Module 1: LDF / plan making evidence base and implementation of the Yorkshire and Humber Renewable and Low Carbon Energy Study 2011. Tuesday 6th March, Leeds.

Group Activity – Using Evidence to Inform Policy Development
Local Authority District: CALDERDALE

Background

Calderdale commissioned jointly with neighbouring local authorities (Kirklees, Pendle, Burnley, and Rossendale) the South Pennines Renewable and Low Carbon Energy Study. The study was undertaken by Maslen Environmental. It was finalised in September 2010, in advance of the AECOM 2011 study, Low Carbon and Renewable Energy Capacity in Yorkshire and Humber.

The rationale for taking a cross boundary approach was that the availability of renewable energy resources and landscape impacts cut across geographic boundaries.

The Maslen study concluded that by far the most significant potential for renewable energy in Calderdale is commercial scale wind. There is also potential for small scale wind, solar and ground source heating. Three scenarios for renewable energy development were considered: high, medium and low uptake. The study identifies Capacity Areas where commercial scale wind energy is considered appropriate.

Previous work undertaken in the study area considered landscape capacity and visual impacts of wind energy developments (the January 2010 study by Julie Martin Associates, Landscape Capacity Study for Wind Energy Developments in the South Pennines). This identified cumulative landscape impacts in Calderdale as an issue. It also recommended requirements for Landscape and Visual Impact Assessments accompanying applications for wind energy proposals.

There are currently several wind energy schemes in Calderdale, or in neighbouring authorities on ridge lines visible from Calderdale, that are consented, but are not yet implemented.

Evidence

Section 1: Extract from AECOM 2011 Low Carbon and Renewable Energy Capacity in Yorkshire and Humber Study

Section 2: Extract from Maslen Environmental September 2010 Renewable and Low Carbon Energy Study

Section 3a: Extract from Julie Martin Associates January 2010, Landscape Capacity Study for Wind Energy Developments in the South Pennines, Capacity Area 6: Calder Valley Moorland Fringe

Section 3b: Extract from Julie Martin Associates January 2010, Landscape Capacity Study for Wind Energy Developments in the South Pennines, Capacity Area 7: Halifax and Brighouse

Section 1: Extract from AECOM 2011 Low Carbon and Renewable Energy Capacity in Yorkshire and Humber Study

Appendix B.3. Renewable Energy Resource for Calderdale

B.3 Calderdale

Population: 200,100

Land area (km^2): 364

Calderdale is located on the western edge of Leeds City Region. Halifax is the largest urban area, containing heat density capable of supporting a heating network, and many public buildings that could provide anchor loads for a network. This is a prime example of a heating network which the Council can initiate and lead, encouraging other developments and buildings to connect to. Within the high heat density areas is a CHP plant located at Sonoco in the South.

Wind also has strong potential in the borough, although sites may have limited viability due to environmental reasons such as high sensitivity to birds (these areas are shown with purple hatching on the Energy Opportunities Plan). This conclusion was supported by the Landscape Capacity Study prepared by Julie Martin Associates on behalf of a number of South Pennine Authorities.[63] As part of developing their evidence base, Calderdale undertook a renewable energy and low carbon energy study with surrounding local authorities, which also suggested that wind is Calderdale's largest opportunity for renewable energy. Two wind farms have been granted planning permission: Todmorden Moor and Crook Hill in the west. A planning application has also been submitted for the repowering of the 9.2MW Ovenden Moor Wind Farm with larger turbines.

Calderdale Council has given planning consent to at least over 40 small wind turbines, representing over 0.5 MW_e of renewable energy capacity.

Biomass and microgeneration could also play a role in increasing the capacity of renewable energy. Hydro is also a promising renewable energy in the Borough, ranking among the top five in the region. There is currently only one hydro scheme, Hebden Bridge, operating in the centre of the Borough. With the potential to be a hydro leader in the Region, other hydro options should be explored.

[63] Landscape Capacity Study for Wind Energy Developments in the South Pennines, Julie Martin Associates, January 2010

Capabilities on project:
Building Engineering - Sustainability

Calderdale	Current capacity (MW)	Current capacity (GWh)	Potential resource - heat (MW)	Potential resource - electricity (MW)	Potential resource (GWh)	Potential resource (No of existing homes equivalent energy demand)	Potential resource (Proportion of regional resource)
Commercial wind	37	96	0	110	290	0	0%
Small scale wind	1	1	0	1	1	0	3%
Hydro	0	0	0	2	8	0	0%
Solar PV	0	0	0	7	6	0	0%
Solar thermal	0	0	12	0	8	822	3%
Air source heat pumps	0	0	12	0	20	831	5%
Ground source heat pumps	0	0	1	0	2	87	1%
Biomass energy crops	0	0	5	3	41	333	1%
Biomass woodfuel	0	0	10	0	27	694	3%
Biomass agricultural arisings (straw)	0	0	0	0	2	17	0%
Biomass waste wood	0	0	1	1	8	67	2%
Energy from waste wet	0	0	1	1	10	79	1%
Energy from waste poultry litter	0	0	0	0	1	0	0%
Energy from waste MSW	0	0	2	1	14	114	2%
Energy from waste C&I	0	0	4	2	30	258	2%
Energy from waste landfill gas	1	6	0	0	0	0	0%
Energy from waste sewage gas	0	0	0	0	4	0	0%
Total	39	104	62	128	527	4,154	

Table 54 Current capacity and renewable energy resource in Calderdale. Current" refers to facilities that are operational or have planning consent

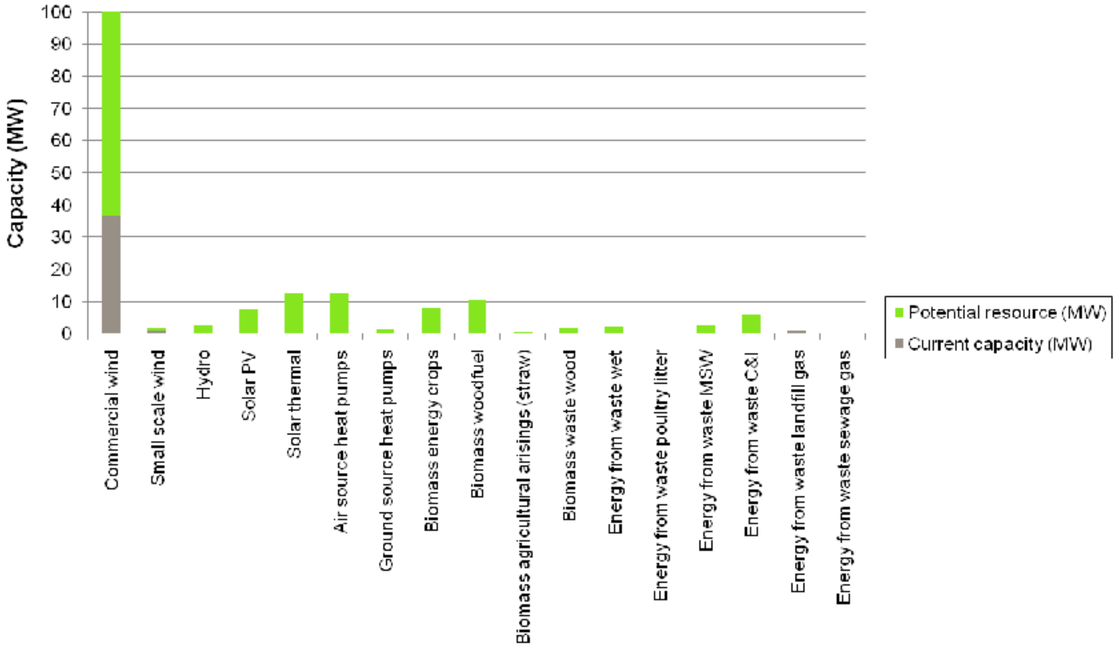


Figure 64 Current capacity and renewable energy resource in Calderdale. Current" refers to facilities that are operational or have planning consent

