⮒ **WindFarm**   **4.2.1.1 Release Notes**

This details the changes from release 4.1.2.2 to 4.2.1.1. Release 4.1.2.3 only had the Photomontage changes of umbrellas, borders and exclusion zone movement. The help system and tutorials have been updated and expanded. This release is compatible with Windows 7.

The major changes are improved turbine geometry specification, text boxes in the Designer, boundary files, shape files, the ISO 9613 noise standard, shadow flicker merged listings and shutdown list, and the extended optimisation constraints including fast constraint satisfaction. Most of these changes are only available to **WindFarm** standard version users as shown in the list.

A number of important file changes have been made in this new release. In particular the layout and turbine data files have had major revisions. Consequently the files are not backward compatible, and therefore it is necessary to back up the data of any projects previously developed. It is also essential that all users that share files within a company are updated to the new release at the same time.

The simplest form of backup is to copy the entire default project folder C:\WindFarmR4 to a new folder, say C:\WindFarmR4Backup. You may of course be using a different drive and / or name for the default folder.

After backing up your projects uninstall your present release using the Control Panel / Add or Remove Programs. Then install the new release 4.2.1.1 and your projects should be ready for use.

While it will take a few minutes to do this, I consider it precautionary in order to allow an orderly return to using the previous release if it proves necessary. I am, however, confident that reversion will not be required.

There have also been some bug fixes and a minor correction to energy yield calculations has been made. The latter relates to the integration of the highest wind speed bin and in tests the resulting energy yield changes were less than +/-0.1%. This correction applies to the Energy Yield, Turbine Studio, Wind Flow and Designer modules. In all of these it is possible to toggle between the corrected calculation and the previous one using ctrl-Y.

WindFarm Release 4.2.1.1 Changes	Basic	Standard
Grid Viewer		
View noise and ZVI data files	Y	Y
Height modification using boundary files		Y
Contour Viewer		
Check for intersections	Y	Y
New boundary file type - CTB		Y
File conversion CTH <-> CTR <-> WFM <-> CTB		Y
Import and viewing of ESRI shape files		Y
Turbine Studio		
Include cone angle	Y	Y
More complex geometry	Y	Y
Coloured sections - blade and tower	Y	Y
Multiple noise wind speed points (8)	Y	Y
Designer		
Movable object labels	Y	Y
Custom object labels	Y	Y
House separation circles hatched	Y	Y
Text boxes in project and layout		Y
Noise Calculation		
ISO 9613 standard		Y
Individual house receivers		Y
Base noise level		Y
Distance limiting		Y
Optimisation		
Elliptical / rectangular turbine separation		Y
Fast constraint satisfaction		Y
Individual house noise level		Y
Individual house separation		Y

Photomontage		
Wireframe SVG output		Y
Wireframe multiple viewpoint image export	Y	Y
Border and line width control	Y	Y
Umbrella labels		Y
Exclusion zone movement		Y
Shadow Flicker		
Average blade chord limit	Y	Y
Merged listings		Y
Turbine shutdown listing		Y
Sunrise and sunset lines on graph	Y	Y

Designer

Text boxes are new objects that can be included as part of a project's or a layout's data. They are not available in the basic version of **WindFarm**. There is a new "A" icon on the toolbar for editing text boxes. Text boxes can be added to a project and therefore visible all the time or added to a specific layout. If a layout is open they are automatically stored with the layout. Otherwise, they are stored with the project data and can only be edited when a layout is not open. The text and text box attributes are specified via the location dialog. As well as specifying the fill and border settings, a pointer can be shown, which will be drawn from the selected location around the text box (the default is the centre) to the specified location.

When using the "Edit / Symbols and labels" menu item the dialog now includes a Location button for each object to change the position and justification of the label relative to the symbol. The location dialog now allows the customisation of labels for individual objects including the use of "%i" or "%I" as textual replacements for the identifier number.

The turbine selection dialog has been improved along with the setting of windows. For houses the noise receptor height and porosity can be individually specified (see noise calculation below), but not in the basic version.

