

TURBINE INTERACTION IN LARGE OFFSHORE WIND FARMS

Wind Tunnel Measurements

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Acknowledgement / Preface

This report describes the measurements carried out within the project "Turbine Interaction in large Offshore Wind Farms". This project was supported by the Program Renewable Energy (Programma Duurzame Energie, PDE) in the Netherlands, which is carried out by the Netherlands Agency for Energy and Environment (NOVEM) under the authority of the ministry of economic affairs (Ministerie van Economische Zaken). The contract number is 2020-01-13-10-004 and ECN's project number is 74170. The theoretical part of the work is reported in the paper ECN-C-04-033. The measurements were carried out with a model wind farm designed by ECN, in the boundary layer tunnel of TNO, Apeldoorn.

Summary

Background and Aims

Large wind farms are to be expected in the coming decades. We are talking about farms of for example 20 times 20 turbines or larger. Of course it is of utmost importance to be able to predict the production of such farms accurately. However, little is known on cumulative effects of wind turbine wakes. Therefore this project studies the wind turbine interference and especially wake losses for larger offshore farms.

Model

The decrease of the wind speed in the wake of wind turbines can be compared to the frictional drag exerted to the planetary boundary layer by surface roughness. We calculated the effect to the boundary layer when the wind encounters a wind farm. The wind farm was implemented as a sudden change of the surface roughness. Our calculations showed that after an increase of the surface roughness, the wind speed was decreasing up to large distances downstream. Several wind farm models assume that equilibrium is reached after 5 rows of wind turbines, our model showed that it will take at least 10 rows before equilibrium is reached to some extent. This means that our classical models predict a too high power output for really large wind farms.

Experiment

In order to validate the results of the model we set up an experiment in the boundary layer tunnel of TNO, Apeldoorn. We designed and manufactured 30 wind turbines on a scale of 1:400. The turbines are 25 cm diameter and have a hub height of 25 cm. Our design philosophy has delivered rotors which are very similar to full scale rotors regarding the axial force and wake properties, however regarding the efficiency their performance is less. The power coefficient is about 0.30, while it can be between 0.45 and 0.50 for commercial rotors. In the wind tunnel the surface roughness (excluding that due to the wind turbines) was set to sea conditions: after scaling this was approximately 0.2 mm / 400. Sometimes the roughness was adapted to onshore circumstances as well. We installed several wind farms layouts and measured the wake losses and the effects on the boundary layer.

Results and Discussion

The validation suggests that the wind velocity has not reached its equilibrium value after 5 rows, which indicates that the numerical model can be used for global studies of atmospheric flows above (and behind) large wind farms. The words 'suggests' and 'indicates' were used since the situation in the tunnel was different from the real situation in several aspects. For several reasons the interpretation of the results was difficult. Especially the accurate measurement of the wind speed was a difficulty. A way out for this accuracy problem was the application of differential measurements: we finally set up two farms next to each other in the tunnel.

Conclusion

We can not rely on wind farm models that assume that the wind flow in a farm is stabilized after five rows of turbines. Many models will over predict production.

Recommendation

We recommend that much attention is to be paid to improvement of the accuracy in the wind tunnel and to the organization of good experiments with actual farms in the field. Both suggestions have been implemented in successive projects, which already have been started.

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Executive Summary

Turbine Interaction in Large Offshore Wind Farms

Background and Aims

The worldwide installed wind power increases by about 25% annually. In 2002, this rapid growth has driven the total globally installed wind power to over 31 GW. Much of this power is realized in a few crowded countries such as Germany, the UK or the Netherlands. Since the public acceptance for much more power is becoming a serious drawback, several countries have developed plans for offshore wind energy. For example in the Netherlands the plan is to have 6 GW of wind power installed in the North Sea by the year 2020. Germany, France, Great Britain etc. have similar plans. This means that very large wind farms are to be expected in the coming decades. We are talking about farms of for example 20 times 20 turbines or larger. Of course it is of utmost importance to be able to predict the production of such farms accurately. This means that the wind resource should be known and that we need good models on the interference of the turbines in large farms. Although wind turbine interference can decrease production much, little is known on cumulative effects of wind turbine wakes. One of the largest present offshore farms is Horns Rev, which consists of 10 rows of 8 turbines each. Precise wake farm efficiencies are still confidential for this farm, but numbers in the order of overall efficiencies of about 85% are mentioned. This project studies the wind turbine interference and especially wake losses for larger offshore farms.

Model

The decrease of the wind speed in the wake of wind turbines can be compared to the frictional drag exerted to the planetary boundary layer by surface roughness. The surface roughness is determined normally by an inventory of all obstacles (trees, buildings, etc.) in a certain area and calculating the value for the surface roughness according to certain rules. In this report the surface roughness associated to a wind farm is calculated in a similar way. Subsequently it was calculated what the effect was to the boundary layer when the wind encounters a wind farm. In the models this was implemented as a sudden change of the surface roughness. Our calculations showed that after an increase of the surface roughness, the wind speed was decreasing up to large distances downstream. Several wind farm models assume that equilibrium is reached after 5 rows of wind turbines, our model showed that it will take at least 10 rows before equilibrium is reached to some extent. This means that the classical models predict a too high power output for really large wind farms.

In our model we accounted for thermal effects in a simple manner. Thermal activity in the atmosphere causes a higher turbulence level and an increase of the surface roughness also increases turbulence. This gave us the idea to account for thermal effects by adapting the surface roughness. Via this trick, our model can estimate the effects of a wind farm for atmospheric conditions including slight departures from neutral atmosphere.

Experiment

In order to validate the results of the model we set up an experiment in the boundary layer tunnel of TNO, Apeldoorn. We designed and manufactured 30 wind turbines on a scale of 1:400. The turbines are 25 cm diameter and have a hub height of 25 cm. The turbine rotors are two-bladed and look rather different from full scale rotors. The reason is that they are not simple geometric scaled versions of the large rotors of practice. Instead, the rotors are designed in such a way that they have wind turbine wake characteristics, which are similar to those of full scale rotors. When the size of a rotor is reduced from about 100 m to 25 cm, the so-called Reynolds number decreases from about 10 million to just above 25 thousands. In other words, the viscous effects in the flow are much more significant for small rotors. The rotors were designed so that their chord based Reynolds numbers were just above 25.000 since the aerodynamic behavior becomes unpredictable below this value. This was realized by reducing the rotor speed and by increasing the chord. This explains the strange shape of the large chords of the rotor blades. For the airfoils the NACA 0009 was chosen, since this airfoil has a relatively low Reynolds dependency. Despite of those measures to minimize Reynolds effects the airfoils of the models have more frictional drag (loss of energy) and therefore the rotor performance is less than that of much larger rotors.

Our design philosophy has delivered rotors that are very similar to full scale rotors regarding the axial force and wake properties, however regarding the efficiency their performance is less. The power coefficient is about 0.30, while it can be between 0.45 and 0.50 for commercial rotors. The turbines reach an optimum C_p of 0.30 for a pitch angle of $+2.5^\circ$ and a tip speed ratio of 5. This value is very good regarding the small rotor size. From each turbine the rotor speed, the torque, the local wind speed, the power and the axial force could be derived from measured signals combined with calibrations. Six turbines were equipped with strain gauges on the bottom of the tower to measure the axial force. Five different rotors have been manufactured. Those rotors were different regarding the pitch angle, which ranged from -2.5° to $+7.5^\circ$ with step 2.5° . Changing the pitch angle of a wind turbine rotor was carried out by a simple exchange of the rotor. This method yielded accurate and reproducible pitch angle adjustments.

The model results were tested in the boundary layer tunnel wherein the boundary layer was also scaled by a factor 400. The surface roughness (excluding that due to the wind turbines) was set to sea conditions: approximately 0.2 mm / 400. Sometimes the roughness was adapted to onshore circumstances as well. We installed several wind farm layouts and measured the wake losses and the effects on the boundary layer. The latter measurements were collected by a hot wire traverse system that could measure the wind speed at any location with a high sample rate.

Results and Discussion

The validation suggests that the wind velocity has not reached its equilibrium value after 5 rows, which indicates that the numerical model can be used for global studies of atmospheric flows above (and behind) large wind farms. The words 'suggests' and 'indicates' were used since the situation in the tunnel was different from the real situation in several aspects: in the field there is a pressure gradient perpendicular to the wind, while it is parallel to the wind in the tunnel. The expansion of the wake flow is hindered in the tunnel due to the walls and thermal effects could not be investigated in the tunnel. Finally it should be noted that the accuracy of the measurements often was a problem to conclude with definite answers. Especially the accurate measurement of the wind speed was a difficulty. A way out for this accuracy problem was the application of differential measurements: we finally set up two farms next to each other in the tunnel.

Conclusion

We can not rely on wind farm models that assume that the wind flow in a farm is stabilized after five rows of turbines. Many models will over predict production.

Recommendation

Improving the models and experiments regarding the wind farm efficiency of large farms is difficult for several reasons. In the modeling many effects are excluded since they are unknown or very complicated to include. Think of the precise influence of turbulence, thermal instabilities and pressure gradients in the atmospheric boundary layer. Also the effect of turbulence on the power curve of a turbine is not known. Furthermore the effect of the pressure fields and generated turbulence to the boundary layer is not known. Regarding the experiments we also encountered several problems. Very few large wind farms do exist and regarding the few existing ones the data is often confidential or not reliable. The model experiments we have been taken in the tunnel are a way out. However also these experiments have their difficulties: the scaling of the turbines, the blockage of the tunnel and the different thermal effects and different pressure gradients all add uncertainty. It should be noted that the model wind farm we used was built with so much care that it could be used for many different purposes. For example the effects on the power of different types of turbine control or different farm layouts can be tested accurately. Next to this the precise wind speed deficits in the turbine wakes and the generated turbulence can be measured. Such data is valuable input for wind farm design codes and via this way we will come to more reliable codes.

What we finally recommend is that much attention is to be paid to improvement of the accuracy in the wind tunnel and to the organization of good experiments with actual farms in the field. Both suggestions have been implemented in successive projects, which already have been started.

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1. Introduction

The project "Turbine Interaction in Large Offshore Wind Farms" aims at the development of a model to quantify the effects of large wind farms on the atmospheric boundary layer. The actual model and the validation are reported in ECN paper ECN-C-04-033. This report describes the measurements that were set up for the validation in detail.

The validation was carried out in the atmospheric boundary layer wind tunnel of TNO in Apeldoorn, The Netherlands. This tunnel of 3 metres width and 2 metres height models the boundary layer at a scale of approximately 1:400. The set-up of the experiment is described in chapter 2.

