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EMD webinar 9/1-2014:

SITE COMPLIANCE in WindPRO

Questions submitted during the webinar

Questions		Answers
Will licenses for WindPro 2.9 be valid for WindPro 3.0?		If you have a valid service agreement, you automatically get a new license for WindPRO 3.0. You can check your service status and renew at sales@emd.dk.
For the WEng calculation in Site Compliance, what would you suggest to be the maximum number of grid points we use? I ask because I have performed some Site Compliance Calculations where just the WEng calculations took up to 30 mins and the computer often crashed during this calculation.		Well, this is also a matter of your computer resources, RAM and processor power. My own experience is that WEng3 is much more stable than previous versions even for very large domains and very rarely crashes. I have seldom seen problems if you stay below 680 cells in both directions. But if you do see crashes they might also relate to problems in the terrain file – we have seen this several times. So give your terrain model an extra check. If crashes persist, please send us an export of the WindPRO project and we will analyse it together with Risø/DTU who develops WEng.
For Weng calculations, if site is reasonably complex (no requirement for CFD) but which can affect turbulence calculation in this case doing the Weng calculation twice (for each mast) makes sense or it is always should be done once for only one mast?		I am not fully sure what you mean? If you have a setup with multiple site masts they are automatically both included in the WEng calculation. But perhaps you refer to the link between mast and WTG – in that case I agree that if you have doubt which mast is more appropriate you should try to see if it makes a big difference which mast you link to - if it does you should analyse further which is more representative in terms of height, terrain and roughness.
Why does wasp engineering calculation needs a site data object?		The site data object is just used as a fast way to define the terrain roughness model to WEng.
Can you explain the interaction of weng3 and the met mast turbulence, how will it be scaled?		There are several user options and the calculation is a little complex to describe. But the principal details are given on page 700-701 in the SITE COMPLIANCE manual (find it at: http://help.emd.dk/knowledgebase/).
Is WAsP Version 11 necessary to run the Site compliance Module?		No – you can use any WAsP license that works with WindPRO – which means basically all I think, also those with dongles.
We don't have WEng but we use Meteodyn WT for TI calculations etc. Any plans to interface to WT in the future?		Yes, I have had talks with Meteodyn and other CFD providers; however, we want to integrate WAsP-CFD first to define a fixed format specification which will then be required to use for other CFD results.

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Are you considering options to include turbulence data from CFD models instead of Weng?		That will be a part of WindPRO 3.0, where WAsP-CFD is integrated in SITE COMPLIANCE too (and the question above). However, in some regards WEng's turbulence model is more advanced than those in the CFD models, mainly because it models all three components of turbulence – the CFD models used in Wind energy I know of only model one component. The three components adds a lot of value in the calculation of the turbulence structure correction factor, which the IEC standard requires for complex sites.
How would you quantify the difference in accuracy between using WaSP 11 and WAsP Engineering, for average terrain and complex terrain?		Depends on the calculation. The main difference would be for the extreme wind check if measurements are at a lower height than the hub height. Using WAsP which per default has a quite stable profile (high shear) would then lead to conservative speed-ups and hence likely conservative extreme wind estimates. For turbulence there is also a gain, but basing the turbulence scaling on WAsP speed-ups actually works quite accurately in most cases where the mast is representative in terms of turbulence level (mainly roughness driven) – the benefit from WEng is mainly if the mast is not so representative in terms of turbulence level and also to provide a valuable second (or first ☺) opinion.
How is the displacement height factor included in the calculations especially for heavily non-homogeniusly forested sites?		The usual way in WindPRO. If a displacement height is set in either a Meteo object or a WTG object it will be used in the WAsP or WEng calculations.
What about compliance calculation for a hybrid park ?		I mentioned this briefly in the beginning of the webinar. The design class can also be set individually on each WTG object just as you can set the power curve or noise level. Simply access the WTG properties via the maps and objects window and define the design class individually for each WTG object.
Why did´nt you choose a turbine IEC IIA		Well, I had only a partial exceedance of the turbulence at lower wind speeds, hence the turbulence was only yellow, not red. This means that the fatigue approximation done "behind the curtain" in SITE COMPLIANCE evaluates that the buffer at higher wind speeds more than balances the exceedance at lower wind speeds. If a class IIB is suitable for a site it is likely cheaper than a IIA and hence a more optimal choice.

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Turbine manufacturers claim the IEC standard is over restrictive, i.e. lower air density can compensate for exceedance on shear or turbulence		See next answer.
So how strict should the IEC standard be interpreted?		The IEC standard gives you two options: A) Compare each check individually to the IEC limits B) Make a load calculation and show that loads for all components are less than those for the chosen IEC class. If one or more checks fail you have to use, B, and only the manufacturer can perform the load calculation (at least until WindPRO 3.0 and release of our Load Response model ;-)). However, we have made the an intermediate step in the direction of a load calculation and introduced the yellow "Caution" category, where things are most likely to be OK although there is a minor exceedance of the IEC limit. The limits of the yellow category are based on experience from a lot of load assessments and a detailed sensitivity study of load calculations we have made.
Hi Lasse, is there any option for correction of different measurement intervals than 10 min in the TI calculation to comply with the IEC recommended 10min measurement intervals?		I have looked quite a bit in to this and had intentions to implement it - and the module will give you a warning in the current version if your data are not 10min. The problem is that hourly data may be either: a) 10 min averages sampled each hour (WMO standard) or b) actual hourly averages and the corrections for extreme wind and turbulence are different for a) and b). In WindPRO we have now way of knowing if the data are a) or b), and hence I feel that providing that correction could be a little dangerous.
In your IEC compliance module, you propose to integrate effective turbulence calculations over wind speeds in addition to sectors. But, you point out that this modification of the standard has to be tested. Have you made some progress on this ?		Yes a lot, ☺ So thanks for asking! However, it was actually the late Steen Frandsen the author of the Effective turbulence model himself that proposed that calculation in his 2007 Risø-report which formed the basis for the adoption in the IEC standard (although there is an error in the equation in that report). As part of the development of the new Load Response model for SITE COMPLIANCE we have done a lot of further detailed analyses of the load response to systematic variations in the climate parameters. The calculation you refer to represents the WTG blade fatigue accumulation, with a quite good accuracy.

