ADVICE ON

Wind Turbines and Horses for Riders and Carriage Drivers

The British Horse Society

The UK is committed to producing 15 percent of energy from renewable sources by 2020 and government strategies incorporate the use of wind energy towards this target. The BHS does not express an opinion on the use of wind energy, only for its effect on equestrian safety.

All horses are individual and react to circumstances and structures in different ways. They are, by nature, flight animals whose instinct is to run from a perceived danger. Some will ignore turbines, others may show some initial apprehension, and some may instantly flee before stopping to look more carefully at what they thought might attack them.

People with experience of horses will agree that anything from a leaf to a double decker bus can evidently appear terrifying to them at any time for no obvious reason. Equally, horses over the centuries have proved immensely adaptable as they have learned to accept gunshots, drums, trains, motorbikes, umbrellas and many other inventions that occur in daily life.

The BHS has received many more reports of horses being undisturbed by turbines than of adverse reactions, and very few where the horse's response has not eased with familiarity and sensitive handling, so do not assume that wind energy projects will have a negative effect on your horse or your access opportunities or business.

Why might horses react to turbines?

Riders with experience of wind turbines whose horses have reacted have assumed the source to have been noise, movement or shadows.

Noise and Movement

Generally, horses are more likely to react to unusual noises and sudden movements than the rhythmical normal movement of blades. Blades which start to turn while in a horse's sight might provoke more reaction than turbines which are already moving as you ride towards them, but start-up movement is usually slow and gradual, so will not affect most horses. However, certain machines may be noisier and less rhythmic in start-up, although this is unlikely with new developments as technology improves.

Horses' vision allows them to see to a certain extent behind them, so they may be frightened by something you have not noticed. If you are on ground higher than the turbine so the blade movement appears to be at ground level, whether in front or behind, this might be seen as more of a threat by some horses.

Large turbines will adjust to changes in wind speed and direction relatively

slowly which is unlikely to be apparent unless watching closely. Small units will change direction much more quickly and the sound will change as the turbine turns into the wind. The smaller turbines that work with a tail fin can move very quickly, which will be particularly evident in fitful gusting wind conditions. However, although the sudden movement and sound are more likely to startle a horse, they are not dissimilar from many other hazards in windy conditions such as loose, flapping plastic.

Horses have a greater range of hearing than humans, especially for higher sounds, and they also hear sounds from further away because the large cup shape of the external ear enables them to pick up sound that the small flat human ear will miss. However, they are not good at locating the source of a sound and this may be the cause of some unexpected reactions, because if a horse hears a threatening noise, looks in what it thinks is the right direction and does not see a source, it may simply run in the opposite direction, which may not be what you are expecting.

The type of noise produced by large turbines may not be easy for some horses to pinpoint and the quiet swoosh sound of the blades, which humans think is unthreatening, might sound soft and stealthy to a horse, the type of sound made by a creeping predator, from which a horse has a strong instinctive reaction to run away.

Different sounds from several directions when among a group of turbines could be the source of some horses' distress as it will not be easy to identify where a sound is coming from or what is causing it.

Noise changes with distance and angle from the turbines, speed of rotation and ambient background noise. On a calm day the background noise will be less and the turbines may be more audible; on windier days the background noise may be greater. The latest machines have much lower noise generation than older models, so the implications of noise should not be judged on past levels, except by applying safeguards against noise levels increasing with ageing components.

Shadows

In sunshine the turbine blades will cast a shadow on the ground of varying distance depending on the time of day and year. Shadows are longest early in the day and during the evening when the sun is at its lowest. Some horses may hesitate if the shadows extend across their path, especially if they are moving towards you. Some horses ignore them, but others may perceive them as a threat, especially if they are horses who are also troubled by conditions such as long grass being rippled by the wind. Moving shadows may seem more threatening to some horses when they fall on a hard surface than on vegetation, perhaps because their shape and movement

is more obvious. Turbines positioned north of a route will not cast shadows over it unless very close.

