly defined as “*up to five turbines*”, and
- medium scale wind energy development which is broadly defined as “*up to 20-25 turbines*”.

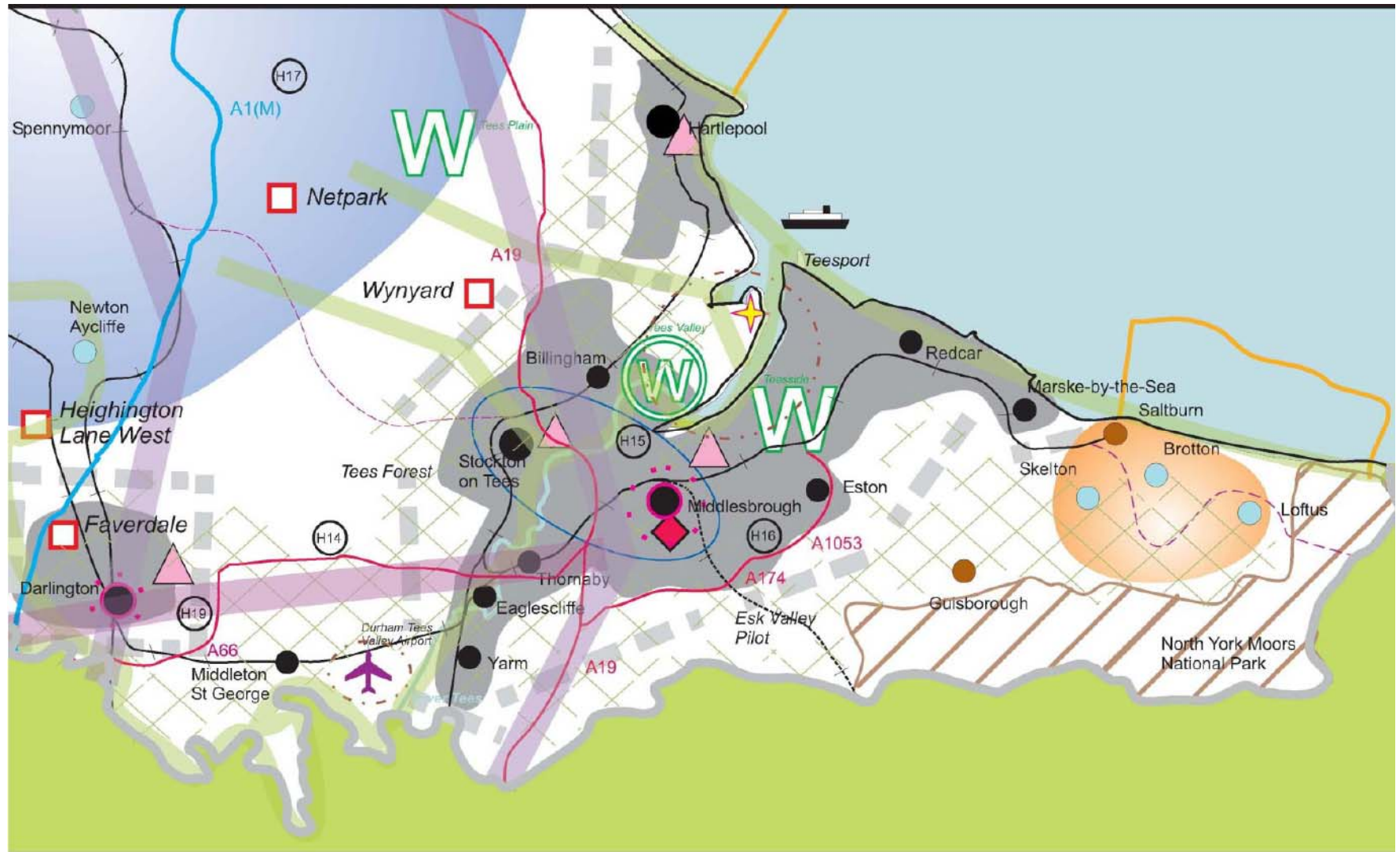
Policy 41: Onshore Wind Energy Development states that



*“Strategies, plans and programmes should provide a positive policy framework to facilitate onshore wind energy development within the ... broad areas of least constraint for wind energy developments.”*

A small scale broad area of least constraint is identified within the borough of Stockton in the RSS, see Figure 1 below. However, Policy 41 also notes that the identification of broad areas of least constraint *“does not preclude proposals being considered in other areas in terms of Policy 40.”*

Figure 1 – Inset (S) Diagram from The North East of England Plan Regional Spatial Strategy to 2021



## 2.4 Local Policy

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Under the provisions of the Planning and Compulsory Purchase Act 2004 Local Plans are to be replaced by Local Development Frameworks. The Stockton-on-Tees Local Plan published in 1997 ceased to have effect as of 27th September 2007. However, to prevent a policy void, provision was made under the Planning and Compulsory Purchase Act 2004 for saving certain Local Plan policies until the Stockton-on-Tees Local Development Framework is adopted. The Secretary of State issued a Direction, dated 31<sup>st</sup> August 2007, together with a schedule specifying those policies in the Local Plan that are to be saved<sup>15</sup> during the preparation of the Local Development Framework.