ECN had to develop models of wind turbines on a scale of 1:400 with characteristics very similar to those of 100m full-scale commercial wind turbines. The turbines were designed with great care. This design process is described in chapter 3.

Using the model turbines large model wind farms of different dimensions are placed in the wind tunnel. Scaled boundary layers were created for onshore and offshore situations by placing standard tunnel barriers far upstream in the tunnel. We measured the influence on the wind speed and turbulence around large wind farms. Reference measurements in the scaled boundary layers in absence of a farm are included. We measured many farm characteristics for several different layouts. The measurements were carried out in two campaigns. The first campaign of May 2003 was already very successful. We learned much from this campaign and further improved the turbines and the measurement system for our second campaign in November 2003. A description of both the measurements of May and November is given in chapter 4.

The tunnel measurements showed to be of great value to increase understanding of the behaviour of wind farms. The measurements turned out to be of such value thanks to the accurate and therefore representative design of the turbines. For this reason many more measurements with the same farm are foreseen. Chapter 5 gives the main conclusions and a list of recommended changes for the next campaign.

Appendices A to I present most of the measurement data in large detail.

2. Experimental Set-up

The experiments were carried out in the boundary layer wind tunnel of TNO in Apeldoorn, the Netherlands. This is an open loop, suction type wind tunnel. The measurement area measured 2 m in height, 3 m in width and 10 m in length. Before the measurement area a boundary layer is built up over about 10 m. Placing standard obstacles at the tunnel inlet created an offshore or onshore boundary layer on scale 1:400.

In the tunnel we placed wind farms on the same scale. Therefore we designed model turbines with rotors of diameter $D = 25$ cm that were comparable to full size commercial wind turbines of 100 m diameter regarding the wake characteristics (see figure 1). The rotors were designed so that their chord based Reynolds numbers were just above 25.000 since the aerodynamic behaviour becomes unpredictable below this value. For the airfoil the NACA 0009 was chosen since this airfoil has a low Reynolds dependency. The rotors reach an optimum power coefficient C_p of 0.30 for a pitch angle of $+2.5^\circ$ and a tip speed ratio of about 5. This is a good result for such a small turbine.

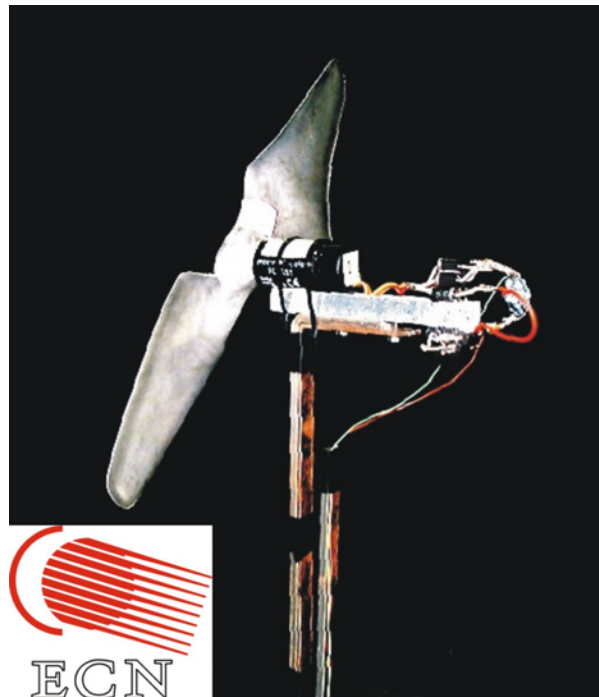


Figure 1. Model wind turbine, 25 cm diameter, 25 cm hub height, NACA 0009 airfoils, pitch between -2.5° and $+7.5^\circ$ adjustable. $C_{p,max} \approx 0.30$.

Besides the first requirement of being representative for full-scale circumstances, the turbines are designed for ease in use. Measuring turbine performance characteristics and changing farm layouts can be accomplished effortlessly. The next section describes the turbines in detail.

Speed measurements were taken of the boundary layer profile at many positions in and above the model wind farms. This has been performed for both offshore farms and onshore farms and for different farm layouts. We used a hotwire traverse system to measure the velocity profiles in and above the farms. The tunnel wind speed is measured by a Schildtknecht

airscrew meter. A Betz manometer is used to calibrate both wind speed sensors. We combined the wind speed data with data from each of our 28 turbines in the farm. Those data serve as indication for the effects to be expected in large farms and of course can be useful for model validation.

All the measurements are incorporated in this report. The best measurements concern farms of 8 and 14 rows in a matrix configuration. Those farms are placed in the middle of the tunnel width, while the rows are placed perpendicular to the wind (see figures 2 and 3). Measurements on those farms are discussed most thoroughly.



Figure 2: Farm 8x3, farm of 8 rows of 3 turbines on scale 1:400

The farm of 8 rows comprehends rows of 3 turbines. We call this farm the 8x3 farm. The rows are separated by $5D$, the turbines in a row are separated by $3D$. For this farm we will look at the differences between an onshore and offshore boundary layer. We measured the wind speed and turbulence at different depths, i.e. between different rows, in the farm. The measurements were carried out in the middle column of turbines.

The farm of 14 rows comprehends rows of 2 turbines. We call this farm the 14x2 farm. A distance of $4D$ separates as well the rows as the turbines in a row. This farm was too large to be placed in the measurement area completely. Therefore the first rows were placed in a zone where in fact the boundary layer was building up. Profile measurements were carried out in one of the columns of turbines, in the middle of the 2 columns and halfway those 2 positions, i.e. $1D$ besides a column. Counting rows from the upwind side we measured the wind speed and turbulence in the middle of 12th and 13th row only. Still we measured the profiles for different farm depths by removing rows from the upwind side of the farm. This way the profile measurements do not suffer from different tunnel behaviour for different depths.

Wind speed and turbulence profiles were measured by means of a hot-wire traverse system. The traverse system was used to position the hot-wire somewhere in the tunnel and then the wind speed was registered there by 200 Hz.

Further we established the extraction of kinetic power from the flow per turbine row on the basis of the product of axial force and wind speed, which are comparable to the situation in the field. This power measurement does not suffer from Reynolds effects since it concerns the extraction of the flow instead of the mechanical power of the rotor.



Figure 3 Farm 14x2, farm of 14 rows of 2 turbines on scale 1:400

Due to the continuity of the flow the decrease of speed in the farm will have caused an increase of speed closer to the ceiling of the tunnel. This increase will not be seen in the field. Furthermore the fan of the tunnel must deliver an additional effort to realise the increase of speed, which leads to an additional drop of pressure over the model turbines that also does not occur in the field. This additional drop of pressure causes an unmentioned recovery of the decreased flow of approximately 8 % in case of 3 turbines per row (see appendix A9).

3. Model Turbines

3.1 Design of Model Turbines

We designed 2-bladed model turbines on scale 1:400. A turbine of the May campaign is shown by picture 4, a turbine from the November campaign is shown by picture 5.

The turbines are mounted on iron plates of 5 mm thickness. Under the plates we attached anti-slip feet. Thanks to the weight of the plates and the friction of the feet the turbines can be positioned in the tunnel without fixation. This enabled us to change farm layouts easily.

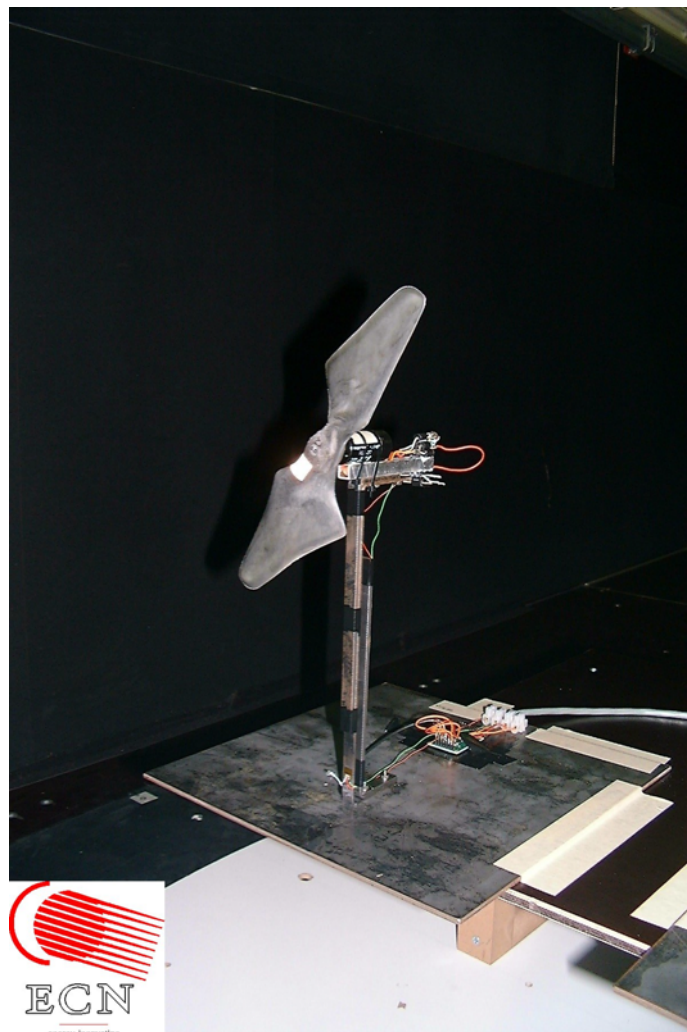


Figure 4: Model wind turbine on scale 1:400 of the May campaign

The towers have been bent from an iron rod. This is simple and cheap. By measuring the tower bending using strain gauges on the lower part of the towers we obtained a measure of the applied axial forces. Between May and November the towers were improved. The first version had been designed on maximum strain to get good signals from the strain gauges. However the stiffness of the towers turned out to be insufficient at high wind speeds when dynamic vibrations occurred. So we used stiffer towers in November.

The rotors were made of glass fibre reinforced plastic, which was moulded in an aluminium mould. Using this fabrication method guaranteed precisely equal and highly accurate rotors. We applied 5 rotor types that differ from each other by the pitch angle. This enabled us to change pitch angles without using an expensive pitch system.

