Porter, Karen

From: Tony Benson <tony@caminus.co.uk>
Sent: 11 February 2015 10:41
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Cc: mark.hinnells
Subject: H10-0290-12 Additional Information
Attachments: Additional information H10-0290-12 Wind Turbine Long Sutton.pdf

Karen, Mark
I have been unable to submit this document through the planning portal.
At some point I have opened the application for amendments and it has saved itself without many necessary elements.
Support, at the planning portal, say the only way is to re-complete the application and submit it all again.
I thought that may be more confusing, and require unnecessary work to just extract this one additional document.

I trust that you can accept it this way.

Regards

Tony Benson
Susenco
07831 686324

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Information in Support of Planning Application

Wind Turbine Power Generation Scheme

H10-0290-12

Additional Information Requested by the Planning Committee



the little sutton energy company

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1 Introduction

The planning application was considered by the Planning Committee on 2nd December 2014. The discussion in Committee:

- challenged the need for the scheme just here;
- raised concerns over shadow flicker, how the technology works, and questioned whether more than 3 properties were affected;
- included concerns on impact on residents, especially in the light of the inspector's decision at Treading Fields, where, although only a small number of people are adversely affected, the impact was so severe as to cause refusal on appeal, on the basis no person could be expected to live there. To inform this assessment the committee requested photomontages be taken from the closest residential properties, and assessment against recent inspectors' decisions.

This current report addresses these three points in order.

2 The need for the scheme

The NPPF[1] states in para 98:

> *When determining planning applications, local planning authorities should:*
>
> - *not require applicants for energy development to demonstrate the overall need for renewable or low carbon energy and also recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and*
> - *approve the application if its impacts are (or can be made) acceptable. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should also expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.*

This location was selected because:

- it is one of a few locations that was identified for wind turbine development in the South Holland, consistent with the direction of the NPPF;
- the location has access to the electricity grid and we have been offered and have accepted a connection to the grid;
- whilst there is no agreement in place with a local business, we will seek to supply local businesses, and the laws of physics are such that the electricity generated, regardless of any contract, would be used by the closest available user of electricity. This means that local generation of any type loses less electricity in grid losses than centrally generated electricity; and

[1] DCLG (2012) National Planning Policy Framework
www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf

- there are a good many members of the local community who have expressed an interest in purchasing a share of the turbine and running it on a community owned basis, and the developer is keen to finance the capital investment on this basis so that the benefits stay local. Planning Practice Guidance Note[2] supports this in para 17: *Community initiatives are likely to play an increasingly important role and should be encouraged as a way of providing positive local benefit from renewable energy.*

3 Shadow Flicker

Concern was raised by the committee about shadow flicker from the proposed wind turbine and how this may affect residential properties, and whether more than 3 properties were affected. The committee did not understand the technology that is used to stop the problem.

The original Environmental Impact Assessment explored shadow flicker (Section 14, Pages 352 to 357). Shadow flicker is totally predictable so its range and duration can be calculated with accuracy. Technology in the turbine will automatically feather the blades and apply a brake to stop them from turning when any flicker would otherwise fall on any dwellings. No human intervention is required.

The range of shadow flicker is dictated by the height and diameter of the turbine blades and the level of the sun. It is of concern only in the winter during mornings and evenings when the sun is low. It is less likely to affect properties directly to the north of a turbine because even in winter, the sun is too high in the sky. The original application included the results of such calculations, indicating that three properties would be exposed in winter for a few hours per year.

These are:

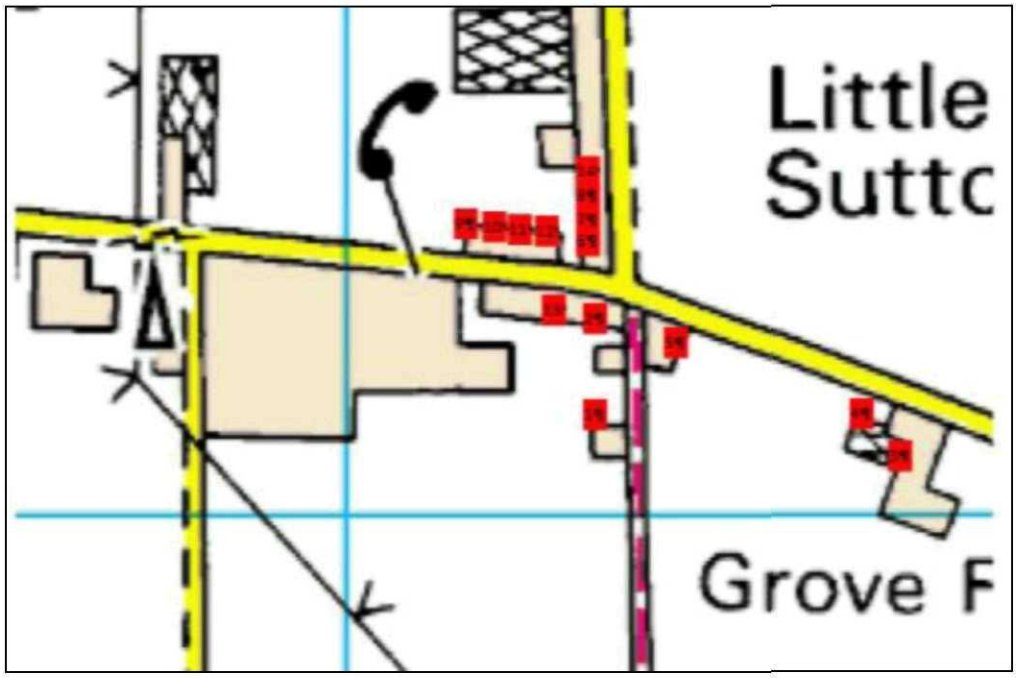
Tower Bungalow	18 hours per year
Halfway House	27 hours per year
Grove Farm	17 hours per year

[2] Planning practice guidance for renewable and low carbon energy
www.gov.uk/government/uploads/system/uploads/attachment_data/file/225689/Planning_Practice_Guidance_for_Renewable_and_Low_Carbon_Energy.pdf

3.1 Validation of the methodology

The original report indicated the potential area for shadow flicker to occur as 10 rotor blade diameters from the turbine.





All fourteen houses in this area were then subject to calculation of the position of the sun, rotor blade and house windows, excluding any vegetation screening that may be present. Only three were found to be at risk of shadow flicker. It is possible that some uncertainty was created in the minds of

committee members by indicating that there are eleven properties in the risk zone which do not receive shadow flicker. There is a clear technical reason for this.

The at-risk semi circle zone of 10 rotor diameters indicated in our application is determined to catch all at-risk properties at all latitudes of the UK. The semi-circle that forms the potential shadow flicker zone has a further semi-circular section removed from the northern area as shown in the overlay map below. Properties due north of the turbine will receive varying exposure dependent on latitude, because at more northerly latitudes the sun tracks across the sky at a lower height in winter, thus more properties would be at risk for a turbine in a northern latitude.

In southerly latitudes it is actually areas to the east and west, within the 10 rotor diameter radius, where the sun is low, that are more at risk than properties to the north. Importantly there are no receptors in these areas.

At Long Sutton, the height of the sun at midday is high enough that all properties on both sides of Bridge Road to the west of Hospital Drove fall outside the actual shadow flicker envelope, and for the three properties that have been predicted to be at risk of some shadow flicker, the coloured bands indicate the approximate time of exposure. We confirm therefore, that the submission is correct and that only three properties have a risk of shadow flicker.

We further confirm that these three properties will not actually suffer shadow flicker as the turbine will automatically cease turning at these times of risk. Risk of shadow flicker is not the same as experiencing it, because experiencing it depends on a coincidence of the right time of day and year, the sun being out to cause a shadow, and the wind blowing. In this circumstance, the technology kicks in to feather the blades and prevent the turbine turning for the period of time that the shadow of the turbine crosses the house, before the turbine starts up again.



3.2 Validation of the methodology: government studies on shadow flicker

It should be noted that since the original application an independent research study into the phenomenon of shadow flicker from wind turbines was published in March 2011 by the Department of Energy and Climate Change (DECC)[3]. The study, commissioned from Parsons Brinckerhoff following a competitive tender process, found that:

- there have not been extensive issues with shadow flicker in the UK;
- the frequency of the flickering caused by the wind turbine rotation is such that it should not cause a significant risk to health;
- in the few cases where problems have arisen, they have been resolved effectively using mitigation measures, in particular turbine shut down systems.

The report was peer reviewed by independent experts, The Energy Workshop, and DECC's Engineering and Analysis team. The Department for Communities and Local Government, DEFRA and the Department of Health also engaged in the review. The Government has considered the report's findings and concluded that existing planning guidance on shadow flicker is fit for purpose, and no changes to it are necessary.

3.3 Technology to eliminate risk of shadow flicker

The wind turbine being considered by the Applicant is an Enercon machine. The manufacturers have provided a technical description of their technology to manage and eliminate any risk of shadow flicker and this has been submitted as part of the application documentation. Such systems are common in wind turbine schemes. In brief, this uses shadow/light sensors on the turbine to detect incoming sun brightness and shadow flicker potential. The turbine also knows the time of day and year and the position of the sun. The sensitive receptors are programmed into the on-board control system and the turbine is programmed to shut down if shadow flicker at a residential house is possible. If adjustments are necessary they can be effected by regular maintenance personnel.

For completeness and convenience, the technical information is appended to this document.

The Planning Officer's report to committee has stated that a condition of consent would be to demonstrate that such technology would be installed, and we have indicated we are happy to accept such a condition.

Despite the above assessment, some residents may still be concerned that the list of houses that are predicted to be at risk of shadow flicker is incomplete. The applicant will respond to any operational differences that develop during operation by changing the operation of the turbine to fully negate all such incidences.

[3] Department of Energy and Climate Change (DECC) (2011) *Update of UK Shadow Flicker Evidence Base*, downloadable from www.gov.uk/government/uploads/system/uploads/attachment_data/file/48052/1416-update-uk-shadow-flicker-evidence-base.pdf

4 Impact on views

The applicant and the Planning Officer in his recommendation to committee concluded that a single wind turbine could only affect a small proportion of any view, leaving the rest of an existing view intact.

The Planning Committee were concerned with the impact on some residential properties in the immediate community, and requested photomontages from the closest properties, to inform discussion on the potential impact and also allow any form of screening to be assessed more effectively. The new photomontages with a discussion of each are below.