Capabilities on project:
Building Engineering - Sustainability

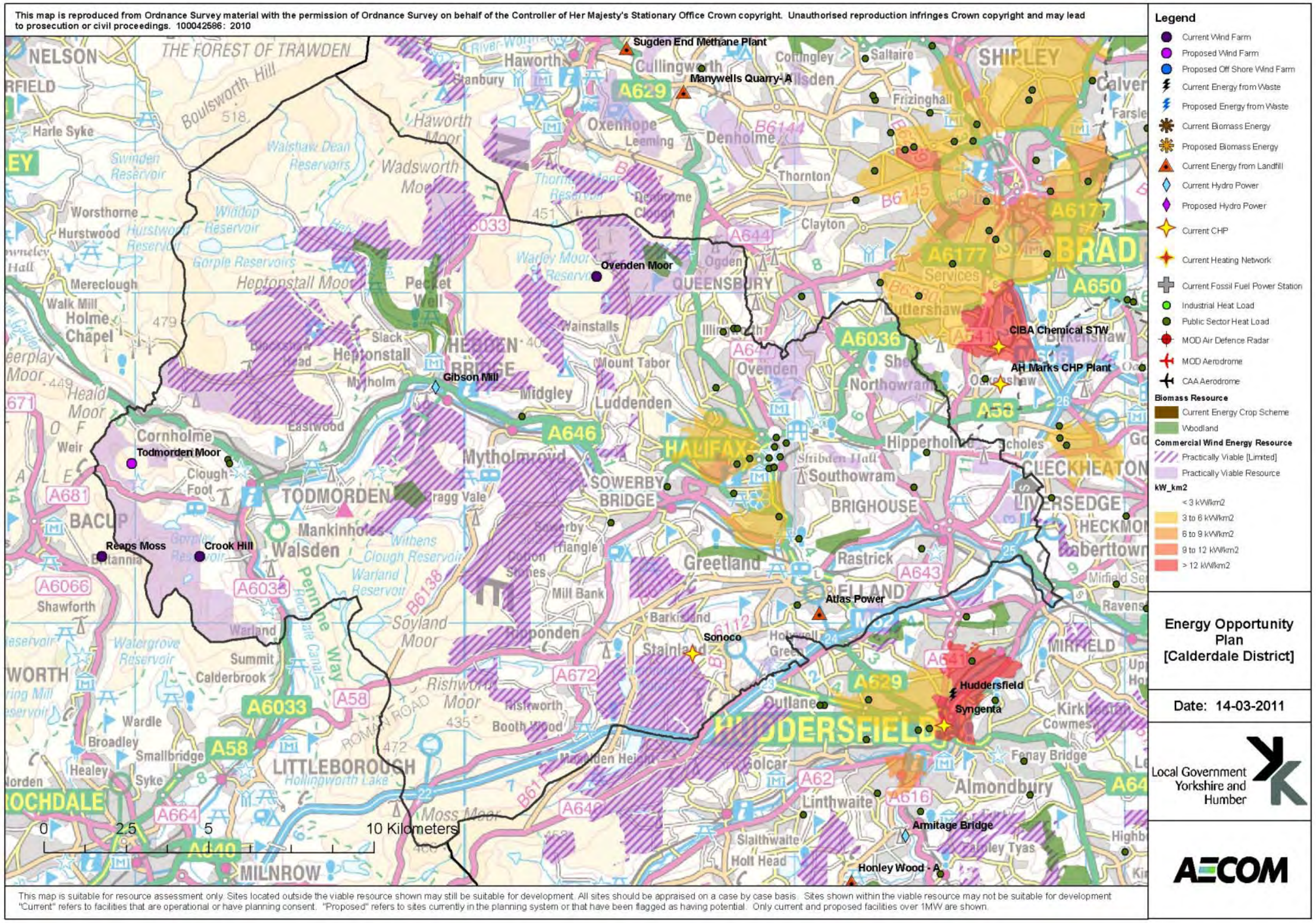


Figure 65 Energy opportunities plan for Calderdale. “Current” refers to facilities that are operational or have planning consent. “Proposed” refers to facilities currently in the planning system or sites that have been flagged as having potential. For all technologies except hydro, only current and proposed facilities over 1MW are shown. The areas with purple hatched shading described as “Practically viable [Limited]” represent areas where commercial scale wind energy development should be viable but the number of turbines may be restricted due to environmental constraints. Please refer to section 5.14 and appendix A for more details.

Section 2: Extract from Maslen Environmental September 2010 Renewable and Low Carbon Energy Study

Executive Summary

Conclusions

Maps on Wind Energy Potential, and Wind Energy potential when applying a constraints filter

Executive Summary

Maslen Environmental were commissioned to undertake a study on the capacity for renewable and low carbon energy in the Partnership councils: Burnley Borough Council, Pendle Borough Council, Rossendale Borough Council, Calderdale Metropolitan Borough Council and Kirklees Metropolitan Council, situated in the South Pennines. In particular it was to identify the opportunities for delivering energy from renewable and low carbon (RLC) sources, including micro and district scale technologies, in order to meet both local and site specific targets.

The UK has signed up to the EU Renewable Energy Directive, which includes a UK target of 15% of energy from renewable sources by 2020. This is equivalent to a seven-fold increase in the UK renewable energy consumption from 2008 levels.

Indicative percentages as to how the government envisages that the 15% target could be fulfilled are: 30% of electricity; 12% heat and 10% transport energy from renewables. This study considers the production of electricity and heat. Since the recent revocation of Regional Spatial Strategies, **there are currently no standing regional and sub-regional renewable energy targets**. This study has therefore developed local notional targets based on national targets. The notional electricity target is based on 30% of local electricity demand; however contributions from off-shore wind generation could reduce, on-shore local authority electricity generation targets and may lead to future South Pennine Local Authority RLC generation targets being lower than suggested by the notional targets developed in this study.

The potential technologies and sources of renewable energy which are assessed through a capacity assessment are summarised in the following table.

Types of Renewable and Low Carbon Energy

Category	Sub - category Level 1	Sub -category level 2	Comment
Electricity and CHP	Large scale (>50 MW)	Wind	
		Biomass combustion	Municipal solid waste, virgin and recycled timber, energy crops, solid recovered fuel, all biomass co-firing with coal and other wastes.
	Medium scale (50 kW to 50 MW	Wind	
		Biomass combustion	Municipal solid waste, virgin and recycled timber, solid recovered fuel.
		Biomass anaerobic digestion	Agricultural waste, food waste, energy crops.
		Hydro	
		PV	
		Natural Gas CHP	Heat use from CHP.
	Micro scale (<50 kW)	Wind	
		Hydro	
		PV	
Heat only	Medium scale (50 kW to 50 MW)	Biomass combustion	Municipal solid waste, virgin and recycled timber, solid recovered fuel.
		Biomass anaerobic digestion	Injection to gas grid or local use.
		Solar thermal	Water or space heating.
		Heat pumps (heating and cooling)	Ground source, air source, water source.
	Micro scale (<50 kW)	Biomass combustion	Virgin and recycled timber.
		Solar thermal	Water or space heating
		Heat pumps	Ground source, air source, water source.

Notes.
Combined heat and power is a more efficient use (in certain contexts) of energy generation, which can be used with either fossil fuels (gas or solid fuels) or renewable (biomass) fuels.
Waste to energy is generally an incineration process for dry matter and includes biomass combustion.

Overall the study indicates that:

Electricity

- By far the most significant potential for renewable electricity in all the council areas is commercial scale wind.
- There is significant potential also for small scale wind energy.
- There is the potential for large amounts of solar electricity generation, but the current efficiencies of solar technology mean that installations have a relatively low load factor (a measure of effectiveness) and so installations may only deliver limited electricity. Improvements in technology may change this in the future.

Heat

- The largest available low carbon heat source is ground source heating. This is a mature technology which has been used extensively in Europe, particularly Scandinavia, but has been used less in the UK. There is a growing level of experience particularly in the south of England and London. The setup costs are likely to be more than the solar heat costs. Air source heating can also be used instead of ground source heating, although this may be slightly less efficient.

- There is also considerable potential for solar energy. This is a relatively mature technology and has some uptake in the area already. There is the potential for a high level of uptake of this technology.
- Additionally there is some potential for energy from wood (various forms), digestion and energy crops in most of the council areas (Rossendale has little energy crop potential). However, these are mainly small scale potential sources of renewable heat. It should be noted that if heat is obtained from biomass this may be at the expense of generating electricity from biomass.

The most suitable types of RLC for each district and the Partnership Area overall are identified based upon the capacity for developing each type of renewable energy technology.

Scenarios are presented which consider the potential for uptake of renewable and low carbon energy within the Partnership Area. The renewable energy uptake is considered in the context of the wider energy provision in the area.

The scenarios highlight both the uncertainties with regard to renewable energy uptake and also the importance of the scale of installations. Large scale installations can generate large amounts of energy, whereas small scale installations only provide a small contribution.

The theoretical capacity available for many technologies is much greater than a more 'pragmatic capacity' which is limited by physical, technical, economic, environmental and legislative constraints. For example the technical resource for solar PV is large; however, it is very expensive and current technology is not very efficient. Similarly there is a very significant wind resource, but its full exploitation would have visual impacts. The 'pragmatic' accessible resource therefore represents the resource that could be utilised if all projects received planning consent and the political, infrastructural and institutional barriers facing development were all overcome. The scenario development provides an opportunity to consider in more detail the extent to which the planning, political, institutional and infrastructural issues may influence uptake.