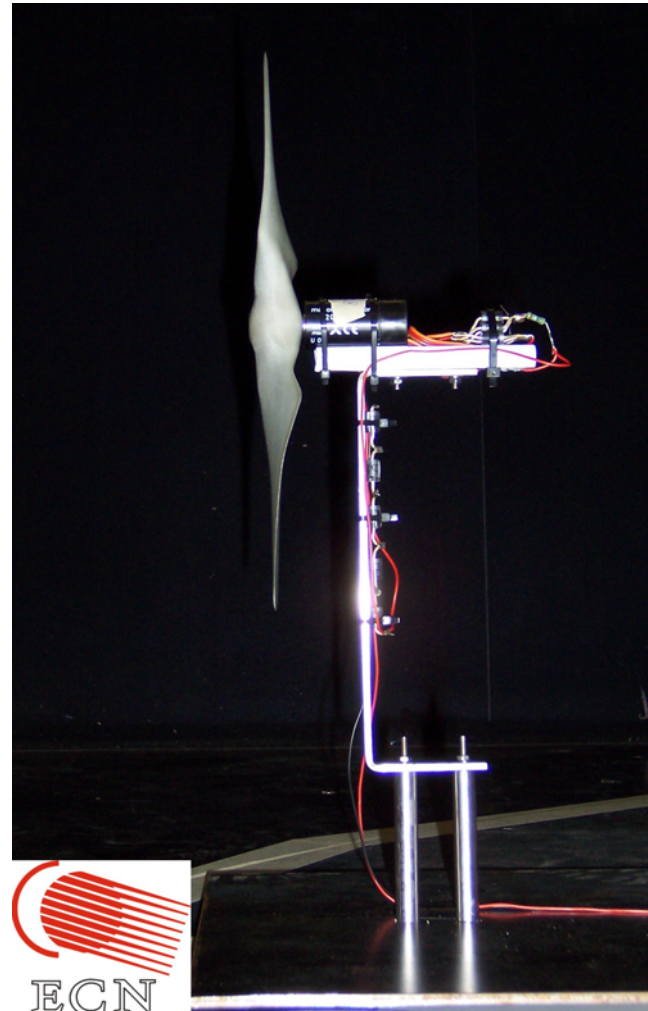


Figure 5: Model wind turbines on scale 1:400 of the November campaign

To prevent for unpredictable aerodynamic behaviour we chose the NACA 0009 airfoil over most of the span (NACA 0012 near the root), since this profile has low Reynolds dependency at low speed. To keep the chord-based Reynolds numbers above the critical value the minimum diameter required was 25 cm.

Due to the relatively high aerodynamic drag of small airfoils, the design tip speed ratio was low: about 5.5, compared to about 7 in the field. This lower tip speed ratio means that the chord has to be enlarged by a factor of about $(7/5.5)^2$ to get the same lift. And to keep the lift over drag ratio acceptable for this low Reynolds numbers we chose $c_l = 0.6$, where $c_l/c_d = 17$. Full scale turbines with Reynolds number above 300.000 reach c_l/c_d -values above 100 for $c_l=1.2$. This means that we had to extend the chord by another factor $1.2/0.6 = 2$. Therefore a large commercial rotor scaled by a factor 400 look geometrically rather different.

The model turbines are equipped with three phase generators. That guarantees a constant torque over each rotor revolution and thus low vibrations. The output power is rectified with low voltage (0.2 V) Schottky diodes, then it is fed via an adjustable number of diodes to a load resistor. The diodes hardly change of operating temperature. So their characteristics are stable during the experiments.

This diode control gives a low torque at low generator speed (since the diodes are not conducting) so that the rotors with their low starting torque can easily speed up the generators. When a certain speed is reached, the diodes start conducting and the generator is loaded. We can adjust the number of diodes to obtain the proper rotation speed.

From most turbines we measure only one signal: the voltage over the high precision resistor. We call that voltage the generator voltage U_g . It is measured at 16 Hz. By applying previously determined calibration curves we derive 4 different physical quantities from the generator voltage:

- aerodynamic torque T_a
- generator speed Ω
- axial force on the rotor F_{ax}
- undisturbed wind speed at the rotor V

The last two quantities depend on the pitch angle of the rotor. So we determined a calibration curve for each combination of rotor and diode control.

For 5 (May) or 6 (November) turbines we also measure the axial forces by strain gauges at the foot of the towers. The error in the axial force is rather high due to the uncertainty about the vertical position where the aerodynamic force acts on the rotor: wind shear will cause the upper half of the rotor to be loaded more than the lower half. We estimated that this could be maximally 2 cm above the hub. The strain gauges were installed about 20 cm below the rotor centre and so we find that the axial force will be underestimated by 5-10%.

Table 1 gives the resulting signals and the corresponding accuracies.

Table 1: measurement accuracy's

quantity	unit	accuracy
generator voltage	[V]	$1\% \pm 0.0024$
aerodynamic torque T_a	[mNm]	$3\% \pm 0.25$
generator speed Ω	[rpm]	$1\% \pm 50$
axial force F_{ax}	[N]	$5-10\% \pm 0.02$
wind speed V	[m/s]	$2\% \pm 0.25$
axial force (strain gauge)	[N]	$5-10\% \pm 0.02$

Before we started the actual wind farm measurements we characterised the turbines (see the next paragraph). The turbine type used most behaved as a classical Lanchester-Betz turbine, $C_t \approx \frac{8}{9}$, around the aimed tip speed ratio of 5.5. This was reached by a pitch angle of 0.0° and applying zero diodes. The C_p and C_t curves of such a turbine are shown in figure 9 to 11 of the next paragraph. It can be seen that the rotor reaches a good performance ($C_p \approx 0.28$) given its small size.

3.2 Model turbines - Characterisation

The behaviour of the model turbines is identified on the basis of measurements on 5 or 3 turbines besides each other in the wind tunnel in May or November respectively (see figure 6 and 7).



Figure 6: Model turbine characterisation arrangement of May

The tunnel wind speed was going through a stairway regulation that covered the circumstances during the farm experiments. An example of such a wind speed is given in figure 8.

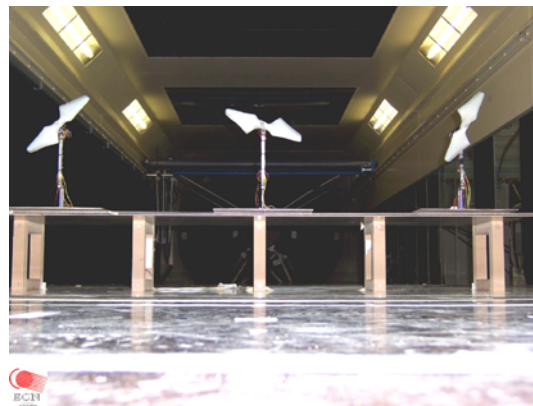


Figure 7: Model turbine characterisation arrangement of November

Herewith we measured the relations between the following quantities for different combinations of pitch angle and generator control:

- Ambient wind speed V
- Axial force F_{ax}
- Aerodynamic torque T_a
- Rotor speed Ω
- Generator voltage U_g

V (that equals the tunnel wind speed), F_{ax} , and U_g are measured using the ECN measurement system and Ω using the hand-held rpm counter (see appendix A). T_a is derived from U_g . When the relations between the variables are established, it fulfils to measure only U_g during the farm experiments. The other quantities follow from the relations then.

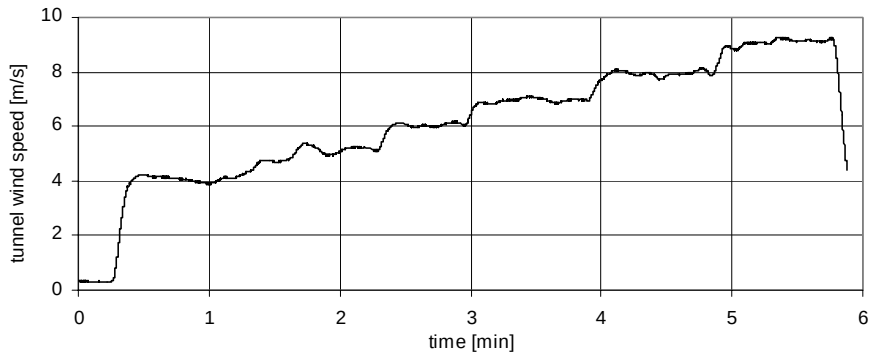


Figure 8: Stairway regulated tunnel wind speed (source file: tkarakter +25 platform.xls)

Intermezzo

To be able to obtain V , F_{ax} and T_a it is necessary to know the relations between:

- The ambient wind speed V and the tunnel wind speed measurement voltage U_V
- the axial force F_{ax} and strain gauge output voltage U_F
- aerodynamic torque T_a and generator voltage U_g

The relation between V and U_V is described in appendix A. The identifications of F_{ax} as a function of U_F , and T_a as a function of U_g are described in appendix D and E. The outcomes are:

- $V = 10 \cdot U_V$ [m/s] (1)
- $F_{ax} = c_F \cdot U_F$ [N] (2)
- $T_a = 10.8 \cdot U_g / R_{load} + 0.24$ [mNm] (3)

In which all voltages U_x in [V], c_F as in table 2 and R_{load} [Ω] is the load resistor at the generator output. Remark that U_g is the voltage over the load resistor.

Table 2: $F_{ax} = c_F \cdot U_F$

Wind turbine number	Month of measuring	c_F [N/V]
1..5	May 2003	0.477
1	November 2003	1.616
2		1.591
3		1.635
15		1.642
16		1.628
17		1.664

The difference in c_F values in May and November is caused by using improved stiffer towers in November. The dispersion in November is because the strain gauges were placed less accurate than in May. That resulted in different positions on the tower where bending is different for equal axial forces.

The raw measurements using the ECN measurement system and hand-held rpm counter are averaged over a period of time that the tunnel wind speed setting is unchanged. These

averages are listed in appendix F. Using appendix F and equations (1), (2) and (3) we found the relations that we were looking for:

- $V = \text{look up}(U_g)$ see table 3, 4 and 5 (4)
- $F_{ax} = \text{look up}(U_g)$ see table 3, 4 and 5 (5)
- $T_a = \text{slope} \cdot U_g + \text{offset}$ see table 6 (6)
- $\Omega = \text{slope} \cdot U_g + \text{offset}$ see table 7 (7)

V and F_{ax} can be obtained for all applicable U_g by looking up and interpolating in table 3, 4 or 5. Each table is the result of a measurement series for different circumstances:

- Table 3: turbines in a uniform flow in May.
- Table 4: turbines in a uniform flow in November.
- Table 5: turbines in an offshore boundary layer in November.

To realise a uniform flow we placed no barriers or obstacles upstream from the turbines. Moreover the turbines were placed on a platform above the boundary layer of the tunnel floor, like in figure 6 and 7. The platform had a height of 1D. Placing a standard tunnel barrier far upstream in the tunnel created the offshore boundary layer. Then the turbines were placed on the tunnel floor, i.e. in the on-scale offshore boundary layer.

