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Welsh Assembly Government

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Research: Strategic Search Area (SSA) Reassessment and Validation

Research Report to the
Welsh Assembly Government
July 2010

Wales Planning Policy Development Programme

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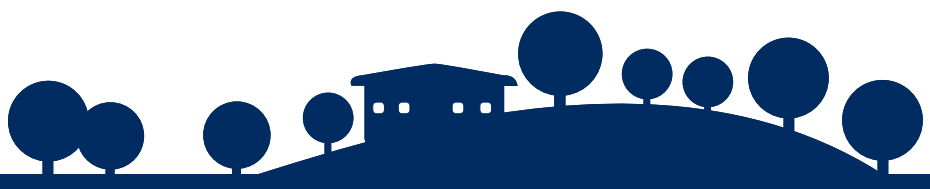

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Executive Summary

Arup were commissioned by the Welsh Assembly Government to undertake a study that would provide an evidence base to inform a revised planning policy framework for onshore wind development in and around the Strategic Search Areas (SSA). The study included the compilation of a database of all wind farms in the planning system (pre-application scoping through to submission), the development of a comprehensive GIS mapping system of all these projects and a cumulative project timeline for the deployment of all projects.

A total of 320.75MW installed capacity of onshore wind is currently (March 2010) in operation across Wales. Of this total, 173.55MW is currently in operation within the study area (i.e. SSAs and 5km buffer). Proposals for some 2300MW of onshore wind are currently under consideration in and around the SSAs, almost all since the publication of TAN 8 in July 2005. Of these projects, around 1950MW are located within an SSA and a further 350MW approx. of wind developments are located within 5km of an SSA.

The study has shown that based on knowledge of current project developments, there appears to be only the potential for around 300MW of additional development in and around (i.e. up to 5km) the SSAs. This figure takes into account known environmental and technical constraintsas far as has been possible to address in this study.

The study has also shown that around 2000MW of cumulative installed capacity should be possible by 2015-2017 under a *best case development scenario* from within and around the SSAs based on those known projects.

1 Introduction

1.1 Background and Aims

The UK faces a significant challenge in delivering a secure, affordable low and zero carbon energy supply. In the short term, the UK must meet a legally binding target of 15% of our energy consumption from renewable sources by 2020. The UK Renewable Energy Strategy (RES) anticipates a small contribution from transport fuels and renewable heat which highlights the importance of understanding and developing the renewable electricity resource available[1]. In March 2010, the Assembly Government published '*A Low Carbon Revolution - the Welsh Assembly Governments Energy Policy Statement'* which builds on the 2008 *Renewable Energy Route Map.* It indicates that Wales has the renewable potential able to produce at least twice as much electricity from renewable technologies by 2025 – with about 40% of this from marine wave and tidal, a third from wind, and the rest mainly from sustianble biomass (including waste, hydropower, and microgeneration.

In 2004, Arup produced a 'decision support tool' which identified strategic areas in Wales capable of accommodating large scale (>25MW) onshore wind farms. In total, 7 Strategic Search Areas (SSA) were adopted and outlined in *Technical Advice Note 8: Planning for Renewable Energy*[2] in July 2005, these had a total indicative capacity of 1120MW of onshore wind to accommodate a flexible target of 800MW proposed by the Welsh Assembly in contributing to national renewable electricity targets. Prior to the adoption of TAN 8, the technical basis behind the onshore wind energy aspects of Draft TAN 8 were extensively reviewed following wide consultation. Recommendations were also aimed towards local planning authorities (LPA) to undertake further assessment work to refine the SSAs to take account of local factors (TAN 8 Annex D).

Given the *One Wales*[3] agreement which contains a commitment to review TAN 8; in October 2009, Arup were commissioned by the Welsh Assembly Government to undertake a study that would provide an evidence base to inform a revised planning policy framework for onshore wind development in and around the Strategic Search Areas (SSA).

The study aims were to:

- Accurately monitor current progress towards the TAN 8 onshore wind targets set in 2005;
- Through the implementation of best practice, locate the remaining areas of land suitable for onshore wind farm development within (and 5km adjacent to)[4] each Strategic Search Area (SSA);
- Define the resource potential of the remaining areas of land for electricity generation through onshore wind development;
- Introduce a well-structured timeline to successfully develop the SSAs to full capacity, taking into account wind farm developments currently in operation and those in planning (pre-application scoping through to submission) as well as the impact of grid connection.

The contents of this report and its appendices represent the view of Arup and are not the policy of the Welsh Assembly Government.

[1] *The UK Renewable Energy Strategy, HM Government, 2009*
[2] *Technical Advice Note 8: Renewable Energy, Welsh Assembly Government, 2005*
[3] *One Wales – A Progressive Agenda for the Government of Wales, Welsh Assembly Government , 2007*
[4] *Added to brief following Progress Meeting (8th December 2009)*

1.2 Specific elements of the research

As outlined in the original Project Brief, there are five phases to the study.

i. Data collection and assimilation for Geographical Information Systems (GIS) analysis:
   (a) Information on existing wind farm developments in Wales;
   (b) Environmental constraints data; and
   (c) Technical constraints data.

ii. Spatial analysis of environmental and technical constraints adjacent to existing wind farm developments (operational through to planning).

iii. Digitisation of remaining areas of less constrained land suitable for wind farm development taking into account a varying range of residential buffers (500m-1000m).

iv. An assessment of the average installed capacity per unit area based on developments in the planning system (MW/km²).

v. Production of a project development timeline for individual SSAs in order to sufficiently determine full capacity based on existing wind farm developments.

vi. Production of a project development timeline for all wind farm developments within (and 5km adjacent to) each SSA.

vii. To provide comprehensive list of caveats and assumptions influencing the results of the study including advice on their likely implications on the remaining areas of identified land suitable for wind farm development.

1.3 Report Content and Structure

This report describes the findings of the work that has been undertaken on the above research elements. It forms a key part of the evidence base to inform any changes to the planning policy framework, however policy development does not form part of this contract. Whilst the information presented here is appropriate for a strategic level study at the national scale, it is not a sufficient basis for decisions about individual renewable energy proposals in Wales and it must not be used as such. Each wind farm application in Wales must be considered on its merits, including site-specific issues that are not appropriate for discussion in a national study such as this.

Chapter 2 Considers the three part methodology behind the study

Chapter 3 Reviews the existing status of wind farm project in Wales.

Chapter 4 Considers the delivery and project timescales associated with existing wind farm projects currently in planning in Wales.

Chapter 5 Identifies and quantifies the remaining areas of developable land as well as the constraints to the development of this land.

Chapter 6 Highlights the key conclusions and recommendations of the study.

2 Methodology and Data Management

This chapter can be considered in three parts. Firstly, there is a discussion of the methods used by the researchers in collecting the data which has informed the study. Secondly, this chapter sets out the different tasks that have been combined to fulfil the aims of the project. And finally, in combination with **Appendix A**, this chapter presents the methods and techniques used to generate and combine all datasets used as part of the study to cartographically identify and quantify the main results of the study.

2.1 Research Methods

This section briefly explains the methods used to collect the evidence that has informed the study. The primary results of this study rely upon existing information, and the consultant's professional view. It merges datasets from a range of sources in order to draw conclusions on wind development expected to generate across Wales and what might be possible in future.

The main research techniques used to inform the study have been:

- Internet research and Literature Review;
- Contact with Local Planning Officers;
- Contact with third party stakeholders;
- Contact with wind farm developers; and
- Consultation workshop presentation with BWEA Cymru Members[5].

This section describes these research techniques in more detail.