Familiarising your horse

As with many hazards there may be a correlation between reaction and rider's expectation so it is important to ride positively and confidently while remaining sensitive to your horse's response. By keeping calm and relaxed, and quietly reassuring your horse, you can help minimise its reaction, just as you would in any other situation. Horses are very sensitive to their handler's emotions so you could unsettle your horse by your own anticipation of an adverse reaction. It is also possible that if you are personally against wind energy or upset by a new development, your feelings about turbines could influence your horse's response, so re-framing your thoughts with a positive slant may help your horse.

Horses are herd animals which find safety in numbers. You can use this to your advantage in familiarising your horse with wind turbines. The same principles apply as introducing young horses to traffic; do it gradually, ideally in the company of an experienced horse.

Tips from riders and carriage-drivers who have ridden or driven among turbines include:

- Watch your horse's ears, it is more likely to run in the direction away from the ear that has turned towards what it thinks is the location of the sound – this may not be what you perceive as the direction, especially as you are using additional knowledge such as knowing there is a turbine there. It may help to turn the horse in the direction of the turbine to help it identify the source of the noise.
- Different sounds from several directions when among a group of turbines could make it difficult for a horse to identify where a sound is coming from, and therefore to decide whether or not it is threatening. It may help to turn or circle so that the horse can check movement from all directions and relate it to the noise it is hearing.
- In certain conditions there may be a low hum. If you think your horse will be upset by it, try singing!
- The first time you are likely to encounter shadows across your path, it may help if you can ride in a direction so that the shadows are moving away from you and are therefore less threatening. Whether this is possible will depend on the location of the turbines relative to your route.
- Weather can change quickly, especially on high ground, with wind rising

suddenly. If you are close to turbines, or even among many turbines on a large wind farm when the wind rises, being surrounded by several turbines all coming into motion together may be unnerving for any horse. The presence of turbines anywhere on your route means that you should be particularly alert to weather conditions and have alternative routes avoiding the wind farm if appropriate.

The BHS has run several training days at Whitelee Wind Farm near East Kilbride in Scotland offering riders an opportunity to familiarise their horse with turbines under the expert guidance of Rhoda McVey, a highly experienced qualified BHS instructor. You can watch a video of the event at www.youtube.com/watch?v=b0O1hZdaihI. If there is a wind farm near you, it is possible that a similar familiarisation event could be arranged, local circumstances permitting.

What to do about new wind energy projects

Current planning regulations give local communities some control over wind farm developments and the Government's current guidance[6] refers at paragraph 31 to "Safety may be an issue in certain circumstances, but risks can often be mitigated through appropriate siting and consultation with affected bodies". The Highways Agency seeks[7] a setback from the highway boundary of height +10 percent for turbines less than 50kW and height +50 metres for commercial turbines. Both statements can be considered inclusive of equestrians and minor highways (bridleways and byways are highways in law).

Equestrians who are concerned about proposals for a wind farm may seek support of the local community to modify or oppose the proposal. If community benefit is sought then creation of new bridleways or restricted byways can be included in the agreement and as a condition of planning permission.

The difficulty can be finding out about a planning application. The British Horse Society is not a statutory consultee for planning applications unless there is a requirement to divert a bridleway, so will not have been involved. A large project is likely to be well known locally from earliest stages of proposal but microgeneration projects may not be known of at all and it is not practical for most people to go through the weekly lists of applications

[6] Planning practice guidance for renewable and low carbon energy (July 2013 Dept for Communities and Local Government)

[7] The Strategic Road Network and the Delivery of Sustainable Development (February 2013 Dept for Transport)

issued by planning authorities. Parish councils will be informed of applications, so it may be feasible to find out if they are aware of any applications being considered if this is of concern to you.

The planning process may start with an application for a temporary anemometer, a device for measuring wind, which is likely to indicate interest in using the site for a wind project. An anemometer is a mast supported by four sets of cables. Cables should not cross a bridleway or byway, during or after construction. Ideally, their ground points should be at least 3m from an unfenced bridleway or byway and they should be wrapped or sleeved up to 1.5m height so they are easily visible.