5 Appeal Inspector Reports

At the committee meeting for the wind turbine proposed at Long Sutton, a member queried the rejection of the scheme at Treading Fields and asked if this contained the basis for refusal at Long Sutton, so the photomontages are placed in the context of the Appeal Inspector's decision at Treading Fields.

5.1 Treading Fields Appeal Inspector Report

Treading Fields is a nearby scheme which was refused consent, and subsequently also denied on appeal. Many properties would have visibility of the scheme, and the Appeal Inspector's report includes much detail about how the scheme impacts on nearby properties.

At the committee meeting for the wind turbine proposed at Long Sutton, a member queried the rejection of the scheme at Treading Fields and asked if this contained the basis for refusal at Long Sutton.

The two schemes are very different, as pointed out by Officer Jackson at the meeting.

The test

The Appeal Inspector (also called Paul Jackson) noted in his decision that:[4]

> *para 23 …the impact on individuals living in any particular dwelling varies depending on factors including the possible layout of furniture relative to windows in rooms, dwelling orientation, the location of outside recreation space and the availability, type and location of any screening.*
>
> *Para 24…. The material question is whether the proposal would have a detrimental effect on the locality generally, and on amenities that ought, in the public interest, to be protected". In terms of visual amenity, this translates into the long established principle that there is 'no right to a view', meaning that it is not possible to protect a property simply on the basis that an attractive or cherished view would be adversely affected by*

[4] Appeal Report APP/D0515/A/12/2181777 & APP/A2525/A/12/2184954, see www.gov.uk/government/uploads/system/uploads/attachment_data/file/250187/Treading_Windfarm_near_Sutton_St_Edmund__Lincolnshire__refs_2181777___2184954__9_October_2013_.pdf

development. It has become an accepted principle that when turbines are present in such number, size and proximity that they represent an unpleasantly overwhelming and unavoidable presence in main views from a house or garden, there is every likelihood that the property concerned would come to be widely regarded as an unattractive and thus unsatisfactory (but not necessarily uninhabitable) place in which to live. It may not be in the public interest to create such living conditions where they did not exist before. Private and public interests could coincide in such a way that the outlook from a dwelling would be so harmed as to be generally regarded as unacceptable.

The size and number of turbines (6 machines at 125m high, compared to 1 machine 77m high), combined with the number of affected properties (8 settlements and 37 individual properties) was of a very different scale to what is proposed at Long Sutton. Many properties at Treading Fields had turbines within an angle of view between 35 and 143 degrees. There were three properties on which the decision to refuse turned, and these had multiple views over multiple aspects affected by turbines. Outside areas were assessed as well, and in the three cases all (or most) outside areas were felt to be affected by the turbine as well.

Acceptable impacts

Most of the properties would have had views altered, but the inspector concluded the views would *not be altered in an un-acceptable way*, for example these extracts from the inspectors report on Chestnut Farm and Poplar Tree House.

Para 34 Property 22 (Chestnut Farm/Riverside Cottage) lies at right angles to the main turbine field and has significant surrounding vegetation. All the turbines would be visible from the front door in the flank wall and obliquely from some south west facing rooms, the nearest T6 being 780m away. As an isolated property, the occupiers would notice the change in the character of the land on the other side of the existing line of pylons, but the turbines would not affect other views out from the property and would not dominate their outlook.

Para 36 The main habitable rooms of Poplar Tree House (23) would face the turbines slightly obliquely to the west but T6 would be further away, at around 815m. The turbines would occupy an angle of view of about 21 degrees including the anemometer mast, with some overlap, but there would be some screening from trees and bushes on the boundary. The turbines would bring about a noticeable change in outlook from ground floor and upper floor windows but would not be so close or so dominant as to make the house an unacceptable place to live.

Unacceptable impacts

The three properties on which a refusal was made were The Birches, St Malo and Ashtree Barn, which were considered at paras 27, and 37-9 of the inspectors report:

Para 27 ***At The Birches*** *(8), a bungalow, the main living area window looks directly east towards T2 at 695m. From almost all of the seating in this room, which is conventionally arranged around a wood burner on the north wall, T2 would unavoidably dominate the view out of the large picture window eastwards… Two windows facing north in the flank wall would provide oblique views of T1 at about 835m and the remaining turbines lie at various greater distances between them, partially screened by vegetation. Two*

bedrooms provide similar views eastwards in which T2 would stand out. The main entrance currently has an obscured sliding patio door but visitors would notice T2 on entering and leaving. I consider that T2, in combination with the other turbines, would have an overwhelming and overbearing impact on the living conditions of the occupants unless it/they could be sufficiently screened.

Para 28 … In consultation with Council officers, the appellant has put forward a screening proposal which consists of a new mixed hawthorn hedge on land on the opposite side of the electricity line... Over time, it would increasingly screen T2 but would not make a noticeable difference for at least 10 years…

Para 37 …at ***St Malo*** *(31) T5 and T6 would be dominant features at 900 and 690m from the south east elevation and T6 would loom over the house and garage on entering the property. From the south west facing glazed patio doors in the main living area, T1-T5 would occupy about 57 degrees of the view. From all the main seating areas in the living room, the turbines would be dominant in an otherwise flat rural outlook. From the outside patio the visual impact would be more marked. The removal of a tall evergreen tree outside the patio door since the RVAS was carried out has removed screening that would have obscured T5. The most significant factor at St Malo is that from day to day, inside and around the outside the dwelling, it would be hard to avoid a view of turbines, at least one of which would be relatively close. There would be no relief on the patio or in the long garden, which extends even closer to T6. The entrance to the property would be dominated by T6. Overall, I consider that the spread and proximity of turbines would make this property an unattractive place to live.*

Para 38. ***At Ashtree Barn****, T1 and T4 would dominate views from the west and south elevations at distances of 695 and 720m respectively. These together with the remaining turbines would occupy about 142 degrees of the available outlook from the dwelling, ranging from the south west to the east. T1 would be increasingly conspicuous on approaching the house along Broad Drove West. On turning into the drive T3 and T4 would come prominently into view at 775 and 720m, T4 appearing immediately to the side of the house. T4 would also feature most prominently in the main southerly outlook from most of the habitable rooms which extend across 3 floors. Because of the wide angle within which turbines would be seen, it would be very difficult to avoid a turbine within a relatively short distance in any view from the house. This would be particularly true in the dual aspect main living room, where it is likely that T1, T2, T3 and T4 would be seen, sometimes 2 or even 3 at the same time. There would be a framed view of T4 through windows opposite the dining room table and over the kitchen sink.*

Para 39. Although there are rooms with windows facing north including a fully glazed 'barn door', the main habitable rooms are designed to take advantage of the far reaching southerly views, for which 13 windows are provided on the south elevation. For all practical purposes, the family that lives there would not be able to escape the overbearing and wide ranging visual impact of T1-T4; and the blade tips of T5 and T6 at least would be visible over a tree belt to the south east. There are very few locations on the grassed relaxation areas where turbines would not be oppressively near and

sunshine could be enjoyed at the same time; from the area immediately outside the rear French doors, all the turbines would probably be visible.

Thus the reasons for refusal were based on at least two turbines visible together in a wide angle of view from 57 to 143 degrees. The current proposal is for a single turbine and whilst other turbines are visible in the landscape they are not part of the same group and their visibility is so distant and very substantially screened that they do not give rise to a situation described by the Inspector as "*an unpleasantly overwhelming and unavoidable presence in main views".*

5.2 Grange Farm, Tydd St Mary Appeal Inspector Report

The planning committee refused the application citing:

3. The turbines, because of their size, number, location and motion would have an adverse visual impact on the living conditions and quality of life of people living in the locality of the sitecontrary to Local Plan Policy SG1which seeks to protect or enhance the quality of life for residents; and when considered in the light of criteria for policies for onshore wind energy inRegional Plan Policy 40.

The inspector overturned the refusal, and said of the impact on residents that:

24.Due to the orientation of the houses and the presence of intervening buildings or vegetation, some or all of the proposed turbines would be visible from within these houses or their gardens to varying degrees, and would be prominent features in such views. As a result of the magnitude of change to the views from the houses and the sensitivity of the residents as receptors, the impact of the turbines would be of major significance and, from what I saw the quality of views currently enjoyed by local residents would be eroded.

31.With respect to local residents, change of outlook alone is not necessarily unacceptable and no-one has the right to expect that the view from their homes will remain unchanged in perpetuity. However, notwithstanding that consideration, nowhere would any erosion of views be to such a degree as to give rise to a material objection in planning terms such that planning permission must necessarily be refused. Neither would the proposed turbines be of such size or proximity to the houses as to have an overbearing or dominating and oppressive impact. I therefore conclude that in respect of its impact on neighbouring residents, the proposed development would conform to Policy SG1.

This part of the Appeal Inspectors report, dealing with the residential impact from a wind farm application reinforces the conclusion of the applicant that the single smaller wind turbine of the current application does not cause any residential property to receive material erosion of views.

6 Photomontages and Discussions

Nine viewpoints have been used to demonstrate the visual impact of the proposed wind turbine on nearby residences.

Figure 1 shows the general position of the proposed wind turbine and the nearby wind turbines at Winters Lane and Grange Farm which are referred to in the description of some views.

The location of the viewpoints is listed and shown in **Figure 2** below.

Viewpoints Used for Photomontages in this Volume

The following photomontage heading numbers match the viewpoint numbering in this table.

View Point	Distance from Site (m)	NGR Position
No 16 1 Bridge Road	440	TF45156 322337
No 17 4-5 Bridge Road	410	TF45216 22317
No 18 8 Bridge Road	420	TF45272 22311
No 19 144 Bridge Road	370	TF45267 22242
No 20 146 Bridge Road	370	TF45272 22311
No 21 Bridge Road/Hospital Drove Junction	410	TF45344 22303
No 22 Halfway Farm	380	TF45426 22233
No 23 Tower Bungalow	340	TF45356 22229
No 24 Hope House Farm	610	TF44840 214410

The assessment criteria for visual impacts are based on the sensitivity of the receptor and the magnitude of the effect. The classification is reproduced below for the convenience of readers.

High	Strategic recreational footpaths; important landscape features with physical, cultural or historic attributes; principal views from residential buildings including farmsteads
Medium	Public rights of way; secondary or oblique views from residential buildings; views from the curtilage of a farm; drivers and passengers in vehicles engaged in tourism or journeys of a recreational nature
Low	Other land accessible to the public away from well trodden footpaths; views from industrial or commercial buildings; drivers and passengers of vehicles engaged in commercial travel or commuting, and views from primarily functional main roads

Table 1 The classification of the sensitivity of visual receptors

High:	The majority of viewers affected / major changes in the character, make-up and balance of the view
Medium	Many viewers affected / moderate changes in the nature of the view
Low	Few viewers affected / minor change in the nature of the view

Table 2 The classification of the magnitude of change

The combination of these classifications leads to a classification of the visual effect of the development.