2.1.1 Review of Existing Literature and Studies

There are many existing policy initiatives and studies which are relevant to the consideration of onshore wind development in Wales. Together, these documents provide a solid basis for, and endorsement of, the development of wind farms in Wales:

National Planning Policy

- The Wales Spatial plan (2004) and the Wales Spatial Plan Update (2008);
- Planning Policy Wales (2002);
- Ministerial Interim Planning Policy Statement (MIPPS) Planning for Renewable Energy (2005);
- Technical Advice Note 8: Planning for Renewable Energy (2005);
- Renewable Energy Route Map for Wales (2008); and
- A Low Carbon Revolution – the Welsh Assembly Government Energy Policy Statement (2010)

Relevant Technical Studies and Guidance

- TAN 8: Annex D Local Refinement Studies (SSA A to G), Arup (2005-2007);
- Facilitating Planning for Renewable Energy in Wales: Meeting the target, Arup (2005);
- Energy Assessment of TAN 8 Wind Energy Strategic Search Areas, Garrad Hassan (2005); and
- ETSU-R-97 Noise Guidance for Onshore Wind Farms, DTI Working Group.

[5] *BWEA became Renewables UK in 2010*

2.1.2 Contact with external parties

The following local planning authorities were consulted to obtain information on levels of developer interest for onshore wind farms. The data requested included proposed site location/name, installed capacity (MW), state of application, any additional information on the proposed number of wind turbines, and the name of the agent/developer concerned:

- Powys County Council;
- Carmarthenshire County Council;
- Neath Port Talbot County Borough Council;
- Conwy County Council;
- Denbighshire County Council;
- Ceredigion County Council;
- Rhondda Cynon Taf County Borough Council;
- Bridgend County Borough Council; and
- Swansea City Council.

The following governmental/non-governmental organisations were consulted to obtain up to date environmental and technical constraints datasets to inform the GIS spatial analysis:

- Ministry of Defence (MoD);
- Forestry Commission Wales (FCW);
- Royal Society for the Protection of Birds (RSPB);
- National Grid;
- British Wind Energy Association (BWEA) Cymru Members;
- Countryside Council for Wales (CCW); and
- Cadw Wales.

2.1.3 BWEA Cymru Members Presentation

Arup delivered a presentation to BWEA Cymru Members on January 12th 2010 in order to:

- Make members aware of the study (for those which had not already been in contact with Arup);
- Present draft results from the study;
- Determine whether the members generally agreed with the methodology and draft outcomes of the study; and
- Comment on the major issues which should be considered in taking the study forward

A summary of the main points raised at the presentation as well as a copy of the PowerPoint presentation can be found in **Appendix F**.

2.2 Data Management

2.2.1 Developer Interest Late 2009/Early 2010

A developer interest database was compiled by the Welsh Assembly in June 2009. Arup obtained updates on current application status and any additional information on planned developments through each of the Local Planning Authorities whose boundaries intersect any part of an SSA and the 5km region adjacent to each SSA.

Note: **5km buffer to SSAs in Wales**. The main text of TAN 8 makes no reference to any buffer zone around the SSAs. However in Annex D '*Methodology for Local Planning Authorities with Strategic Search Areas*, paragraph 2.2 indicates for an assessment of possible technically feasible areas "*An overall study area of some 5km radius from the margins of each SSA is recommended to allow consideration of technically feasible areas for possible wind turbines*".

The 5km buffer has been used in all seven of the local refinement studies commissioned by the appropriate local authorities in Wales when revising the nationally published TAN 8 boundaries for use in their plan preparation and development control activities.

Whilst the 5km buffer has no formal status, its use by the local authorities has encouraged developers to push forward with projects within this distance of the SSAs; especially in areas where the local authority refinement studies have indicated that there may be environmental merits in including selected areas currently out with the SSAs,

The majority of the local authority local refinements studies carried out by consultants have not been given any significant weight in the planning system e.g. by inclusion in supplementary planning guidance. This study has therefore gathered data on all projects within 5km of the TAN 8 SSA boundaries, regardless of local refinement exercises.

The data (on current application status and any additional information on planned developments) was compiled in the form of an updateable spreadsheet and represents the relative state of planning applications and the potential contribution to national targets. Information within the spreadsheet can be broken down to identify the total installed capacity of all developments in Wales for each allocated stage of the planning process. This information can also be used identify which developments fall within an SSA, within 5km of an SSA, sites located elsewhere in Wales, sites which do not yet have spatial recognition, and those sites which have not been included in the study.

The allocated stage of the planning process identified for each development site considered within the study is broken down as follows:

- Pre-application ad-hoc (undetermined due to early stage of application);
- Pre-application scoping (under the Town and Country Planning Act, 1990);
- Infrastructure Planning Commission (IPC) Pre-application (under the Electricity Act, 1989);
- Application lodged (under the Town and Country Planning Act, 1990, and/or the Electricity Act, 1989);
- Consented (date provided if known); and
- Operational.

Note: From April 1st 2010, new developments with a capacity greater than 50MW are subject to consent under the Infrastructure Planning Commission (previously Section 36) and remain undetermined. A short note on the role of the IPC and the planning process involved in consenting what are considered Nationally Significant Projects can be found in **Appendix B**.

The allocated stage of the planning process identified for each development site not considered within the study is broken down as follows:

- Refused – Following Appeal (date provided if known);
- Refused – Appeal lodged (under the Town and Country Planning Act, 1990);
- Refused – Withdrawn before appeal; and
- Superseded.

2.2.2 Geographical Information Systems (GIS) Datasets

The development of the GIS used during the study and a detailed description of the way the data was collated and analysed in the GIS can be found in **Appendix A**. Arup was responsible for identifying what factors to consider within the study, mapping each relevant dataset, and undertaking several pieces of analysis to verify the aims of the study.

Data to inform the study was kindly provided by the Cartographic Unit in the Welsh Assembly Government and through third party stakeholders as set out in Section 2.1.2.

2.3 Research Tasks

Several different task elements have been combined in order to meet the aims of this study. Some – such as acknowledging developer interest – have to be considered iteratively, while others have been undertaken in sequence. As a result, there are three main research tasks which have been carried out on the SSAs and their 5km buffers, as part of the study:

- **Task A** – Identifying the remaining areas of developable land;
- **Task B** – Quantifying the remaining areas of developable land; and
- **Task C** – Developing project timelines for each SSA+5km buffer.

These are discussed in more detail in this section.

2.3.1 (Task A) Identifying the Remaining Areas of Developable Land

The principal method used for this stage in the study has been a GIS constraints mapping exercise. Building on previous studies carried out as an evidence base for TAN 8 (and similar elsewhere in the UK); a series of environmental and technical constraints were mapped. The constraints were divided into two categories: 'Absolute' constraints and 'Secondary' constraints.

Absolute Constraints: Are defined as those which, for all intent and purposes (at the all Wales level), would be likely to prevent large-scale wind energy developments.

Secondary Constraints: Are defined as those which are likely to inhibit the development of large wind energy developments but for which there is either (a) some variability/uncertainty in their spatial extent or (b) the possibility to develop within the area concerned but with appropriate mitigation.

The constraints considered within this study are discussed in further detail in **Appendix A**. The GIS constraints model and the two categories of data used to identify areas of remaining developable land provide a valuable tool for assessing the remaining installed capacity of Wales for the development of onshore wind in line with current/future targets.

In the same GIS model, the spatial extent (Consultation or Application Boundary) of each wind farm development in the planning process and/or operational was included. This information was assembled through Local Planning Authorities and individual Developers and is available within the public domain. **No wind farm development information has been included within the study that cannot be obtained through public sources**.

The methodology to identify the remaining areas of developable land follows **two broad stages** (i.e. **A1**, **A2**).

A1. The **first stage** comprises a traditional 'sieve analyses' of spatial constraints (both environmental and technical). These are constraints to the development of onshore wind energy developments in Wales that are capable of being mapped and are available digitally for use in a GIS.