If there are new wind energy projects in your area, become involved at an early stage of the planning process to ensure that effects on horses are reduced wherever possible, such as temporary closures and use of equestrian routes for construction, and any potential for improved access is explored. It is also possible to ensure that key activities are advertised during construction and through the life of the project (for instance, notification of days of high numbers of vehicle movements, such as when pouring concrete, and tests that incur unusual noise levels).

With early involvement, new or alternative routes for horses can be gained as developers may be willing to provide increased equestrian access. This may include new definitive bridleways, permissive paths, or enhancement of existing bridleways to make them more useful – examples have included new bridges, light-controlled crossings and surface improvements. There is also a fund for any commercial development comprising a sum for each megawatt produced each year which is intended for the benefit of the community. Benefits through the fund could include increased or improved access, not just on the wind farm, but anywhere in the area covered by the fund.

Discussions with developers are of primary importance and should include riding clubs, bridleway groups, livery yards and other businesses with horses and any local riders. Social media has been used very successfully to notify people and encourage their involvement at such meetings. The result can be many actions to assist riders through the design, build and operation of the site.

Horses are most likely to be frightened by blade and shadow movement or sudden noise, so a proposed development should be considered with these issues in mind. Check the proposal or planning application for:

- Locations of turbines relative to an equestrian route
- Length of blades and how close they will be to an equestrian route in any conditions

- Extent of shadow throw from the moving blades in any conditions
- Distance that snow and ice will be thrown when turbines re-start or during a rapid thaw.

If any of this information has not been provided you should ask the planning officer for details.

Turbines can be programmed to shut down under conditions which would affect a bridleway, whether over-sail, shadow-cast or ice-throw. This may be the solution on some sites where turbines are close to equestrian routes.

Large commercial developments with several turbines will have little scope for changing location of turbines unless the number on site is reduced, which may make the project unviable, and is likely to require strong evidence to substantiate it. At present, the evidence of adverse effect on horses is very slight.

The site of a microgeneration unit has probably been selected as a compromise between the landholder's wishes and optimum energy generation so there may be scope for adjusting its location to reduce the effect on horses.

The area that will be affected by blades sailing over, moving shadows and ice throw can be defined and made available by the developer so that you can gauge the effect on equestrian routes.

BHS Policy Statement

The BHS strongly recommends that the views and concerns of local equestrians should be recognised and taken into account when determining separation distances and that normally a

minimum separation distance of 200m or three times blade tip height (whichever is greater) will be required between a turbine and any route used by horses[8] or a business with horses.

This minimum separation distance may not be appropriate in all situations. Every site should be considered independently because there are likely to be many interdependent factors involved. A holistic approach is required that considers all of those factors, common ones of which are listed below, although less usual ones may occur in any location and require individual consideration.

The BHS is aware that every site is different and a blanket policy to cover all situations may be excessively restrictive for some sites. Emphasis is therefore placed on consideration of all factors with consultation and negotiation with local riders.

A single microgeneration unit for which three times tip height is less than 200m will be accepted at the lesser distance, provided that there are no other factors that increase the separation distance required.

Factors which affect the separation distance required:

- Availability of alternative routes and their desirability compared with the affected route. An assessment of routes and use patterns in the location may be needed. The fewer alternatives available, the more the impact on the affected route should be mitigated by increasing separation distances.
- The number of turbines and their location relative to the route:
  - One turbine is much easier to cope with than many; the more machines, the greater the threat.
  - Turbines to one side only create an easier situation than to both.
  - Several turbines to both sides of a route; the longer the corridor, the

[8] Includes all classes of highway available to horses – bridleway, restricted bridleway, byway open to all traffic, general purpose road (surfaced or unsurfaced) – and permissive routes

greater the risk.

- Clear ahead or clear behind is better than turbines visible both in front and behind at the same time. A horse has nearly 350 degree vision and may react to a threat from behind that the rider cannot see.
- Location north of a route is better than south as it will not cast shadows across the route – turbines east and west of a north-south route is the worst scenario for incidence of shadow cast at any time of day. However, on some sites this instance may be occasional and it may be feasible for a turbine to be turned off in such circumstances but able to generate at all other times.