Table 3: series My3uni, turbine characteristics measured in May 2003 in a uniform flow

Ugen [V]		0.1R0d	0.5R0d	1.0R0d	1.0R2d	1.0R5d	0.1R0d	0.5R0d	1.0R0d	1.0R2d	1.0R5d	0.1R0d	0.5R0d	1.0R0d	1.0R2d	1.0R5d	0.1R0d	0.5R0d	1.0R0d	1.0R2d	1.0R5d
-2.5 -2.5		-2.5	-2.5	-2.5	-2.5	-2.5	0.0	0.0	0.0	0.0	0.0	0.1R0d	0.5R0d	1.0R0d	1.0R2d	1.0R5d	0.1R0d	0.5R0d	1.0R0d	1.0R2d	1.0R5d
wgen [V]		0.02	0.04	0.06	0.12	0.12	0.09	0.11	0.21	0.36	0.33	0.03	0.09	0.16	0.18	0.08	0.03	0.09	0.17	0.17	0.16
0.02		0.02	0.07	0.12	0.21	0.21	0.19	0.21	0.36	0.33	0.33	0.04	0.16	0.30	0.31	0.20	0.05	0.17	0.31	0.28	0.16
0.03		0.03	0.12	0.21	0.21	0.21	0.33	0.36	0.33	0.33	0.33	0.07	0.27	0.49	0.48	0.34	0.07	0.25	0.44	0.44	0.30
0.04		0.04	0.17	0.31	0.28	0.28	0.50	0.54	0.50	0.50	0.50	0.09	0.37	0.67	0.65	0.51	0.09	0.34	0.58	0.58	0.44
0.06		0.06	0.22	0.43	0.31	0.37	0.68	0.75	0.68	0.68	0.68	0.12	0.49	0.85	0.84	0.66	0.12	0.44	0.76	0.76	0.59
0.07		0.07	0.29	0.54	0.70	0.49	0.86	1.00	0.86	0.86	0.86	0.14	0.60	1.04	1.02	0.87	0.14	0.53	0.94	0.94	0.74
0.09		0.09	0.32	0.65	0.87	0.65	1.05	1.22	1.05	1.05	1.05	0.16	0.69	1.24	1.20	1.23	0.16	0.62	1.08	1.08	0.90
0.11		0.11	0.48	1.05	1.05	1.05	1.25	1.44	1.25	1.25	1.25	0.16	0.69	1.45	1.39	1.34	0.16	0.62	1.23	1.23	1.07
0.13		0.13	0.58				1.66		1.66	1.66	1.66	0.16	0.69	1.66	1.52	1.09	0.16	0.69	1.23	1.23	0.91
wind [m/s]																					
2.99		2.99	3.03	2.98	3.95	3.97	2.99	3.02	3.97	3.96	3.96	3.03	3.06	2.94	3.04	2.95	3.03	3.06	3.04	3.04	3.04
4.06		4.06	3.99	3.95	3.97	3.97	3.96	3.97	3.96	3.96	3.96	4.02	3.98	4.00	3.98	4.01	4.02	3.98	3.96	3.96	3.97
5.09		5.09	5.09	4.98	5.01	5.01	4.99	5.06	5.06	5.06	5.06	5.08	5.01	5.01	5.08	5.02	5.06	5.03	4.99	5.00	5.00
6.09		6.09	5.95	5.96	5.92	5.92	5.97	5.92	5.92	5.97	5.97	6.00	5.99	5.99	5.94	6.00	6.01	5.93	5.96	5.90	5.98
6.98		6.98	6.92	6.96	6.98	6.98	6.98	6.88	6.88	6.98	6.98	7.06	6.98	6.87	6.90	6.89	6.98	7.07	6.99	6.97	6.97
7.93		7.93	7.97	7.89	8.11	8.01	7.91	7.93	7.93	7.91	7.91	8.20	7.94	7.80	7.95	7.99	8.04	8.02	7.90	8.09	7.92
9.10		9.10	9.06	8.89	8.97	9.01	8.91	9.01	9.01	8.91	8.91	9.07	8.93	8.95	9.03	9.01	9.14	9.04	8.88	8.95	9.08
10.09		10.09	10.15				9.97	10.10	10.10	9.97	9.97			9.92	10.12	10.08	10.24	9.99	9.99	8.93	10.06
11.19		11.19	11.09											11.01	11.06	11.18				9.83	11.16
Fax [N]																					
0.23		0.23	0.22	0.24	0.24	0.24	0.28	0.24	0.41	0.47	0.47	0.20	0.21	0.20	0.23	0.19	0.16	0.18	0.19	0.15	0.15
0.40		0.40	0.38	0.41	0.51	0.51	0.47	0.41	0.41	0.47	0.47	0.34	0.36	0.37	0.39	0.32	0.28	0.30	0.30	0.24	0.23
0.62		0.62	0.63	0.66	0.80	0.80	0.73	0.69	0.69	0.73	0.73	0.57	0.57	0.58	0.62	0.48	0.46	0.48	0.48	0.38	0.36
0.89		0.89	0.87	0.94	1.08	1.08	1.03	0.97	0.97	1.03	0.98	0.80	0.82	0.83	0.83	0.78	0.66	0.66	0.67	0.50	0.49
1.17		1.17	1.18	1.29	1.33	1.33	1.39	1.32	1.32	1.39	1.39	1.10	1.10	1.08	1.10	0.83	0.89	0.88	0.88	0.68	0.64
1.53		1.53	1.60	1.67	2.05	1.98	1.78	1.75	1.75	1.78	1.82	1.49	1.42	1.39	1.45	1.35	1.13	1.17	1.11	0.86	0.80
2.01		2.01	2.01	2.13	2.37	2.37	2.24	2.26	2.26	2.24	2.22	1.77	1.77	1.80	1.84	1.71	1.41	1.41	1.37	1.02	0.98
														2.21	2.28	2.02	1.58	1.27	1.19	1.17	
																	1.89				

First row: generator control, x.xRyd means that a turbine was controlled by a load resistor of x.x Ω and y diodes

Second row: pitch angle in degrees

Source file: tkarakter Conclusion.xls

Table 4: series Nv3uni, turbine characteristics measured in November 2003 in a uniform flow

0.1R0d 0.5R0d 1.0R0d 1.0R2d 1.0R5d		0.1R0d 0.5R0d 1.0R0d 1.0R2d 1.0R5d		0.1R0d 0.5R0d 1.0R0d 1.0R2d 1.0R5d		0.1R0d 0.5R0d 1.0R0d 1.0R2d 1.0R5d		0.1R0d 0.5R0d 1.0R0d 1.0R2d 1.0R5d		0.1R0d 0.5R0d 1.0R0d 1.0R2d 1.0R5d		0.1R0d 0.5R0d 1.0R0d 1.0R2d 1.0R5d		0.1R0d 0.5R0d 1.0R0d 1.0R2d 1.0R5d		0.1R0d 0.5R0d 1.0R0d 1.0R2d 1.0R5d	
-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5
Ugen [V]																	
0.06	0.13	0.02	0.10	0.20	0.04	0.15	0.28	0.05	0.14	0.27	0.02	0.14	0.26	0.01	0.14	0.26	0.01
0.10	0.23	0.10	0.17	0.37	0.15	0.25	0.47	0.16	0.24	0.45	0.11	0.24	0.39	0.06	0.24	0.39	0.06
0.15	0.34	0.21	0.24	0.56	0.28	0.34	0.63	0.29	0.33	0.61	0.22	0.33	0.55	0.15	0.33	0.55	0.15
0.21	0.46	0.33	0.36	0.78	0.43	0.45	0.82	0.45	0.44	0.80	0.38	0.44	0.70	0.28	0.40	0.70	0.28
0.28	0.66	0.49	0.53	1.02	0.61	0.55	0.99	0.59	0.54	0.99	0.53	0.54	0.86	0.41	0.49	0.86	0.41
0.36	0.99	0.67	0.66	1.22	0.80	0.70	1.24	0.82	0.65	1.17	0.68	0.65	1.03	0.56	0.59	1.03	0.56
wind [m/s]																	
4.02	4.02	4.02	4.07	4.07	4.07	4.03	4.03	4.03	3.96	3.96	3.96	3.96	4.04	4.04	4.04	4.04	4.04
5.13	5.13	5.13	5.11	5.11	5.11	5.10	5.10	5.10	5.05	5.05	5.05	5.05	5.00	5.00	5.00	5.00	5.00
6.06	6.06	6.06	5.95	5.95	5.95	6.02	6.02	6.02	6.02	6.02	6.02	6.02	6.05	6.05	6.05	6.05	6.05
6.98	6.98	6.98	6.96	6.96	6.96	7.00	7.00	7.00	7.08	7.08	7.08	7.08	7.02	7.02	7.02	7.02	7.02
8.08	8.08	8.08	8.06	8.08	8.08	7.89	7.89	7.89	8.09	8.09	8.09	8.09	8.02	8.02	8.02	8.02	8.02
9.15	9.15	9.15	9.07	9.07	9.07	9.16	9.16	9.16	9.05	9.05	9.05	9.05	9.08	9.08	9.08	9.08	9.08
Fax [N]																	
0.37	0.42	0.50	0.38	0.39	0.42	0.34	0.34	0.30	0.26	0.27	0.19	0.26	0.22	0.15	0.23	0.22	0.15
0.59	0.66	0.80	0.62	0.65	0.67	0.56	0.55	0.52	0.42	0.44	0.32	0.42	0.33	0.22	0.34	0.33	0.22
0.83	0.93	1.10	0.85	0.90	0.91	0.78	0.77	0.73	0.59	0.61	0.47	0.59	0.47	0.35	0.49	0.47	0.35
1.11	1.24	1.45	1.19	1.25	1.26	1.00	1.06	0.97	0.79	0.81	0.66	0.79	0.63	0.47	0.63	0.61	0.47
1.50	1.73	1.93	1.61	1.66	1.66	1.26	1.30	1.24	0.98	1.05	0.85	0.98	0.79	0.61	0.79	0.76	0.61
2.01	2.35	2.48	2.02	2.07	2.10	1.65	1.72	1.66	1.21	1.25	1.08	1.21	0.98	0.79	0.98	0.94	0.79
speed meas [rpm]																	
877			1077			1307			1303			1303			1297		
1094			1413			1762			1740			1740			1652		
1326			1730			2198			2150			2150			2056		
1581			2247			2691			2637			2637			2460		
1912			3031			3159			3128			3128			2878		
2268			3678			3860			3612			3612			3347		
First row: generator control, x.xRyd means that a turbine was controlled by a load resistor of x.x Ω and y diodes																	
Second row: pitch angle in degrees																	