As an alternative to turbine separation ellipses, rectangles can now be drawn with the appropriate orientation. The separation distance from houses can be hatched and though normally drawn as a circle, a percentage factor can be applied to the North or South parts of the circle. This can be useful if a shadow flicker boundary is being drawn, where in the Northern hemisphere a turbine could be placed closer if it is to the North of a house.

Turbine Studio

The geometry specification has been extended to permit better representation of more complex geometries (see the Enercon E82 as an example). This includes additional sections on the tower and blades. A cone angle can be set with a positive angle rotating the tip upwind for an upwind rotor. The rotor can be specified as a downwind rotor. When this is required specify all of the turbine geometry as though the turbine is an upwind one and the downwind switch will take care of the geometry transform.

There are a few new turbines - Enercon E33, E70 and E82, PowerWind 500-56, Vergnet GEVMP and GEVHP and WindFlow 500. The Vergnet and Windflow turbines are two-bladed.

Tower Geometry

The roughness of the tower can be set. Roughness relates to the spectral reflection of the surface used when rendered. Typical values are 1 to 100. 10 is a reasonable representation of a glossy surface and 100 will be more like a satin or eggshell surface where the reflection is spread over a wider angle. 100 is the default.

For more detail an additional 8 sections can be added by setting the "Use extra sections" check box. The "Details" buttons next to each section permit the local specification of colour and section junction to appear smooth when rendered. The colour can be specified as a constant colour (this colour is used from this section down to the previous one) or as a gradient, when the colour will vary linearly from the colour at the previous section to this one.

Blade Geometry

The roughness of the blade can be set. In previous versions the chord lengths at three radial locations (A, B and tip) were used to define the blade planform. To this has been added location C (at a nominal 90% radius) that is used in the Shadow Flicker module. It does not have to be at 90% radius as the chord at 90% will be interpolated if necessary.

To provide more detail an additional 4 sections can be added by setting the "Use extra sections" check box. A2 and A3 are added between A1 and B1 (the old A and B), with B2 and B3 being added between B1 and C. The "Details" buttons next to each section permit the local specification of colour and the section junction to appear smooth when rendered. The colour can be specified as a constant colour (this colour is used from the section being set inward to the previous one) or as a gradient, when the colour will vary linearly from the colour at the previous section to this one.

To permit more accurate blades to be defined the twist, pitch axis, thickness and section profile can be set. The default twist angle is 0, which aligns the blade chord with the plane of rotation. A positive twist angle rotates the leading edge of the section upwind. The pitch axis is the percentage chord point that is aligned along the blade rotation axis. 25% would be typical for the main part of the blade. Near the hub where there is often a cylindrical section, a pitch axis of 50% centralises the section about the rotation axis. The thickness is the section thickness to chord length ratio (t/c) specified as a percentage. The section profile can be selected as a circle (an ellipse is used if the t/c is not 1) cambered, symmetric or root faired. The last of these is suitable where a large faired cylinder is required near the hub.

Hub Geometry
The roughness of the hub can be set and the hub can now be elliptical or cylindrical.

Nacelle Geometry
The roughness of the nacelle can be set. When defined as a box with rounded corners the radius of the corner can be specified as a percentage of the width. The default is 25% and the maximum 45%.

There are "Smooth blend" check boxes to make the section junctions appear smooth when rendered. For more detail an additional 2 sections can be added by setting the "Use extra sections" check box.

Noise Data
Noise data for up to 8 wind speeds can now be specified for both broadband and octave noise data. A tonal penalty can also be specified at individual wind speeds. The wind speeds must be in ascending order. Always try to include noise data for 8m/s at 10m height as this is the default reference wind speed.

Contour Viewer
Boundary Files
A new contour format has been introduced to act as a general boundary file. Contour boundary data files (*.CTB) only contain polygons and can be used as exclusion zones in the ZVI module, interference zones in the Radar module and optimisation boundaries in the Optimisation module. They can also have a roughness height set and therefore act as roughness files. For example, forests could be represented as boundary files with the appropriate roughness set, tree height set as interior height and set as an optimisation exclusion boundary with a margin. They can then be used in each of the above modules. As with roughness files the order of boundary contours is important as they form closed regions, which can be overlaid. They can also be displayed with specific graphics attributes similar to feature files.