To represent Stage 1, a map has been produced for each SSA (and adjacent 5km zone) that indicates the spatial distribution of cumulative environmental constraints to large-scale wind energy development in Wales. Each area of developable land identified by Arup was viewed with the Ordnance Survey 1:25,000 map as a backdrop. The Stage 1 maps can be found in **Appendix C**.

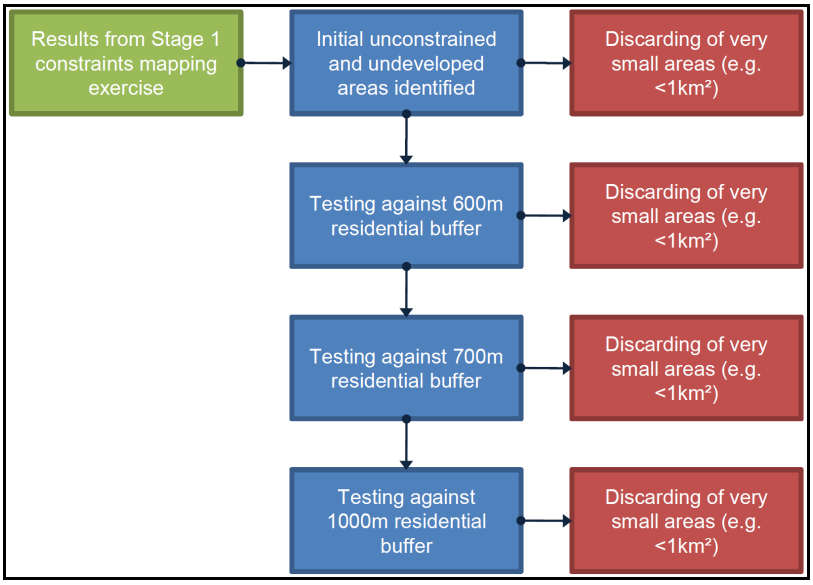
Note: Separation Distances
Phase 4 of the tender brief indicates that areas of outstanding capacities identified through the constraints exercise should be *tested against the possible introduction of a policy to establish minimum separation distances (buffer zones) between the TAN 8 SSAs and neighbouring settlements*. *These capacities should be tested against a variety of thresholds of separation*. In-line with best practice at the project level for wind farm development in Wales, Arup have selected buffer distances of **500m**, **600m**, **700m**, and **1000m**, to test the outstanding capacities against. A 2km residential buffer has not been included as part of the study, this is because a 2km buffer would rule out the possibility of any further development within and 5km around the SSAs. This is discussed further in **Chapter 6**.

A2. The **second stage** represents a refinement of the relatively unconstrained areas that emerged from the sieve analysis and are not already recognised development areas. Experience gained during similar work suggests that any estimates of unconstrained land area remaining is likely to be an overestimate of the potential land available, therefore further refinement must be undertaken. The approach taken for this exercise is set out in **Figure 2.1**.

To represent Stage 2, a map has been produced for each SSA (and adjacent 5km zone) that indicates areas of less constrained and undeveloped land for a variety of residential separation distances. Each area of developable land identified by Arup was viewed with the Ordnance Survey 1:25,000 map as a backdrop. Any area of outstanding capacity less than 1km^2 has been discounted (Areas <1km^2 are highly unlikely to give rise to the 'large-scale' wind farm projects anticipated by TAN 8 and may not lend themselves to any form of commercial development). All maps are presented in **Appendix D**.

Note: Grid Connection
The original study for TAN 8, *Facilitating Planning for Renewable Energy in Wales: Meeting the Target*, carried out by Arup, broadly considered the limitations of grid connection to the *national electricity transmission network*[6] and *local distribution networks (LDN)*[7] in Wales for wind farm developments. The principal constraints relating to grid connection have been considered within **Section 2.3.3**.

Figure 2.1 – Refinement of remaining areas of undeveloped land



[6] *The National Grid connects North and South Wales to the English network and further afield. There is no National Grid connection directly between North and South Wales.*
[7] *The Local Distribution Network (LDN) transmits power from the National Grid to consumers. This local grid tends to reflect the population density of the area it supplies.*

2.3.2 (Task B) Quantifying the Remaining Areas of Developable Land

In order to assist in the quantification of the remaining capacities of each SSA and the adjacent 5km area, a exercise was undertaken to identify an average installed capacity (MW) representative of future wind farm developments within Wales.

To determine the average installed capacity of any given spatial area (>1km^2) identified as undeveloped within the study area, up to date information on the installed capacity per unit area (**MW/km^2**) of current wind farm developments in Wales must be acquired. For this study, 40 wind farm developments were selected and the installed capacity (MW) per given area (km^2) was calculated.

Note: Wind Turbine Distancing
Wind turbines typically need to be positioned so that the spacing between them represents a compromise between compactness, which minimises land required, and the need for adequate separations to lessen energy loss through wind shadowing from upstream machines. Spacing is typically defined by the rotor diameter spacing for wind farm modelling i.e. 3 x rotor diameter facing wind, 2 x rotor diameter perpendicular to wind.

With regards to the unit by which the additional areas of outstanding capacity will be measured, the current TAN 8 onshore wind targets concentrate on installed capacity (MW) as apposed to energy yield (GWh), therefore the remaining capacity will be presented in the same format.

2.3.3 (Task C) Project Development Timeline

In line with the tender brief, a timeline representing full capacity development of each SSA - taking into account all wind farm developments currently in planning has been produced.

For wind farm developments currently in operation, information has been extracted from the British Wind Energy Association (BWEA)[8] website. For wind farm developments currently in planning, specific dates regarding pre-application scoping reports and planning submissions have been taken from various sources including Local Authority and developer websites.

Given the varying stages of development and the level of information available for different projects, a time-based step-by-step approach typically involved in the development of wind farm site has been assumed:

- **Pre-application Environmental Impact Assessment studies and Environmental Statement preparation and subsequent submittal of application**: 1 Year
- **Planning consent determination period (Local Authority)**: This could be 4-18 months depending on response of determining authority and completeness of application. For those planning applications not yet submitted, 4 months has been assumed based on a complete application and swift response of the planning authority.

  Note: This assumes no public inquiries (singularly or in combination).

  Or

- **Planning consent determination period (Infrastructure Planning Commission (IPC) i.e. +50MW)**:-
  IPC Acceptance Stage: 1 month
  IPC Pre-examination Stage: 3 months
  IPC Examination Stage: 6 months
  IPC Decision: 2 months

  Note: This is still a new and untested process.

- **Discharge of any conditions agreed**: 6 months
- **Order and delivery of turbines/construction of all turbines and rest of wind farm infrastructure including grid connection**: -

[8] *http://www.bwea.com/ukwed/operational.asp*

Installed Capacity (0-25MW Scheme): 12 months
Installed Capacity (25-50MW Scheme): 24 months
Installed Capacity (50-100MW Scheme): 36 months
Installed Capacity (+100MW Scheme): 48 months

Note: Incremental phasing and generation from the larger schemes has been discounted at this stage; timelines represent the worse-case.

The development of each individual wind farm project within each SSA (and adjacent 5km zone) will be presented on a timetable which has allocated a time period for each stage of the development process (as discussed above). In turn, this will identify an estimated date of operation. Information for each SSA will be combined to present an overview of expected development in Wales 2010-2020 and beyond.

3 Onshore Wind in Wales

3.1 Results

As discussed in Chapter 3, in order to determine the developer interest across Wales for development sites located within each SSA and 5km outside of it, a number of sources (including Local Authorities and Developers) were contacted for information[9]. **Figure 3.1** and **Table 3.1** present the results of the exercise. It shows the potentially significant contribution which may be made by large scale wind farm developments, and additionally the number of applications in the system.