- Other hazards on the route so that the addition of turbines to existing hazards creates an unreasonable situation, examples would be a deep ditch, reduced width, barbed wire fence, gate, blind bend or ruts. This is also true for turbines near a road, where an equestrian on the road already has motor vehicular traffic to consider and a horse's reactions may have immediate impact on other road users.
- Undulating ground which alters the height at which moving blades are in view is different from flat ground where all movement is well above eye level from any approach.
- Encountering a moving turbine at close quarters because it was obscured on approach by a hill, wood or building is a greater risk than approaching a turbine clearly in view from several hundred metres.

Depending on local variation caused by prevailing wind and day length, the separation distance to avoid shadow cast will be greater where a route lies north of a turbine between west south west and east south east. Figure 1 roughly shows the area which will be affected by shadows and where the separation distance

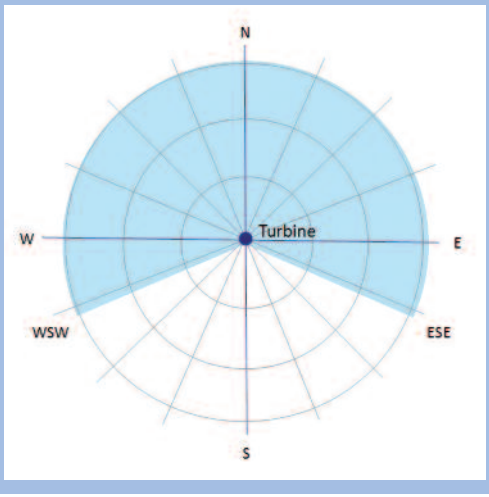

Figure 2: Separation distance between the turbine and route should be greater for routes in the blue area

between route and turbine should be greater. The shaded area also reflects where noise is likely to be more of a problem because the route is downwind of prevailing wind in much of England and Wales.

Provision of alternative routes or improvement of existing facilities may reduce the impact of a wind farm, for example if a path can be provided off-road so that riders are not coping with traffic and tarmac as well as the wind turbines. Even if the separation distance between the turbines and the alternative route is less than to the road, it may be preferable and safer for some users.

Anemometers should be located at a distance greater than their overall height from an equestrian route. Cables must not cross an equestrian route, including during erection of the mast. Their ground points should be at least 3m from an unfenced equestrian route and cables should be wrapped or sleeved to a height of 1.5m to increase their visibility to a panic-stricken horse.

Access for construction purposes should avoid bridleways or byways as it is incompatible with equestrian use and routes should not be closed to equestrians so as to facilitate construction. Alternative construction traffic routes may be required.

Commercial developments take several months from the start of construction to commissioning so there are many opportunities for horses to become accustomed to the new structures by degrees during the process: first the changes to the site, then the towers being erected, then with blades but static, then moving very slowly while tests are made. With attention during the planning process, all of these stages can be advertised to local riders, perhaps through a website or notices on site and at livery yards, or continued liaison with the project manager.

With small microgeneration 'domestic' projects, the period from preparing the site to the turbine working is very much shorter, sometimes accomplished within a day, which makes it much more difficult to expose a horse to them gradually. It may also be that riders are less likely to know about the planning application as only immediate local impact will be considered.

The smaller the turbine, the faster the blades appear to be rotating and they are closer to the horse so may seem more alarming. In addition, the mechanism and shape of the blades may produce higher noise levels. As with commercial developments, if you are aware of new applications, you can use the planning process to contact the applicant and ask for mitigating

actions, such as notification of when the turbine will be erected and for a period when it will be static before fully operational. With a single turbine there may also be greater scope for positioning it further from an equestrian route, but bear in mind that the site is most likely to have been selected for optimum wind conditions and not to cause maximum inconvenience to neighbours or bridleway users.

For both a commercial or domestic development, if there is felt to be a risk from a new turbine while on roads, a bridleway or byway, or to a business, it may be possible to liaise with the developer, the landowner or an adjacent landowner for a 'familiarisation day' promoted locally, when horses can be accommodated in a field close by to experience the turbines (perhaps static, then turning very slowly, then in normal operation) while in an environment that is safer than the public highway.