- No Effect
- Negligible Effect
- Minor Effect
- Moderate Effect
- Major Effect
- Substantial Effect

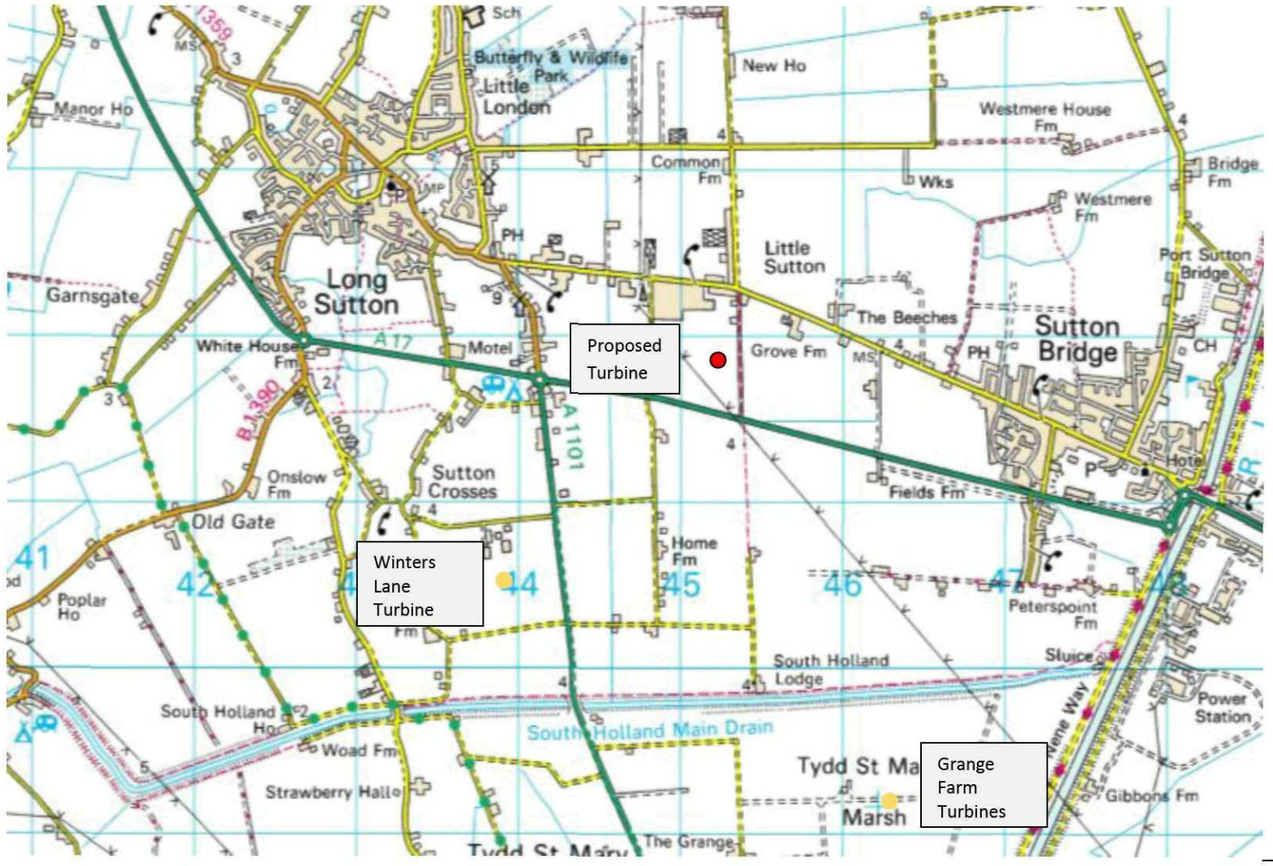


Figure 1 Location of Proposed and Nearby Wind Turbines

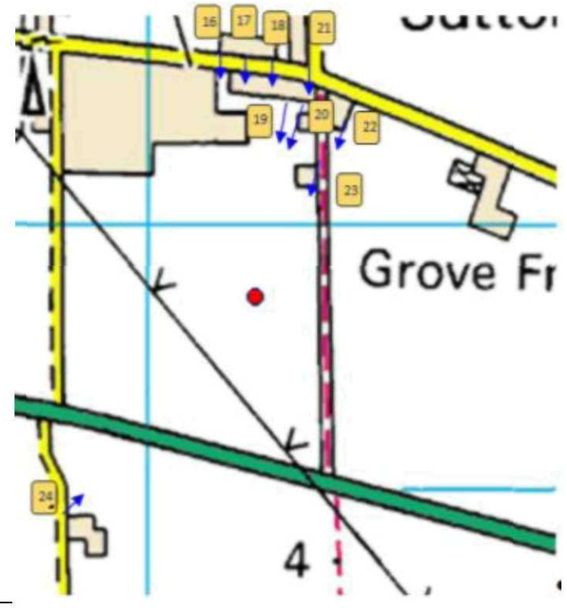
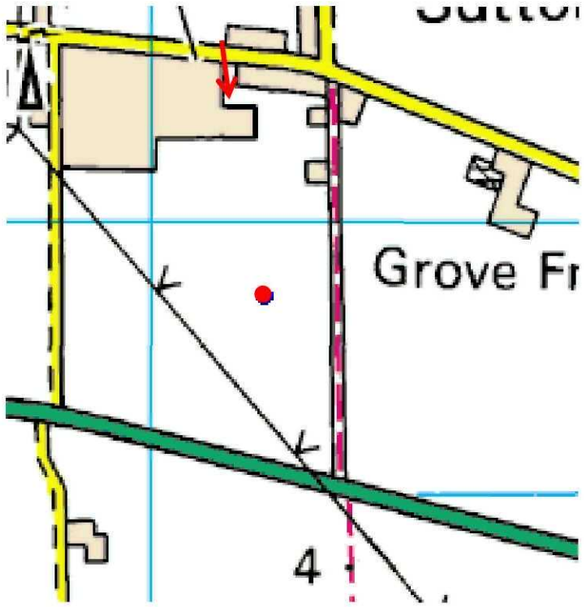


Figure 2 Location of Viewpoints



7 Viewpoint No. 16

Title: 1 Bridge Road, Long Sutton

Viewpoint Grid Reference TF45156 322337

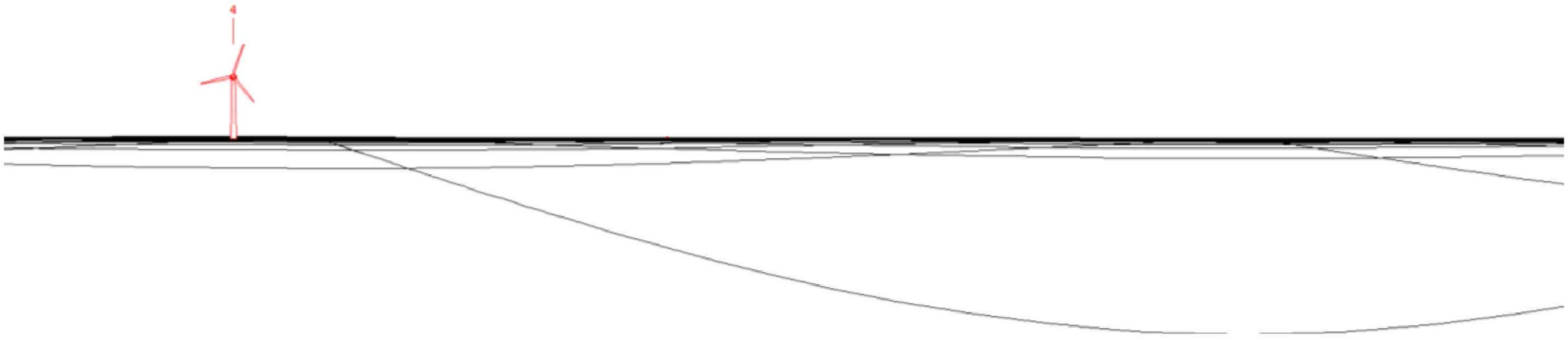
Included angle 151.5°

View height 2m

Direction 225.5°

Visible nacelles 1

Visible blade tips 1



Wireframe

Recommended viewing distance for flat projection of this page on A3 =15.1cm

7.1 View From Position 16, 1 Bridge Road, Long Sutton



Viewpoint No. 16 Existing View

Recommended viewing distance for flat projection of this page on A3 =15.1cm



Viewpoint No. 16 Existing View with Outline Turbine

Recommended viewing distance for flat projection of this page on A3 =15.1cm

7.2 Discussion of Viewpoint 16, 1 Bridge Road

This viewpoint is adjacent to 1 Bridge Road. The view looks across Bridge Road towards the Princes Foods factory. The factory dominates the view with cooling towers, pylons, chimneys and buildings creating an industrial landscape. Open country is visible to the right towards Long Sutton, though a large ditch and further high voltage electricity pylons compromise this view of arable fields.

An office building and car park faces the viewpoint.

Immediately in front of the viewpoint is Bridge Road, a busy local road which joins Long Sutton and Sutton Bridge.

The front of the property 1 Bridge Road is aligned with the photograph and is immediately to the left, but below normal ground level. There are two ground floor windows to the house and these will receive the same view as shown, though there is some screening in the garden some 5m in front of the window.

The view above shows the proposed wind turbine superimposed on the picture. The office block of Princes Foods provides a significant visual barrier and only the nacelle and the top part of the rotor blade arc is visible. The existing industrial landscape is almost unchanged. When looking to the right towards open countryside the viewer turns away from the turbine and that view continues uninterrupted.

Although the wind turbine introduces a new type of activity into the forwards view, the general view is not static. The many employees working at Princes Foods use the car park and there are two- and three-shift rotations and visitors that keep vehicular movement at a high level. In addition Bridge Road is a busy local road and it carries heavy traffic for the factory in this area.

The room use is not known but it is thought that the main living room is on the other side of the house, facing away from the factory.

It is not felt that new plantings to screen the wind turbine from view are necessary, but if the resident felt otherwise, the applicant would be happy for a planning condition to be imposed to provide screening for any house which feels itself to be affected.

As a residential location for which this proposal would not form the principle view, the sensitivity of this viewpoint is medium.

The industrial outlook indicates that the change to the view is moderate.