Changing the File Type - Converting Files
The "File / File Information" dialog now has a "Change File Data Type" button, which activates drop-down boxes that permit the file type to be changed. Note that when changed the file qualifier will be automatically changed to match the selected file type. Also if switching height or feature types to roughness or boundary types any open contours will be closed automatically.

ESRI Shape Files
Shape data files can be opened and viewed using the Contour Viewer. Shape files are a general format, and therefore it is difficult to predict how they may be used. On opening a shape file a dialog is used to select which of the four contour file formats (height, roughness, features and boundaries) it represents.

A right click on a selected contour will show an attribute selection dialog with the attributes extracted from the shape file database for the selected contour. These attributes can be mapped to the four parameters associated with **WindFarm** contours. See **WindFarm** file formats in the Data Conversion section in the help system for more information on the parameters.

The shape file cannot be saved directly in its own format, only in the **WindFarm** format it represents. The data then becomes a standard **WindFarm** contour file and can be used, accessed and edited accordingly.

Digitising Data
The digitiser now creates **WindFarm** contour files for features (*.WFM) and boundaries (*.CTB) as well as height (*.CTH) and roughness (*.CTR).

Check for Intersections

To check if there are any contours crossing (height data only) select Check for Intersections from the Options menu. If one is found, you can continue to find the next or end checking, in which case the contour will be selected on return to the main view.

Editing Contours

All contours can be deleted using the "Edit/Delete All the Contours" menu option. Also a click on the right mouse button displays the new contour parameters (or area and line type for feature files), which can then be edited. There are now four parameters associated with each contour. The use of these depends on the file type. See **WindFarm** file formats in the Data Conversion section in the help system for more information on the parameters.

Grid Viewer

Noise grid files (used to draw noise contours) and ZVI grid files (in the ZVI subfolder of the project folder) can be opened. The noise file (*.NOI) is stored in the project folder and is overwritten every time a calculation is made. Therefore, rename or copy the file if you want to retain it. For cumulative impact ZVIs the file *.ZVI contains the combined result and *.Zxx the result for each wind farm in turn (xx=01, 02 etc.).

Photomontage

There are a number of changes to the photomontage module including an increase in the maximum number of wind farms in a cumulative impact to 128, and a new viewpoint symbol in the Designer that represents the direction and included angle of the viewpoint. This will be used automatically for a new layout. For an existing one you will have to change the symbol from the Edit / Symbols and Labels menu option in the Designer (it is at the end of the dropdown symbol list)

The wire frame display can now be controlled with two new buttons on the toolbar - one for a full wire frame and the second for horizon only. If neither is set then no wire frame is drawn. The wire frame can now be exported as an SVG file via File / Export vector file - SVG files can be viewed in most internet browsers.

Improvements in turbine geometry definition (see Turbine Studio) permit better representation of more complex geometries.

The View / Viewpoint Data menu option will now show the distance to the nearest turbine along with identifying that turbine and its wind farm. It also has a button to set all targets the same.

There is a new "Options / Borders" menu item to control the display of borders in the wire frame. The "Options / Markers and Identifiers" can now be changed to umbrellas (inverted bracket over a wind farm) and labels, with their colour made the same as the turbine outline colour. Labels are set in the "Options / Multiple Layouts" menu item for wire frames and the Cumulative page when editing photomontage run data.

The wire frame line width defaults are 0 for the screen and export and 2 for printing. Turbine and marker line widths are 2 in each case. The value is a multiple of 0.1mm with 0 being one pixel. They can now be changed with a dialog activated by the "Options / Line Widths" menu item.

A selected exclusion zone can be moved in its entirety using the cursor keys. Use cursor + shift to move by 1 pixel, cursor + shift + Alt to move by 10 and cursor + shift + Alt + Ctrl to move by 100.