Ensure that:

- The authority's Access or Rights of Way Officer is aware of the application and the potential effect on equestrian routes.
- Local riders are aware of and involved in meeting and discussing plans with the developer.

Although riders may be understandably apprehensive about taking their horses near wind turbines, in some parts of the country wind farms may provide welcome opportunities for off-road riding and carriage driving where none previously existed and many developments provide an opportunity for increasing or improving local access.

Mitigation

There are a number of actions which may benefit riders and carriage drivers or reduce the effect of turbines on them. They include:

- Provision of new definitive or permissive routes or improvement of existing routes in the locality to provide alternatives for those at risk for the life of the wind energy project.
- Diversion of routes to a greater distance or with increased sightlines to avoid suddenly coming upon turbines within 500m.
- Consideration of potential impact on riders and/or carriage drivers should they be unable to continue using a route because of turbines, such as availability of alternative routes in the immediate vicinity.
- Consideration of the nature of the route in terms of space for a horse to shy, spin, jump or be manoeuvred on firm level ground; proximity of and

access to roads if a horse was to bolt out of control.

- On many developments it can be identified that a limited number of turbines will affect an equestrian route with over-sail or shadow cast only under certain conditions. It is possible to model those conditions and to programme specific turbines to switch off as required to abate the nuisance.
- Notification to equestrians of certain days during construction most likely to be a hazard, for instance concrete pouring creates many vehicle movements during a short period of time.
- Restriction of construction and construction traffic to 8am-6pm week days only so that routes can still be used during the construction period at the times of highest demand for equestrians.
- Notification of when turbine blades will be static, prior to commissioning, so that riders can familiarise horses by degree.
- Notification after commissioning of test days throughout the life of the turbine(s) which may produce increased or unusual noise or speed.
- Familiarisation days organised on site.
- Using microgeneration machines of a design that minimises 'yawing' of the head with the changing wind direction as sudden movements are those most likely to frighten horses and risk an accident.
- Ensure non-reflective surfaces throughout machine[9].
- Strategic hedge or tree planting or hedge management to shield an equestrian route from the effect of moving shadows on a path or blades at eye level.

Smaller turbines have greater potential for sudden movement as they adjust to wind speed or direction, which may be perceived by some horses as threatening.

This guidance does not apply in Scotland, for which the BHS produces separate guidance. Variation in the two documents arises from very different law relating to access and to patterns of land use between the countries.

[9] This is said to be standard on commercial turbines (more than 50kW output) but has been reported as a problem on more than one model of micro turbine where reflective surfaces create a strobe light effect in certain conditions and which has affected horses

Common Concerns about Turbines

A great deal of information in circulation about wind turbines naturally causes alarm for equestrians. However, some of it is very misleading and many riders or horse owners find that their horses are not bothered by wind turbines when they do come across them. It is necessary of course to be alert and aware that your horse may be disturbed by a wind turbine, just as it may react to a wind blown plastic bag, unusual vehicle or umbrella.

Here are answers to some common concerns about turbines and horses.

Soon there will be turbines all over the place and nowhere will be rideable any more

The existence of turbines does not make areas inaccessible to horses. With appropriate handling and training, many horses are not disturbed by turbines, although this will vary and some horses will be affected, just as some are more affected by many noises, movements, objects or conditions.

There are few sites in England that can accommodate wind farms of more than a few turbines because of the many constraints such as protected landscapes, flight paths, wireless transmissions, roads, communities, heritage, archaeology and ecology, all of which form a dense web of exclusion zones in most areas before even considering wind conditions and access to the national grid, which are crucial.

The size of current applications in England varies from three to twenty turbines depending on where in the country, although more than seven is increasingly rare except in northern England. It is unlikely that constraints leave space for larger numbers in the South or Midlands as many of those sites which can accommodate them are already going through the planning process or have been ruled out for other reasons.

Northern England, Scotland and Wales have sites where constraints leave a large enough area for more turbines and applications for sites with more than 20 turbines are common.