Policy EN42: Wind Turbines in Open Countryside, saved under the Secretary of States Direction, provides guidance for single turbine developments stating that:

*“Single wind turbines and associated plant in the countryside will normally be permitted unless:*

- a) It is detrimental to the character of a special landscape area; or*
- b) It causes unacceptable harm to the amenity of neighbouring residents.”*

Neither the Stockton-on-Tees Local Plan, nor any of the saved policies provide policy guidance for the development of wind energy developments consisting of more than one turbine.

Details of other saved environmental policies which may be relevant to the development of wind energy development within the borough are provided in Appendix A. It should be noted that the saved policies should be read in context, it is likely that material considerations, in particular the emergence of new national and regional policy will now be afforded considerable weight in planning decisions.

Stockton-on-Tees Borough Council is currently in the process of preparing the Local Development Framework (LDF) for Stockton-on-Tees. The LDF will consist of a series of ‘Local Development Documents’ which include Statement of Community Involvement, Development Plan Documents (such as a Core Strategy) and (non statutory) Supplementary Planning Documents.

The Submission Draft Core Strategy, the key Local Development Document, which sets out the Borough wide spatial strategy and area-based strategic policies for the next 15 years, and its supporting documents were submitted for approval to the Secretary of State on 27<sup>th</sup> May 2009; this began the Independent Examination process. The Core Strategy, in its current state, is supportive of renewable energy and recognises need to exploit the *“Borough’s potential to produce and use renewable energy”* to support the Council’s vision for the future of the Borough.

At this stage a Supplementary Planning Document dealing specifically with onshore wind energy or renewable energy has not been proposed.

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<sup>15</sup> Direction under paragraph 1(3) of Schedule 8 to the Planning and Compulsory Purchase Act 2004 policies contained in Stockton-on-Tees Local Plan (1997)

### 3 Overview of Methodology

The methodology proposed for the Stockton Renewables Study Phase 1: Wind Study was broadly based on the methodology used by Arup for the series of ongoing Wind Farm Development and Landscape Capacity Studies commissioned by the former North East Assembly (NEA)<sup>16</sup>. This methodology comprised two stages – a review of the technical and environmental constraints to wind energy development followed by a landscape sensitivity and capacity analysis.

**Table 1: Outline of the methodology stages in the Wind Farm Development and Landscape Capacity Studies commissioned by the former NEA.**

1.	<b>Technical and environmental constraints review.</b> This aims to reduce the scope of the area to be subject to landscape/visual analysis, largely to maximise available resources. It comprises a standard constraint sieving exercise using a Geographic Information System (GIS), similar to that undertaken by all wind farm developers when selecting sites. This identifies the “least constrained” <sup>17</sup> land with respect to range of parameters which can then be tested for its suitability in landscape and visual terms.
2.	<b>Landscape, visual and cumulative analysis.</b> This stage aims to determine the relative landscape and visual performance of parts of the study area. It also attempts to examine the potential for cumulative landscape and visual impact and thus will consider thresholds for acceptable change.

Stockton-on-Tees Borough Council has commissioned a separate consultant to undertake a Landscape Character Assessment for the Borough which is due to be completed in summer 2009. To avoid duplication of landscape characterisation work and the possibility of discrepancies between the boundaries used in both studies, it was agreed with SBC that the Phase 1: Wind Study would only undertake the first stage of the Wind Farm Development and Landscape Capacity Studies methodology – the technical and environmental constraints review. This methodology was built upon and developed to provide a high level estimate of the possible theoretical maximum energy generation from onshore wind energy within the borough not taking landscape sensitivity into account. A more detailed account of the methodology used within this study is provided in Section 4: Technical and Environment Constraints Review and Section 5: Theoretical Maximum Energy Generation.

<sup>16</sup> NEA closed on 1<sup>st</sup> April 2009 and staff transferred over to the Association for North East Councils.

<sup>17</sup> “Least constrained” in this context refers to the absence or comparatively lower frequency (when compared to the surrounding area) of a set of pre-defined technical and environmental constraints that prohibit development in absolute terms. It does not relate to the landscape and visual characteristics of an area or suggest that there are not other constraints that either singularly or in combination may affect the ability to develop wind turbines.

## 4 Technical and Environmental Constraints Review

The potential development of onshore wind energy proposals can be constrained or prohibited by many high level factors including inadequate wind speed and statutory designations. Other constraints to wind energy development such as presence of protected species within a site can only be realistically considered at a site specific level.

