

Government Office for the West Midlands

West Midlands Wind Energy Information Tool

Assessment of Wind Energy Resource



March 2004

Halcrow Group Limited

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1 Introduction

1.1 *Role of this report*

This report presents an assessment of the large scale wind energy resource available in the West Midlands Region for electricity generation by 2010. It is based on the a wind energy resource tool which has been developed by the Government Office for the West Midlands to help identify where wind energy developments might be a possibility within the West Midlands Region. Previous studies have shown that wind has the potential to make a leading contribution (~ 70 %) towards renewable energy generation in the region. The tool has been developed to raise awareness of the potential for wind energy development across the region, and provide an input into the Regional Energy Strategy.

This report aims to provide the relevant data for the entire West Midlands region as well as six sub-regional groupings of authorities:

- Staffordshire county (including the Stoke on Trent Unitary Authority);
- Shropshire county (including the Telford & Wreken Unitary Authority);
- Herefordshire county;
- Worcestershire county;
- Warwickshire county;
- West Midlands metropolitan areas of Birmingham, Solihull, Walsall, Dudley, Sandwell and Wolverhampton.

These divisions have been chosen to aid discussion at a local level.

1.2

Key differences in this report

In this wind energy assessment for the region, the deployment of large scale wind turbines (considered to have rated powers of between 600 kW and 2.75 MW) is expected to be limited to projects that are economically viable. This is generally considered to be the case in areas with average wind speeds above 7 m/s.

Using the wind information tool a substantially comprehensive set of currently accurate constraints was used to determine where wind energy may be appropriate within the region. The study involved various levels of filtering, with detailed analysis of topography and rural dwellings on 1:50 000 OS mapping allowing the specific location of turbines. The simple but precise nature of this methodology has resulted in a highly accurate assessment of economically viable wind potential in the region. The figures obtained show a greater potential than previously returned in the last Halcrow report 'Renewable Energy Prospects for the West Midlands – Reassessment of Wind Resource' issued in September 2001, which was purely computational.

2

Assessment Methodology

2.1

Site Selection – the Filtering Process

This analysis is based on the data used and displayed in the ‘Wind Information Tool for the West Midlands’, as completed at the end of February 2004.

The wind information tool provides up-to-date information on the spatial relationship between potential sites for wind energy developments in the West Midlands and constraints which may restrict such developments. Key layers include an OS map bases, wind speed predictions, urban areas and settlements, aeronautical information, telecommunications data, electricity network plans, environmental designations, historic features and landscape character types.

The areas considered in this study are those displaying indicative wind speeds of above 7 m/s at 45 m. There are over seventy discreet areas that meet this criterion as shown below in Figure 1. These areas were divided up into suitably sized blocks and given identifying numbers.