The following scenarios for renewable energy development within the Partnership Area are considered:

- **High Renewable Energy Uptake Scenario -** this equates to a level of uptake which is within the pragmatic capacity available and feasible. However, the level of uptake required to generate this level of renewable energy would be high and would entail a level of commitment to renewable energy that has not currently been seen.
- **Medium Renewable Energy Uptake Scenario-** the medium uptake scenario equates to a considerable but feasible uptake of renewable energy resources.
- **Low Renewable Energy Uptake Scenario-** this is a baseline scenario - it assumes that the current situation largely persists – i.e. onshore wind, and waste technologies remain as the main source of renewable generation, and biomass (electricity generation) and solar technologies don't prove to be technically and commercially viable at a large scale, though there will be some small capacity increase from demonstration projects.

Uptake Scenarios - Electricity

Scenario	Total Generation (MW) (approx.)	Additional Generation Requirement to meet the notional 2020 Target (MW)[1]	Technologies required	Comment
Burnley				
High Uptake	25.4	9.2	High level of commercial wind and other technologies.	Potential to exceed the notional target by a significant margin.
Medium Uptake	15.6		Some commercial wind, moderate uptake of other technologies.	Potential to meet and exceed the target.
Low Uptake	11.8		Some commercial wind, some biomass, some domestic installations.	Target met by a small margin.
Calderdale				
High Uptake	47.0	28.34	High level of commercial wind and other technologies.	Potential to exceed the notional target by a significant margin.
Medium Uptake	29.0		Some commercial wind, moderate uptake of other technologies.	Potential to meet the target by a small margin.
Low Uptake	21.4		Some commercial wind, some biomass, some domestic installations.	Target not met by a significant margin.
Kirklees				
High Uptake	28.4	44.6	High level of commercial wind and other technologies.	Target not met by a significant margin.
Medium Uptake	16.7		Some commercial wind, moderate uptake of other technologies.	Target not met by a significant margin.
Low Uptake	10.6		Some commercial wind, some biomass, some domestic installations.	Target not met by a significant margin.
Pendle				
High Uptake	33.2	15.3	High level of commercial wind and other technologies.	Potential to exceed the notional target by a significant margin.
Medium Uptake	20.5		Some commercial wind, moderate	Potential to exceed the

Scenario	Total Generation (MW) (approx.)	Additional Generation Requirement to meet the notional 2020 Target (MW)[1]	Technologies required	Comment
			uptake of other technologies.	target.
Low Uptake	15.7		Some commercial wind, some biomass, some domestic installations.	Target met by a small margin.
Rossendale				
High Uptake	42.6	4.03	High level of commercial wind and other technologies.	Potential to significantly exceed target due to high wind resource.
Medium Uptake	26.4		Some commercial wind, moderate uptake of other technologies.	Potential to significantly exceed target due to high wind resource.
Low Uptake	20.6		Some commercial wind, some biomass, some domestic installations.	Potential to significantly exceed target due to high wind resource.
Notes 1. Additional Requirement to meet target consists of the notional 2020 30% target minus the existing renewable generation.				

Similar scenarios were developed for renewable heat generation; these showed that a medium level uptake of the potential resource available is required in order to meet the 12% local notional heat targets developed by this study.

Development of Potential Future Baskets of Technology

In this study, three potential electricity baskets of technology were developed to show possible ways that the notional local electricity targets could be achieved.

'High Wind' uptake basket

The high wind basket considers 100% utilisation of the pragmatically available potential wind energy with some further uptake in non-wind technologies.

When you consider this approach and the notional targets for generation as a measure of performance then, with the exception of Kirklees, all the individual councils significantly out perform the target and collectively as a Partnership Area they exceed the combined targets.

Generation Shortfall under the High Wind Uptake Basket

Councils	Generation Shortfall from Notional Target (MW)
Burnley	+20.7
Calderdale	+26.7
Kirklees	-16.5
Pendle	+24.5
Rossendale	+47.5
N.B. –ve equals shortfall and +ve equal exceedance	

Enough Wind

This basket considers the previously used medium level uptake rates for non-wind technology; it then considers that the notional target for each council is met with topping up from wind technologies.

The following summary table expresses as a percentage the proportion of additional wind resource required to reach the notional targets.

Proportion of Wind Resource Utilised under the Enough Wind Basket

Councils	Total Available Commercial and Small Scale Wind Resource (MW)	Proportion of wind resource that would be utilised under this basket (%)
Burnley	29.4	29
Calderdale	53.7	48
Kirklees	26.0	100+
Pendle	39.2	36
Rossendale	51.1	6
N.B. Under is scenario Kirklees can not achieve its notional target		

Maximising Non-Wind

This basket considers that the potential generation from non-wind technologies is fully utilised, and compares the total generation to the notional targets. As in all these technology baskets existing generation has been accounted for.

The following table summarises this and additionally expresses the shortfall in the number of 2.5MW capacity turbines that would be required to make up this shortfall in generation.

Generation Shortfall and Required Turbines under the Maximising Non Wind Scenario

Councils	Generation Shortfall from Notional Target (MW)	Number of additional turbines required to meet the target
Burnley	-6.1	9
Calderdale	-21.1	31
Kirklees	-31.5	47
Pendle	-12.1	18
Rossendale	-0.88	1
N.B. –ve equals shortfall and +ve equal exceedance The number of additional turbine was calculated on the basis of a 2.5 MW capacity turbine, generating 0.675 MW of electricity (assuming a 27% capacity factor).		

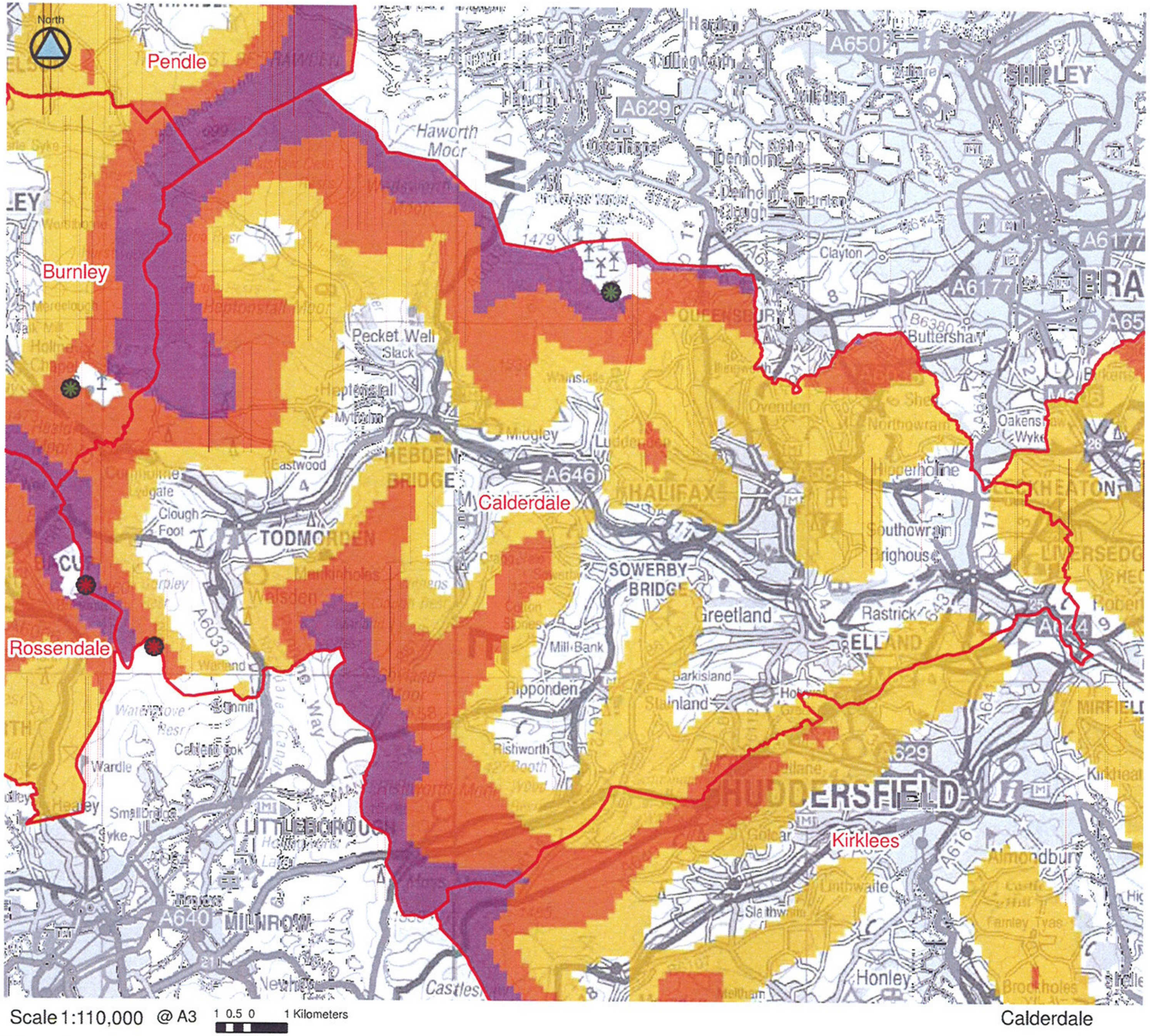
These baskets show that the development of the local wind energy potential would be needed to meet the local notional targets; however the degree to which it is needed could be reduced to a small degree by the effective utilisation of other resources.