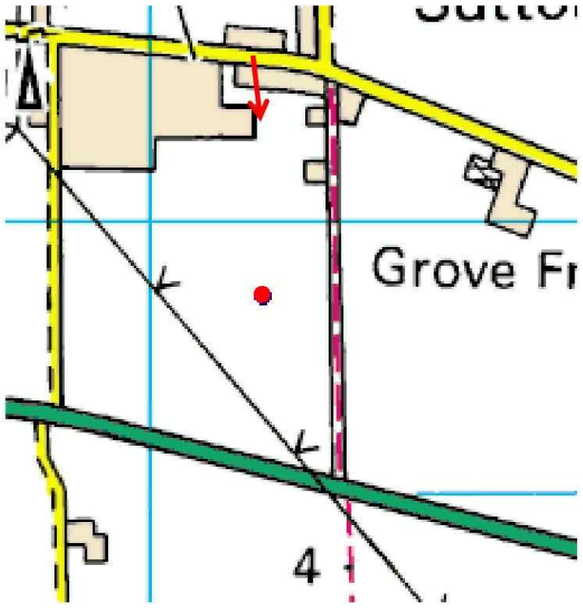
The scheme is temporary with no residual effects beyond 25 years.

The significance of the impact is minor-moderate.

In terms of cumulative impact, the two closest wind turbine schemes are at Winters Lane and Grange Farm. None of the wind turbines at these schemes is visible at the viewpoint. The factory screens Winters Lane (shown below) and Grange Farm is screened by houses and hedging on the other side of Bridge Road. The photomontage below shows the scale and screening for the Winters Lane wind turbine.

There is no cumulative impact at this viewpoint.





8 Viewpoint No. 17

Title 4-5 Bridge Road, Long Sutton

Viewpoint Grid Reference TF45216 22317

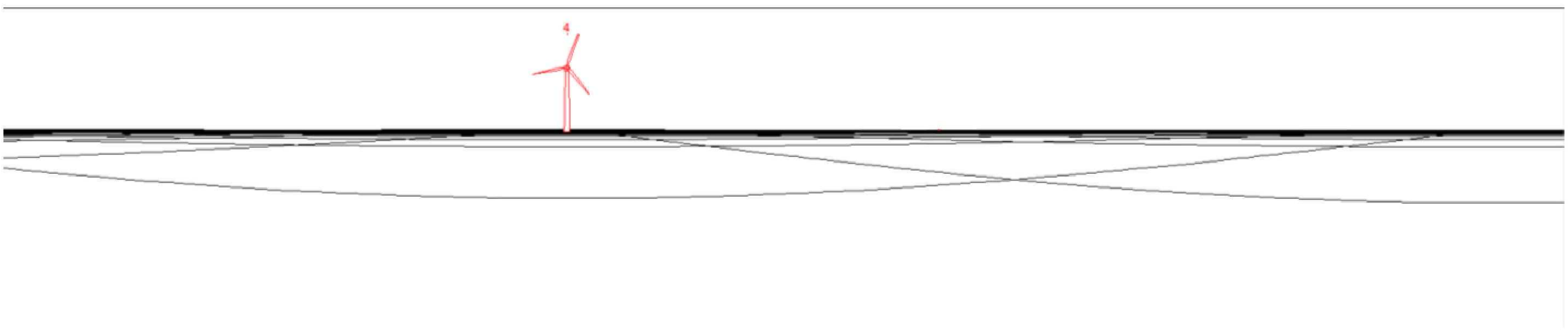
Included angle 153°

View height 2m

Direction 200.5°

Visible nacelles 1

Visible blade tips 1



Wireframe

Recommended viewing distance for flat projection of this page on A3 = 4.8cm

8.1 View From Position 17, 4-5 Bridge Road, Long Sutton



Viewpoint No. 17 Existing View

Recommended viewing distance for flat projection of this page on A3 = 4.8cm



Viewpoint No. 17 Existing View with Outline Turbine

Recommended viewing distance for flat projection of this page on A3 = 4.8cm

8.2 Discussion of Viewpoint 17, 4-5 Bridge Road

This view from the public pavement adjacent to Bridge Road and outside nos 4-5 Bridge Road shows the industrial outlook of the location.

The industrial business of Princes Foods including silos, waste treatment lagoons, chimneys, car park, offices and cooling towers dominates the view.

The busy Bridge Road passes in the foreground of the picture

The houses have some shrubs which relieve the view from inside the houses, but most activity would seem to be at the rear of the properties.

To the left are tall Leylandii hedges that prevent any views in that direction. There are no views over rural areas.

When the proposed wind turbine is introduced it creates a major new item in the view, but mitigated by the industrial and urban clutter which is in close proximity. As a single turbine it occupies a small proportion of the view. There is no rural view and industrial evidence is visible throughout the photograph. The main activity area of the property is focussed to the rear where vehicular access and a garden exist. The room use is not known but it is thought that the main living room is on the other side of the house, facing away from the factory.

Whilst Viewpoint 17 is taken from the pavement adjacent to Bridge Road, this is not indicative of the views seen by the houses which are set back and down from the road and have existing screening by garden bushes . A second photomontage (17A) adjacent to, rather than above and in front of the property, shows that a modest shrub this shield visibility of the turbine for the residents. Further modest planting is possible and as before would be an acceptable planning condition.



Viewpoint No. 17A Existing View level with windows showing significant existing screening

This view is constrained by vegetation but looks onto the busy Bridge Road and the Princes Foods car park and various parts of the engineering installation of the factory. This includes silos, water treatment facilities and storage buildings. The view clearly shows that a modest shrub can conceal the wind turbine to its full height.

As a residential location for which this proposal would not form the principle view, the sensitivity of this viewpoint is medium.

The single wind turbine in this industrial outlook indicates that the change to the view is moderate.

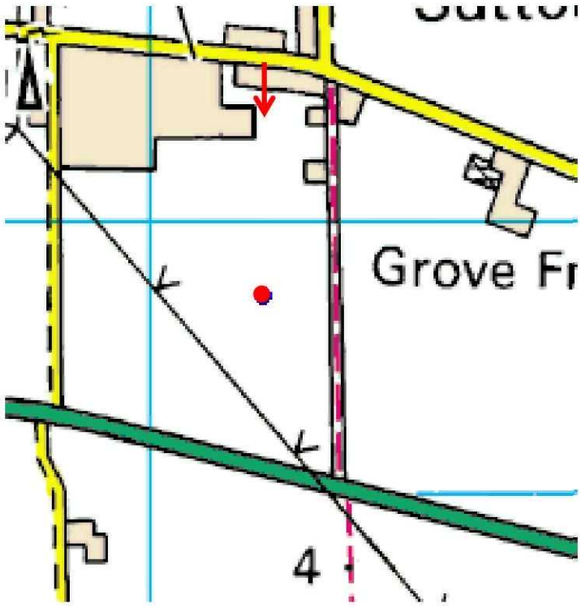
The scheme is temporary with no residual effects beyond 25 years.

Because a large portion of the wind turbine is visible, the significance of the impact is moderate.

There is no visibility of the other wind turbines in the area at Grange Farm or at Winters Lane, and therefore, there is no cumulative visual impact.

The Winters Lane turbine is fully shielded by the factory buildings.





9 Viewpoint No. 18

Title: 8 Bridge Road, Long Sutton

Viewpoint Grid Reference TF45272 22311

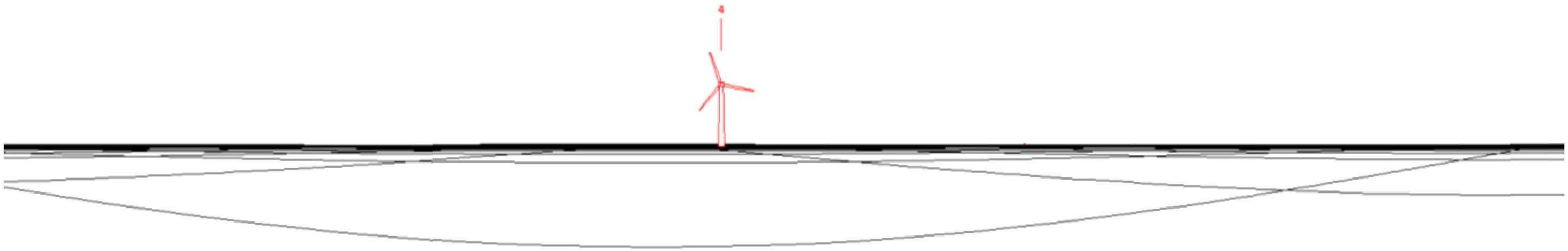
Included angle 158°

View height 2m

Direction 193°

Visible nacelles 0

Visible blade tips 0



Wireframe

Recommended viewing distance for flat projection of this page on A3 =3.9cm

9.1 View From Position 18, 8 Bridge Road, Long Sutton



Viewpoint No. 18 Existing View

Recommended viewing distance for flat projection of this page on A3 =3.9cm



Viewpoint No. 18 Existing View with Outline Turbine

Recommended viewing distance for flat projection of this page on A3 =3.9cm

Discussion of Viewpoint 18, 8 Bridge Road

This viewpoint is on the public footpath outside 8 Bridge Road.

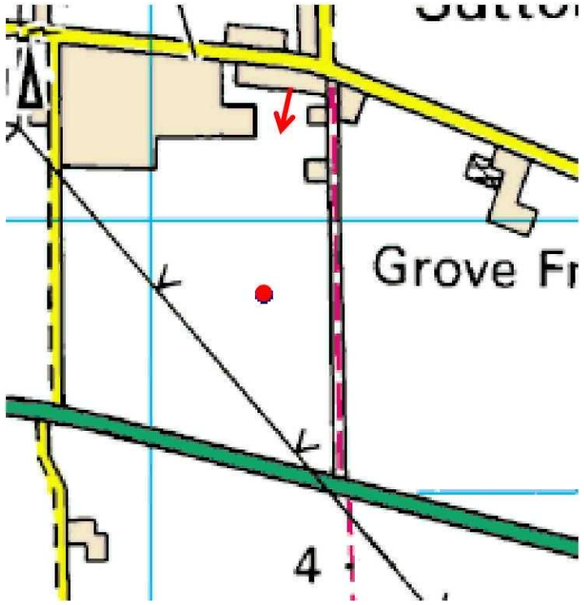
Unlike other properties in the row of houses, this view includes a 6m high Leylandii hedge directly opposite the house. This screens much of the industrial activity of Princes Foods, though the chimneys and cooling towers are visible to the west. Bridge road and its traffic are present immediately in front of the viewpoint.