The study methodology builds upon on and develops the first stage of the methodology – the technical and environmental constraints review – used by Arup for the series of ongoing Wind Farm Development and Landscape Capacity studies commissioned by the former NEA.

The technical and environmental constraints review comprises a standard constraint sieving exercise overlaying various constraint datasets within a Geographic Information System (GIS) model, similar to that undertaken by all wind farm developers when selecting sites. This allows the identification of the land “least constrained” for wind energy development i.e. land with no or a comparatively lower frequency (when compared to the surrounding area) of pre-defined technical and environmental constraints that prohibit wind energy development in absolute terms.

Many constraining factors such as statutory designations which preclude or are incompatible with wind energy development and physical constraints such as low wind speeds or excessively steep topography can be easily mapped. However, certain constraints such as landowner willingness to be considered for wind energy development cannot be mapped because the information is not currently nor is it likely to become readily available.

Constraints to wind energy development can be crudely split into “major” and “variable” constraints.

- **Major constraints** include features which are likely to be incompatible with wind energy developments based on statutory or planning policy protection afforded to the feature, for example Sites of Special Scientific Interest.
- **Variable constraints** include features which could inhibit wind energy development but for which there is either some variability/uncertainty in their spatial extent or the potential to develop within the area concerned with appropriate mitigation, for example residential amenity.

The technical and environmental constraints review for this study utilises many of the same constraints used in the series of Wind Farm Development and Landscape Capacity studies along with local planning designations and other specific local datasets for Stockton-on-Tees.

**Table 2** provides details of the potential statutory, planning, technical and environmental constraints to wind energy development within the borough.

A GIS model of Stockton-on-Tees was built by overlaying the various constraints to provide a spatial indication of the potential constraints to wind energy development within the borough. The results of the constraint analysis are shown on **Figure 2**. Each major constraint is coloured dark blue with each variable constraint coloured pink to help define between the two constraints. The darker the area of colour on the constraints figure the more constrained that area of land is to commercial scale onshore wind energy development.

**Table 2 – Constraints to commercial scale wind energy development**

<b>Constraint</b>	<b>Data Source</b>	<b>Justification</b>	<b>Major or variable constraint</b>
Aural amenity of residential and employment receptors (All residential properties, business premises etc. with a valid postal address)	OS Gazetteer data  (500 m radius buffer of all postal addresses)	<p>Commercial scale turbines must be sited an appropriate distance from residential properties for noise amenity reasons. It is acknowledged that detailed modelling work is required to determine actual acoustic separation distances for live projects. A separation distance of 500m has been chosen for this study as a general approximation of a typical separation distance.</p> <p>It should be noted that a separation distance of 600m has been used for the Wind Farm Development and Landscape Capacity studies. The separation distance has been reduced for this study as, given the heavily settled nature of the borough; it is unlikely that the larger scale wind energy proposals which were the original focus of the Wind Farm Development and Landscape Capacity studies will come forward in this location.</p> <p><b>This is not to suggest that a 500m or 600m buffer around residential properties represents a new planning criterion for use at the development control level.</b></p>	Major
Wind speed	DTI / NOABL Model on 1km square basis	<p>Developers of commercial scale turbines will typically seek sites with the greatest mean annual wind speed, as well as with the lowest number of other constraints. For this study it is assumed that a minimum mean annual wind speed of 6.5 m/s would be sought (defined at 80m above ground level). Areas with lower wind speeds are unlikely to be considered economically viable; however, with modern turbines there may be some flexibility available on the margins of the areas of higher wind speeds.</p> <p>It should be noted that a minimum mean annual wind speed of 6.8 m/s has been used for the Wind Farm Development and Landscape Capacity studies. The minimum mean annual wind speed has been reduced for this study as, given the heavily settled nature of the borough; it is unlikely that the larger scale wind energy proposals which were the original focus of the Wind Farm Development and Landscape Capacity studies will come forward in this location.</p> <p><b>This is not to suggest that areas with wind speeds less than 6.5m/s represent a new planning criterion for use at the development control level or that turbine proposals will not come forward in areas of lower wind speed; the data is used to help broadly illustrate the least promising areas in terms of wind resource.</b></p>	Major/Variable Developers may chose to progress sites with lower wind speeds this is a commercial decision. As such wind speed below 6.5m/s has been shown as a blue hatch.