Through discussions with wind farm developers throughout the study and Arup experience from the technical design work, one consideration for the installed capacity of existing schemes at Pre-application Scoping is that this stated project capacity may be lower following detailed technical studies (including noise, landscape and visual, and cultural heritage) which can alter the feasible area of development.

Figure 3.1 – Status of wind farm planning applications/interest and wind farms in operation

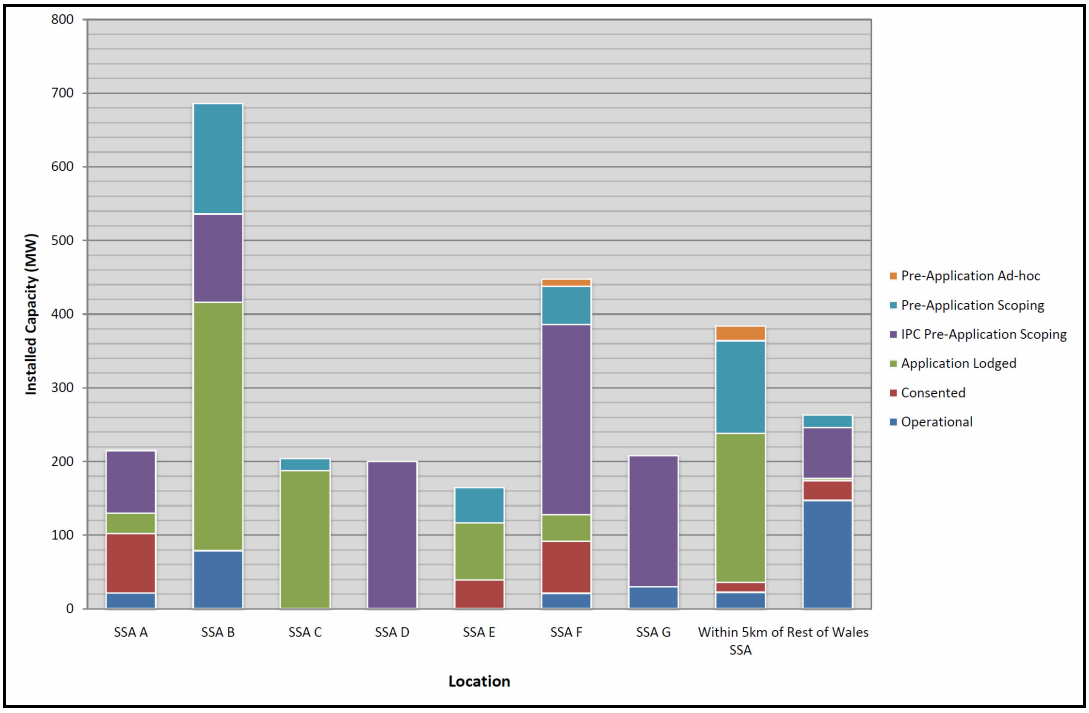


Table 3.1 - Status of wind farm planning applications/interest and wind farms in operation (*as of March 2010*)

Location	Operational	Consented	Application Lodged	IPC Pre-Application Scoping	Pre-Application Scoping	Pre-Application Ad-hoc	**Total**
SSA A	21.25	81	27.5	85	0	0	**214.75**
SSA B	78.95	0	337	120	150	0	**685.95**
SSA C	0	0	187.7	0	16.1	0	**203.8**
SSA D	0	0	0	170	0	0	**170**
SSA E	0	39	77.5	0	48.3	0	**164.8**
SSA F	21	70.9	36	258	52	10	**447.9**
SSA G	30	0	0	178	0	0	**208**
Within 5km of SSA	22.35	13.35	202.3	0	125.9	20	**383.9**
Rest of Wales	147.2	26.9	2.95	69	17	0	**263.05**

[9] *Note: Data requested included – the name of the project, the developer, the number and size of turbines, the installed capacity/potential output of the scheme, the planning status of the scheme, the name of the host authority, and any spatial information (e.g. development boundary) which can be provided.*

3.2 Discussion

The key conclusions regarding existing developer interest information are highlighted below:

- Baseline situation - a total of **320.75MW** installed capacity of onshore wind is currently (March 2010) in operation across Wales. Of this total, **173.55MW** is currently in operation within the study area (i.e. SSAs and 5km buffer);
- Forthcoming developments – Proposals for some **2306MW** are currently under consideration in and around the SSAs, almost all since the publication of TAN 8 in July 2005. This is significantly in excess of the 2010 target of 800MW. Of these projects, a total of **1944MW** of wind farm developments (consenting through to pre-application ad-hoc) are located within an SSA; and a further **362MW** of wind farm developments (consenting through to pre-application ad-hoc) are located within 5km of an SSA.

  It should be noted developers have been working together on schemes which are adjacent to each other in order to prevent cumulative issues, however cumulative issues, especially noise, landscape and ecological issues, may progressively affect the planning success of the last schemes to be determined (this is further discussed in *Section 4.4*);

- Of the forthcoming developments (within the SSAs and 5km around the SSAs), a total of **204MW** have been consented, a total of **868MW** of wind farm applications have been lodged but are yet to receive a decision, and a total of **811MW** have chosen to submit their application through the IPC[10];
- Developer interest within 5km of the SSAs is fairly substantial (**16%** of all wind farm developments), given many of these projects could be argued to be at greater planning risk under the current policy regime than those within the TAN 8 SSAs; and
- Across the rest of Wales, approximately **116MW** are currently in the planning system (consented through to pre-application ad-hoc).

Up to date tables for each wind farm development considered within the study can be found in **Appendix H**. This includes a list of developments which were not considered within the study, and those which could not be located given the early status of development.

From **Figure 4.1**, it can be seen that there is a skewed distribution of wind farm developments between the SSAs, in part reflecting the differential areas of the TAN 8 SSAs as defined. There is a heavy reliance on SSA B (Carno North) and SSA F (Coed Morgannwg) to deliver approx. **45%** of all wind farm developments coming forward.

3.3 Development Control in Local Authorities

As discussed in Section 4.2, **811MW (39%)** of forthcoming wind farm projects are submitting their planning application through the IPC. Therefore, the remaining **1290MW (61%)** of forthcoming wind farm projects (including those which have already been lodged) will require a decision from the relevant Local Authorities with support from stakeholders and the Welsh Assembly. A breakdown of within the boundaries of which Local Authorities these decisions will lie can be found in **Table 3.2**.

[10] *A timetable of all IPC Planning Applications can be found at: http://infrastructure.independent.gov.uk/?page_id=202*

Table 3.2 – Projects expected to require Local Authority decision

Local Authority	No. of Projects	Installed Capacity (MW)	% of Forthcoming Developments (MW)
Conwy County Borough Council	2	77.4	3.5%
Powys County Council	20	915.3	44%
Neath Port Talbot Country Borough Council	9	167.3	8%
Swansea City Council	1	47.5	2%
Rhondda Cynon Taff County Borough Council	1	36	1.5%
Carmarthenshire County Council	2	46.8	2%
Total	**35**	**1290**	**61%**

It is evident from **Table 3.2** that the majority of expected projects will fall in Powys County Council and Neath Port Talbot County Borough Council. Both will share approximately 52% of all wind farm application decisions within and 5kms around SSAs.

3.4 Technical Constraints on Forthcoming Developments

The planning success of forthcoming developments adjacent to each other will sometimes rely on constructive communication and joint working between developers in order to avoid any negative cumulative impacts on the surrounding landscape and surrounding receptors (i.e. residential properties and ecological habitats/species).

From a technical perspective, **cumulative noise** and **wind array loss** can have a detrimental effect on the energy output of a development depending on the location and size of the wind turbines.