Similar baskets of technology are presented to achieve the local notional heat targets. They show that a high uptake solar heating and/or the ground source heating potential of the study area would have to be utilised.

Conclusions

The potential for commercial wind energy development is significantly larger than any other local resource and will have to be further utilised to varying degrees if the local notional targets are to be met.

The two important actions arising from the study are the need to promote greater acceptance, public and political, of the need for locally generated renewable energy and the continued expansion of long term government financial support for RLC development at all scales. Large scale RLC installation are likely to be more significant in meeting targets than small scale developments and a suitable planning regime is likely to be key in promoting these technologies in suitable locations and appropriate ways.



LEGEND

- Consented Wind Farms
- Operational Wind Farms

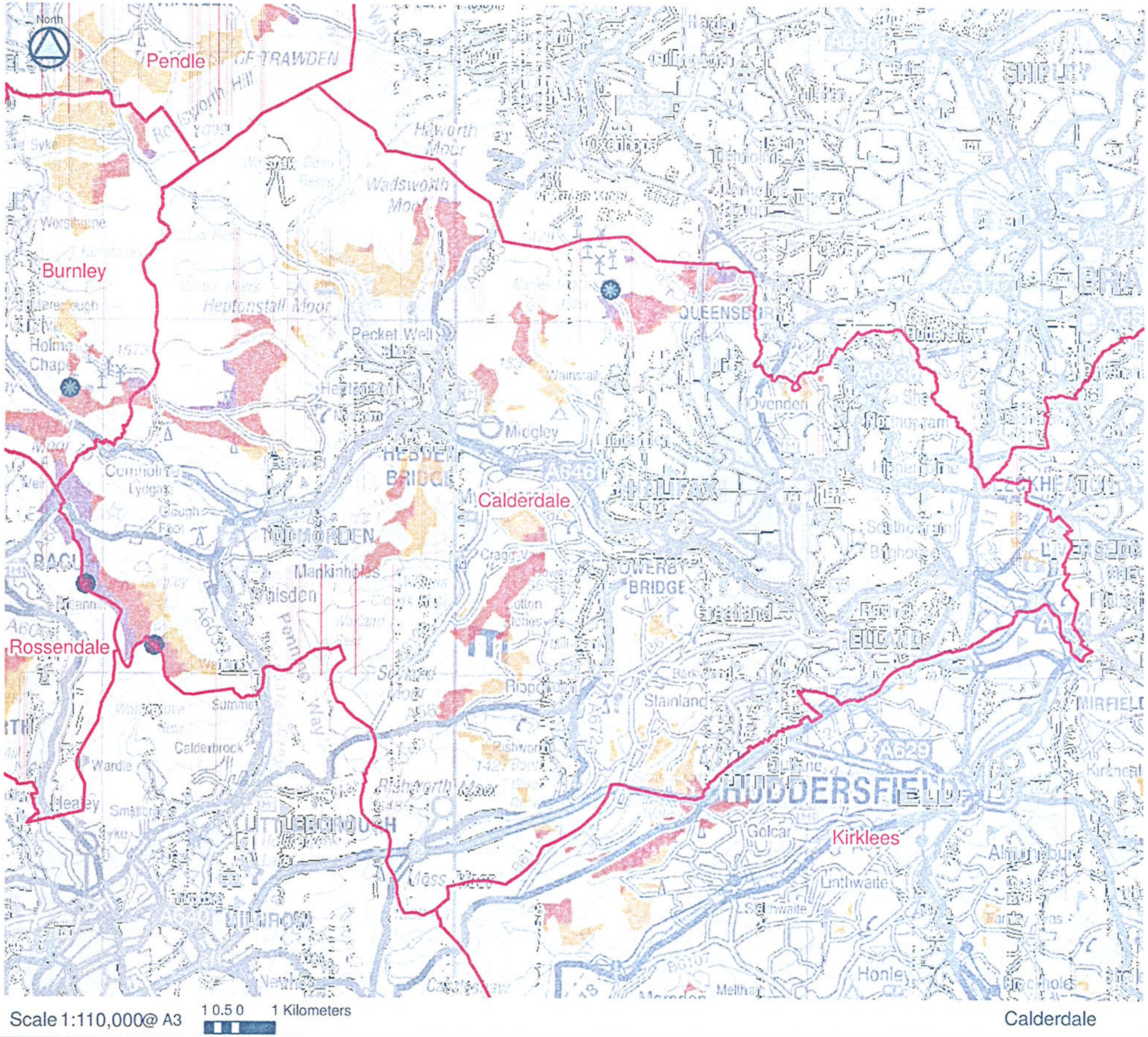
Wind Speed (m/s) at 45m AGL

- 6-7 m/s
- 7-8 m/s
- 8-9 m/s
- >9 m/s

Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationary Office© Crown copyright. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings. Ordnance Survey License No. 100018418(2010)

maslen environmental part of the JBA Group

FIGURE A6
Commercial Scale Wind Energy Opportunities



LEGEND

Consented Wind Farms

Operational Wind Farms

Wind Speed (m/s) at 45m AGL

6-7 m/s

7-8 m/s

8-9 m/s

>9 m/s

Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationary Office© Crown copyright. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings. Ordnance Survey License No. 100018418(2010)

maslen environmental
part of the RSA Group

FIGURE A7
Commercial Scale Wind Energy Constraints Assessment

Section 3a: Extract from Julie Martin Associates January 2010, Landscape Capacity Study for Wind Energy Developments in the South Pennines

Capacity Area 6: Calder Valley Moorland Fringe

Figure 1: How to Use This Report

Steps and Tasks	Relevant Report Sections	Key Reference Material
Step 1: Review background and collect information ▼		
Understand factors underlying landscape sensitivity	Section 2.3	• Table 3 Landscape sensitivity criteria
Understand factors underlying landscape capacity	Sections 2.4 and 2.5	• Table 6 Principles of fit with landscape character • Table 7 Principles relating to scale and cumulative impact
Consider the South Pennines landscape as a whole	Section 4.2	• Figure 3 Physical features of the study area • Figure 4 South Pennines landscape context
Step 2: Assess landscape sensitivity and capacity ▼		
Identify location of proposed development		• OS 1:25,000 scale map
Identify scale of proposed development		• Table 4 Wind energy development typology
Consider existing wind energy developments and their impacts at a strategic scale	Section 4.5 – text for relevant National Character Area	• Figure 6 Wind energy developments and National Character Areas
Identify landscape character type(s) and capacity area(s) within which the development would sit	Annexes 1 and 2 Landscape character descriptions	• Figure 7 Landscape character types • Figure 8 Capacity areas
Review sensitivity and capacity assessment sheets and consider whether or not location and scale are consistent with advice given. *(If so, proceed to Step 3. If not, identify alternative location and/or scale)*	Sections 5.2 and 5.3	• Relevant sensitivity and capacity assessment sheets
Step 3: Design and assess impacts of proposed development ▼		
If location and scale are appropriate, review and address detailed siting, layout and design issues	Section 6.4	• Table 11 Principles of good siting, layout and design • Guidance and cumulative and cross-district sections of capacity assessment sheet(s)
Assess landscape and visual impacts and if necessary, seek to revise scheme siting, layout and design	Section 6.5	• Table 12 Good practice requirements for landscape and visual impact assessment • Table 13 Checklist of presentation material

Hence the capacity assessment provides a reasoned appraisal and brief guidance on the general location, type and level of wind energy development that may be accommodated without significant adverse impacts on landscape resources. The general assumption is that change will be easiest to accommodate in areas of low sensitivity, and most difficult to accommodate in areas of high sensitivity. Areas of moderate sensitivity are generally taken to have capacity to accommodate some change. However it is also recognised that every specific case is different and that ultimately capacity will also be affected by other factors, including technical feasibility and perceptions of the need for development, which are not considered in this study.

In assessing overall capacity we have endeavoured to identify and refer to the key ***thresholds*** or 'tipping points' of landscape change that may occur as a result of wind energy development. The diagram below summarises these thresholds and shows how they may relate to the strategy for a given landscape. Thresholds vary from one landscape to another and are also dependent on the specific nature of the development proposals concerned. However, it can be seen that, in general, there is most likely to be significant capacity for wind energy development where landscape change (or indeed the creation of a new character) is considered acceptable. Conversely, where the strategy is one of conservation, capacity is likely to be limited.