The potential for more microgeneration projects is greater but is still dependent on local factors which rule out many sites and planning authorities should be aware of the cumulative effect.

If one application is approved, there will be lots of others in the area

This is a valid concern but it is a planning consideration, so each application will be judged on its merits and planning authorities should take account of the cumulative effect. In some areas it will be more significant for small wind systems, where if each property erects a single turbine, the effect will

be equivalent to a wind farm; however, it is unlikely to occur. It is a consideration for commercial developments in northern England, Wales and Scotland where constraints do not rule it out; elsewhere, clusters are unlikely because the constraints leave few suitable sites in a locality where multiple projects would be feasible.

Construction traffic for wind farms will make roads in the area unsafe because of the number of vehicle movements and large vehicles

There will be construction traffic but, except on a very large wind farm, it will usually be for relatively short periods. It is usually restricted to normal working hours on week days, possibly including Saturday mornings, although there may be exceptions for delivery of large parts at any time.

If particular sections of road are of concern, for example between two bridleways, crossing points, or close to livery yards or riding schools, they can be drawn to the developer's attention if equestrians are involved during the planning process. Drivers can then be made aware of the increased risk and additional safety precautions undertaken, or temporary alternative routes put in place.

It is against a developer's interest for incidents to occur and the project manager will work with communities and local authorities on the best means of notification of works commencing and delivery hours. However, what one group would prefer on delivery may conflict with another, such as avoiding school runs but also avoiding riding times, so compromise will be necessary. A Traffic Management Plan will be created during consultation with input from the planning authority and parish councils to facilitate road safety during construction. Equestrians should check with the planning authority for restrictions and working hours for construction traffic so that they can plan riding or driving accordingly.

The turbines will suddenly be erected without horses having time to get used to them

This can be true of domestic turbines and, unless riders know the landowner personally, it may be difficult to find out when the turbine will be erected. Commercial turbines are large machines and cannot be erected quickly and it is unlikely that local people will not be aware of the construction process and timetable.

For commercial developments, there is a testing period of months before the turbines are commissioned during which time there will be many days when the blades are static or moving so slowly as to be almost imperceptible. This is an ideal time for horses to be introduced to something new in their environment and, if riders raise the request during the planning process, the developer can agree to give notice of times when turbines are

likely to be static. Riders can be advised by consulting a website, by staying in contact with the developer or with local liaison.

In windy weather the blades will be moving fast and scare horses

Modern commercial turbines have an optimum rotation speed for energy generation which is not exceeded even if the wind increases beyond that level because there is a limit on how fast the tip of the blade can move. Moderation is achieved by angling the turbine blades with increasing wind speed, so there is less surface area against the wind. The larger the blades, the more slowly they will rotate. In very high winds (or certain ice-forming conditions), turbines may be turned off to avoid damage, but otherwise the speed of rotation in a very strong wind will be the same as in a strong breeze once it has reached maximum revolutions[10]. Once the optimum rotation speed is reached, sound from the turbines will be constant but will tend to be masked by the general noise created by wind. Maximum rotation of blades is strongly controlled and unlikely to exceed 18[11] rpm[12]. Most people find the speed calm and sedate.

Small domestic units may appear to be turning faster because the blades are much shorter. The settings for optimum generation may be very different from those of larger turbines.

The blades will suddenly start turning when a horse is near a turbine and it will be frightened by the sudden movement

Horses are most likely to be scared by sudden unexpected movements or noises. Normally a turbine will start rotating when wind speed reaches 3-5m/s at hub height and increase only gradually because wind speed does not suddenly jump from still to windy. Sudden gusts may be apparent at ground level on a relatively still day, but this is influenced by many factors creating local turbulence. Turbines are sited to avoid air turbulence and wind conditions at hub height are very different from those at base level. This is also true of wind direction and large turbines will move slowly to accommodate a change in wind direction.

If a turbine has been shut down for any reason, it will not be put back into operation during windy conditions because of the strain on the machine; it will be re-started at low wind speeds and will take several revolutions[13] to reach operating speed. However, the sound made as a turbine starts moving may be more spasmodic and could be more disturbing to some horses than when in full operation.