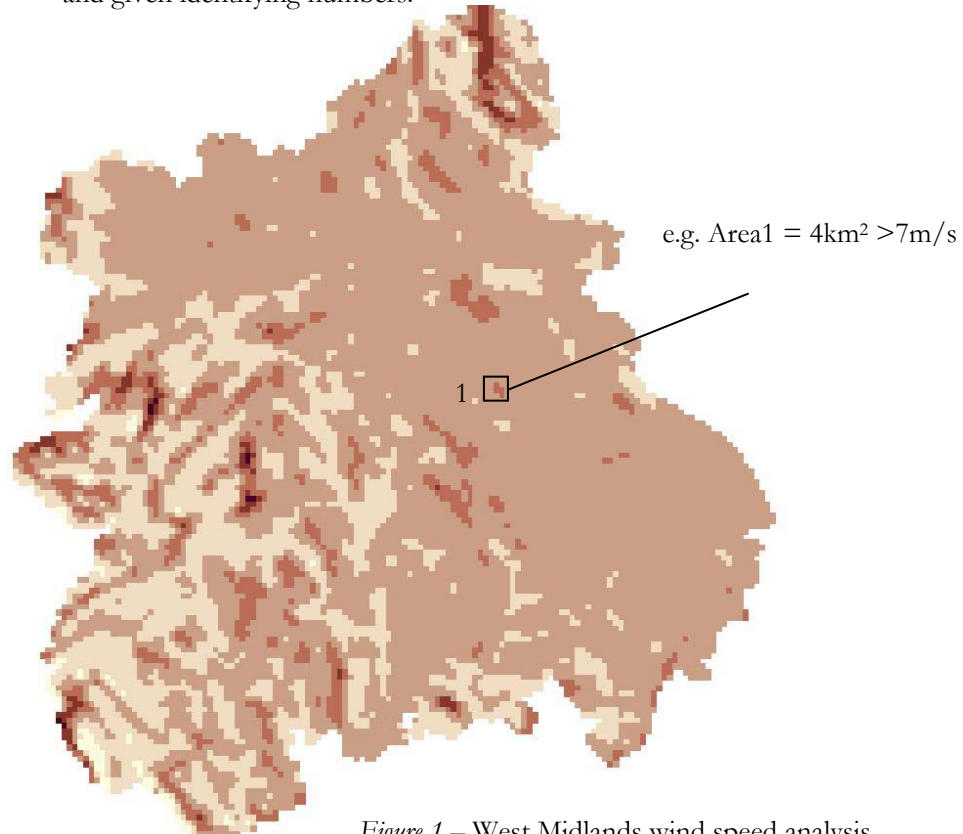


Figure 1 – West Midlands wind speed analysis

Each area was then examined at a large scale ($\sim 1:250\,000$) to ascertain the effects of all the major constraints at this scale. These are primarily AONB, SLA / AGLV, national parks, large urban areas and their buffers (500 m), and airport restricted areas. The screen shot in Figure 2 shows typical output from the tool at this scale.



Figure 2 – 1:100 000 scale analysis

A large number of the favourable wind locations are excluded immediately on the basis of this first level analysis. Those that still show through (all or part) unconstrained are examined in detail for wind energy development potential at a scale of $\sim 1:75\,000$.

This second level analysis includes the more local effects of motorways, a-roads, distribution network, broadcasting links, microwave links, telemetry links, ancient woodland, SSSI, ancient monuments etc. A screen shot of the output typical at this scale is shown below in Figure 3.



Figure 3 – 1:75 000 scale analysis

Finally, if there is still no major constraint visible, the 1:50 000 OS mapping is used to ascertain the suitability of local topography as well as the effects of rural dwellings and farms (500m buffers), and ordinary woodland on unconstrained areas.