Source file: tkarakter Conclusion.xls

Table 5: series Nv3bl, turbine characteristics measured in November 2003 in an offshore boundary layer

	0.1R0d	0.5R0d	1.0R0d	1.0R2d	1.0R5d	0.1R0d	0.5R0d	1.0R0d	1.0R2d	1.0R5d	0.1R0d	0.5R0d	1.0R0d	1.0R2d	1.0R5d	0.1R0d	0.5R0d	1.0R0d	1.0R2d	1.0R5d	0.1R0d	0.5R0d	1.0R0d	1.0R2d	1.0R5d
Ugen [V]	-2.5	-2.5	-2.5	-2.5	-2.5	0.0	0.0	0.0	0.0	0.0	2.5	2.5	2.5	2.5	2.5	5.0	5.0	5.0	5.0	5.0	7.5	7.5	7.5	7.5	7.5
wind [m/s]	0.07	0.15	0.02	0.09	0.11	0.22	0.11	0.22	0.05	0.05	0.15	0.29	0.15	0.29	0.02	0.15	0.28	0.15	0.28	0.01	0.15	0.28	0.15	0.28	0.01
	0.11	0.24	0.09	0.17	0.19	0.41	0.19	0.41	0.17	0.17	0.24	0.45	0.24	0.45	0.09	0.23	0.39	0.23	0.39	0.05	0.22	0.39	0.22	0.39	0.05
	0.16	0.35	0.21	0.21	0.27	0.60	0.27	0.60	0.30	0.28	0.34	0.62	0.34	0.62	0.21	0.30	0.53	0.30	0.53	0.15	0.30	0.53	0.30	0.53	0.15
	0.22	0.50	0.36	0.36	0.39	0.80	0.39	0.80	0.44	0.46	0.48	0.85	0.48	0.85	0.51	0.53	0.69	0.40	0.69	0.27	0.51	0.87	0.40	0.69	0.27
	0.30	0.65	0.46	0.46	0.56	1.06	0.56	1.06	0.63	0.60	0.56	1.03	0.56	1.03	0.51	0.55	0.87	0.51	0.87	0.42	0.51	0.87	0.51	0.87	0.42
	0.38	1.01	0.65	0.65	0.71	1.30	0.71	1.30	0.81	0.81	0.71	1.25	0.71	1.25	0.68	0.65	1.05	0.61	1.05	0.57	0.61	1.05	0.61	1.05	0.57
Fax [N]	4.12	4.12	4.12	4.12	4.11	4.11	4.11	4.11	4.11	4.12	4.12	4.12	4.12	4.12	4.11	4.11	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12
	4.95	4.95	4.95	4.95	5.21	5.21	5.21	5.21	5.21	5.02	5.02	5.02	5.02	5.02	4.95	4.95	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
	5.96	5.96	5.96	5.96	6.02	6.02	6.02	6.02	6.02	5.91	5.91	5.91	5.91	5.91	6.00	6.00	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90
	6.90	6.90	6.90	6.90	6.97	6.97	6.97	6.97	6.97	7.07	7.07	7.07	7.07	7.07	7.89	7.89	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
	7.89	7.89	7.89	7.89	8.05	8.05	8.05	8.05	8.05	7.92	7.92	7.92	7.92	7.92	7.94	7.94	7.96	7.96	7.96	7.96	7.96	7.96	7.96	7.96	7.96
	8.90	8.90	8.90	8.90	9.15	9.15	9.15	9.15	9.15	9.02	9.02	9.02	9.02	9.02	8.99	8.99	9.14	9.14	9.14	9.14	9.14	9.14	9.14	9.14	9.14
speed meas [rpm]	0.34	0.42	0.50	0.50	0.38	0.41	0.38	0.41	0.42	0.31	0.34	0.36	0.34	0.36	0.19	0.28	0.24	0.23	0.24	0.14	0.23	0.24	0.23	0.24	0.14
	0.56	0.63	0.75	0.75	0.64	0.68	0.64	0.68	0.69	0.47	0.52	0.53	0.52	0.53	0.29	0.42	0.33	0.34	0.33	0.22	0.34	0.33	0.34	0.22	
	0.84	0.93	1.12	1.12	0.91	0.96	0.91	0.96	1.00	0.71	0.75	0.76	0.75	0.76	0.44	0.61	0.45	0.61	0.45	0.34	0.49	0.45	0.49	0.34	
	1.15	1.31	1.56	1.56	1.20	1.28	1.20	1.28	1.29	1.01	1.05	1.08	1.05	1.08	0.84	1.02	0.60	1.02	0.60	0.46	0.65	0.60	0.65	0.46	
	1.54	1.69	1.89	1.89	1.66	1.74	1.66	1.74	1.72	1.26	1.25	1.35	1.25	1.35	0.82	1.03	0.79	1.03	0.79	0.64	0.86	0.79	0.86	0.64	
	2.04	2.36	2.47	2.47	2.18	2.27	2.18	2.27		1.64	1.69	1.72	1.69	1.72	1.07	1.26	0.95	1.26	0.95	0.81	0.99	0.95	0.99	0.81	
First row: generator control. x.xRyd means that a turbine was controlled by a load resistor of x.x Ω and y diodes Second row: pitch angle in degrees																									
Source file: tkarakter Conclusion.xls																									
	915				1128						1332					1325					1315				
	1119				1502						1730					1694					1625				
	1367				1909						2203					2144					2024				
	1657				2422						2842					3069					2470				
	1985				3184						3231					3129					2951				
	2363				3894						3919					3619					3433				

The first rows of table 3, 4 and 5 indicate the applicable generator control, in which $x.xRy$ means that a turbine was controlled by a load resistor of $x.x \Omega$ and y diodes. The second rows of the tables indicate the applicable pitch angle in degrees. The spreading of generator and rotor performance over different generators and rotors has not been significant for the turbine characteristics (see appendix E and G).

In table 6 and 7 it is the first column that indicates the applicable generator control. The pitch angle is not mentioned, since the generator characteristics $T_a(U_g)$ and $\Omega(U_g)$ are independent of that. We used the same generator type in May and November. Though the relation between U_g and Ω had to be adapted for a different assemblage of the resistors in November. The applied adaptation assumes a linear relation between the load resistor and the slope of $\Omega(U_g)$. This approximation does deliver realistic results, but the validity of it will be investigated further.

Table 6: $\Omega = \text{slope} \cdot U_g + \text{offset}$

Generator control *)	May		November **)	
	offset [rpm]	slope [rpm/V]	offset [rpm]	slope [rpm/V]
0.1R0d	374	19636		
0.5R0d	567	4670	567	4488
1.0R0d	568	2854	568	2672
1.0R2d	1186	2877		
1.0R5d	2224	3011	2224	3011

*) Generator control: $x.xRy$ means that a turbine was controlled by a load resistor of $x.x \Omega$ and y diodes
 **) November data is copied from May, but when $y = 0$ diodes the resistance $x.x$ is 0.05Ω larger than in May. Therefore the slope is increased by $(4670 - 2854) / (1.0 - 0.5) \cdot 0.05 = 182 \text{ rpm/V}$ if $y = 0$.

Source file: tkarakter Conclusion.xls

Table 7: $T_a = \text{slope} \cdot U_g + \text{offset}$

Generator control *)	offset [mNm]	slope [mNm/V]
0.1R0d	0.24	108.0
0.5R0d	0.24	21.6
1.0R0d	0.24	10.8
1.0R2d	0.24	10.8
1.0R5d	0.24	10.8

*) Generator control: $x.xRy$ means that a turbine was controlled by a load resistor of $x.x \Omega$ and y diodes

Source file: tkarakter Conclusion.xls

Now we can determine V , F_{ax} , T_a and Ω for every applicable U_g . And after that we can also calculate:

- Axial thrust coefficient $C_t = F_{ax} / (0.5\rho AV^2)$ (8)
- Induction factor $a = 0.5 - 0.5\sqrt{(1 - C_t)}$ (9)
- Tip-to-speed-ratio $\lambda = \Omega R / V$ (10)
- Power $P_{QxN} = \Omega T_a$ (11)
- Power with C_t $P_{\text{with } C_t} = F_{ax} \cdot (1 - a) \cdot V$ (12)
- Power coefficient $C_{p, \text{real}} = P_{QxN} / (0.5\rho AV^3)$ (13)
- Power coefficient with C_t $C_{p, \text{with } C_t} = P_{\text{with } C_t} / (0.5\rho AV^3)$ (14)

In which A is the rotor area and R is the rotor radius.

The really applicable transfer of power from the flow into mechanical power follows from the product of rotor speed and aerodynamic torque. The 'with C_t ' power and power coefficient are

calculated from the thrust behaviour of the turbines, under the assumption that the turbines meet the relations derived by Lanchester and Betz:

$$\blacksquare \quad C_p = 4a(1-a)^2 \quad (15)$$

$$\blacksquare \quad C_t = 4a(1-a) \quad (16)$$

Although this leads to quite large C_p values, this might deliver a better insight in farm power performance as a function of turbine settings than the real C_p . Due to the low Reynolds number the real C_p is smaller for the scaled model turbines than for full-scale turbines. The thrust behaviour of the model turbines better represents the aerodynamic behaviour that is similar for full-scale turbines. The so calculated C_p concerns the extraction of kinetic power from the flow.

The complete sets of data that characterise the turbines for several combinations of pitch angle and generator control are found in appendix H. Figure 9, 10 and 11 show the characteristic figures $C_p(\lambda)$ and $C_t(\lambda)$. Here C_p is the 'real' C_p that is based on the product of rotor speed and aerodynamic torque.

For this project the C_p is not very important, since we consider the airflow through and around the farm and not the amount of aerodynamic power that is transferred into kinetic power. Nevertheless we like to mention that we have realised quite good C_p values given the scale of the turbines. In literature we did not find turbines of this scale that have a more realistic power performance.

The turbines equipped with a pitch angle of 0° and generator control 1.0R0d perform closely to the Lanchester-Betz optimum (i.e. $a = 1/3$, $C_t = 8/9 \approx 0.89$) for a broad range of tip-to-speed-ratio's. Therefore that is the turbine type used most. Using larger pitch angles we realise the partial load behaviour of a variable speed turbine ($a < 1/3$). Smaller pitch angles lead to turbulent wake behaviour. Different generator controls leads to turbine operation that is less realistic in practice.