[10] Machines vary but for example a Siemens 92m operates between 6-16rpm

[11] This will vary for each type of turbine and blade length

[12] rpm = revolutions per minute

[13] This will vary by machine

Riders and carriage drivers should be aware that static turbines may start up unexpectedly, and horses may react differently to turbines which start moving at close quarters than those which are in constant motion. Turbines which start to turn behind a horse are more likely to provoke a reaction than those which are readily visible.

Small turbines will adjust more quickly to variation in wind speed or direction but are unlikely go instantly from static to rotating at high speed.

Tests will cause the turbine to make unusual frightening noise

The BHS has received reports of safety checks which run the turbine at high speed producing a noise that may frighten horses. However, some developers have stated that it does not occur on their turbines, so you should raise the matter during the planning process and ensure that if such tests may occur, there is provision for notification at least five days in advance, typically by notices in the vicinity and on a website, and by contacting local livery yards or riding schools if appropriate.

Noise is stringently controlled by planning conditions and government guidelines and can be enforced by the planning authority once the turbine is in operation if transgression should occur.

Turbines might break and frighten a horse or cause injury

There is the possibility of structural failure and there are incidents of a blade breaking or tower collapsing, but overall the wind energy industry has one of the best safety records of any energy industry and the risk of structural incidents is relatively very low and mostly during high winds.

Ice will be thrown from blades quite a distance and may frighten a horse or cause injury

The possibility of ice forming and subsequently shedding, especially during a rapid thaw, is rare because modern turbines have mechanisms to both prevent ice forming and to prevent rotation while ice is on the blades. However, during adverse weather conditions, all riders and carriage drivers need to think carefully about the risk of ice shedding from turbines before riding near turbines or through a wind farm, taking particular account of proximity of equestrian routes to turbines. Some wind farms flag up ice risk on their websites during winter months.

The movement of the blades over such a big area will scare a horse

New commercial wind turbines in England are commonly 120-135 metres high from ground to blade tip. Larger turbines mean that fewer are needed to generate more electricity and although visually the turbine may be more noticeable, fewer mean that noise and potential effects on equestrian access are likely to be reduced. From observation it appears that probably horses' vision, like humans, does not really take account of the height

beyond the top of the tower and that the sweep area is not really registered; it is likely that the larger sweep will be less evident because the blade movement will appear to be slower.

The majority of horses appear unperturbed, possibly because of the height of the movement and because the horse as a species does not have aerial predators so its senses are directed to ground dangers or possibly to an animal dropping from a tree. Although the actual sweep of the blades covers a large area, it is not one that is immediately apparent even to humans, and most horses do not seem disturbed by it.

Shadows cast by the blades will appear to be animals or snakes dashing towards the horse

From birth, horses become accustomed to moving shadows cast by clouds, passing birds, themselves, people or other animals. Movement of shadows over the ground will be slower than many other moving shadows they will encounter. Although the rhythmic shadow movement from a turbine is not natural, this may be as likely to cause a horse to ignore it as to react to it.

There are horses that are troubled by movement at ground level, such as wind through long grass, and they may respond similarly to a shadow of a turbine blade but such sensitivities are probably already known to the rider and considered, perhaps taking advantage of familiarisation days in a safer environment.

Any turbine north of a route will not cast shadows towards horses on the route. The incidence of shadow cast over a route can be predicted and defined for time of year, time of day and wind direction. Domestic turbines with shorter blades will not cast shadows very far from the turbine.

Shadow flicker through trees or hedges will scare horses

Shadow flicker is a term which often arises with reference to turbines and is frequently misused. Shadow flicker occurs only within buildings where a turbine blade is passing between a window and the sun. It does not affect bridleways, although it could possibly affect stables very close to turbines, depending on the site. The phenomenon is specific; it can be accurately predicted for a site and is a planning consideration. Because the phenomenon will only occur in certain conditions, the solution is sometimes that the offending turbine is turned off in those conditions.