3.4.1 Wind Array Loss

Wind Array Loss refers to the reduction in energy output for a wind farm as a consequence of another wind farm in close vicinity. Depending on the positioning of each turbine and wind direction, if two turbines are functioning within the same wind catchment, the efficiency of one turbine may fall as a result. The study has not considered the individual wind turbine locations for each wind farm scheme and therefore is not in a position to quantify the impact of wind array loss between adjacent schemes. Considerable consultation with wind farm developers controlling the relevant schemes would also be required in order to understand where array loss may become an issue.

3.4.2 Cumulative Noise

Noise limits should be set relative to the background noise at the nearest noise-sensitive properties. The limits should reflect the variation in both turbine source noise and background noise with wind speed. A cumulative assessment considers the impact of noise from several wind farms to realise the absolute noise limits to local receptors, and if a noise limit exceedance beyond ETSU-R-97 occurs, controlling turbine noise levels with minimal impact on energy generation may be suggested. Noise receptors are subject to a maximum noise limit; noise receptors located between developments are therefore susceptible to a cumulative exceedance of noise limits without communication between developers. Therefore, a fair apportionment of noise limits between developments must be agreed in order for both schemes to successfully reach planning consent.

As with wind array loss, without considerable consultation with wind farm developers, it is not possible to make a professional judgement on whether cumulative noise considerations will impact the total installed capacity at forthcoming developments. However, it is clear from **Appendix C** that the greatest potential for cumulative noise and wind array issues will occur in SSA B, C, and D.

4 Wind Farm Deployment

This chapter represents the background context and results of **Task C i.e. Project development timeline**. The timescales for delivery of each individual wind farm within the study area have been estimated, and the short, medium, and long term national delivery calculated. It should be noted that the remaining areas of developable land have not been considered within this chapter.

4.1 Deployment issues

4.1.1 Planning

Despite the large number of wind farm projects that appear to be 'in the planning system' (i.e. Scoping Stage or Application Submission) at the time of writing this report[11], the level of decision making in recent years has remained low.

As part of TAN 8 Annex D, planning authorities were able to conduct refinement exercises within each of the SSAs as a means to *guide and optimise development within each of the areas*. However, in practice; this has contributed to planning delays whilst these refinement exercises are carried out as; a) developers have been keen to await refinement outcomes before submittal of their projects, and b) local authorities have been keen to complete and endorse the refinement studies prior to determining applications.

There is also strain on planning stakeholders (councils, statutory consultees, and government) who are targeted to provide advice both to developers in their technical assessments, local authorities on the screening and planning application process, and provide evidence at public inquiries. In response to this, the Welsh Assembly Government has been providing financial resources to local planning authorities over the last two years for dealing with large wind farm applications (+50MW).

4.1.2 Transport Networks

The quantity and close positioning of wind farm applications across Wales has raised concerns between stakeholders, members of the public and developers in respect of the number and frequency of abnormal load transport movements which are required for simultaneous construction. In particular, the effects of this are likely to be most apparent in Mid-Wales where majority of projects will await a significant grid reinforcement project (see below).

Following the BWEA presentation and voluntary information from developers, it is clear that all parties are working to resolve these concerns including a BWEA Cymru Transport sub-group, the Welsh Assembly Government, the Mid-Wales Trunk Road Agency, and police authorities. An assessment tool to manage these impacts has been commissioned in order for the authorities to determine the scheduling of transport movements[12].

4.1.3 Grid Network

In SSAs B, C, and D, the majority of developments (i.e. those which have not been given consent to connect directly to the Local Distribution Network (LDN)) may be constrained by the mid-Wales National Grid infrastructure which at present does not contain capacity for large scale wind developments. Improvements to the grid are due to be ready by 2015 at the earliest[13].

[11] Approx. 1950MW (within the SSAs) and 350MW (within 5km of the SSAs)
[12] Wind Energy in Wales – State of the Industry (Report by BWEA Cymru), 16th July 2009
[13] *New Transmission Line to mid Wales, National Grid, Presentation at BWEA Cymru, July 2009 (www.taplondon.co.uk/bweawales/.../BWEA%20Cymru09%20National%20Grid%20Presentation.pdf)*

Those which are due to be connected directly to the LDN include:

- Mynydd Clogau (SSA B);
- Garreg Llwyd (SSA C);
- Llandinam P&L (Extension and Repowering) (SSA C); and
- Tirgwynt (SSA B).

4.1.4 Planning Appeals

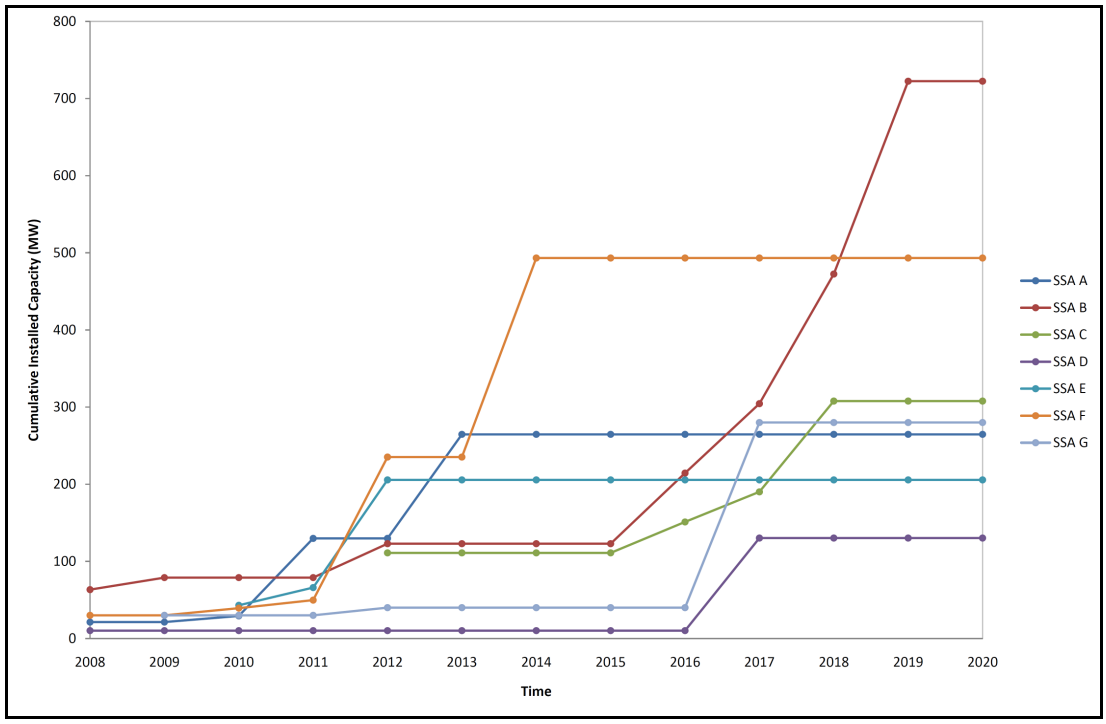
Wind farm developments which do not fall under the IPC criteria (i.e. under 50MW), and as such submit their planning application to a Local Authority, could trigger planning appeals which could further delay the development process. As discussed in the note on the IPC (**Appendix B**), public consultation through the IPC is dealt with separately commissioners and an oral hearing.

4.2 Timelines for Delivery

A number of assumptions have been made to determine the likely timescales for wind farm delivery, based on some of the deployment issues described above. In timescale formulation for each SSA project, it has been assumed that all construction takes place at the first available opportunity i.e. cumulative transport issues will have been resolved and are not considered to constrain deployment.

Forecasts for delivery in each SSAs (and 5km surrounding region) can be found in **Appendix E**. **Figure 4.1** indicates the cumulative installed capacity of wind farm development within each of the SSAs 2008-2020.