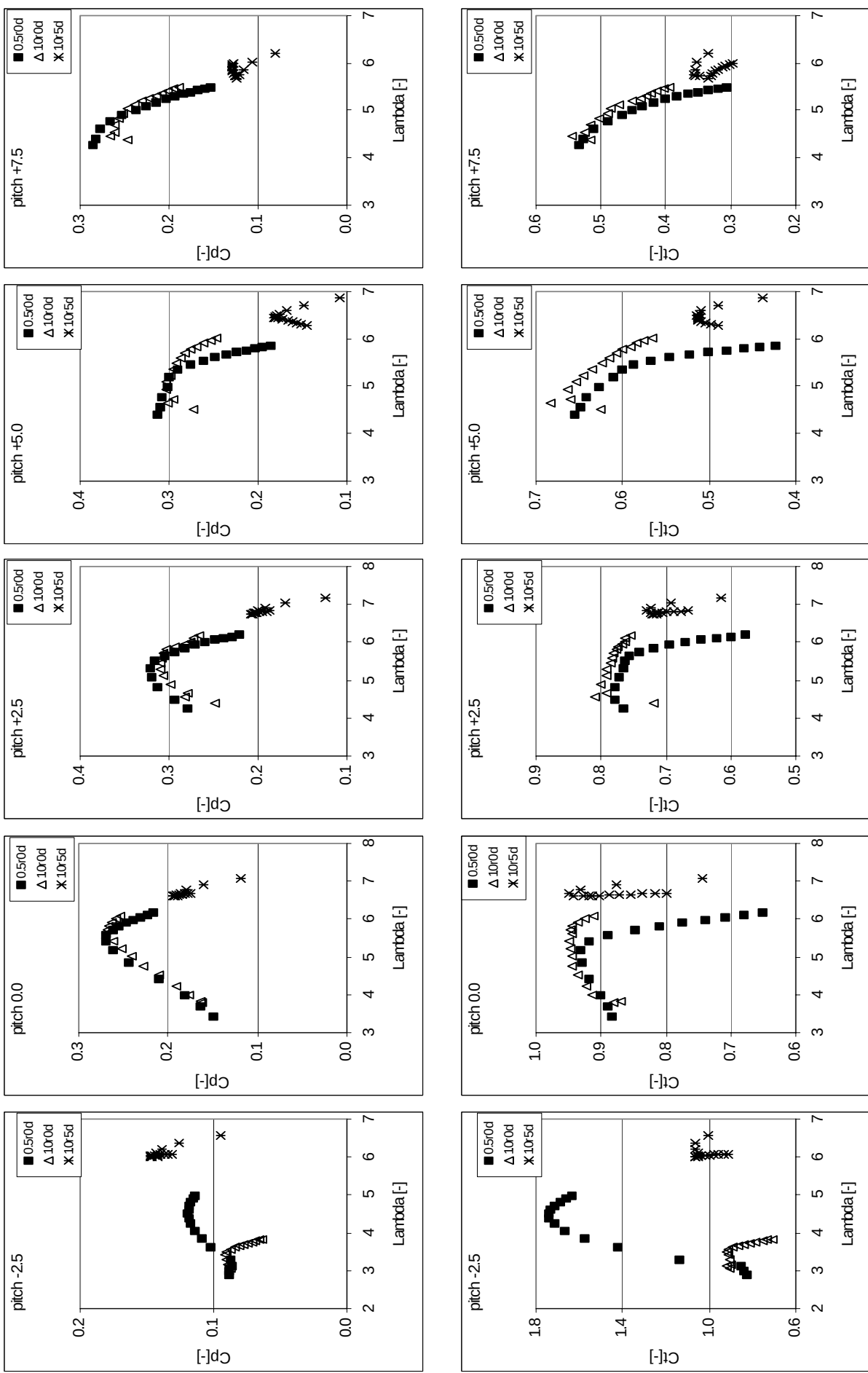


Figure 9: Turbines of May in a uniform flow, power coefficient C_p and thrust coefficient C_t as a function of tip speed ratio λ (source file: karakter C_p $C_t.xls$).

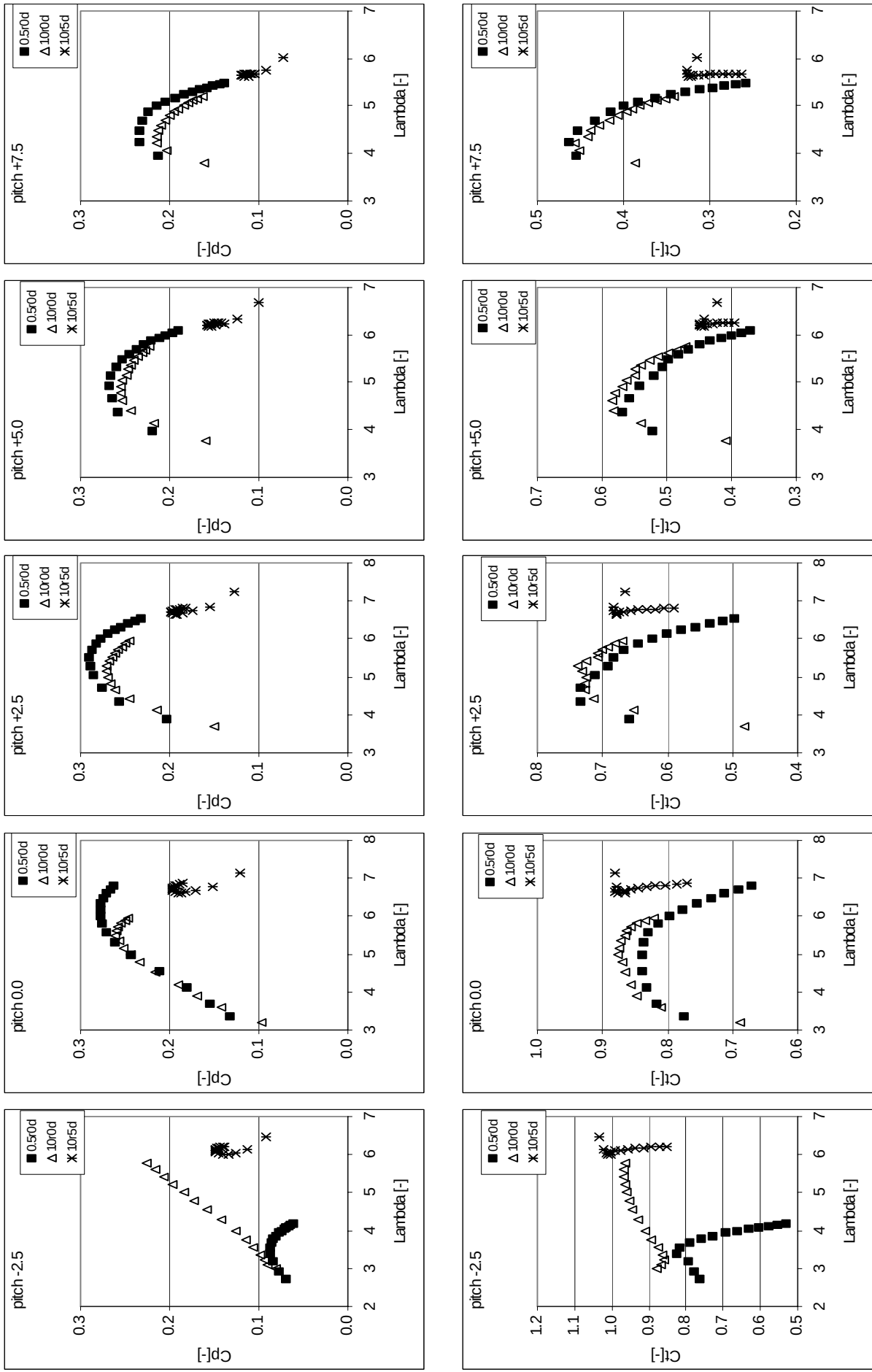


Figure 10: Turbines of November in a uniform flow, power coefficient C_p and thrust coefficient C_t as a function of tip speed ratio λ (source file: karakter Cp Ct.xls).