Shadows cast in strong sunlight causing a flashing effect through spaced trees, such as when passing at speed along a tree-lined road, is technically different from shadow flicker, but as with any shadow the effect will only be in certain conditions and within a distance about twice the blade tip height from the turbine. Beyond that distance, the shadow is diffused and less noticeable.

Flashes of light off the turning blades will distract horses, particularly when jumping or schooling

Commercial turbines have a non-reflecting finish on the blades and tower which is usually a requirement of planning consent, so this phenomenon is very unlikely. In some specific conditions, depending on the angle of sun and orientation of blades to the sun, there could perhaps be flashes of light caused by strong sunlight being reflected from the surface of the blades as they turn, but it would only occur if the surface was reflective and this would be a contravention of the planning conditions. If it did occur, it would be unlikely to affect horses using public rights of way or roads as it would be similar to a flash of sunlight from any reflecting surfaces such as a car windscreen. Depending on its height, it could affect horses in a manège, particularly if jumping, or perhaps on a cross-country course, so should be considered for turbines close to an equestrian business. The periods when it could occur are relatively few and could be defined.

On microgeneration turbines (up to 50kW output) this may be more common as two different models have been reported as reflecting sunlight in a strobing effect in certain conditions, which has affected grazing horses. Non-reflective surfaces can be stipulated in planning conditions.

Horses have more sensitive hearing than humans and will be disturbed by the noise

Noise from turbines is very strictly controlled and is considerably below noise from motor vehicles, farm machinery and many other commonly occurring noises which do not appear to disturb horses. Older turbines may produce

more noise, but if a check is made by the planning authority and the turbine is above the limit, it can be turned off until remedial work has been undertaken. If you think a turbine is making too much noise, you can contact the planning authority in the first instance.

Modern turbine designs produce very little noise from both the gearbox and from the blades through the air. Some models produce less sound than others and this is controlled by planning limits set by the local authority or council. For commercial developments, the quietest turbines available may be required by the planning authority as part of the planning conditions, or may be stipulated following representation. Smaller turbines do tend to produce more noise, which is partly because the moving parts are closer to the ground so the sound is more audible. They may also be prone to making sudden noises as they are more rapidly affected by changes in wind direction and speed, and as the head of the turbine moves into the wind, there will be a change of sound.

Particular localised sites may suffer unusual sounds in certain rare conditions and these may be at some distance from the turbine(s) owing to the configuration of structures in producing standing waves. This is unlikely to be a problem to a horse on the move, though it could be an irritant in a stable or field in those particular weather conditions causing the effect.

On the whole, sound from commercial turbines will be masked by the general noise created by wind unless in very close proximity.

Horses have a slightly greater range of hearing than humans[14] and they also hear sounds from further away, but many horses do not appear to be disturbed by the sounds made by turbines, particularly the more modern ones which are much quieter than older units.

Turbines keep getting bigger and bigger!

Turbines are more efficient at greater height because the air speed increases dramatically with height and turbulence reduces, so much more electricity can be generated, so they have increased in size. However, in England and Wales, the size of turbine possible is currently limited by the size of blades that can be transported by road – 45m long blades are the current standard and require lorries that cannot use many minor roads, particularly with bends, so larger turbines will be limited to sites with immediate access from main roads. Air-lifting such components is often not feasible because of air traffic restrictions or financially it is not viable.

[14] Approximate range Hz: human 64-23,000; horse 55-33,500

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For more information on The British Horse Society's rights of way work contact:

Access and Rights of Way Department,
The British Horse Society, Abbey Park, Stareton, Kenilworth,
Warwickshire CV8 2XZ
Tel: 02476 840515 Email: access@bhs.org.uk

This advice note applies to England and Wales. For information on Scotland, contact Helene Mauchlen, BHS Director Scotland,
Woodburn, Crieff, Perthshire PH7 3RG
Tel: 02476 141077 Email: helene.mauchlen@bhs.org.uk

For information on Northern Ireland please contact
Susan Spratt, BHS Director Ireland,
Grove Farm, 5 Quarry Road, Greyabbey, Newtownards, Co. Down BT22 2QF
Tel: 02476 840736 Mob: 07808 141079 Email: s.irwin@bhs.org.uk

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