The hedge totally screens the proposed wind turbine and those at grange farm and at winters lane, were they to be visible otherwise.

As a residential location for which this proposal would not form the principle view, the sensitivity of this viewpoint is medium.

There is no change to the view.

The significance of the impact is no effect.



10 Viewpoint No. 19

Title: 144 Bridge Road, Long Sutton

Viewpoint Grid Reference TF45267 22242

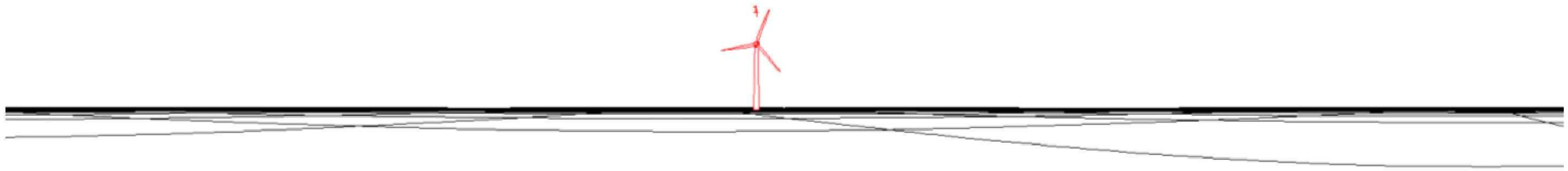
Included angle 178°

View height 2m

Direction 190°

Visible nacelles 0

Visible blade tips 1



Wireframe

Recommended viewing distance for flat projection of this page on A3 =1cm

10.1 View From Position 19, 144 Bridge Road, Long Sutton



Viewpoint No. 19 Existing View

Recommended viewing distance for flat projection of this page on A3 =1cm



Viewpoint No. 19 Existing View with Outline Turbine

Recommended viewing distance for flat projection of this page on A3 =1cm

10.2 Discussion of Viewpoint 19, 144 Bridge Road

Along the back of the house at 144 Bridge Road, from east to west, are views from the dining room, kitchen and sun lounge. The main lounge area is to the front of the house on to Bridge Road. The view is taken from in front of the sun lounge at the west end of the house, and includes the patio area (an obvious recreational area) and significant parts of the Princes Foods factory. The factory elements include a busy car park with lighting, warehouse, storage silo, waste treatment plant and the main factory with cooling tower and chimneys. Apart from the view towards the neighbouring garden there are no views that do not include the industrial landscape of the factory. This view would not include the proposed turbine. At the far end of the garden there is tall hedging and a group of mature trees which the present owner has improved into something of a nature reserve.

The view with the proposed wind turbine is shown. The wind turbine is substantially screened by hedging and only the top of the upper half of the rotor blade arc is visible. Indeed, when seated at the patio area the existing screening will be very effective.

This degree of new movement in a very active view is not damaging to the enjoyment of the view of the patio area from the house. It is felt that new plantings to screen the wind turbine from view are not essential, however, we would be happy for a planning condition to require us to offer planting.

As a residential location including a principal view, the sensitivity of this viewpoint is high. However, the overall view is not tranquil, and there is much movement around the factory which is in full view. The industrial outlook indicates that the change to the view is medium.

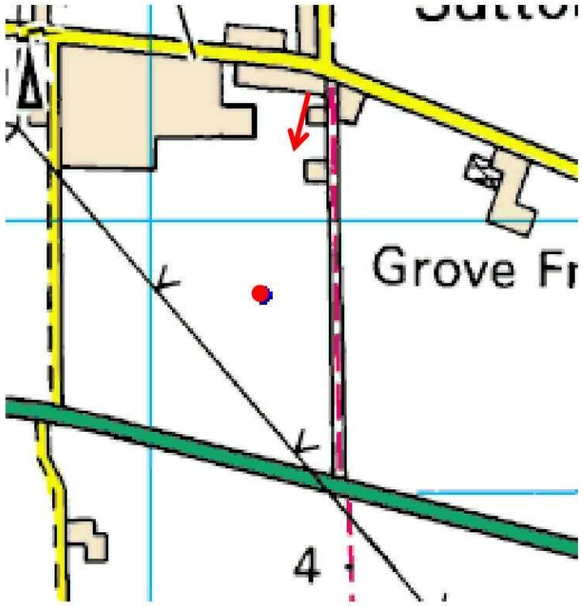
The scheme is temporary with no residual effects beyond 25 years.

The significance of the impact is minor-moderate.

In terms of cumulative impact, the two closest wind turbine schemes are at Winters Lane and Grange Farm. None of the wind turbines at Grange Farm is visible from the downstairs windows. This is screened by plants in the intervening neighbour's garden. Winters Lane is visible at the east end of the house, but not from the west end when it is screened by a warehouse of Princes Foods. When Winters Lane is visible, the proposed turbine will be hidden behind the tall trees at the end of the garden. There is not thought to be concurrent visibility.

The Winters Lane turbine is shown below as it would be if the intervening storage shed was not there. It's projection would be similar to the many car park lights of Princes Foods.





11 Viewpoint No. 20

Title: 146 Bridge Road, Long Sutton

Viewpoint Grid Reference TF45272 22311

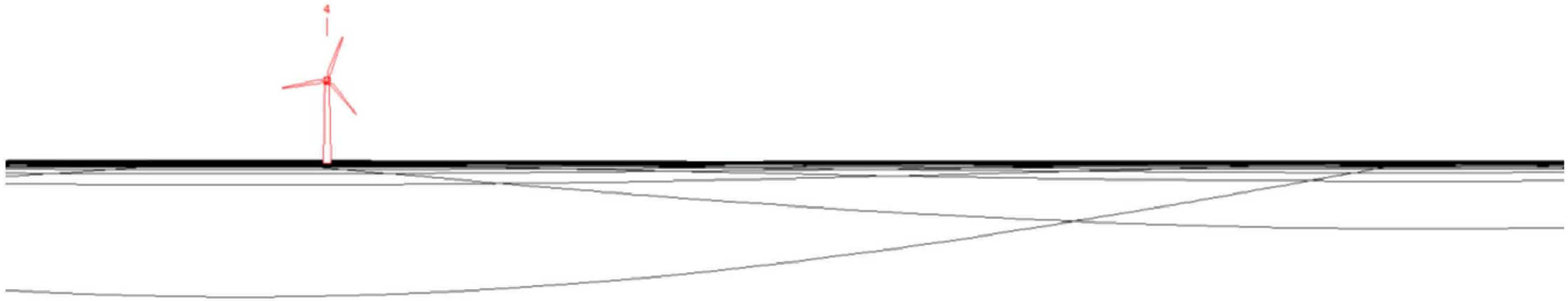
Included angle 120°

View height 2m

Direction 222°

Visible nacelles 01

Visible blade tips 0



Wireframe

Recommended viewing distance for flat projection of this page on A3 =1.5cm

11.1 View From Position 20, 146 Bridge Road, Long Sutton



Viewpoint No. 20 Existing View

Recommended viewing distance for flat projection of this page on A3 =11.5cm



Viewpoint No. 20 Existing View with Outline Turbine

Recommended viewing distance for flat projection of this page on A3 =11.5cm

11.2 Discussion of Viewpoint 20, 146 Bridge Road

146 Bridge Road was not accessible because the owner was suffering a long term illness. This view is from 144 Bridge Road, but beside the fence that divides 144 and 146 Bridge Road. Behind the viewer is the house and to the left a fence and hedging. If the viewpoint was the other side of the fence in 146, then at or below fence height would be hidden by the wooden fence panels. However, the skyline of the Princes Foods factory waste treatment works, silos, chimneys and water tower would still be visible. This is an industrial view with no visible countryside. A large shed and hedging obscure views to the south.

The view with the proposed wind turbine showing indicates that visibility is obscured by the shed, although when taken in conjunction with the views from the neighbouring garden to the west, there may be some visibility of the turbine nacelle and the top part of the rotor blade arc from other points in the garden.

There is no visibility of the Grange Farm wind turbines. The wind turbine at Winters Lane is shielded by the warehouse, though it appears as behind the south east corner and has some visibility to part of the rotor arc. This is not intrusive and vegetation will shield all the blades in the summer. This is shown in the photomontage below.

The room use is a conservatory but it is thought that the main living room is on the other side of the house, facing away from the factory.

It is not felt that new plantings to screen the wind turbine from view are necessary, but again, we would be happy to provide it as a condition of consent.

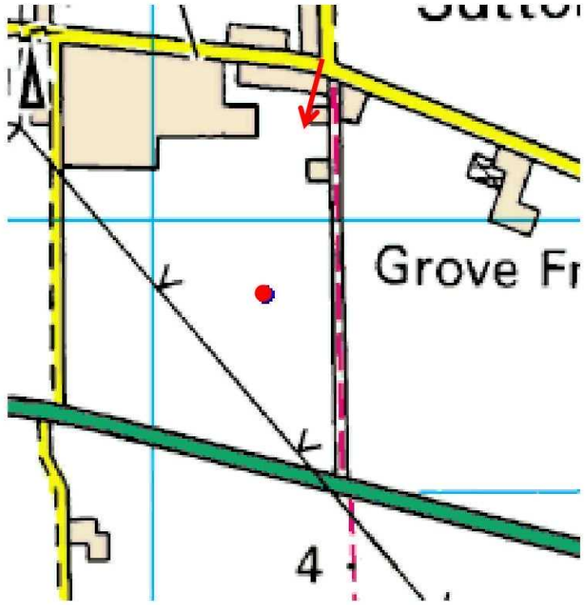
As a residential location for which this proposal would not form the principle view, the sensitivity of this viewpoint is medium.

The industrial outlook indicates that the change to the view is moderate.

The scheme is temporary with no residual effects beyond 25 years.

The significance of the impact is minor-moderate.