Table 5: Thresholds of Landscape Change

Landscape strategy	**Conservation**	**Accommodation**	**Change**	**New character**
Wind energy development capacity	A 'landscape with no wind farms or infrequent wind farms'	A 'landscape with occasional wind farms'	A 'landscape with wind farms'	A 'wind farm landscape'

2.5 Principles Affecting Landscape Capacity for Wind Energy Development

As discussed above, in assessing landscape capacity for wind energy development, there is a need to consider issues of fit with landscape character, scale and cumulative impact. The tables below summarise some of the general principles that have been applied in this assessment. These are developed further in *Section 6*, which advises on good siting, layout and design in the South Pennines specifically.

Table 6: General Principles Relating to Fit with Landscape Character

Upland landscapes
• The broader the upland, the greater its capacity for wind energy development is likely to be. • Uplands with a simple, rounded and generally horizontal form may be able to accommodate larger turbine groupings than more dramatic or convoluted upland landforms. • In areas of more complex upland landform, smaller turbine groupings will generally fit better than larger groupings. • Development that is well set back from upland edges or scarps will be less prominent in the landscape than development close to the upland edge.

- The central part of an upland area will often be least visible from adjoining lowland landscapes. Convex landform in particular may offer some screening and reduce visible turbine heights, especially in short range views from valleys below.
- Siting of turbines on obvious summits or other prominent landforms should generally be avoided.
- Impacts can be reduced by selecting sites on less prominent side slopes, benches and gentle undulations as sites rather than tops themselves.
- Locations close to distinctive topographic features, field patterns, buildings or other features may bring undesirable scale comparisons.
- Wilder areas of upland, characterised by open heather moor and bog, are usually more sensitive than areas of grass moor or forestry which may have a more intensively managed character.
- Locations that can utilise existing roads or tracks for access are preferable to locations that require lengthy and often highly visible new access tracks.

Intermediate landscapes

- Such landscapes, typified by rolling ridge and drumlin landscapes, tend to suit smaller turbine groupings and turbine heights.
- Where the landscape is rolling or undulating, small turbine groups are likely to fit best in the landscape; where the landscape is flatter or more gently sloping, larger turbine groups may sometimes be accommodated.
- Where skylines are especially sensitive, it may be helpful to site turbines so that they are backclothed against hillsides beyond.
- Where sited on low ridges or hills, particular care should be given to turbine height in relation to landform.
- As rule of thumb, turbine heights should not exceed the average hill or drumlin height (note, height, not elevation AOD) and should ideally be no taller than half that height.

Lowland landscapes

- These landscapes, including valleys, floodplains and lowland farmlands, may accommodate larger turbines and turbine groupings than intermediate landscapes, provided that their character is simple and expansive.
- However capacity may be reduced by the presence of features such as prominent church spires that offer a scale comparison nearby.
- Valley landscapes that are enclosed by uplands with existing wind farm development should generally be kept free of wind turbines, to maintain a sense of contrast and ensure that the wider landscape does not become dominated by wind energy development.
- Floodplain landscapes, unless very extensive, may have little landscape capacity for wind turbines because openness is an essential part of their character.
- Extensive flat farmlands may be better able to accommodate wind energy development. Here regular rows or lines of turbines may provide the best fit with large, regular field patterns.

Urban and industrial landscapes

- These landscapes may have capacity for wind energy development due to the presence of existing man-made influences.
- For example sites close to power stations, factories, large institutions such as hospitals, business parks, major transport corridors and quarries may have capacity for wind turbines in landscape terms.
- Wind turbines should be carefully sited and designed relative to existing structures. Particular attention should be paid to relative heights and proportions; close visual relationships may help to reinforce functional relationships.
- In some cases turbines may be used to create a new focal point or landmark, drawing the eye upwards and away from existing intrusive features.
- However care should be taken to avoid creating visual clutter by placing turbines too close to other complex structures such as pylons or telecommunications masts.
- Functional relationships between domestic, community and industrial turbines and their landscape settings should be reflected in turbine siting, turbines being closely associated with, and in scale with, the farms, settlements or industrial plant that they serve.

Figure 1: How to Use This Report

Steps and Tasks	Relevant Report Sections	Key Reference Material
Step 1: Review background and collect information ▼		
Understand factors underlying landscape sensitivity	Section 2.3	• Table 3 Landscape sensitivity criteria
Understand factors underlying landscape capacity	Sections 2.4 and 2.5	• Table 6 Principles of fit with landscape character • Table 7 Principles relating to scale and cumulative impact
Consider the South Pennines landscape as a whole	Section 4.2	• Figure 3 Physical features of the study area • Figure 4 South Pennines landscape context
Step 2: Assess landscape sensitivity and capacity ▼		
Identify location of proposed development		• OS 1:25,000 scale map
Identify scale of proposed development		• Table 4 Wind energy development typology
Consider existing wind energy developments and their impacts at a strategic scale	Section 4.5 – text for relevant National Character Area	• Figure 6 Wind energy developments and National Character Areas
Identify landscape character type(s) and capacity area(s) within which the development would sit	Annexes 1 and 2 Landscape character descriptions	• Figure 7 Landscape character types • Figure 8 Capacity areas
Review sensitivity and capacity assessment sheets and consider whether or not location and scale are consistent with advice given. *(If so, proceed to Step 3. If not, identify alternative location and/or scale)*	Sections 5.2 and 5.3	• Relevant sensitivity and capacity assessment sheets
Step 3: Design and assess impacts of proposed development ▼		
If location and scale are appropriate, review and address detailed siting, layout and design issues	Section 6.4	• Table 11 Principles of good siting, layout and design • Guidance and cumulative and cross-district sections of capacity assessment sheet(s)
Assess landscape and visual impacts and if necessary, seek to revise scheme siting, layout and design	Section 6.5	• Table 12 Good practice requirements for landscape and visual impact assessment • Table 13 Checklist of presentation material

Hence the capacity assessment provides a reasoned appraisal and brief guidance on the general location, type and level of wind energy development that may be accommodated without significant adverse impacts on landscape resources. The general assumption is that change will be easiest to accommodate in areas of low sensitivity, and most difficult to accommodate in areas of high sensitivity. Areas of moderate sensitivity are generally taken to have capacity to accommodate some change. However it is also recognised that every specific case is different and that ultimately capacity will also be affected by other factors, including technical feasibility and perceptions of the need for development, which are not considered in this study.

In assessing overall capacity we have endeavoured to identify and refer to the key ***thresholds*** or 'tipping points' of landscape change that may occur as a result of wind energy development. The diagram below summarises these thresholds and shows how they may relate to the strategy for a given landscape. Thresholds vary from one landscape to another and are also dependent on the specific nature of the development proposals concerned. However, it can be seen that, in general, there is most likely to be significant capacity for wind energy development where landscape change (or indeed the creation of a new character) is considered acceptable. Conversely, where the strategy is one of conservation, capacity is likely to be limited.

Table 5: Thresholds of Landscape Change

Landscape strategy	►	**Conservation**	►	**Accommodation**	►	**Change**	►	**New character**
Wind energy development capacity		A 'landscape with no wind farms or infrequent wind farms'		A 'landscape with occasional wind farms'		A 'landscape with wind farms'		A 'wind farm landscape'

2.5 Principles Affecting Landscape Capacity for Wind Energy Development

As discussed above, in assessing landscape capacity for wind energy development, there is a need to consider issues of fit with landscape character, scale and cumulative impact. The tables below summarise some of the general principles that have been applied in this assessment. These are developed further in *Section 6*, which advises on good siting, layout and design in the South Pennines specifically.

Table 6: General Principles Relating to Fit with Landscape Character

Upland landscapes
• The broader the upland, the greater its capacity for wind energy development is likely to be. • Uplands with a simple, rounded and generally horizontal form may be able to accommodate larger turbine groupings than more dramatic or convoluted upland landforms. • In areas of more complex upland landform, smaller turbine groupings will generally fit better than larger groupings. • Development that is well set back from upland edges or scarps will be less prominent in the landscape than development close to the upland edge.

- The central part of an upland area will often be least visible from adjoining lowland landscapes. Convex landform in particular may offer some screening and reduce visible turbine heights, especially in short range views from valleys below.
- Siting of turbines on obvious summits or other prominent landforms should generally be avoided.
- Impacts can be reduced by selecting sites on less prominent side slopes, benches and gentle undulations as sites rather than tops themselves.
- Locations close to distinctive topographic features, field patterns, buildings or other features may bring undesirable scale comparisons.
- Wilder areas of upland, characterised by open heather moor and bog, are usually more sensitive than areas of grass moor or forestry which may have a more intensively managed character.
- Locations that can utilise existing roads or tracks for access are preferable to locations that require lengthy and often highly visible new access tracks.