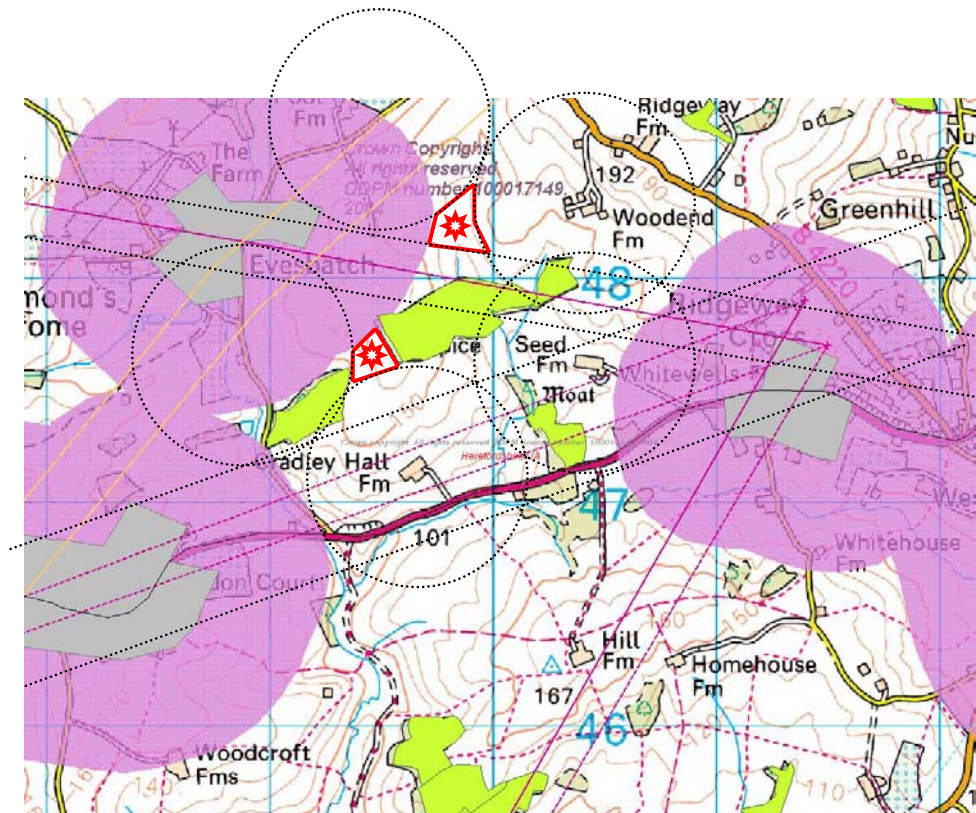


Figure 4 – Detailed analysis of unconstrained areas using 1:50 000 OS mapping.

The result is a few small areas of land where wind energy development may be possible (illustrated in red in Figure 4). Whilst turbines are sited by judgement, this is based on a wind energy development density of 9 MW per square km (equivalent to 6 x 1.5 MW wind turbines).

Table 1 below shows all the constraints to wind energy development that are considered in this analysis.

<i>Layer name</i>	<i>Description</i>
Motorways	West Midlands Motorways (buffer of 150 m used)
A roads	West Midlands A roads (buffer of 150 m used)
Electrical distribution network	West Midlands Electrical Distribution Network (Aquila 2003)
Re-Broadcasting Transmitters	Analogue TV Broadcasting and Re-Broadcasting Transmitters (buffer of 500 m used)
Re-Broadcasting links	Analogue TV Broadcasting and Re-Broadcasting Links (buffer of 500 m used)
Microwave Transmitters	Microwave Fixed Link Transmitters (buffer of 150 m used)
Microwave Fixed Links	Microwave Fixed Links (buffer of 150 m used)
Telemetry Transmitters	Scanning Telemetry transmitters for the Gas and Electric Industries (buffer of 500 m used)
Telemetry links	Scanning Telemetry Links for the Gas and Electric Industries (buffer of 500 m used)
Urban Area	Urban areas
Urban Area Buffer Zone	500m buffer zone around the urban areas
Administrative Boundary	Local Authority and County boundaries
National Park	National Parks
NNR	National Nature Reserve
RAMSAR sites	Internationally Important Wetlands
SAC	Special Area for Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
AONB	Area of Outstanding Natural Beauty
SLA and AGLV	Special Landscape Areas / Areas of Great Landscape Value
Scheduled ancient monument (point feature)	Scheduled ancient monuments (point file) (buffer of 150 m used)
Scheduled ancient monument (area feature)	Scheduled ancient monuments (polygon file) (buffer of 150 m used)
World Heritage Site	World Heritage Site
Ancient Woodland	Ancient Woodland
Wind at 45m	NOABL Windspeeds 45 m above ground level
Airport	Military and Civil airports
Restricted air space	Restricted air space around airports
OS Mapping	1:250 000 OS mapping for the West Midlands 1:50 000 OS mapping for West Midlands for detailed analysis of unconstrained areas including: woodland, topography, farms and rural dwellings (plus 500m buffers).

Table 1 – Constraints list

2.2

Assumptions

Various assumptions have been made and criteria set in order to complete this analysis effectively and these are outlined below.

The wind information tool contains approximately 95 % of all constraints datasets relevant to the deployment of large scale wind energy projects. Much of the data supplied in this tool is highly dynamic where changes between the time of publishing and time of use are inevitable. It should therefore be realised that the information is provided for initial guidance only and contact with the relevant agencies is recommended to confirm these results for specific sites of interest.

Two datasets that were unavailable for use are the CAA civilian radar set and the Water Industries telemetry network.