12 Viewpoint No. 21

Title: Bridge Road/Hospital Drove Junction, Long Sutton

Viewpoint Grid Reference TF45344 22303

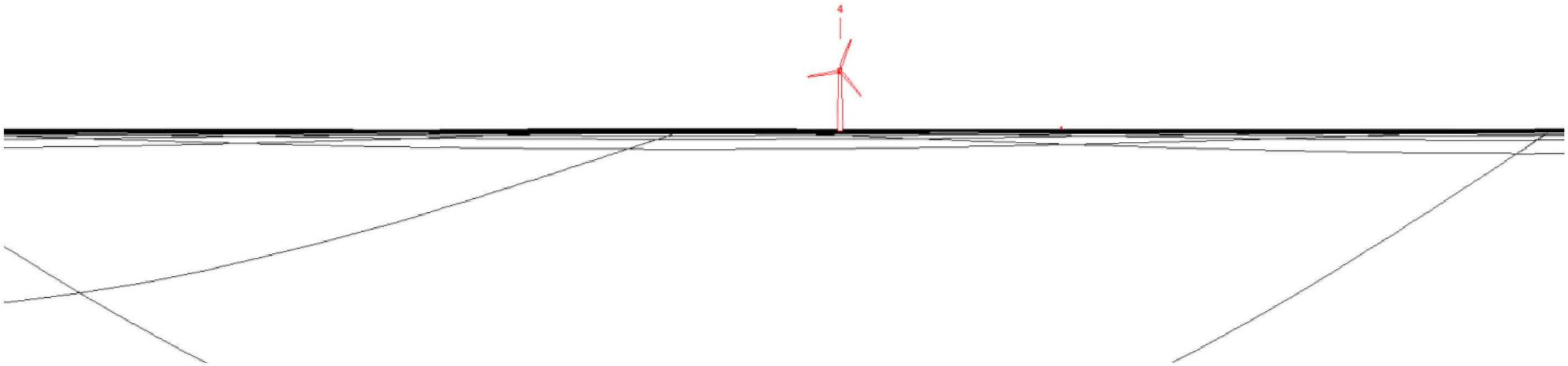
Included angle 164°

View height 2m

Direction 190°

Visible nacelles 1

Visible blade tips 1



Wireframe

Recommended viewing distance for flat projection of this page on A3 =2.8cm

12.1 View From Position 21, Bridge Road/Hospital Drove Junction, Long Sutton



Viewpoint No. 21 Existing View

Recommended viewing distance for flat projection of this page on A3 =2.8cm



Viewpoint No. 21 Existing View with Outline Turbine

Recommended viewing distance for flat projection of this page on A3 =2.8cm

12.2 Discussion of Viewpoint 21, 146 Bridge Road Bridge Road/Hospital Drove Junction

This viewpoint at the corner of Hospital Drove and Bridge Road is indicative of houses 10 to 12 Bridge Road.

From here the industry of Princes Foods almost disappears from the view and Bridge Road traffic becomes the dominant intrusion.

There are two houses on the other side of the road and along Hospital Drove some of the wind turbines at Grange Farm can be seen.

There are many items of telegraph poles, electricity poles and road light poles which introduce a set of strong vertical elements to the view.

From this viewpoint there are some country views to the east along the road to Sutton Bridge.

The proposed wind turbine shows in the view with the top part of the rotor arc becoming visible above the houses opposite. This is not an intrusive object in this setting.

The country views to the east are not compromised because a viewer must turn more than 90^0 to see them and the wind turbine drops out of the view.

Behind the viewpoint there are several houses along Hospital Drove. These are heavily screened with mature trees and hedging and this viewpoint does not indicate visibility from these houses.

The viewpoint is at a road junction and people travelling towards Bridge Road would have the visibility indicated for a brief period.

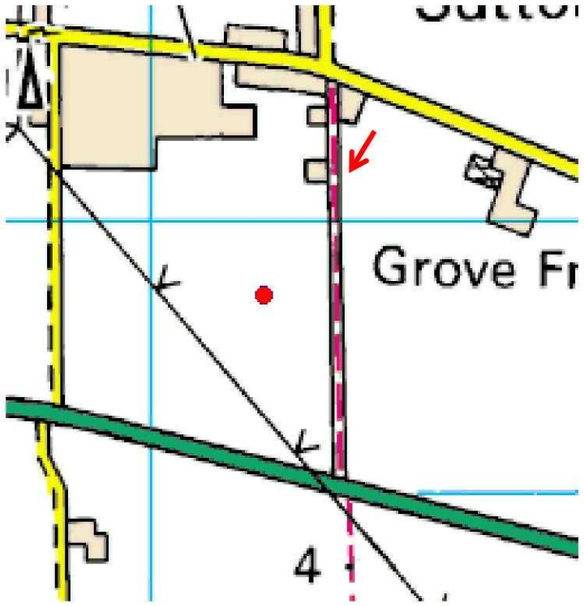
As a commercial road junction, the sensitivity of this viewpoint is low.

The industrial outlook and partial visibility of the turbine indicate that the change to the view is low.

The scheme is temporary with no residual effects beyond 25 years.

The significance of the impact is negligible.

It is possible in this view to see the proposed wind turbine and those at Grange Farm. However, those at Grange Farm are 3 – 4 km away and do not compromise the living conditions at the houses behind the viewer on Hospital Drove. The small visible section of the proposed wind turbine also does not compromise living quality. The turbine at Winters Lane is not visible.



13 Viewpoint No. 22

Title: Halfway Farm, Long Sutton

Viewpoint Grid Reference TF45426 22233

Included angle 175°

View height 2m

Direction 234°

Visible nacelles 0

Visible blade tips 1



Wireframe

Recommended viewing distance for flat projection of this page on A3 =1cm

13.1 View From Position 22, Halfway Farm, Long Sutton



Viewpoint No. 22 Existing View

Recommended viewing distance for flat projection of this page on A3 =1cm



Viewpoint No. 22 Existing View with Outline Turbine

Recommended viewing distance for flat projection of this page on A3 =1cm

13.2 Discussion of Viewpoint 22, Halfway Farm, Long Sutton

This viewpoint from Halfway Farm was select to demonstrate the part of the residential part of the property most exposed to the proposed wind turbine.

The view is dominated by a glasshouse which is used as a store. In the foreground is a small building and the access drive runs away to the west with some general farmyard clutter.

One of the turbines at Grange Farm is visible, the rest being shielded by the foreground building. Other viewpoints would allow more of these to be seen.

The land owner says that he is planning to remove the glasshouse, but it is present at the time of application and performs a screening function.

The wind turbines at Grange Farm do not compromise landscape and visual impacts at this location and the new wind turbine would not damage any aspect of quality of life here.

The room use is a kitchen. It is thought that the main living room is on the south side of the house, facing the proposed wind turbine.

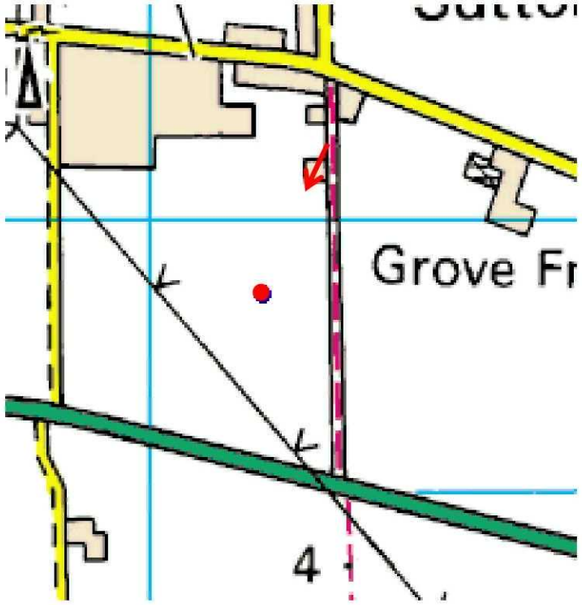
It is not felt that new plantings to screen the wind turbine from view are necessary because there is only partial visibility. It is not felt that new plantings to screen the wind turbine from view are necessary because there is only partial visibility. However, the glasshouse demonstrates that a modest hedge and tree planting of the same visual angle (ie possibly smaller and closer) would screen visibility of the proposed wind turbine and the applicant would be amenable to providing such in the event of demolition.

As a residential location for which this proposal would form the principal view, the sensitivity of this viewpoint is medium because of the limited visibility.

The active farmyard environment indicates that the change to the view is moderate.

The scheme is temporary with no residual effects beyond 25 years.

The significance of the impact is moderate because of the principal view.



14 Viewpoint No. 23

Title: Tower Bungalow, Long Sutton

Viewpoint Grid Reference TF45356 22229

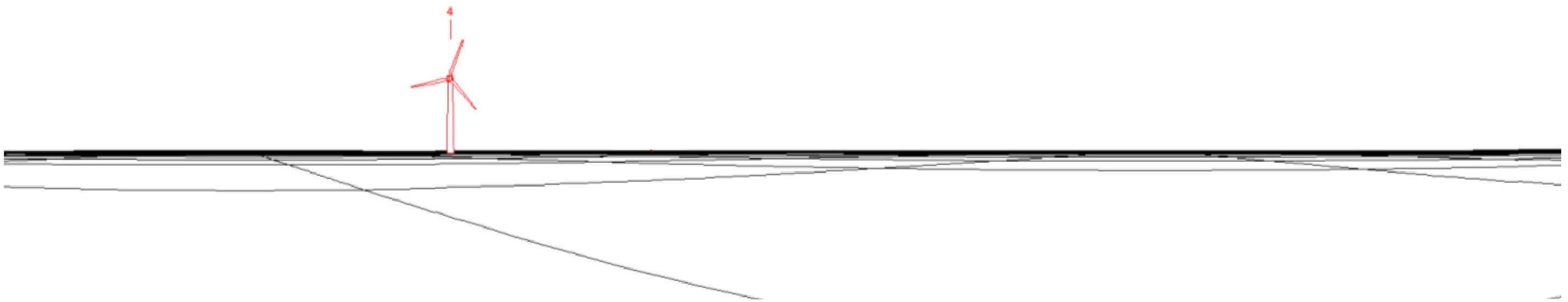
Included angle 155°

View height 2m

Direction 233°

Visible nacelles 0

Visible blade tips 1



Wireframe

Recommended viewing distance for flat projection of this page on A3 =4.4cm

14.1 View From Position 23, Tower Bungalow, Long Sutton



Viewpoint No. 23 Existing View

Recommended viewing distance for flat projection of this page on A3 =4.4cm

Turbine blade visible



Viewpoint No. 23 Existing View with Outline Turbine

Recommended viewing distance for flat projection of this page on A3 =4.4cm

14.2 Discussion of Viewpoint 23, Tower Bungalow, Long Sutton

This viewpoint is to the side of Tower Bungalow and it is used to look through the Tower Bungalow plot towards the proposed wind turbine.

In the present view it is evident that Tower Bungalow is located in a heavily wooded plot with limited outward views. Some parts of the Princes Foods factory are visible and these compromise the setting.

The proposed wind turbine is to the south and although it can be taken in with the factory elements from this viewpoint, from within the curtilage of Tower Bungalow it will be necessary to turn 90^0 between viewing each item.