Constraint	Data Source	Justification	Major or variable constraint
Statutory Ecological Designations: – National Nature Reserves (NNR) – Ramsar sites – Special Protection Area (SPA)	Derived from Natural England and Stockton-on-Tees Borough Council data	No specific policies relating to these designations are contained within the saved policies of the Local Plan. However, because of the national and international ecological importance of these sites and the statutory nature of the designation, such sites are considered as absolute constraints to commercial scale wind farm developments.	Major
Sites of Special Scientific Interest (SSSIs)	Derived from Natural England and Stockton-on-Tees Borough Council data	Wind farms generally have a very small physical footprint compared to the total area occupied by the development, since only the turbine footings and access / maintenance tracks require the disturbance of the ground surface. Nonetheless, because of the ecological and/or geological importance of the sites, SSSIs are considered as a constraint to wind farm development.  Local Plan Policy EN1 outlines that developments which have a significantly adverse effect either directly or indirectly on SSSIs will not be permitted unless the reasons for the development clearly outweigh the value of the site itself.	Major
Scheduled Monuments	Derived from Stockton-on-Tees Borough Council data	Scheduled Monuments (SMs) are designated by English Heritage and are statutorily protected, thus are considered a constraint to large-scale wind farm developments.  Local Plan Policy EN29 states that development which will adversely affect the site, fabric or setting of a Scheduled [Ancient] Monument will not be permitted. The setting of each SM cannot be established at this stage; however, a 100m buffer has been placed around each SM to provide some indication of the sites immediate setting.  <b>This is not to suggest that a 100m buffer around a SM represents the true setting of the SM nor is it a new planning criterion for use at the development control level.</b>	Major for the actual SM  Variable for the 100m buffer

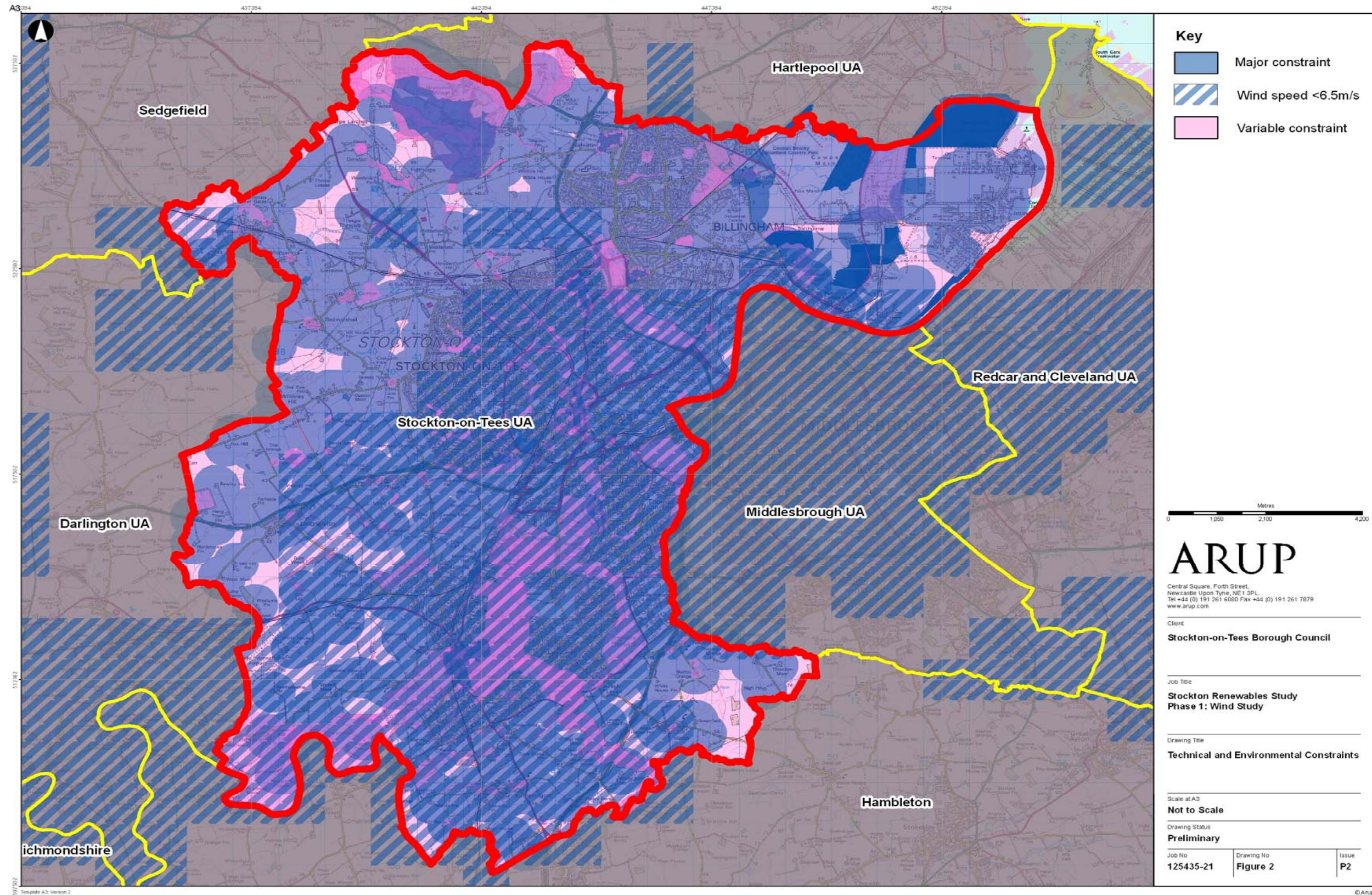
Constraint	Data Source	Justification	Major or variable constraint
Listed building	Derived from Stockton-on-Tees Borough Council data	<p>Listed Buildings are designated by English Heritage and are statutorily protected, thus are considered a constraint to large-scale wind farm developments.</p> <p>Local Plan Policy EN28 states that development which is likely to detract from the setting of a Listed Building will not be permitted. The setting of each Listed Building cannot be established at this stage; however, a 100m buffer has been placed around each Listed Building to provide some indication of the sites immediate setting.</p> <p><b>This is not to suggest that a 100m buffer around a Listed Building represents the true setting of the Listed Building nor is it a new planning criterion for use at the development control level.</b></p>	Major for the actual Listed Building Variable for the 100m buffer
Conservation Area	Stockton-on-Tees Borough Council	<p>Conservation areas are 'areas of special architectural or historic interest the character or appearance of which it is desirable to preserve or enhance' designated by local planning authorities under Section 69 of the Planning (Listed Buildings and Conservation Areas) Act1990.</p> <p>No specific polices relating to these designations are contained within the saved policies of the Local Plan. However, commercial scale wind energy development is not considered compatible with the preservation or enhancement of Conservation Areas.</p>	Major
Registered Historic Parks and Gardens	Derived from English Heritage and Stockton-on-Tees Borough Council data	<p>Local Plan Policy EN9 states that development which is likely to be detrimental to the special historic interest of Wynyard Park will not be permitted.</p> <p>No additional statutory controls follow from the inclusion of a site in English Heritage's Register of Parks and Gardens of Special Historic Interest; however, Planning Policy Guidance Note 15: Planning and the Historic Environment requires that <i>"local planning authorities should protect registered parks and gardens in preparing development plans and in determining planning applications."</i></p>	Major
Proposed International Nature Reserve (pINR)*	Derived from Stockton-on-Tees Borough Council data	Local Plan Policy EN12 states that development will only be permitted in the pINR if it is required in connection with existing industry, for the management of wildlife, for marshland grazing or if it facilitates public access for the enjoyment and interpretation of the environment and nature.	Major
Local Nature Reserve (LNR)*	Derived from Stockton-on-Tees Borough Council data	Local Plan Policy EN2states that development in LNRs will not be permitted if it would be harmful to the elements giving rise to their designation.	Variable