Key notes on the output:

- The analysis is for large-scale wind-generating potential throughout the region. Typically, this encompasses turbines with rated powers above 600 kW.
- This analysis uses 'The Wind Information Tool for the West Midlands Region' and is based on areas with wind speeds indicated in the NOABL data set as above 7m/s. This data set was generated by ETSU on behalf of the DTU in 1992. Annual mean wind speeds were calculated for the UK at a resolution of one square kilometre using long term records and predicted topographical effects. However, the model used does not take surface roughness into account, and thus tends to overstate the resource available.
- Development is assumed to be acceptable up to national park boundaries and within areas of greenbelt.
- The wind energy resource is calculated from a capacity of 9 MW per square km equivalent to 6 x 1.5 MW wind turbines; however, topography, individual dwellings (+ 500m buffer) and woodland are all assessed and have a direct impact on the estimated capacity in unconstrained areas.
- A wind turbine rated at 1.5 MW will generally have a rotor diameter of 60-80m and a tower height of 60-80m.

- The analysis assumes that large scale wind developments in good wind regimes (NOABL 7 m/s plus) will attain a load factor of 0.3. This returns an annual yield of 2.63 GWh per MW installed.
- Radar and Analogue TV Broadcasting and Military Low flying are not considered in this analysis. Radar and broadcasting are both currently subject to further line of sight analysis. Radar interference (both civil and military) is one of the major constraints to wind energy projects with an average of only fifty percent of applications gaining approval. A 50% failure rate due to negative impacts on Radar and Broadcasting is therefore included in the analysis. The CAA and Defence Estates are working towards producing national safeguarding maps in 2004. The use of this information when available as an additional layer to this assessment will further improve the accuracy of the estimates.
- Telemetry, Broadcasting and Urban Areas all use a buffer of 500m
- Microwave fixed links, Motorways, A-roads, and Ancient Monuments all use a buffer of 150m.
- The remaining constraints do not include any buffered area.

The results of this detailed analysis into the regions economically viable wind energy potential are shown in section 3.

3 Conclusions

Of the 78 areas examined with NOABL wind speeds in excess of 7 m/s (Figure 5), 22 sites show some extent of potential for wind energy deployment. In terms of area some 27% of that examined contained pockets of unconstrained areas suitable for development.