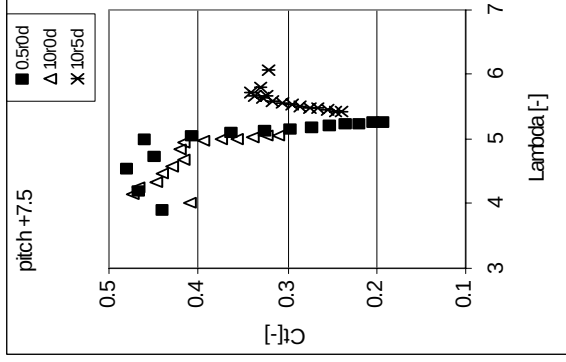
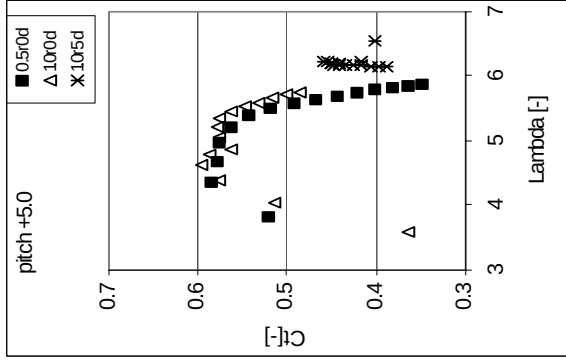
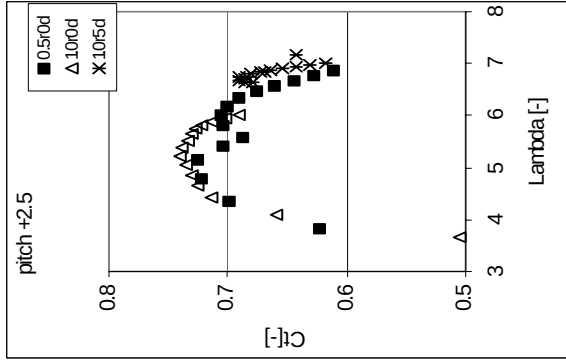
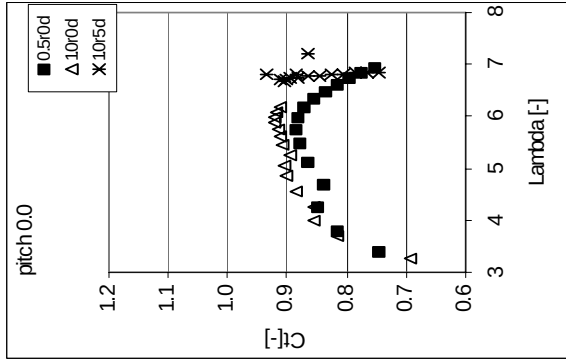
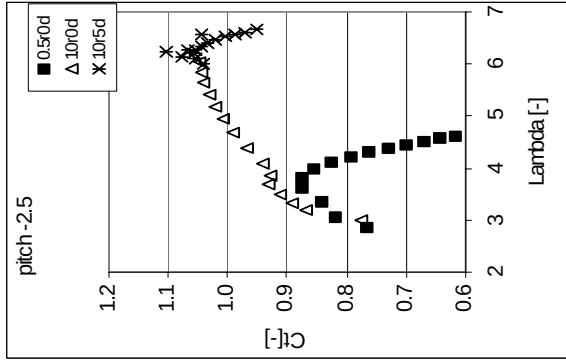
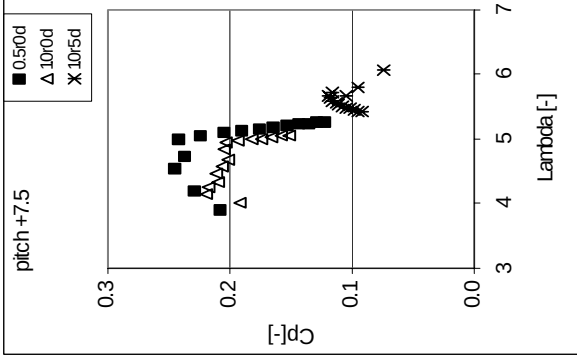
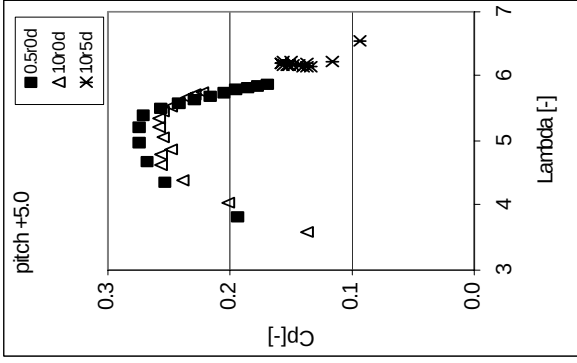
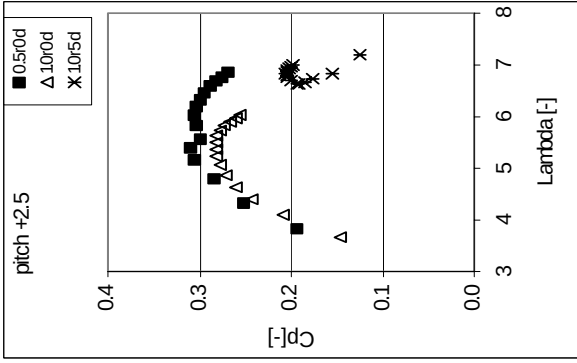
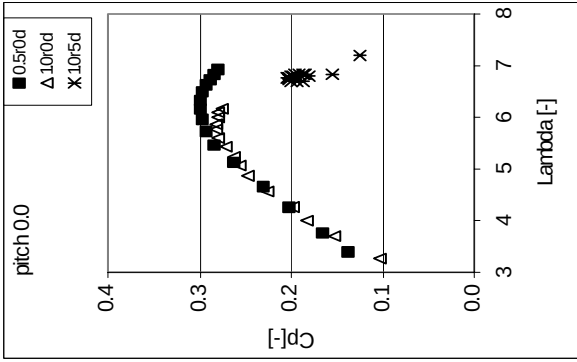
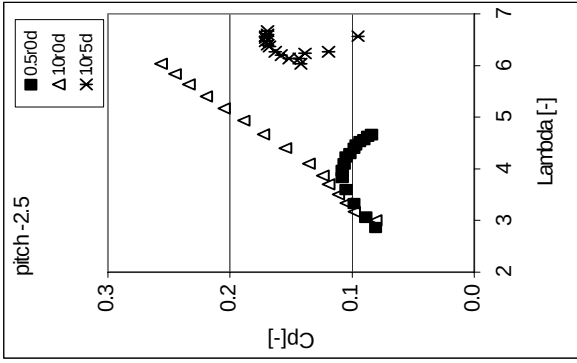


Figure 11: Turbines of November in an offshore boundary layer, power coefficient C_p and thrust coefficient C_t as a function of tip speed ratio λ (source file: karakter Cp Ct.xls).

4. Tunnel measurements

Farm behaviour is studied on the basis of measurements during a period of unchanged regulation of the tunnel wind speed. To eliminate transition phenomena the studied periods are preceded by unchanged regulation as well. The measurement output data is recorded using the TNO and ECN measurement systems (see appendix A for the measurement set-up):

- The TNO measurement system delivers scan files with average wind speeds and turbulence intensities per tunnel co-ordinate. Speeds and intensities are given in the direction of the flow x and in vertical direction z . Averages concern two periods of 10.24 seconds, unless specified differently. The tunnel co-ordinates are relative to the co-ordinate $(x,y,z) = (0,0,0)$ in which x , y and z are perpendicular. The co-ordinate $(0,0,0)$ is no absolute reference, but is adjusted with respect to the tunnel arrangement.
- The ECN measurement system delivers scl-files with voltage signals that represent the tunnel wind speed, generator voltages and strain gauge voltages. The applicable sampling frequency has been 16 Hz. Along with the equations 2 to 14 of chapter 3 we reduced the measured voltage signals to a manageable amount of characteristic average values per measuring period. This data processing is applied lots of times and therefore largely automated (see appendix C).

In paragraph 4.1 we describe the tunnel experiments that have been applicable. Herewith we refer to the recorded scan and scl-files. The scan files and the resulting characteristic averages of the scl-files are found in appendix B. Paragraph 4.2 concerns the analysis of the best experiments.

4.1 Measurement Data

4.1.1 Farm 8x3: a farm of 8 rows

Date May 23, 2003

Experiments: wind profile scans

Aim: the wind profile through a farm

Farm layout:

Upwind side

Generator 9	Generator 1 Strain gauge 1	Generator 17
Generator 10	Generator 2 Strain gauge 2	Generator 18
Generator 11	Generator 3 Strain gauge 3	Generator 19
Generator 12	Generator 4 Strain gauge 4	Generator 20
Generator 13	Generator 5 Strain gauge 5	Generator 21
Generator 14	Generator 6 Strain gauge 6	Generator 22
Generator 15	Generator 7	Generator 23
Generator 16	Generator 8	Generator 24
The grey area means that those generator signals were filtered at 10 Hz while the others were fed directly to the AD converter.		

Downwind side

Width spacing: 3D

Depth spacing: 5D upto row 6; 4.32D between row 6 and 7; 5.68D between row 7 and 8.

Space between tunnel side walls and outer columns: 3D

(Spacing concerns rotor centers, $D = 250$ mm, i.e. the rotor diameter)

The last row of turbines is bothered by blockage from the hotwire traverse system.

Schildknecht: hub height, $\approx 5D$ upwind from generator 9

Control of all generators: 1 Ω , 0 diodes

Boundary layer: offshore and onshore

Measured voltage signals (in order of appearance in scl-files):

- Utunnel: Wind speed (10x amplified and 10 Hz filtered Schildknecht output)
- Fax1, Fax2, ...: Strain gauge: 1 to 6
- Gen1, Gen2, ...: Generator: 1 to 24

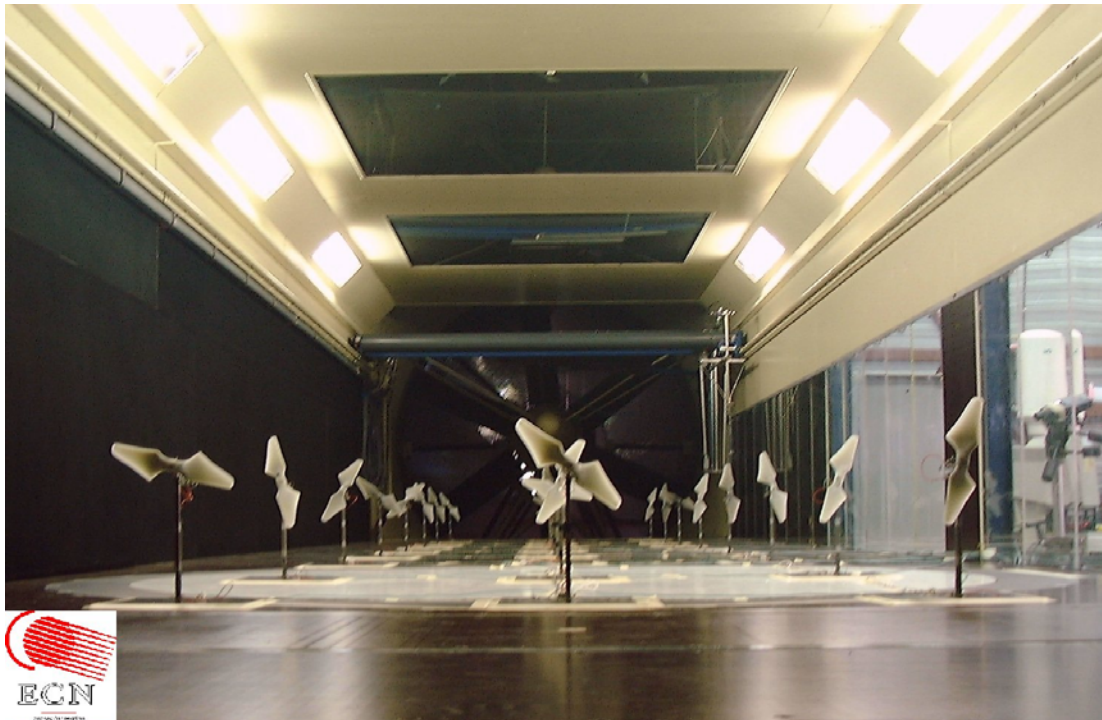


Figure 12: A form of 8 rows of 3 turbines on scale 1: 400 in the boundary layer wind tunnel

File name (scl)	Accompanying scan files	Comments
Park alles 0 ruw	Ecn011 Ecn012	All turbines pitch 0.0, onshore boundary layer
Park 0	Ecn010	All turbines pitch 0.0, offshore boundary layer, ex in filename indicates removed turbines or turbine rows (whole turbines out of the tunnel?)
Park 0 ex rij 2468		
Park 0 ex turbine 2		
Park 0 ex turbine 13		
Alles 0 ex rij 78		
Alles 0 ex rij 8		
Alles 0 ex turbine 13		

First row = upwind

4.1.2 Zigzag: turbines in a zigzag layout

Date May 27-28, 2003

Experiments: turbine measurements

Aim: the behaviour of turbines in a zigzag layout

Farm layout:

Upwind side

Generator 9		Generator 1 Strain gauge 1		Generator 17
	Generator 14		Generator 22	
Generator 10		Generator 2 Strain gauge 2		Generator 18
	Generator 15		Generator 23	
Generator 11		Generator 3 Strain gauge 3		Generator 19
	Generator 16		Generator 24	
Generator 12		Generator 4 Strain gauge 4		Generator 20
	Generator 7		Generator 8	
Generator 13		Generator 6 Strain gauge 6		Generator 21
Column 1	Column 2	Column 3	Column 4	Column 5

Downwind side

Width spacing: 1.5D (between columns)

Depth spacing: 2.5D (between rows, row 1 = generators 9-1-17, row 2 = generators 14-22, etc.)