Intermediate landscapes

- Such landscapes, typified by rolling ridge and drumlin landscapes, tend to suit smaller turbine groupings and turbine heights.
- Where the landscape is rolling or undulating, small turbine groups are likely to fit best in the landscape; where the landscape is flatter or more gently sloping, larger turbine groups may sometimes be accommodated.
- Where skylines are especially sensitive, it may be helpful to site turbines so that they are backclothed against hillsides beyond.
- Where sited on low ridges or hills, particular care should be given to turbine height in relation to landform.
- As rule of thumb, turbine heights should not exceed the average hill or drumlin height (note, height, not elevation AOD) and should ideally be no taller than half that height.

Lowland landscapes

- These landscapes, including valleys, floodplains and lowland farmlands, may accommodate larger turbines and turbine groupings than intermediate landscapes, provided that their character is simple and expansive.
- However capacity may be reduced by the presence of features such as prominent church spires that offer a scale comparison nearby.
- Valley landscapes that are enclosed by uplands with existing wind farm development should generally be kept free of wind turbines, to maintain a sense of contrast and ensure that the wider landscape does not become dominated by wind energy development.
- Floodplain landscapes, unless very extensive, may have little landscape capacity for wind turbines because openness is an essential part of their character.
- Extensive flat farmlands may be better able to accommodate wind energy development. Here regular rows or lines of turbines may provide the best fit with large, regular field patterns.

Urban and industrial landscapes

- These landscapes may have capacity for wind energy development due to the presence of existing man-made influences.
- For example sites close to power stations, factories, large institutions such as hospitals, business parks, major transport corridors and quarries may have capacity for wind turbines in landscape terms.
- Wind turbines should be carefully sited and designed relative to existing structures. Particular attention should be paid to relative heights and proportions; close visual relationships may help to reinforce functional relationships.
- In some cases turbines may be used to create a new focal point or landmark, drawing the eye upwards and away from existing intrusive features.
- However care should be taken to avoid creating visual clutter by placing turbines too close to other complex structures such as pylons or telecommunications masts.
- Functional relationships between domestic, community and industrial turbines and their landscape settings should be reflected in turbine siting, turbines being closely associated with, and in scale with, the farms, settlements or industrial plant that they serve.

Capacity Area 6: Calder Valley Moorland Fringe

Location and Context

This area lies to the south and east of the South Pennine Moors and represents the immediate, enclosed moorland fringes and valleys on the dip slope of the Southern Pennines. Typically these landscapes lie at elevations of between 250 and 300m AOD and form complex sloping terraces of farmland, just below the steep, pronounced gritstone edges that fringe the moorlands on the east. Below these terraces there is frequently a further very steep drop into the valley bottoms below. The landscape character types within this area include some prominent fingers of A: High Moorland Plateaux (notably Midgley Moor north of Mytholmroyd), but the bulk of the area is D: Moorland Fringes/ Upland Pastures and E: Rural Fringes, enclosing areas of F: Settled Valleys and G: Wooded Rural Valleys in the valley bottoms below. There is no significant operational or consented wind energy development in this area at present.

Intervisibility

Visually this area is perceived separately from the open, level, undulating tops of the South Pennine Moors. It looks westwards towards the valleys of the Yorkshire River Calder and its principal tributary, the River Ryburn. Because of the terracing and generally broad valley form, most of the area can be seen from below and forms an outstanding landscape setting to the scenic towns of Mytholmroyd, Hebden Bridge, Todmorden and Ripponden on the A646 and A58, with their early industrial heritage. West of Hebden Bridge, visibility is generally contained within the valleys but further east, towards Sowerby Bridge, views to and from Halifax (just outside the area) open up.

Capacity Assessment

Constraints

This is a complex, small scale and highly scenic landscape which, like the South Pennine Moors, lies at the heart of the South Pennines Heritage Area in terms of scenic, natural and cultural heritage interest. Fine vernacular buildings and settlements, including a strong concentration of Conservation Areas and early industrial heritage, characterise the valleys. The dramatic, valley slopes, for example those around Midgley Moor and Stoodley Pike, are highly sensitive, affording some of the finest panoramic views within the whole of the Pennine uplands, which can be enjoyed from the Pennine Way, Pennine Bridleway and other routes such as the Calderdale Way. There are extensive areas of small, early, patterned enclosures; narrow winding lanes; areas of deep peat; and ancient woodlands in deeply incised valleys below. Hence most of the landscape is both highly sensitive to any physical change and affords very little space for wind energy development.

Opportunities

There are very few opportunities for any significant wind energy development. Only two small areas may have some capacity for a small group of turbines or small wind farm, subject to consideration of any specific impacts on landscape interests including those outlined above. These lie at the northern end of the area, around Blackshaw, where the moorland fringe landscape (type D) is relatively simple, large scale, and steps back from the valley edge; and in the rural fringe landscape (type E) of the southern part of the area, where proximity to the M62 motorway and quarrying influences reduce landscape sensitivity somewhat. Otherwise this area is likely to be able to accommodate single very small turbines at most.

Guidance

Any wind energy development, of whatever scale, should avoid locations close to the lower edge of the moorland fringe terrace, as such locations are very prominent in views from the settled valleys below. Where development is sited within moorland or rural fringe landscapes, turbines of small or medium height at most are likely to be appropriate; these should be backclothed against hillsides above. Close juxtaposition with small scale landscape features such as gritstone tors and farm buildings should be avoided. The impacts of access tracks on enclosure patterns should be minimised; any damage should be carefully restored; and grid connections should be underground.

Cumulative and cross-district issues

Some of the higher ground within this area already has views of surrounding wind farms at Coal Clough, Ovenden Moor, Royd Moor and Scout Moor; there will also be views of Reaps Moss and

Table 7: General Principles Relating to Scale and Cumulative Impact

Turbine groupings

- Landscapes with a simple, strong and mainly horizontal form are more likely to be able to accommodate large turbine groupings successfully.
- Small turbine groupings may however fit less well in these horizontal landscapes, because their height may appear disproportionate.
- Conversely, in landscapes with more complex and varied landform, large turbine groupings may have an undesirable 'flattening' effect on landscape character.
- Smaller turbine groupings are likely to fit better in these smaller scale, more intricate landscapes.
- Compact clusters of turbines may sometimes be used to create or highlight a focal point within the landscape, adding or reinforcing a vertical emphasis in the landscape.
- However such an approach needs to be used very selectively if it is to be effective in creating a visual focus.

Turbine height

- In general, turbine height should be proportionate to landform height, with taller turbines being used on higher hills and smaller turbines on lower ground. This will help to retain topographic distinctions and contrasts between upland and lowland landscapes.
- Hence elevated upland landscapes can often accommodate taller turbines than lowland landscapes, especially where the lowland landscapes have a rolling, varied topography whose subtle variations could be overwhelmed by tall turbines.
- However, extensive, flat, uniform lowland landscapes may also be able to accommodate tall turbines because of the lack of topographic distinctions and because the larger horizontal extent of such landscapes tends to diminish perceived turbine height.

Cumulative impacts and spacing between wind farms

- Satisfactory spacing depends both on landscape character and on the degree of intervisibility.
- Where several wind farms are visible together or sequentially they may cumulatively affect landscape character and visual amenity at a strategic level.
- Retention of areas of undeveloped landscape is important. For example, where a small lowland wind farm connects larger upland sites visually, wind farm influence on landscape character may become much more significant and dominant.
- Inconsistencies in turbine layout, height or design between adjacent wind farms can draw the eye and may cause increased landscape and visual impact.
- Appropriate spacing depends at least partly on landscape patterns and rhythms. Hence on an undulating upland ridge, wind farm spacing may reflect the pattern and frequency of undulations, whereas on a simple rounded upland ridge a cluster of wind farms may give a better landform fit.
- As a rule of thumb, separation distances ranging from 6km (for smaller sites in landscapes with some visual enclosure) to 12 km (for larger sites in open exposed landscapes) are desirable to prevent the landscape becoming dominated by wind farms and to reduce intervisibility.
- If small and medium sized wind farms are located less than 3-5km apart (to the outermost turbines) they may be seen as clusters and in areas of appropriate character may be accommodated as such within the landscape.