The wind turbine is heavily screened and views of it are limited even in winter.

The room use (if any) facing towards the turbine is not known.

It is not felt that new plantings to screen the wind turbine from view are necessary.

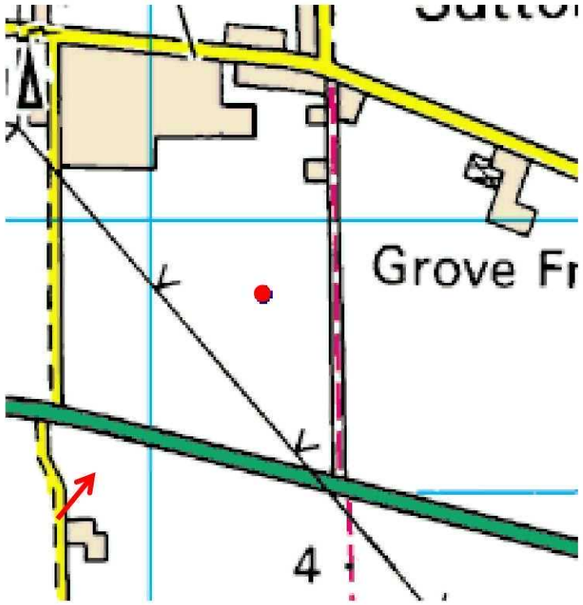
As a residential location for which this proposal would not form the principle view because of intervening vegetation, the sensitivity of this viewpoint is medium.

The industrial outlook indicates that the magnitude of change to the view is medium.

The scheme is temporary with no residual effects beyond 25 years.

The significance of the impact is minor.

To the south east the wind farm at Grange Farm is visible. The distance of 3-4 km minimises its impact, but the new wind turbine adds very little to the view because of low visibility.



15 Viewpoint No. 24

Title: Hope House Farm, Long Sutton

Viewpoint Grid Reference TF44840 21441

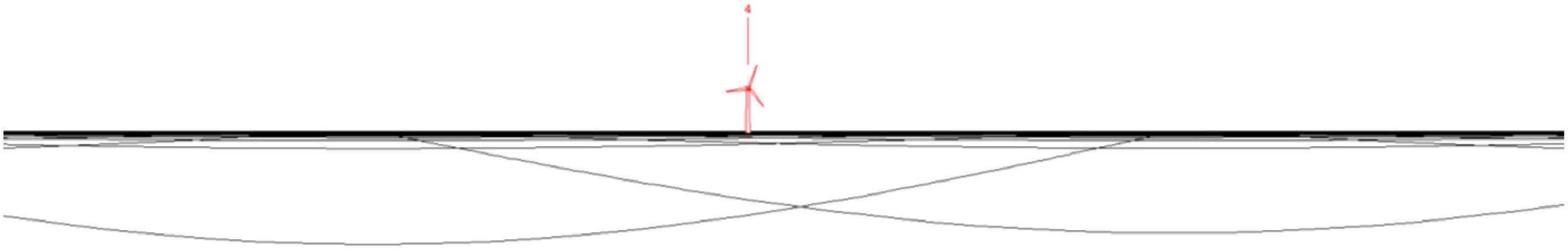
Included angle 176°

View height 2m

Direction 46°

Visible nacelles 1

Visible blade tips 1



Wireframe

Recommended viewing distance for flat projection of this page on A3 =1cm

15.1 View From Position 24, Halfway Farm, Long Sutton



Viewpoint No. 24 Existing View

Recommended viewing distance for flat projection of this page on A3 =1cm



Viewpoint No. 24 Existing View with Outline Turbine

Recommended viewing distance for flat projection of this page on A3 =1cm

15.2 Discussion of Viewpoint 24, Hope House Farm, Long Sutton

Hope House Farm has views across open countryside towards the factory of Princes Foods. The view includes high voltage electricity pylons, chimneys, cooling towers, water treatment tanks, silos and the buildings of the factory. There are also low voltage electricity poles.

The middle distance is taken by the traffic on the A17. This introduces constant movement into the landscape.

This is an indicative viewpoint because it can be seen at the right of the picture that Hope House Farm is set behind screening vegetation of some 2m height. This limits views across this whole area.

The main house has views on several aspects, with the front door facing east away from the turbine.

Although views of the wind turbines at Grange Farm are similarly screened by boundary vegetation, views of the Winters Lane turbine will exist. The compass bearing of the two turbines is such that co-visibility is difficult as they are more than 90^0at the viewpoint.

It is not felt that new plantings to screen the wind turbine from view are necessary.

As a residential location for which this proposal would not form the principle view, the sensitivity of this viewpoint is medium.

The industrial outlook indicates that the change to the view is moderate.

The scheme is temporary with no residual effects beyond 25 years.

The significance of the impact is minor.

This viewpoint is the only North facing view amongst the close properties considered in this note. In this view it is possible to see the turbines at Gedney Hill at the extreme left edge of the view through the trees lining the road. These turbines are some 8 km away and would generally be considered to be outside the zone that may cause visual interference to a residential property. They are also sited on the other side of the A17 whose traffic further mitigates direct impacts. The impact of the Gedney Hill wind turbines is so small that the proposed turbine cannot be considered to create a cumulative impact with them.

The cumulative impact in minor.

16 Summary of residential visual impacts

The table below summarizes the impacts noted above.

View Point	Visual Effect	Cumulative Effect
No 16 1 Bridge Road	Minor-moderate	None
No 17 4-5 Bridge Road	Moderate	None
No 18 8 Bridge Road	No effect	None
No 19 144 Bridge Road	Minor-moderate	None
No 20 146 Bridge Road	Minor-moderate	Possible co-visibility with Winters Lane blade tips, but too distant
No 21 Bridge Road/Hospital Drove Junction	Negligible	Co-visibility with Grange Farm but too distant
No 22 Halfway Farm	Moderate	Co-visibility with Grange Farm but too distant
No 23 Tower Bungalow	Minor	Co-visibility with Grange Farm but too distant
No 24 Hope House Farm	Minor	Co-visibility with Gedney Hill Farm but too distant

None of the viewpoints considered present significant negative impacts, and impacts could further be reduced by appropriate mitigation,

17 Mitigation Options

Planting is seen by several inspectors as an option for wind turbines, and was suggested by our own planning officer. Extensive screening has become more common with solar farms and we have experience of designing and procuring screening on solar farms. With this experience in mind, we would be happy to pay for such screening as felt is necessary by neighbouring households, and to replace such screening if it were to die within an agreed period (say 5 years) and would be happy for this to be a condition of planning consent.

The acceptability of screening in policy terms depends on:

- **turbine sizes**, the number of turbines and how extensive they are in the views affected. A single turbine is obviously easier than multiple turbines, and a single aspect is easier than if the turbine (or turbines) are visible from multiple aspects
- **where its located in comparison to a house** – eg it is best in an existing hedge or border, not in lawns or pathways.
- **how quickly** and fully it could be established

Options for householders include:

- **screening partially** (say ground floor or living rooms where much time in daylight is spent) or completely (eg from all windows including bedrooms), and
- **screening for part of the year** (with deciduous trees in periods of longer daylight) or all year (with evergreen trees or plants).
- It may be that some householders would **prefer not to be screened**, and this preference in itself would be revealing in that the view of the turbine is less oppressive than a tree. The policy issue is whether screening is an effective option.
- **Screening with hedging or with individual trees**. This is a function of what height is needed, and whether a hedge may be easier to maintain. Choice of tree is important too. For example many evergreens are conical, and have most mass at the base. Many deciduous trees are more 'turbine shaped', and with maintenance can allow much light around the base of the trunk, but with screening in the right places for a turbine. The ideal is an evergreen tree with a defined trunk and foliage at the top. One example of a tree is holly, but this is very slow growing, and speed of growth is another factor.

With these issues and options in mind, the heights and widths of the screening needed is assessed for each property in the tables below.

Height of screening needed

	Unscreened			Partial screening			fully screened
	Distance to turbine (m)	Height (m)	Visual angle (degrees)	Distance of screening (m)	Height of screening (m)	Height of screening to eye height (add 1.5m)	to eye height at first floor (add further 2.2m)
144 Bridge Rd to tip	382	77	11	19.6	4.0	5.5	7.7
Halfway Farm to tip	409	77	11	15.0	2.8	4.3	6.5
1-8 Bridge Rd to tip	440	77	10	7.7	1.3	2.8	5.0

Width of screening needed

	Unscreened			Partial screening		fully screened
	Distance to turbine (m)	Width (m)	Visual angle (degrees)	Distance of screening (m)	Width of screening for a single point (m)	Width of screening for a 3m picture window (m)
144 Bridge Rd width of rotor	382	54	8	19.6	2.8	5.75

Examples of screening

The line of view from each window (the receptor) to the turbine from two properties which may be considered by the owners to need screening is shown below, on the left 144 Bridge Road and on the right, Halfway Farm. The following is for illustration purposes, and planting would be agreed with the owners.

At 144 Bridge Road, a deciduous tree of 5.5m in height and 2.8 wide, planted in the border of the garden against the fence, 19.6m from the house, would screen the downstairs sunlounge in summer, and soften the view of the turbine in winter (when it is visible fewer hours in any case), without blocking sunlight which is higher in the sky even in winter. A larger tree or multiple trees could further block the view from other windows or from upstairs windows. Evergreen trees would block the view of the turbine in winter as well as summer.

At Halfway Farm the view of the turbine is currently substantially hidden by the glasshouse, but a hedge or tree could be planted outside the kitchen window at a distance of around 15.8m and at 4.3m high would hide the turbine. There is no upstairs view in this part of the house.



Viewpoint 17A and 18 showed how effective screening could be from the houses at 1-8 bridge road. We would be happy to offer additional screening as needed.

18 Conclusions and Planning Policy discussion

This document presents a range of additional material following consideration by the planning committee.

18.1 Need

NPPF shows that the applicant does not need to prove a local need for the project and even smaller projects such as this make a valuable contribution. That said, the site has been identified as a suitable location for wind, there is a grid connection which is increasingly difficult to procure. There are also local benefits in terms of the supply of electricity to local businesses and participation of local people in a community share issue.

18.2 Shadow flicker

The original Shadow flicker assessment has been validated and the risks can be entirely controlled, using technology which is commercially available and which has been described in written evidence to SHDC. We would be happy to accept a condition requiring us to eliminate shadow flicker.

18.3 Impact on residential amenity

The view from a dwelling can be altered, this is not the test. The test is whether a turbine can *be so close or so dominant as to make the house an unacceptable place to live.* A range of viewpoints for nearest properties have been assessed and it cannot be said that the views are such that the proposed turbine is so close or so dominant as to make the house an unacceptable place to live.