The yaw angle is set via "Options / Turbine Settings and Scale" menu item. In the wire frame mode yaw angle is relative to the view direction (i.e. 0° means the rotor faces the viewer). In the photomontage mode it used to be 0° means the rotor faces south, but now the wind direction is specified. The dialog changes according to the mode being used. When a new photomontage is created it uses the viewpoint settings from the wire frame viewpoint being viewed and the wind direction will be set automatically to retain the rotor direction.

Shadow Flicker

In some countries the shadow flicker limit is defined as the distance at which the average blade chord covers 20% of the sun's disc (usually equivalent to about 15 diameters). Therefore, a multiple of the average blade chord (defined as the mean of maximum chord and chord at 90% radius) can now be set as a limit. To obtain the 20% coverage the default multiple is 682, but typical numbers between 679 and 685 may be specified for use by a particular country. If you wish to override the choice of turbine in the layout data file, then the average chord may be specified.

The summary results listing can now be listed by house or turbine and is selected from the View menu. When viewed by house multiple windows in the same house are merged and any overlapping events excluded. When viewed by turbine the results show the merged shadow hours of each turbine on all houses.

Extra listings are available by selecting Detailed Listing from the View menu. Listings can be grouped by window, house or by turbine. When grouped by windows or houses "List merged times for all turbines" can now be selected, which then shows the shadow events in chronological order from all the turbines (merged to remove overlaps). When grouped by turbines "List merged times for all houses" can be selected, which then shows the shadow events in chronological order on all houses for each turbine. This last listing is a useful summary of the total impact of each turbine and when selected also permits a new shutdown listing to be generated. The format button allows the latter to be customised using textual replacements detailed on the dialog. Merged listings and shutdown lists are not available to users of the basic version of **WindFarm**.

Graphs now display two lines representing the sunrise and sunset times, which can be toggled on and off using the "View / Sunrise and Sunset" menu option.

Noise Calculation

WindFarm now provides two noise models - the Danish and ISO 9613 noise standards. The latter is being used more around the World as the primary noise standard. They are described in detail in the help system and in the technical note on noise propagation (NoisePropagation.pdf stored in the C:\WindFarmR4\Tutorial folder). Please read this carefully if you intend making noise calculations.

In ISO 9613 the propagation of noise is modified by attenuation from physical effects and meteorological properties. Meteorological effects include atmospheric attenuation, which is included in the **WindFarm** implementation by specifying the conditions of temperature and humidity. However, it does not include possible additional effects for wind speed, wind direction and cloud cover. Physical properties are the ground surface, barriers, reflection and topography. Only ground surface attenuation is included in **WindFarm**.

ISO 9613 uses the receiver height and ground porosity to calculate the ground attenuation. Global values for the porosity at the turbines, receivers and middle distance are specified. However, houses can be specified with their own individual values in the Designer.

A base noise level can be specified, which is added to the turbine noise to give the total noise level. For example, if a turbine was generating 40 dB at a dwelling, but a base noise level of 35 dB has to be applied, then the total noise level becomes 41.2 dB.

The noise from turbines that are further away than some defined limiting distance (5km would be typical) can be ignored in calculating the total noise level.

Turbine noise data can now be specified at a number of wind speeds. These can be selected when a noise calculation is made.

The ISO 9613 noise standard, base noise level addition and distance limiting are not available to users of the basic version of **WindFarm**.

The tutorial Noise.pdf should be read for more information.

Optimisation

There have been a number of improvements and additions to the Optimisation module. The constraints have been extended and when editing the run data each constraint now has its own page.

Turbine constraints have been extended to include elliptical and rectangular separation shapes. As well as specifying the minor axis separation, the direction of the major axis has to be defined. 0° or 180° means the major axis is aligned North-South, 90° or 270° means East-West.

If a layout contains turbines of different diameters they can be selected for use. If not, then the diameter of the first turbine in the layout will be used for all separation distances.

Different house distance and noise constraints can be applied for each house. Both noise models can be used in the calculations.

Fast Constraint Satisfaction

It is now possible to run the optimiser to satisfy constraints only (no energy yield calculation). The choice is to satisfy the constraints only, or to do that while trying to minimise or maximise the turbine separation within the other constraints, notably noise and boundaries.

These additions are not available to users of the basic version of **WindFarm**.