Capacity Area 6: Calder Valley Moorland Fringe

Location and Context

This area lies to the south and east of the South Pennine Moors and represents the immediate, enclosed moorland fringes and valleys on the dip slope of the Southern Pennines. Typically these landscapes lie at elevations of between 250 and 300m AOD and form complex sloping terraces of farmland, just below the steep, pronounced gritstone edges that fringe the moorlands on the east. Below these terraces there is frequently a further very steep drop into the valley bottoms below. The landscape character types within this area include some prominent fingers of A: High Moorland Plateaux (notably Midgley Moor north of Mytholmroyd), but the bulk of the area is D: Moorland Fringes/ Upland Pastures and E: Rural Fringes, enclosing areas of F: Settled Valleys and G: Wooded Rural Valleys in the valley bottoms below. There is no significant operational or consented wind energy development in this area at present.

Intervisibility

Visually this area is perceived separately from the open, level, undulating tops of the South Pennine Moors. It looks westwards towards the valleys of the Yorkshire River Calder and its principal tributary, the River Ryburn. Because of the terracing and generally broad valley form, most of the area can be seen from below and forms an outstanding landscape setting to the scenic towns of Mytholmroyd, Hebden Bridge, Todmorden and Ripponden on the A646 and A58, with their early industrial heritage. West of Hebden Bridge, visibility is generally contained within the valleys but further east, towards Sowerby Bridge, views to and from Halifax (just outside the area) open up.

Capacity Assessment

Constraints

This is a complex, small scale and highly scenic landscape which, like the South Pennine Moors, lies at the heart of the South Pennines Heritage Area in terms of scenic, natural and cultural heritage interest. Fine vernacular buildings and settlements, including a strong concentration of Conservation Areas and early industrial heritage, characterise the valleys. The dramatic, valley slopes, for example those around Midgley Moor and Stoodley Pike, are highly sensitive, affording some of the finest panoramic views within the whole of the Pennine uplands, which can be enjoyed from the Pennine Way, Pennine Bridleway and other routes such as the Calderdale Way. There are extensive areas of small, early, patterned enclosures; narrow winding lanes; areas of deep peat; and ancient woodlands in deeply incised valleys below. Hence most of the landscape is both highly sensitive to any physical change and affords very little space for wind energy development.

Opportunities

There are very few opportunities for any significant wind energy development. Only two small areas may have some capacity for a small group of turbines or small wind farm, subject to consideration of any specific impacts on landscape interests including those outlined above. These lie at the northern end of the area, around Blackshaw, where the moorland fringe landscape (type D) is relatively simple, large scale, and steps back from the valley edge; and in the rural fringe landscape (type E) of the southern part of the area, where proximity to the M62 motorway and quarrying influences reduce landscape sensitivity somewhat. Otherwise this area is likely to be able to accommodate single very small turbines at most.

Guidance

Any wind energy development, of whatever scale, should avoid locations close to the lower edge of the moorland fringe terrace, as such locations are very prominent in views from the settled valleys below. Where development is sited within moorland or rural fringe landscapes, turbines of small or medium height at most are likely to be appropriate; these should be backclothed against hillsides above. Close juxtaposition with small scale landscape features such as gritstone tors and farm buildings should be avoided. The impacts of access tracks on enclosure patterns should be minimised; any damage should be carefully restored; and grid connections should be underground.

Cumulative and cross-district issues

Some of the higher ground within this area already has views of surrounding wind farms at Coal Clough, Ovenden Moor, Royd Moor and Scout Moor; there will also be views of Reaps Moss and

Crook Hill when built. If the development opportunities described above materialise, it will be important to maintain adequate visual separation from the existing wind farm at Coal Clough; and to consider cumulative impacts of any new development with the consented Scapegoat Hill site in CA8 just south of M62 near Huddersfield (2 turbines, 25m).

Overall capacity
This area may have landscape capacity for the following:

- One or two small groups of turbines or a small wind farm, with turbines of small or medium height at most.

This landscape is currently a 'landscape with no wind farms or infrequent wind farms'. Following this development it is likely to remain a 'landscape with no wind farms or infrequent wind farms', representing a continuing landscape strategy of conservation, which is appropriate given the strategic importance and value of this core area of the South Pennines.

Section 3b: Extract from Julie Martin Associates January 2010, Landscape Capacity Study for Wind Energy Developments in the South Pennines

Capacity Area 7: Halifax and Brighouse

Figure 1: How to Use This Report

Steps and Tasks	Relevant Report Sections	Key Reference Material
Step 1: Review background and collect information ▼		
Understand factors underlying landscape sensitivity	Section 2.3	• Table 3 Landscape sensitivity criteria
Understand factors underlying landscape capacity	Sections 2.4 and 2.5	• Table 6 Principles of fit with landscape character • Table 7 Principles relating to scale and cumulative impact
Consider the South Pennines landscape as a whole	Section 4.2	• Figure 3 Physical features of the study area • Figure 4 South Pennines landscape context
Step 2: Assess landscape sensitivity and capacity ▼		
Identify location of proposed development		• OS 1:25,000 scale map
Identify scale of proposed development		• Table 4 Wind energy development typology
Consider existing wind energy developments and their impacts at a strategic scale	Section 4.5 – text for relevant National Character Area	• Figure 6 Wind energy developments and National Character Areas
Identify landscape character type(s) and capacity area(s) within which the development would sit	Annexes 1 and 2 Landscape character descriptions	• Figure 7 Landscape character types • Figure 8 Capacity areas
Review sensitivity and capacity assessment sheets and consider whether or not location and scale are consistent with advice given. *(If so, proceed to Step 3. If not, identify alternative location and/or scale)*	Sections 5.2 and 5.3	• Relevant sensitivity and capacity assessment sheets
Step 3: Design and assess impacts of proposed development ▼		
If location and scale are appropriate, review and address detailed siting, layout and design issues	Section 6.4	• Table 11 Principles of good siting, layout and design • Guidance and cumulative and cross-district sections of capacity assessment sheet(s)
Assess landscape and visual impacts and if necessary, seek to revise scheme siting, layout and design	Section 6.5	• Table 12 Good practice requirements for landscape and visual impact assessment • Table 13 Checklist of presentation material

Hence the capacity assessment provides a reasoned appraisal and brief guidance on the general location, type and level of wind energy development that may be accommodated without significant adverse impacts on landscape resources. The general assumption is that change will be easiest to accommodate in areas of low sensitivity, and most difficult to accommodate in areas of high sensitivity. Areas of moderate sensitivity are generally taken to have capacity to accommodate some change. However it is also recognised that every specific case is different and that ultimately capacity will also be affected by other factors, including technical feasibility and perceptions of the need for development, which are not considered in this study.

In assessing overall capacity we have endeavoured to identify and refer to the key ***thresholds*** or 'tipping points' of landscape change that may occur as a result of wind energy development. The diagram below summarises these thresholds and shows how they may relate to the strategy for a given landscape. Thresholds vary from one landscape to another and are also dependent on the specific nature of the development proposals concerned. However, it can be seen that, in general, there is most likely to be significant capacity for wind energy development where landscape change (or indeed the creation of a new character) is considered acceptable. Conversely, where the strategy is one of conservation, capacity is likely to be limited.

Table 5: Thresholds of Landscape Change

Landscape strategy	►	**Conservation**	►	**Accommodation**	►	**Change**	►	**New character**
Wind energy development capacity		A 'landscape with no wind farms or infrequent wind farms'		A 'landscape with occasional wind farms'		A 'landscape with wind farms'		A 'wind farm landscape'

2.5 *Principles Affecting Landscape Capacity for Wind Energy Development*

As discussed above, in assessing landscape capacity for wind energy development, there is a need to consider issues of fit with landscape character, scale and cumulative impact. The tables below summarise some of the general principles that have been applied in this assessment. These are developed further in *Section 6*, which advises on good siting, layout and design in the South Pennines specifically.

Table 6: General Principles Relating to Fit with Landscape Character

Upland landscapes
• The broader the upland, the greater its capacity for wind energy development is likely to be. • Uplands with a simple, rounded and generally horizontal form may be able to accommodate larger turbine groupings than more dramatic or convoluted upland landforms. • In areas of more complex upland landform, smaller turbine groupings will generally fit better than larger groupings. • Development that is well set back from upland edges or scarps will be less prominent in the landscape than development close to the upland edge.

- The central part of an upland area will often be least visible from adjoining lowland landscapes. Convex landform in particular may offer some screening and reduce visible turbine heights, especially in short range views from valleys below.
- Siting of turbines on obvious summits or other prominent landforms should generally be avoided.
- Impacts can be reduced by selecting sites on less prominent side slopes, benches and gentle undulations as sites rather than tops themselves.
- Locations close to distinctive topographic features, field patterns, buildings or other features may bring undesirable scale comparisons.
- Wilder areas of upland, characterised by open heather moor and bog, are usually more sensitive than areas of grass moor or forestry which may have a more intensively managed character.
- Locations that can utilise existing roads or tracks for access are preferable to locations that require lengthy and often highly visible new access tracks.