<b>Constraint</b>	<b>Data Source</b>	<b>Justification</b>	<b>Major or variable constraint</b>
Site of Nature Conservation Interest (SNCI)*	Derived from Stockton-on-Tees Borough Council data	Local Plan Policy EN4 states that development t which is likely to have an adverse effect upon SNCIs will only be permitted if there is no alternative available site or practicable approach; and any impact on the site's nature conservation value is kept to a minimum.	Variable
Ancient Woodland*	Derived from Stockton-on-Tees Borough Council data	Local Plan Policy EN8 states that development within Ancient Woodland which detracts from its conservation value will not be permitted.	Variable
Special Landscape Areas*	Derived from Stockton-on-Tees Borough Council data	Local Plan Policy EN7 states that development which harms the landscape value of special landscape areas will not be permitted.	Variable
Green Wedges*	Derived from Stockton-on-Tees Borough Council data	Local Plan Policy EN14 states that development will not be permitted which detracts from the open nature of the landscape so as to threaten, by itself or cumulatively, the local identity of the areas separated by the Green Wedge.	Variable
Urban Open Spaces*	Derived from Stockton-on-Tees Borough Council data	Local Plan Policy EN15 states that development will not be permitted unless it would enhance the sporting, recreational, or nature conservation value of the land and the space would still retain its open character; or the development of a small area of open space would result in the enhancement of the remainder to the overall benefit of the local community.	Variable
Radar		<p>The Ministry of Defence (MoD), NATS, the CAA and Airports are concerned about turbines interfering within air traffic control, in particular radar. Wind farms operating near airports, or in prominent positions with a line-of-sight to radar installations, can affect radar by causing 'clutter', where the rotating turbine blades show up as blips on the radar screen, or by causing shadows, which may obstruct an aircraft being detected by radar.</p> <p>Calculating the visibility of Wind turbines to a radar installation allows the identification of sites that are not in the line or site of a radar installation. Distances beyond which this is no longer an issue varies with Airports at 30km and Military Radar 76km. However, not all turbines proposals raise objections from the aforementioned organisations within these distances.</p>	Variable

\* It should be noted that PPS 22 states that “Local landscape and local nature conservation designations should not be used in themselves to refuse planning permission for renewable energy developments”, as such all local level designations have been considered as variable constraints.