There is already, for many properties, mitigating screening by other buildings, industrial units or vegetation. Even at the closest three properties, only a small portion of the turbine can be seen.

The landscape is largely an industrial landscape and the turbine is not out of keeping with the landscape character of the area.

The impacts can be screened further by selective planting and we would be happy to accept a condition that we screen where requested to do so by the household and in accordance with the proposals in this report.

The Planning Officer was in our view right to recommend to the Planning Committee that the proposed scheme does not fail the Lavender test.

18.4 Overall conclusion

The NPPF[5] states in para 98:

> *When determining planning applications, local planning authorities should:*
>
> - *not require applicants for energy development to demonstrate the overall need for renewable or low carbon energy and also recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and*
> - *approve the application if its impacts are (or can be made) acceptable. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should also expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.*

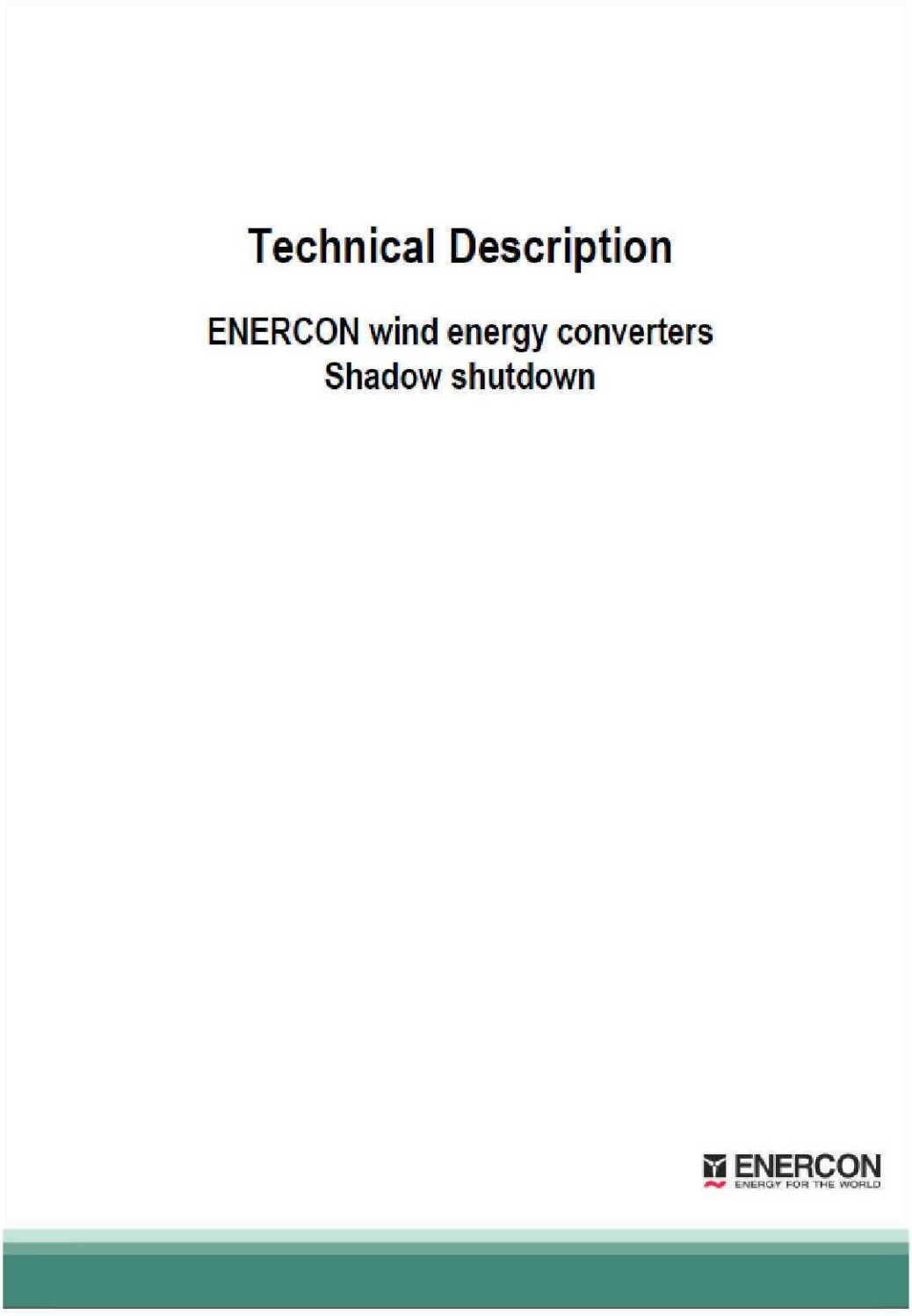
The proposal is consistent with the NPPF in that impacts are or can be made acceptable through conditions and we would ask that the scheme be consented and not be delayed further.

[5] DCLG (2012) National Planning Policy Framework
www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf

19 Appendix The Control of Shadow Flicker

This appendix is the technical description of the shadow flicker control system for the proposed wind turbine.

The shadow flicker control system is contained within the wind turbine control system and does not depend on any remote monitoring or interrogation.



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1 Introduction

Periodic shadow casting (or shadow flickering) is caused by movement of the rotor blades, which shut out the sunlight and create a flickering effect while the rotor is in motion. The occurrence of this effect depends on the current local weather conditions, alignment of the nacelle with the wind direction, the position of the sun, and the wind energy converter (WEC) operating hours.

The objective of the ENERCON shadow shutdown function is to specifically shut down the wind energy converter, taking into account the current weather conditions, and thus to reliably prevent or reduce shadow flickering in relevant locations where it could be a nuisance (e.g. living rooms, bedrooms, schools, patios, etc.).

2 Operating principle

The ENERCON shadow shutdown is a function that is integrated into the control system of ENERCON WECs. It is specifically activated in any WEC where shadow shutdown becomes necessary. Each ENERCON wind energy converter is controlled autonomously. Shutting down multiple WECs at the same time by means of a system such as wind farm control is unfeasible.

Programming and parameter configuration for the ENERCON shadow shutdown function are performed on the control cabinet display of the wind energy converter.

2.1 Determining potential shadow shutdown times

The ENERCON shadow shutdown function is based on a calendric system. The times of the maximum astronomical shadow casting potential at affected immission sites are computed considering site-specific parameters such as hub height, rotor diameter, WEC coordinates, location of the immission site, and topography.

Results include the shadow casting periods at relevant immission sites, indicating daily start and end times of periodic shadow casting. The shutdown times determined are programmed into the ENERCON WEC control system as a table. Fine-tuning of these shutdown times is feasible at any time for each immission site and time period.

2.2 Measuring illuminance

Actual shadow flickering caused by movement of the WEC rotor blades depends on insolation. According to the German Federal States' Immission Control Committee (Länderausschuss für Immissionsschutz), shadow flickering is likely when the sunlight is greater than 120 W/m² at the level vertical to the incidence direction.

The level of illuminance on a horizontal measuring surface is influenced by the incidence angle of the sun (position of the sun) and the photometric equivalent. The latter is determined by refraction and atmospheric opacity; it also depends on the position of the sun. The illuminance depending on the sun's position can therefore only be approximated. In addition, the current position of the sun is unknown to the WEC control system.

Therefore, a procedure has been developed for the ENERCON shadow shutdown function to precisely assess the shadow casting potential at any time. To measure illuminance, three sensors are fitted to the bottom section of the ENERCON wind energy converter tower; these are spaced at 120° angles. This arrangement ensures that at least one sensor is always on the sunny side and one sensor is in the shade of the tower. Based on the measured values from the three sensors, the control system determines the highest and the lowest illuminance values, i.e., the light intensity and the shadow intensity. Instead of an inherently inaccurate measurement of illuminance, the ratio of shadow to light intensity – also referred to as shutdown intensity – is therefore used to determine whether shadow casting is likely to occur.

With an illuminance of 120 W/m², the measured shutdown intensity is 36 %. This value is virtually independent of the position of the sun. Once the ratio of shadow to light intensity drops below 36 %, illuminance is greater than 120 W/m². Shadow casting occurs. This value has been validated in the setting of a two-year field test of shadow shutdown modules. Shutdown intensity can be modified individually as needed.

2.3 Automatic shutdown

The ENERCON shadow shutdown is activated and the ENERCON wind energy converter stops once the shutdown intensity value falls below the setpoint inside the programmed shutdown time frame.

No average is computed for the measured illuminance. Automatic shutdown will therefore respond even if the value falls below the reference value only briefly. Filtering times can be used to define a delay in the response of the start-stop mechanism. The *Filtering time on* parameter specifies for how long the shadow intensity has to be below shutdown intensity (on average) until shadow shutdown is activated. The *Filtering time off* parameter specifies for how long the shadow intensity has to be above shutdown intensity (on average) until shadow shutdown is deactivated.

If the light conditions change such that shadow flickering is no longer possible, shadow shutdown will remain active initially. Shadow shutdown will not be deactivated until the programmed time period has elapsed or light conditions have not changed for a specified time period (as a rule, more than five minutes) and shadow flickering was not possible during that period. The WEC resumes operation.

3 Tolerances and reliability

The sensor used for measuring illuminance typically has a tolerance of ±10 %. Following inspection of the sensors, a set of three sensors with a maximum tolerance of ±1 % towards one another is selected at the factory within the framework of the quality assurance process. As no absolute measured values but only the ratio of the illuminance values is important for signal interpretation, a very high degree of accuracy is achieved.

In addition, the function of the light sensors is automatically checked for plausibility twice daily during operation. This involves measurement of the voltages at the three light sensors at midnight and at 1:00 p.m. If the measured values are implausible, a message will be sent to ENERCON Service and technicians will check the sensors on site and replace them, if necessary.

Failure of a sensor, e.g. due to a broken cable or short-circuiting, results in the ratio of shadow to light intensity falling below the shutdown intensity value. The ENERCON wind energy converter stops outside the programmed time frame. The WEC control system generates a warning message indicating which of the three sensors has failed.

4 Logging and availability

Activation of the ENERCON shadow shutdown system is recorded as a status message by the remote data transmission system together with its date, time and duration and is then stored for several years.

If required, measured data from the light sensors are logged. The ratio of shadow to light intensity is recorded as an average per minute; the minimum and maximum values at one-minute intervals and the defined shutdown intensity are also recorded.

The ENERCON shadow shutdown function is available for all WECs from ENERCON's current product range.