Figure 4.1 – Wind farm development timeline (2008-2020)



Current statistics indicate that since TAN 8 was published in July 2005 approx. 101MW of installed capacity from onshore wind has been consented in Wales. This does not take into account refusals, public inquiry, or any uncertainties regarding the IPC planning route. Beyond 2013, it is anticipated that all applications in the public domain will be operational by 2020, this equates to approx. 2400MW.

5 Remaining Land Suitable for Wind Farm Development

5.1 Overview

The GIS established for this research project, as discussed in **Chapter 2** has been utilised to determine areas of land suitable for wind farm development (within the SSAs and 5km buffer) which are not environmentally or technically constrained and have not yet been leased to wind farm developers to the best of the study team's knowledge. The results of this exercise are summarised in **Section 5.2** (**Part A**) below; supporting figures can be found in **Appendix D**.

However including some of the technically or environmentally constrained land as potentially developable would be misleading due to a number of additional factors which are considered unmappable, and in many cases, unquantifiable. Discussion and likely impacts of these caveats can be found in **Section 5.3** (**Part B**) below.

5.2 Part A: Outstanding land for wind farm development

5.2.1 Constraints Mapping

A cumulative assessment of the land take impact of individual absolute technical and environmental constraints within each SSA and its associated 5km buffer has been undertaken using a GIS. The blue colour and transparency used to indicate areas with a single constraint remains consistent throughout; hence darker blue shading indicates a greater number of constraints are acting on the specific area of land. Conversely, lighter blue shading signifies the presence of fewer absolute constraints.

Secondary constraints are shown with a blue cross-hatch symbol overlying the absolute constraint data. White areas are those that remain completely unconstrained with respect to the constraints defined for the purposes of this exercise.

The results of the constraints exercise for each SSA and 5km buffer are shown in **Appendix C** and this represents **Part A1** of the analysis. The major land use planning constraint recognised in the study is the residential buffer (500-1000m). For the purposes of the constraints mapping exercise, a buffer of 500m has been applied to the figures. The impact of a larger residential buffer is analysed in **Section 5.2.2.**

5.2.2 Identification of remaining areas of outstanding capacity

The potentially developable capacity of an SSA for wind farms can be established by totalling up the number of white 'less constrained' and undeveloped areas (>1km^2) present within the SSA and 5km buffer as shown on the constraints maps. The impacts of varying residential buffers have been considered at this stage and are reflected within the results.

Areas identified as less constrained and undeveloped for each SSA and 5km buffer are shown in **Appendix D**. The quantitative results of this exercise are shown in **Table 5.1**. For clarity, the numbers of least constrained grid squares within and outside of the SSA have been counted.

The total land potentially available for further development **within** all SSAs ranges **64-192km^2**. The total land available for further development **outside** all SSAs but within 5km ranges **36-107km^2**. Therefore, in **total**, **99-299km^2** of land is potentially available for further wind farm development depending on the residential buffer distance.

Individually, SSAs B, D, and F all contain above 20km^2 of land available for further development with a 1000m residential buffer suggesting real project opportunities. It is clear however, that for all figures, the majority of the areas of outstanding capacity are extremely spatially fragmented. One assumption which can be drawn from this is that many of the preferred areas for development have been taken, those areas left may be subject to local constraints (e.g. access, landowner issues) or the cumulative effects of developments already in planning/operation. These issues have been considered in more detail in **Section 5.3**.

Table 5.1 – Outstanding capacities within each SSA and 5km buffer

	Residential Buffer	Within SSA		Outside SSA		Total	
		No. of coherent blocks of least constrained land	Total Land Area (km^2)	No. of coherent blocks of least constrained land	Total Land Area (km^2)	No. of coherent blocks of least constrained land	Total Land Area (km^2)
SSA A	500m	5	28.27	3	6.94	8	35.21
	600m	6	20.54	2	4.79	8	25.33
	700m	5	12.61	1	3.15	6	15.76
	1000m	2	4.11	1	1.17	3	5.28
SSA B	500m	8	39.71	3	15	11	54.71
	600m	8	32.02	3	13.71	11	45.73
	700m	7	24.73	2	11.14	9	35.87
	1000m	5	10.15	2	8.85	7	19.00
SSA C	500m	4	32.75	6	33.73	10	66.48
	600m	6	25.84	5	21.79	11	47.63
	700m	4	13.07	4	20.89	8	33.96
	1000m	1	2.82	2	11.39	3	14.21
SSA D	500m	3	23.89	4	19.3	7	43.19
	600m	3	21.71	3	16.24	6	37.95
	700m	3	14.58	3	19.91	6	34.49
	1000m	3	17.21	3	9.82	6	27.03
SSA E	500m	3	12.45	3	7.42	6	19.87
	600m	4	13.47	2	3.02	6	16.49
	700m	3	10.68	1	1.26	4	11.94
	1000m	2	5.69	0	0	2	5.69
SSA F	500m	8	45.99	2	13.46	10	59.45
	600m	8	41.55	3	12.12	11	53.67
	700m	9	36.89	3	10.53	12	47.42
	1000m	7	22.23	2	4.4	9	26.63
SSA G	500m	1	9.39	4	11.13	5	20.52
	600m	2	7.44	2	5.87	4	13.31
	700m	2	5.61	1	1.83	3	7.44
	1000m	1	1.29	0	0	1	1.29
Total	**500m**	**32**	**192**	**25**	**107**	**57**	**299**
	600m	**37**	**163**	**20**	**78**	**57**	**240**
	700m	**33**	**118**	**15**	**69**	**48**	**187**
	1000m	**21**	**64**	**10**	**36**	**31**	**99**

5.2.3 Quantifying the Outstanding Capacities

In deriving the remaining/outstanding capacity totals for each SSA and 5km buffer, the assumption is made that all potential areas are developed and that each area duly accommodates the maximum number of turbines achievable (an unlikely scenario in reality). At this stage a 'theoretical' maximum installed capacity for each SSA and 5km buffer at varying residential buffer distances is presented.

As a rule of thumb, the potential installed capacity of each $1km^2$ area of less constrained and undeveloped land is taken as being an **$8.5MW/km^2$**. Further justification for this figure is included in **Appendix G**. It should be noted that this figure lies towards the upper limit of average installed capacity per unit area for Welsh wind farms.

In some cases, the installed capacity would be less per unit due to the presence of a range of site specific constraints which cannot be considered in a study of this scale. Taking into account the range of theoretical total area (km^2) available for further development and the average installed capacity (MW/km^2), the analysis reveals an estimated *additional* total capacity range of **843MW-2545WW** for all SSAs and 5km buffers. Results for all SSAs and 5km buffers are shown in Table 5.2.

Table 5.2 – Estimated additional capacities (MW) of each SSA and 5km buffer

	Residential Buffer	Within Strategic Search Area	Outside Strategic Search Area	Total
		Remaining Capacity (MW)	Remaining Capacity (MW)	Remaining Capacity (MW)
SSA A	500m	240.30	58.99	299.29
	600m	174.59	40.72	215.31
	700m	107.19	26.78	133.96
	1000m	34.94	9.95	44.88
SSA B	500m	337.54	127.50	465.04
	600m	272.17	116.54	388.71
	700m	210.21	94.69	304.90
	1000m	86.28	75.23	161.50
SSA C	500m	278.38	286.71	565.08
	600m	219.64	185.22	404.86
	700m	111.10	177.57	288.66
	1000m	23.97	96.82	120.79
SSA D	500m	203.07	164.05	367.12
	600m	184.54	138.04	322.58
	700m	123.93	169.24	293.17
	1000m	146.29	83.47	229.76
SSA E	500m	105.83	63.07	168.90
	600m	114.50	25.67	140.17
	700m	90.78	10.71	101.49
	1000m	48.37	0.00	48.37
SSA F	500m	390.92	114.41	505.33
	600m	353.18	103.02	456.20
	700m	313.57	89.51	403.07
	1000m	188.96	37.40	226.36
SSA G	500m	79.82	94.61	174.42
	600m	63.24	49.90	113.14
	700m	47.69	15.56	63.24
	1000m	10.97	0.00	10.97
Total	**500m**	**1636**	**909**	**2545**
	600m	**1382**	**659**	**2041**
	700m	**1004**	**584**	**1588**
	1000m	**540**	**303**	**843**

Further constraints and their likely impacts are discussed further in **Section 5.3** which follows.