The borough is very heavily constrained; see Figure 2, offering limited potential opportunities for wind energy development. There are no areas of “unconstrained” land i.e. land without any mapped constraints within the borough. Major constraints cover much of the borough with pockets of “variably constrained” land generally located in the north east, north west, west and south east of the borough generally extending towards the borough boundary. Scattered pockets of variably constrained land are located in the north east of the borough, broadly corresponding with an Urban/Urban Fringe resource area indicated within the Regional Spatial Strategy.

The absence of constraints outside the Stockton-on-Tees borough boundary is a result of the GIS datasets not extending beyond the Borough boundary. It should not be taken to imply that other Local Authorities have large areas of unconstrained land.

It must be recognised that Figure 2 only offers an indicative overview of land which may come forward for development for onshore wind. However, it must be noted that developers may be willing to pursue sites with low wind speeds or may open up pockets of land within otherwise apparently constrained areas by taking residential properties under their control out of occupation (thus removing the need for noise buffers).

It must also be noted that an area of land may appear to have few constraints within the GIS model, other constraints which are not possible to model within the resources available for this study such as landowner attitude to wind energy development, telecom links, bird migration routes etc. may place further constraints on any otherwise apparently unconstrained land. The Mapping Sensitive Areas for Birds within Stockton and Five Districts of County Durham study currently being undertaken by E3 Ecologists is an emerging document but is not yet publically available and such has not been taken into account within this study.

## 5 Theoretical Maximum Energy Capacity

This chapter of the report seeks to set out the foreseeable 'theoretical maximum' potential capacity for onshore wind turbine development, based on current technology, within Stockton-on-Tees.

The installed generating capacity of a wind farm (i.e. the maximum possible generating capacity) is not the same as actual generation. The 'theoretical maximum' figure derived for this report is intended as a maximum estimate of the installed generating power of grid connected commercial scale onshore wind power within Stockton not as an estimate of the actual possible maximum generation. It is recognised that technologies such as wind power are highly intermittent due to the natural fluctuations of wind speed and therefore are not in operation all of the time. In order to calculate the actual amount of energy produced during a given period, a *Capacity Factor* must be applied. A detailed explanation of "capacity factors" is provided in Appendix B.

Based on the amount of "least constrained" and "variably constrained" land it is possible to produce a high level estimate of the theoretical maximum energy capacity, in mega watts, from onshore wind that could be achieved within Stockton-on-Tees.

There are several very important caveats, which must be taken into consideration regarding the theoretical maximum:

- **The theoretical maximum is only a hypothetical estimate of the maximum possible energy generating capacity possible from onshore wind energy within the borough. It is NOT intended as suggestion of the level of development that should be considered acceptable within the borough.**
- **The theoretical maximum is an estimate of the maximum possible energy generating capacity not an estimate of the actual generating capacity which may be possible. In order to calculate the actual amount of energy produced during a given period, a *capacity factor* must be applied, see Appendix B.**
- **The theoretical maximum will be constrained by site-specific factors that have not been modelled within the technical and environmental constraints review, e.g. land ownership, archaeology and site access.**
- **The theoretical maximum generated within this study does not take landscape sensitivity into account.**

As noted previously, the borough is very heavily constrained, offering limited potential opportunity for wind energy development. There are no areas of "least constrained" land i.e. land without any mapped constraints within the borough. Variable constraints, namely radar constraints, cover the entire borough with major constraints covering much of the borough.

The absence of constraints outside the Stockton-on-Tees Borough boundary is a result of data sets not extending outside the Borough boundary. It should not be taken to imply that other Local Authorities have large areas of unconstrained land.

As there is no "least constrained land" as previously defined within Stockton-on-Tees, the areas of "variably constrained" land around or over 1km<sup>2</sup> without additional constraints such as overhead power lines as indicated on Ordnance Survey 1:50,000 maps have been identified. Within Stockton-on-Tees this amounts to approximately 8 km<sup>2</sup> of "variably constrained" land.

An estimated capacity of 6.5MW per km<sup>2</sup> which is broadly in line with industry figures has been ascribed to "variably constrained" land. This provides an overall 'theoretical maximum' capacity for onshore wind turbine development of 52MW within Stockton-on-

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Tees. This represents 39% of the sub-regional target to 2010 for the Tees Valley identified in the North East of England Plan Regional Spatial Strategy to 2021.

However, the “theoretical maximum” is not suggested as an acceptable level of onshore wind energy development and it is likely that a considerable part of the “variably constrained” land will not in practice be developable, due to the presence of one or more of the “variable” constraints and other unmapped constraints.

The overall ‘theoretical maximum’ figure does not take effect of landscape sensitivity on acceptable wind farm size or cumulative impact as a result of wind energy development outside of the borough as well as wind energy projects within the borough, into account.