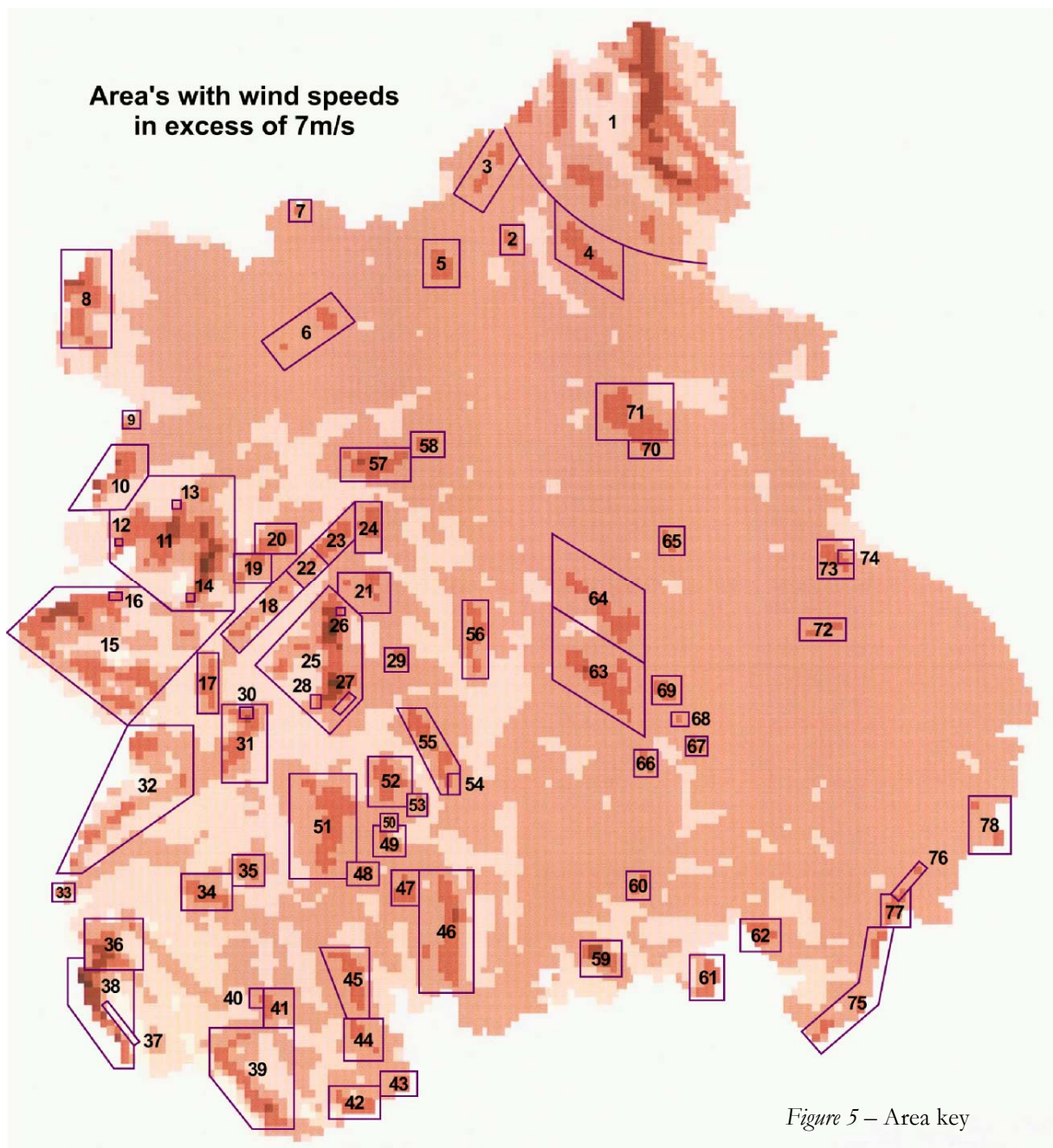


Figure 5 – Area key

Table 2 shows the results from this latest analysis on a sub-regional level.

<i>County</i>	<i>Wind Turbine Potential (Y/N)</i>	<i>Number of turbines</i>	<i>Capacity (MW)</i>	<i>Annual Yield (GWh)</i>	<i>Annual Yield Assuming 50% Success Rate (GWh)</i>
Staffordshire	Y	7	10.5	27.615	13.8075
Shropshire	Y	33	49.5	130.185	65.0925
West Midlands	Y	1	1.5	3.945	1.9725
Warwickshire	N	-	-	-	-
Herefordshire	Y	50	75	197.25	98.625
Worcestershire	Y	3	4.5	11.835	5.9175
Total for West Midlands Region:		94	141	370.83	185.415

Table 2 – Sub-regional assessment

The results display upper (all sites are developed) and lower (assumes a 50 % success rate) limits of the regions potential, this being a capacity of between 70 and 141 MW or in terms of predicted annual output between 185 and 371 GWh. It is estimated that there is a maximum uncertainty in the analysis of 7 %, primarily due to a missing telemetry dataset and also the dynamic nature of much of the data used. Including the maximum deviation results in a potential capacity of 65 – 150 MW or in terms of annual electricity production 171 – 395 GWh.

This is clearly a broad band; however, it is recommended that it is the lower figures that are used as being the more accurate prediction of resource. Both Radar and Broadcasting are neglected in any detail and both are major constraints. Due to the nature of the constraint, only line of sight analysis provides the only true indication of acceptability. Statistics from Defence Estates show that currently only 50 % of wind farm applications are successful. The assumption that only 50 % of the unconstrained sites observed in this assessment are therefore likely to go forward is therefore realistic.

The assessment only considers sites that may be considered to be economically and technically viable. The ability to gain the necessary development consents and obtain the support of the host community is not considered and may further reduce deployment success.

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