5.3 Part B: Further project constraints and their likely impacts

In addition to the strategic environmental and technical constraints analysed to determine the theoretical outstanding capacities, there are other issues which will undoubtedly have an influence on the appropriate location and scale of further wind turbine development in and around the SSAs. This section will look at both the issues which directly impact the outstanding capacities to determine a more realistic figure, and the indirect issues which will not influence the outstanding capacities immediately but are issues which should be considered looking forward.

5.3.1 Further constraints directly influencing outstanding capacity

Table 5.3 outlines the key caveats and assumption which have not been included within the study to date but are likely to directly impact upon the remaining outstanding capacity resource.

Table 5.3 – Direct impacts on outstanding capacity

Caveat	Comments and Assumptions
Residential Buffer / Noise Assessment	The cumulative/individual effect of noise from wind turbines on residential properties is a key constraint to wind farm developments. The Welsh Assembly have made it clear from the brief that a variety of residential buffers must be considered as part of the study and the results of which can be seen in Table 4.1 and 4.2 on land area and installed capacity. TAN 8 (2005) Annex D suggests that *'data should be buffered by 500m….some flexibility is advised'*. At a presentation to BWEA Cymru Members in January 2010, it was agreed that due to recent public inquiries, the use of larger modern turbines in developments, and the effects of cumulative noise, 700m should be considered as a MINIMUM for 'large-scale' wind farm developments (e.g. typically greater than 25MW) in this strategic exercise. In some SSAs, given the complications of existing applications and the potential cumulative impact on outstanding capacities, 700m still remains an optimistic separation distance but will present the minimum buffer as part of this study. 700m is not suggested as a new planning criterion or policy for use in development control or forward planning. Suitable separation distances would have to be determined on their merits.
Planning success of existing and future applications	The local planning system has been subject to a large number of applications in the past 5 years, Developers submitted a total of 24 wind applications in the period July 2005-July 2009, of which there were 8 refusals (33%)[14]. Of those refusals, 3 applications (*Gorsedd Bran, Hirwaun, and Glyncorrwg*) were situated within an SSA. Taking into account the current refusal rate, a conservative **25% refusal rate (upheld at appeal)** on all outstanding capacity areas identified will be applied. This figure assumes that many of the larger schemes, anticipated to submit their planning applications through the IPC, will be approved.

[14] *Wind farm refusals: Gorsedd Bran (2009), Merthyr Common (2009), Mynydd James (2009), Blaen Bowi (2009), Hirwaun (2008), Glyncorrwg (2007), Clun Felin (2006), and Rhos Garn (2006). Nant Bach was also refused (2006) but has since altered its design and has been consented, therefore has not been included.*

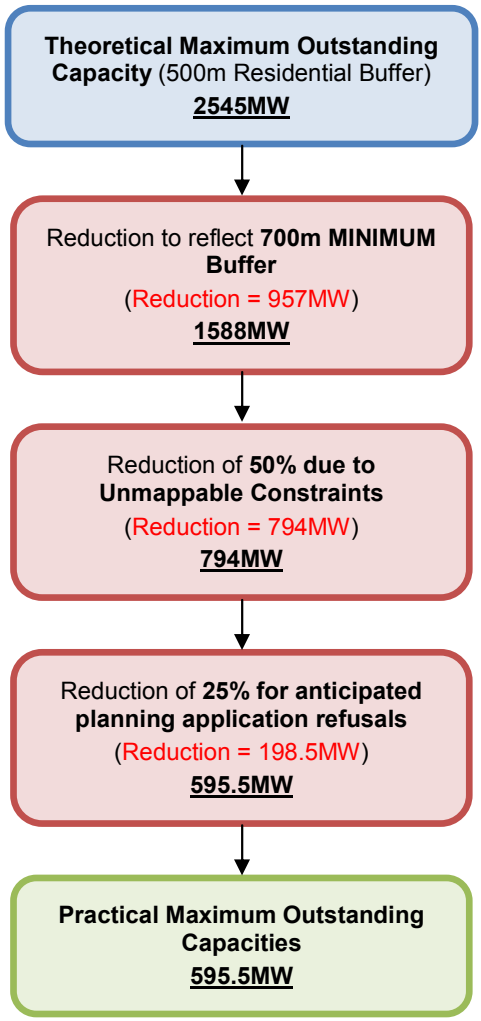
Caveat	Comments and Assumptions
Unmappable Constraints	A number of detailed issues at the local level which are not appropriate to address individually for a national scale study, but may inhibit development coming forward at all, or the capacities of projects, are listed below. • Habitat Regulation Assessments at project scale; • Protected Species; • Geology and hydrological features (above and below ground); • Local wind conditions (e.g. localised turbulence); • Telecommunications; • Utilities and services (e.g. gas and electricity mains); • Shadow flicker; • Archaeological and cultural heritage features; • Historic landscapes; • Transport access for turbine installation; • Bridleways and public rights of way; • Landowner refusal to sign development leases; • LANDMAP[15]; • Areas allocated for habitat management; and • Biodiversity and habitat mosaics especially peat and peaty soils. In previous studies carried out by Arup[16], the impact of these issues has been assumed to represent a **50% reduction** of the theoretical maximum resource. In the absence of other data this reduction is taken forward as part of the study.

Taking into account the quantifiable reductions as shown in Table 5.3, it is possible to determine a 'practical' scenario for the outstanding capacities identified during the study. The method of reaching this 'practical' scenario is shown in **Figure 5.1**.

[15] *LANDMAP (Landscape Assessment and the Decision Making Process) is the adopted methodology for landscape assessment in Wales. All environmental assessments in Wales are expected to include LANDMAP in their consideration of landscape. Landscape evaluation and capacity plays a significant part in appraising areas for potential new wind farm development. LANDMAP is a GIS based landscape resource where landscape characteristics, qualities and influences on the landscape are recorded and evaluated into a nationally consistent data set. Although LANDMAP is an essential local landscape consideration for wind farm development, it has not been possible to quantify the impact it would have on the remaining areas of outstanding capacity. The super-imposition of LANDMAP Visual and Sensory and habitats aspect data on the remaining areas of land in and around the SSAs is shown in* ***Appendix I****.*

[16] *Previous Arup Studies applying the same methodology include: Northern Ireland Renewable Electricity Targets to 2020 (2009), Towards Broad Areas of Renewable Energy Development in the North West (2008), Planning for Renewable Energy in the East of England, and Technical Advice Note 8: Planning for Renewable Energy – Strategic Search Areas (2006/07).*

Figure 5.1 – Route to 'practical' outstanding capacity scenario



Cumulative issues will be a particularly important limited factor on the availability of project opportunities on the remaining developable land within the SSAs and 5km of the SSAs. New projects entering the planning system going forward will have to demonstrate compliance with acoustic standards taking into account all existing projects either operational, consented or under determination. There may also be a need for space to remain between current known projects to allow for ecological mitigation, especially disturbance effects upon birds.

It is considered therefore that a figure of 595MW is still too high to represent a realistic residual developable capacity within and around the SSAs. Following a review of the remaining areas of potentially developable land, it is suggested that only around half of this land is spatially distributed in a way that lends itself to a series of deliverable projects. Also, there are some specific factors which may inhibit/reduce development on some of the remaining land. These are briefly set out in **Table 5.4**.