## 6 Conclusion

This technical and environmental review considered the various constraints to the potential development of commercial scale onshore wind energy within Stockton-on-Tees including: major constraints – features which are likely to be incompatible with wind energy developments based on statutory or planning policy protection afforded to the feature; and variable constraints – features which could inhibit wind energy development but for which there is either some variability/uncertainty in their spatial extent or the potential to develop within the area concerned with appropriate mitigation. Other constraints to wind energy development such as presence of protected species within a site can only be realistically considered at a site specific level.

The technical and environmental constraints mapping, see Figure 2, highlights that the borough is very heavily constrained; offering limited potential opportunity for wind energy development within Stockton-on-Tees. Variable constraints, namely radar constraints, cover the entire borough with major constraints covering much of the borough.

It must be recognised that, while an area of land may appear to have few constraints within the GIS model, other constraints which are not possible within the resources available for this study to model such as landowner attitude to wind energy development, telecom links etc. may place further constraints on land.

The scattered pockets of “variably constrained” land are located in the north east, north west, west and south east of Stockton-on-Tees. The scattered pockets of “variably constrained” land located in the north east of the borough, broadly corresponding with an Urban/Urban Fringe resource area indicated within the Regional Spatial Strategy. While an Urban/Urban Fringe resource area is broadly defined as “*up to five turbines*” within the RSS this is an artificial cap and, following more detailed work on landscape sensitivity, the landscape capacity of this location may be greater.

Following the review of the constraints the absolute theoretical maximum onshore wind energy capacity was estimated for the “variably constrained” land within the borough. The overall ‘theoretical maximum’ onshore wind energy capacity for Stockton-on-Tees is estimated to be 52MW; however this is not to suggest that this would be an appropriate level of development to be taken forward within the borough.

This study has not taken any implications of the impact of the emerging migratory bird study, the specific sensitivity of the landscape to wind energy development on acceptable wind farm size or cumulative impact into account within the derivation of the theoretical maximum figure.

Generally speaking, separation distances are applied through planning decisions in an attempt to minimise the cumulative landscape and visual effects of wind energy development on sensitive receptors including settlements and sensitive landscapes. Appropriate separation distances will vary depending on factors such as the scale and the setting of the proposed development.

Appendix A

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**Stockton-on-Tees Local  
Plan Saved Policies**

## A1 Stockton-on-Tees Local Plan – Saved Policies

### EN 1(a) Sites of Special Scientific Interest (SSSI)

Proposals for development in or likely to affect sites of special scientific interest will be subject to special scrutiny where such development may have a significant adverse effect directly or indirectly on the **SSSI**, it will not be permitted unless the reasons for the development clearly outweigh the value of the site itself and national policy to safeguard the intrinsic nature conservation value of the national network of such sites. Where development is permitted, the Council will consider the use of planning obligations to ensure the protection and enhancement of the site's nature conservation interest.

### EN 1(b) Sites of Special Scientific Interest (SSSI)

Proposals for the development or land use which may affect a European site, a proposed European site or a Ramsar site will be subject to the most rigorous examination. Any proposal which is not directly connected with, or necessary for, the management of the site for nature conservation and which is likely to have a significant adverse effect on the integrity of the site will only be permitted if:-

- (i.) There is no alternative available site or practicable approach for the proposal; and either,
- (ii.) For sites which host priority habitat types and/or species, there are overriding human health and safety considerations or benefits or primary importance to the environment; or
- (iii.) For sites which do not host priority habitat types or species, there are imperative reasons of overriding public interest for the proposal.

Where development is permitted, the council will consider the use of planning conditions or planning obligations to secure compensatory measures necessary to retain the overall coherence of Natura 2000.

### EN 2 Local Nature Reserves (LNR)

Development in the Local Nature Reserves listed below, and in any subsequently declared, will not be permitted if it would be harmful to the elements giving rise to their designation:

- a) Bassleton Woods and the Holmes, Thornaby;
- b) Billingham Beck Valley;
- c) Thorpe Wood, Grindon.

### EN 4 Sites of Nature Conservation Importance (SNCI)

Development which is likely to have an adverse effect upon Sites of Nature Conservation Importance will only be permitted if:-

- (i.) There is no alternative available site or practicable approach; and
- (ii.) Any impact on the site's nature conservation value is kept to a minimum.

Where development is permitted the Council will consider the use of conditions and/or planning obligations to provide appropriate compensatory measures.



### **EN 5 Land Adjoining North Tees Works**

Development on land adjoining the North Tees Works under policies **IN5** and **IN6** that is likely to have an adverse effect upon the sites of nature conservation importance will only be permitted if appropriate compensatory measures are provided.

The Council will require by way of conditions and/or planning obligations that such measures are put into place.

### **EN 7 Special Landscape Areas**

Development which harms the landscape value of the following special landscape area will not be permitted:-

- a) Leven Valley
- b) Tees Valley
- c) Wynyard Park.

### **EN 8 Ancient Woodland**

Development within Ancient Woodland which detracts from its conservation value will not be permitted.