Intermediate landscapes

- Such landscapes, typified by rolling ridge and drumlin landscapes, tend to suit smaller turbine groupings and turbine heights.
- Where the landscape is rolling or undulating, small turbine groups are likely to fit best in the landscape; where the landscape is flatter or more gently sloping, larger turbine groups may sometimes be accommodated.
- Where skylines are especially sensitive, it may be helpful to site turbines so that they are backclothed against hillsides beyond.
- Where sited on low ridges or hills, particular care should be given to turbine height in relation to landform.
- As rule of thumb, turbine heights should not exceed the average hill or drumlin height (note, height, not elevation AOD) and should ideally be no taller than half that height.

Lowland landscapes

- These landscapes, including valleys, floodplains and lowland farmlands, may accommodate larger turbines and turbine groupings than intermediate landscapes, provided that their character is simple and expansive.
- However capacity may be reduced by the presence of features such as prominent church spires that offer a scale comparison nearby.
- Valley landscapes that are enclosed by uplands with existing wind farm development should generally be kept free of wind turbines, to maintain a sense of contrast and ensure that the wider landscape does not become dominated by wind energy development.
- Floodplain landscapes, unless very extensive, may have little landscape capacity for wind turbines because openness is an essential part of their character.
- Extensive flat farmlands may be better able to accommodate wind energy development. Here regular rows or lines of turbines may provide the best fit with large, regular field patterns.

Urban and industrial landscapes

- These landscapes may have capacity for wind energy development due to the presence of existing man-made influences.
- For example sites close to power stations, factories, large institutions such as hospitals, business parks, major transport corridors and quarries may have capacity for wind turbines in landscape terms.
- Wind turbines should be carefully sited and designed relative to existing structures. Particular attention should be paid to relative heights and proportions; close visual relationships may help to reinforce functional relationships.
- In some cases turbines may be used to create a new focal point or landmark, drawing the eye upwards and away from existing intrusive features.
- However care should be taken to avoid creating visual clutter by placing turbines too close to other complex structures such as pylons or telecommunications masts.
- Functional relationships between domestic, community and industrial turbines and their landscape settings should be reflected in turbine siting, turbines being closely associated with, and in scale with, the farms, settlements or industrial plant that they serve.

Table 7: General Principles Relating to Scale and Cumulative Impact

Turbine groupings

- Landscapes with a simple, strong and mainly horizontal form are more likely to be able to accommodate large turbine groupings successfully.
- Small turbine groupings may however fit less well in these horizontal landscapes, because their height may appear disproportionate.
- Conversely, in landscapes with more complex and varied landform, large turbine groupings may have an undesirable 'flattening' effect on landscape character.
- Smaller turbine groupings are likely to fit better in these smaller scale, more intricate landscapes.
- Compact clusters of turbines may sometimes be used to create or highlight a focal point within the landscape, adding or reinforcing a vertical emphasis in the landscape.
- However such an approach needs to be used very selectively if it is to be effective in creating a visual focus.

Turbine height

- In general, turbine height should be proportionate to landform height, with taller turbines being used on higher hills and smaller turbines on lower ground. This will help to retain topographic distinctions and contrasts between upland and lowland landscapes.
- Hence elevated upland landscapes can often accommodate taller turbines than lowland landscapes, especially where the lowland landscapes have a rolling, varied topography whose subtle variations could be overwhelmed by tall turbines.
- However, extensive, flat, uniform lowland landscapes may also be able to accommodate tall turbines because of the lack of topographic distinctions and because the larger horizontal extent of such landscapes tends to diminish perceived turbine height.

Cumulative impacts and spacing between wind farms

- Satisfactory spacing depends both on landscape character and on the degree of intervisibility.
- Where several wind farms are visible together or sequentially they may cumulatively affect landscape character and visual amenity at a strategic level.
- Retention of areas of undeveloped landscape is important. For example, where a small lowland wind farm connects larger upland sites visually, wind farm influence on landscape character may become much more significant and dominant.
- Inconsistencies in turbine layout, height or design between adjacent wind farms can draw the eye and may cause increased landscape and visual impact.
- Appropriate spacing depends at least partly on landscape patterns and rhythms. Hence on an undulating upland ridge, wind farm spacing may reflect the pattern and frequency of undulations, whereas on a simple rounded upland ridge a cluster of wind farms may give a better landform fit.
- As a rule of thumb, separation distances ranging from 6km (for smaller sites in landscapes with some visual enclosure) to 12 km (for larger sites in open exposed landscapes) are desirable to prevent the landscape becoming dominated by wind farms and to reduce intervisibility.
- If small and medium sized wind farms are located less than 3-5km apart (to the outermost turbines) they may be seen as clusters and in areas of appropriate character may be accommodated as such within the landscape.

Capacity Area 7: Halifax and Brighouse

Location and Context

This is a densely settled landscape centred on the urban settlements of Halifax, Brighouse and Elland and their hinterlands north and south of the Calder valley, including a number of tributary valleys north of the main river. The area is bounded to the west by the steep slopes at the foot of the moorland fringe and to the south and east by the M62 motorway, which has become an important physical and perceptual divide. The principal landscape character types in the north are K: Coalfield Edge Urban Fringe Farmland, separated by bands of G: Wooded Rural Valleys trending north-south; while in the south the landscape comprises types M: Industrial Lowland Valleys, F: Settled Valleys and E: Rural Fringes. The highest ground occurs in the north at around 400m AOD, falling to around 100m AOD in the main valley bottom before rising again to 200-300m AOD along the M62 motorway corridor. There is no significant operational or consented wind energy development in this area at present.

Intervisibility

This area forms a broad, inward-facing bowl around the river and the urban areas. The eastern parts of the area can be seen from the M62 motorway, particularly where it crosses the Calder valley at Brighouse. Good views into the area are also obtained from most of the radial routes into Halifax, including the A646 from the east, the A644 from the north, the A649 from the east, and the A629 from the south, which makes a dramatic descent from the M62. The slopes to the north are visually very exposed, and are mainly developed. The edges of the moorland tops above are also visible, but the moorland plateaux are generally hidden from view, from the urban areas at least.

Capacity Assessment

Constraints

Much of this area is of moderate-low sensitivity to wind energy development due to the high degree of human influence and the mixed landscape quality, although the sensitivity of the settled valleys and wooded rural valleys is higher. The key constraint is lack of space for any significant wind energy development, given the densely settled urban and suburban character of most of the area. The relatively few pockets of undeveloped land often represent fragments of higher quality, intact landscape that are highly valued as a recreational resource by nearby urban populations and are accessed via a dense network of public rights of way (including sections of the Calderdale, Brontë and Kirklees Ways). Sites on the crest of narrow ridges that directly overlook settled or wooded rural valleys (eg on the eastern outskirts of Halifax) would be unsuited to development due to their extreme visual prominence.

Opportunities

Some modest opportunities for wind energy development up to the size of a small group of turbines (or exceptionally a small wind farm) may occur on higher ground on the north-eastern edges of this area within the coalfield edge urban fringe farmland (type K) – especially towards the M62 motorway corridor to the east. There may also be opportunities further south, around Southwram (between Halifax and Brighouse), an area that is heavily influenced by quarrying and industrial activity; and in the industrial lowland valley landscapes (type M) within the river corridor (although the wind resource here is limited). In these areas single turbines or small groups of turbines would be more appropriate.

Guidance

A key issue will be appropriate separation from settlements and features such as walking routes. Special attention should be given to impacts on views from surrounding towns and villages, and to the visual relationship with the M62 and the many transmission lines that cross this landscape. When accessing wind energy developments, any damage to field enclosure patterns (stone walls) should be minimised and appropriate restoration undertaken. Given the relatively expansive underlying landform and large enclosures, the landscape within the coalfield edge urban fringe farmland may be capable of accommodating medium or even large turbines. In other areas however, the presence of scale comparators such as woodland and existing industrial structures means that small turbines are likely to be more appropriate.

Cumulative and cross-district issues

Most of this landscape has few or only very distant views to existing wind energy development, except for Ovenden Moor, which is visible from western parts of the area only. In siting any new wind energy development, adequate visual separation from Ovenden Moor is desirable and any cumulative impacts should be given careful consideration. Cumulative impacts with any wind energy development that may take place in CA9 Batley and Dewsbury may need to be considered in future.

Overall capacity

This area may have landscape capacity for the following:

- Several small groups of turbines, or exceptionally a small wind farm with medium or large turbines on the higher ground in the north-eastern part of this capacity area;
- Several single or small groups of very small or small turbines in the south around Southwram and the Calder river corridor.

This landscape is currently a 'landscape with no wind farms or infrequent wind farms'. Following this development it is likely to become a 'landscape with occasional wind farms' or even a 'landscape with wind farms', representing a landscape strategy of accommodation or change.