Areas identified as less constrained and undeveloped for each SSA and 5km buffer are shown in **Appendix D**, and primarily comprise the areas with 1000m buffer (yellow).

Each of the remaining areas has been reviewed to gain an understanding of their development potential, especially whether there are any other factors which may inhibit projects coming forward. The size of the remaining areas has also been consdered ie. Is there likely to be a significant project opportunity available? It is recommended that in the light of the information presented in **Table 5.4**, an indicative figure of 300MW represents a more realistic residual developable capacity within and around the SSAs. 300MW therefore represents a possible development potential over and above those projects made available to the study team.

Table 5.4 – Factors affecting remaining developable land in and around the SSAs

SSA	Commentary
A	• Land around Alwen Reservoir may not be available for development due to ownership restrictions. • Cumulative noise may be a significant issue in combination with other projects.
B	• Cumulative noise likely to be significant issue and may rule out some of the indicative areas. • One or more areas possibly reserved for habitat management for existing schemes.
C	• Cumulative noise likely to be significant issue and may rule out at least one area. • Land ownership/title issues may restrict development.
D	• Cumulative noise may be a significant issue in combination with proposed project. • Plynlimon and areas of LANDMAP visual and sensory outstanding evaluation may further reduce capacity.
E	• Mineral rights/opencast mining may restrict development. • Cumulative noise may be a significant issue in combination with existing project. • Land ownership/title issues particularly in some forestry areas may restrict development.
F	• Cumulative noise likely to be significant issue and may rule out a number of the areas. • Land ownership/title issues particularly in some forestry areas may restrict development.
G	• Broadcast/telecommunication likely to restrict development. • Cumulative noise may be a significant issue in combination with proposed projects.

6 Conclusions and Recommendations

6.1 Wind Farm Development in Wales

In total, based on data gathered for this study, approx. **2500MW** installed capacity of onshore wind could be in operation by 2020 (existing and in planning). However, current constraints to development including slow planning approval, planning application refusal, strategic transport restrictions, and slow grid capacity connection could lower this figure significantly. This figure of 2500MW would assume a 100% planning/IPC approval rate.

Of these projects, a total of **1944MW** of wind farm developments (operation through to pre-application ad-hoc) are located within an SSA; and a further **362MW** of wind farm developments (operation through to pre-application ad-hoc) are located within 5km of an SSA.

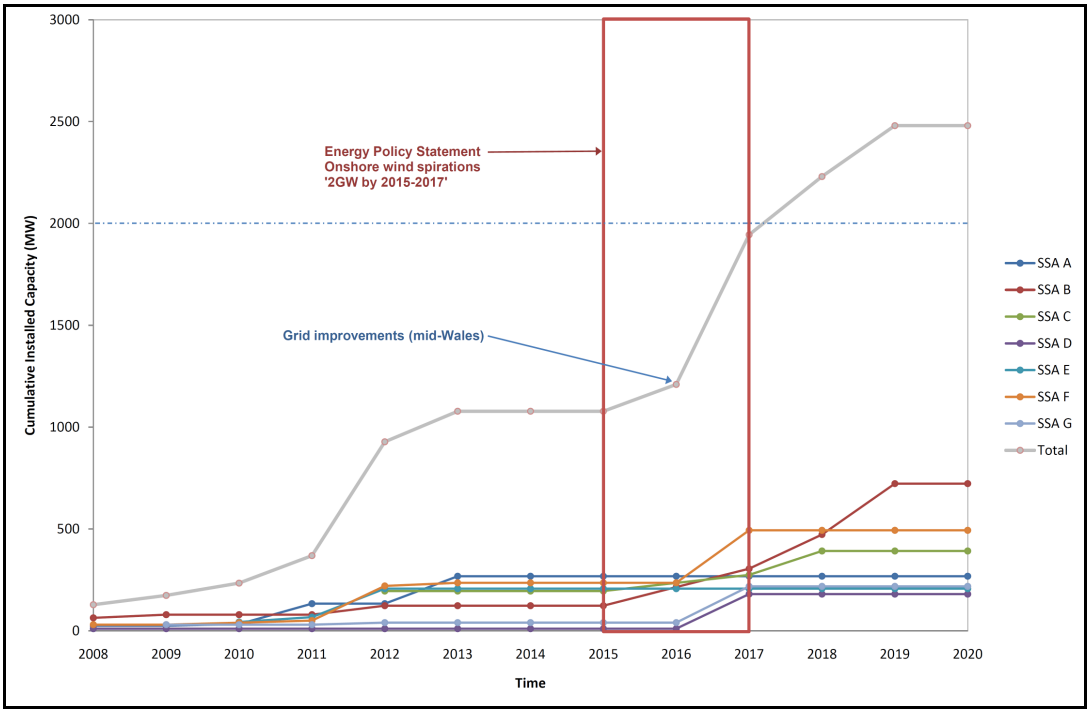
6.2 Wind farm deployment timeline

Current statistics indicate that since TAN 8 was published in July 2005 approx. 101MW of installed capacity from onshore wind has been consented in Wales. This does not take into account refusals, public inquiry, or any uncertainties regarding the IPC consent route. Beyond 2013, it is anticipated that all applications (within the study area) in the public domain will be operational by 2019. This is shown in **Figure 6.1** as the cumulative total.

The recent publication of Wales's Energy Policy Statement '*A Low Carbon Revolution*' indicates an aspirational target of 2GW onshore wind to be delivered 2015-2017. This not only includes commercial scale onshore wind but also smaller schemes identified by criteria based Local Authority policy, community scale schemes, and brownfield opportunities (*this is further discussed in Section 6.4*).

It is clear from **Figure 6.1**, that this aspirational target is achievable by the later 2017 date. However, it does assume concurrent construction of wind farms, planning consent for all schemes (Local Authority, DECC and IPC), on-time delivery of improvement to the National Grid, and negligible construction/transport delays i.e. it is a *best case scenario*.

Figure 6.1 – Wind Farm Development Timeline (2008-2020)



Therefore, **Figure 6.1** represents the '*best case*' scenario for commercial scale wind development in Wales to 2020. However, it does not take into consideration schemes outside of the SSAs or 5km around the SSAs, therefore there is the possibility of 'windfall' outside the study area granted by the IPC or Local Authorities or sites on brownfield land.

6.3 Remaining Areas of Developable Land

Somewhere between 99 and 299km^2 of undeveloped land remains in the SSAs and within 5km of the SSAs, depending on the size of the residential buffer used in the analysis. This could give an installed capacity between 843 and 2545MW.

The study has shown that based on knowledge of current project developments, there appears to be only the potential for around 300MW of additional development in and around (i.e. up to 5km) the SSAs. This figure takes into account known environmental and technical constraintsas far as has been possible to address in this study.

6.4 Other Opportunities

As discussed in Section 6.2, aside from commercial scale wind there are a number of other opportunities for onshore wind development in Wales which will contribute to the aspirational 2GW target as presented in the Energy Policy Statement:

- *Criteria based schemes*: A criteria based 'toolkit' for Local Authorities in identifying opportunities for onshore renewable energy in Wales is due to be published in 2010. This may well allow technical officers to identify sites capable of delivering 5-25MW of onshore wind against environmental and technical criteria.
- *Brownfield opportunities*: The Welsh Assembly is keen to promote further use of brownfield sites across Wales for onshore wind[17].
- *Community Scales Schemes*: The Energy Saving Trust alongside the Welsh Assembly Government is providing funding to deliver community scale renewable energy schemes across Wales, including onshore wind, below the 5MW size. Some 22 projects are anticipated.

[17] *Technical Advice Note 8: Renewable Energy, Welsh Assembly Government, 2005*