### **EN 9 Wynyard Park/ Historic Parks**

Development which is likely to be detrimental to the special historic interest of Wynyard Park will not be permitted.

### **EN 12 International Nature Reserve**

Land to the east of Cowpen Bewley Road and to the west of Seal Sands is identified for an International Nature Reserve. Development will only be permitted if it is required in connection with existing industry, for the management of wildlife, including new habitats, for marshland grazing or if it facilitates public access for the enjoyment and interpretation of the environment and nature. That part of the international nature reserve designated as **SSSI** will be subject to policy **EN1(a)** and **EN1(b)**.

### **EN 14 Green Wedges**

Within the following Green Wedges, development will not be permitted which detracts from the open nature of the landscape so as to threaten, by itself or cumulatively, the local identity of the areas separated by the Green Wedge.

- a) River Tees Floodplain from Surtees Bridge, Stockton, to Yarm;
- b) Leven Valley between Yarm and Ingleby Barwick;
- c) Bassleton Beck Valley between Ingleby Barwick and Thornaby;
- d) Stainsby Beck Valley, Thornaby;
- e) Billingham Beck Valley;
- f) Between North Billingham and Cowpen Lane Industrial Estate.

**EN 15 Urban Open Space**

Development will not be permitted on Urban Open Space unless:

- (i.) It would enhance the sporting, recreational, or nature conservation value of the land and the space would still retain its open character; or
- (ii.) The development of a small area of open space would result in the enhancement of the remainder to the overall benefit of the local community.

**EN 28 Listed Buildings**

Development which is likely to detract from the setting of a Listed Building will not be permitted.

**EN 29 Sites of Archaeological Interest**

Development which will adversely affect the site, fabric or setting of a Scheduled Ancient Monument will not be permitted.

**EN 30 Sites of Archaeological Interest**

Development which affects Sites of Archaeological Interest will not be permitted unless:

- (i.) An investigation of the site has been undertaken; and
- (ii.) An assessment has been made of the impact of the development upon the remains; and where appropriate;
- (iii.) Provision has been made for preservation 'in situ'.

Where preservation is not appropriate, the local planning authority will require the applicant to make proper provision for the investigation and recording of the site before and during development.

**EN 42 Wind Turbines in the Open Countryside**

Single wind turbines and associated plant in the countryside will normally be permitted unless:

- (i.) It is detrimental to the character of a special landscape area; or
- (ii.) It causes unacceptable harm to the amenity of neighbouring residents.

Appendix B

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**Capacity and Load  
Factors**

## B1 Capacity Factor and Load Factor for Onshore Wind Technology

The installed generating capacity of a wind farm (i.e. the maximum possible generating capacity e.g. 30 MW) is not the same as actual generation. Technologies such as wind power are highly intermittent due to the natural fluctuations of wind speed and are not in operation all of the time. In order to calculate the actual amount of energy produced during a given period, a *Capacity Factor* must be applied.

The capacity factor is the ratio of the energy generated over an extended period, typically a year to take account of seasonal effects, compared to the energy that could have been generated if the plant had operated at full capacity the whole time. The capacity factor is normally applied to wind farm developments on a regional scale rather than an individual site basis. If there are any changes to the total installed capacity of wind farm developments across a region during the extended period, this must be taken into consideration and therefore a *Load Factor* is applied.

The calculation for both the Capacity Factor and Load Factor can be found below:

Capacity Factor	Electricity generated during the period [kWh] ÷ (Installed Capacity [kW] × Number of hours in the period [hours]) <sup>18</sup>
Load Factor	Electricity generated during the period [kWh] ÷ ((Installed capacity at beginning of the period [kW] + Installed Capacity at end of period [kW]) × 0.5 × Number of hours in the period [hours]) <sup>18</sup>

There are many reasons why energy generating plants operate at a capacity factor of less than 100%. For conventional plants this may include requirements for maintenance periods, faults or generation not being required from the plant due to variations in consumer demand. For wind generators specifically, the load/capacity factor provides a measure of the amount of electricity generated compared with what could be generated under ideal wind conditions.

For regional analysis, the capacity factor (i.e. the number of schemes in a region where the installed capacity has not changed over the extended period), is used<sup>19</sup>. In combination with the current installed capacity for onshore wind energy across a region, it is therefore possible to calculate the actual power generated on a yearly basis.

In view of the interest shown in such factors for onshore wind, average capacity factors are now reported regionally where the region contains three or more operational wind farms. In 2007, there were ten wind farm schemes in the North East with unchanged configurations relating to the installed capacity. These ten schemes produced an average capacity factor of 23.05%<sup>19</sup>. To put this figure into perspective, the regional onshore wind capacity factors in the UK ranged from 20.17-27.83%<sup>19</sup>.

<sup>18</sup> Energy Trends, DTI, March 2006 (pg. 28-32)

<sup>19</sup> Energy Trends, DTI, September 2008 (pg. 37-38)