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I have seen Ic that is I guess ındex of complexity. If it is, What is the difference from ruggedness index? Thank you very much.		Yes, Ic is the complexity index defined in the IEC standard. That calculation is based on fitting a number of different planes with different radii to the terrain around a WTG and evaluating the slope and vertical terrain deviations from the planes. The RIX (Ruggedness IndeX) calculation is quite different from this and was “invented” by the WAsP team. RIX measures the fractional area within a radius of around 4km where the terrain slope exceeds typically 40%.
For the Wind Distribution, is it not better to use the actual measured distribution instead of the weibull? Is that an option in the IEC?		The IEC 61400-1 ed. 3 does not require a Weibull just a long term representative distribution. The good thing about the Weibull fits are that they remove some of the so-called sampling error due to the limited measuring period by smoothing the distribution. The assumption of a Weibull is not as severe as some think because, sector-wise Weibulls are used and the sector number can be increased to more than 12 if needed. Don’t think of the measured histogram as the truth - the measured histogram one year will quite a bit from that measured the following year, and generally the more years of measurements the closer the fit is to sector-wise Weibulls. But of course there are exceptions.
Is the International Building Code (IBC) method optional for the extreme winds if limited met data is available?		I am not sure what you mean – but the Eurocode is a very good choice or alternative if the measurement period is not long. It is required that you can get the national appendix to the Eurocode and find the required base wind speed (50 year wind at 10m and roughness 5cm) for the site .
Legend colours: does include the total fatigue loads on the WTGs? or it includes only the value calculated, e.g. TI values.		Well, in general the legend colors for each check only represents that check, so they don’t include the total fatigue on the WTG. However, for the Effective turbulence check/result the transition from yellow (warning) to red (critical) actually also accounts for the wind distribution to weigh the turbulence at different wind speeds, and this approximates the accumulated fatigue due to wind distribution and turbulence. This calculation is defined in appendix 3 in the SITE COMPLIANCE manual.
How are you determining if a turbine is "yellow" or "red". What is the threshold value for that?		The thresholds are based on experience from many load assessments and a sensitivity study we have made some time ago. The thresholds are summarized in appendix 3 in the SITE COMPLIANCE manual.

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Changing the IEC class has not solved the turbulence exceedings. Why is your conclusion that the turbine is a good choice now, turbulence is still exceeded?		You are right the effective turbulence is still exceeded, but the exceedance is not evaluated to be critical, that there is an excedance for some wind speeds, mainly lower speeds, but a buffer at other wind speeds, mainly higher speeds where loads are higher. The transition from yellow to red is based on an approximate fatigue calculation which actually estimates if the buffer balances the exceedance and in this case, since it is yellow, it does. Another point is, that because I increased the turbine wind speed class from III to II, I actually also got more buffer in the turbulence check (although I still use class B) – I know this sounds strange. The reason is that a class II WTG is designed to have higher frequencies of occurrence at high wind speeds where turbulence st. dev. is higher and hence loads are higher – in other words a class IIB is built to withstand larger fatigue due to turbulence than a IIIB, because the IIB expects higher frequency of occurrence of higher wind speeds where turbulence gives more fatigue.
You use "quality" measure of applicable functions or options in calculations. I like the idea but how did you define what is "A" or "B" quality as well as I saw somewhere where Quality measure did not indicate anything. What does that mean?		The A, B and C qualities are indicative and not the “truth” – we have based them on experience and theoretical insight in the models. So that in most cases you can expect more accurate results from a quality A calculation than a B, but there can be exceptions in particular depending on how representative your mast is for the turbine positions. The cases where there is no quality like e.g. “Eurocode” calculation in extreme wind, is where there user has to input and value (a base wind speed). Hence, the quality will depend on that input. But, generally the Eurocode with the correct input will produce very reliable results – so with the appropriate input it would typically be quality A.
Is there a long term correction option for air density when calculating from local temperature and/or pressure data?		I actually looked into this when designing the module – but I abandoned it again, firstly because it is not as sensitive as for wind speeds, and secondly because there are fine supplementary sources like GHCH and the free SYNOP stations in on-line data which cover long periods.
Gee, I would really like am an optimisation module that includes the IEC constraints		We will be working on this once the new fatigue Load Response model is released. An optimization using the checks individually is less meaningful – but it really gets powerful once you include the full load assessment.

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When precisely WindPro 3 will be availaible?		2014. Unfortunately, I cannot give a better estimate than that, mainly because it is not I who decide and make the final prioritization.
Are you going to get the load calculation tool certified?		We are still discussing it, so it has not been decided. If our users feedback that it would add value for them we will probably try to get a certification, however we are already having manufacturers requesting to get their own turbines integrated via the load response module for in-house, without asking about certification, so perhaps the need is no so large?