Space between tunnel side walls and outer columns: 3D

All rotors are of pitch 0, except the 5 most upwind ones: generators 9, 1, 17, 14, 22.

(Spacing concerns rotor centers, $D = 250$ mm, i.e. the rotor diameter)

Schildknecht: hub height, $\approx 5D$ upwind from generator 9

Control of all generators: 1 Ω , 0 diodes

Boundary layer: offshore and onshore

Measured voltage signals (in order of appearance in scl-files):

- Utunnel: Wind speed (10x amplified and 10 Hz filtered Schildknecht output)
- Fax1, Fax2, ...: Strain gauge: 1 to 6
- Gen1, Gen2, ...: Generator: 1 to 24

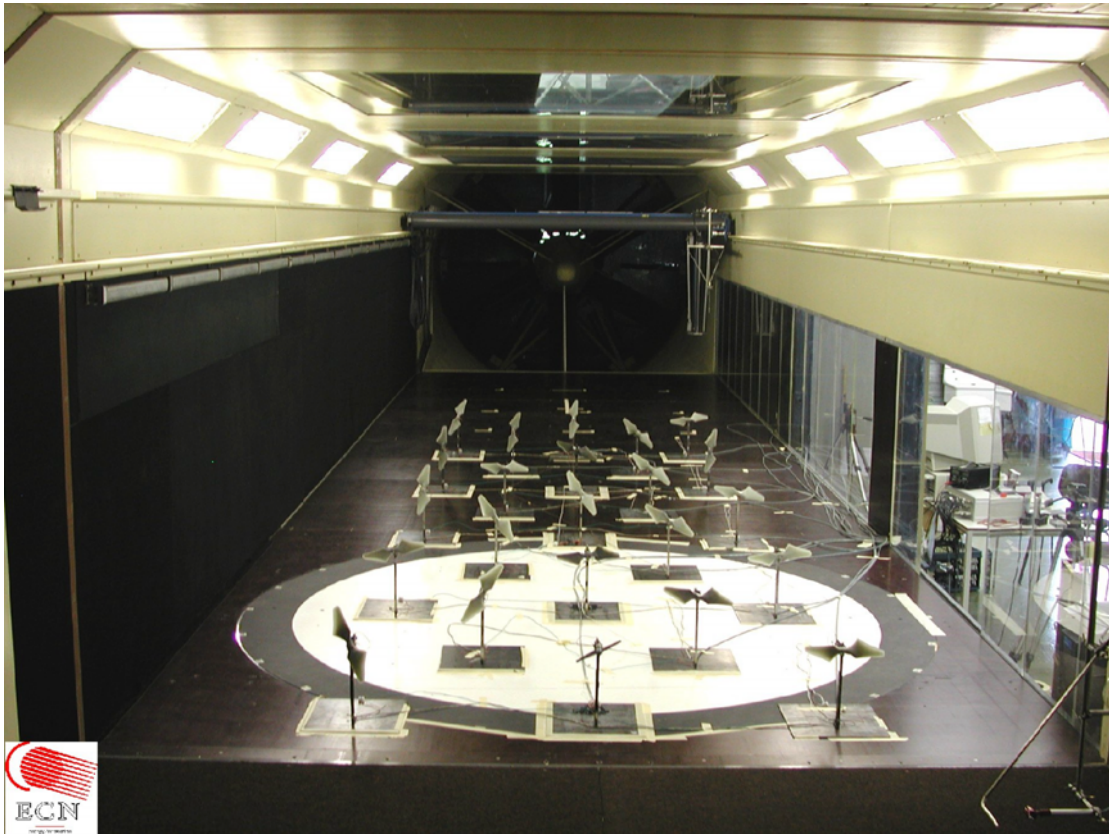


Figure 13: Farm with turbines on scale 1:400 in zigzag layout in the boundary layer wind tunnel

File name (scl)	Accompanying scan files	Comments
Park alles 0 ruw	Ecn011 Ecn012	All turbines pitch 0.0, onshore boundary layer
Park 0	Ecn010	All turbines pitch 0.0, offshore boundary layer, ex in filename indicates removed turbines or turbine rows (whole turbines out of the tunnel?)
Park 0 ex rij 2468		
Park 0 ex turbine 2		
Park 0 ex turbine 13		
Alles 0 ex rij 78		
Alles 0 ex rij 8		
Alles 0 ex turbine 13		

First row = upwind

4.1.3 2 farms 7x2: 2 farms besides each other, farm1 and farm2

Date: November 20-21, 2003

Experiments: turbine measurements after removing 0 to 6 upwind turbine rows from farm1

Aim: to determine the possible changes in the tunnel behaviour of removing rows (shown by reference farm2)

Farm layout:

Upwind side

Generator 8	Generator 1 Generator 3 Strain gauge 3	Generator 15 Strain gauge 15	Generator 22
Generator 9	Generator 2 Generator 2 Strain gauge 2	Generator 16 Strain gauge 16	Generator 23
Generator 10	Position 3 Generator 1 Strain gauge 1	Generator 17 Strain gauge 17	Generator 24
Position 11 Generator 26	Generator 4	Generator 18	Generator 25
Position 12 Generator 12	Generator 5	Generator 19	Position 26 Generator 11
Position 13 Generator 28	Generator 6	Generator 20	Generator 27
Generator 14	Generator 7	Generator 21	Position 28 Generator 13
Farm 1		Farm 2	

Downwind side

Width spacing: 3D

Depth spacing: 4.5D

Space between tunnel side walls and outer columns: 1.5D

(Spacing concerns rotor centers, $D = 250 \text{ mm}$, i.e. the rotor diameter)

Schildknecht: hub height, $\approx 2.5D$ upwind from generator 8

Control of all generators: 1 Ω , 0 diodes

Boundary layer: offshore

Measured voltage signals (in order of appearance in scl-files):

- Utunnel: Wind speed (10x amplified and 10 Hz filtered Schildknecht output)
- Fax1, Fax2, ...: Strain gauge: 1 to 3, 15 to 17
- Gen1, Gen2, ...: Generator: 1 to 24
(generator 25 to 28 are not measured due to limited number of channels)
- Multi_p: Rotor speed of generator 1 (frequency to voltage signal)

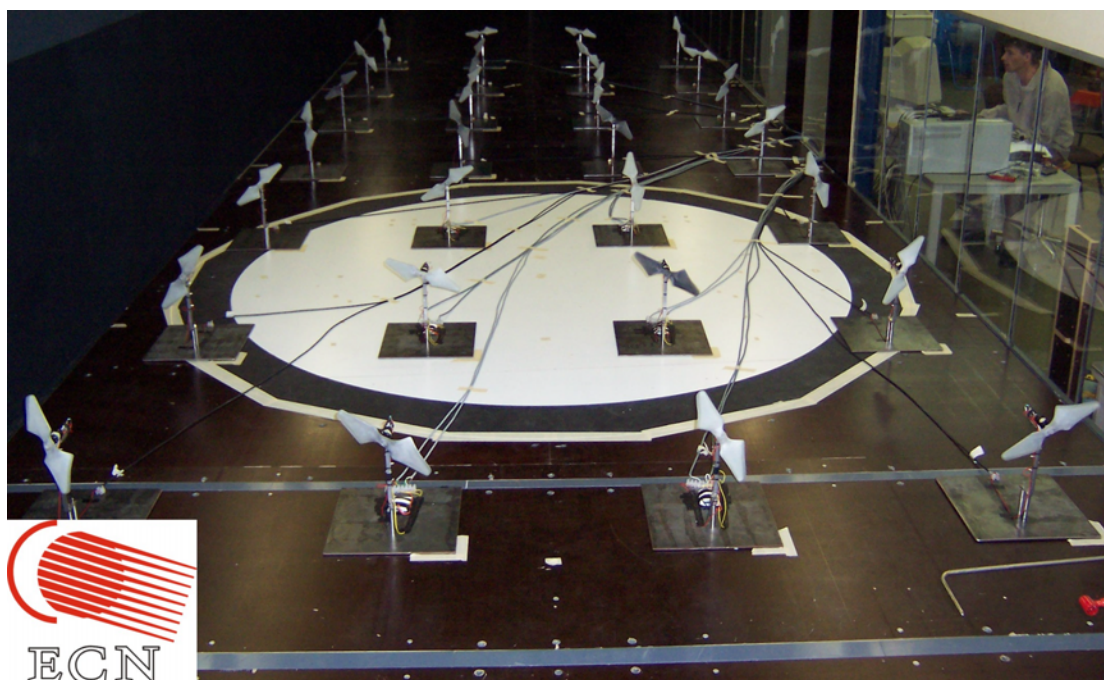


Figure 14: Two farms of 7 rows x 2 model turbines on scale 1:400 in the boundary layer wind tunnel

File name (scl)	Comments	Remarks
Farm1 00 00	All turbines pitch 0.0^1 , ex in filename indicates removed turbine rows (whole turbines out of the tunnel)	Gen1/Fax1and Gen3/Fax3 belong to position 1 resp. 3
Farm1 ex1		
Farm1 ex12		
Farm1 ex123		
Farm1 ex1234		
Farm1 ex12345		
Farm1 ex123456		

First row = upwind

Circumstances measured using standard tunnel instruments (just after the measurements):

- Temperature: 10.9 °C
- Rel. humidity: 79 %
- Air pressure: 1008 mbar
- Wind speed: 3.2 m/s
- Wind direction: 186 [?]

¹ Last row pitch 2.5 due to too less rotors with pitch 0.0

4.1.4: farm 14x2: a long farm of 14 rows

Date: November 24-25, 2003

Experiments: wind profile scans behind the 12th row, after removing 0 to 12 upwind turbine rows and after removing only the 2 downwind rows

Aim: the wind profile through a farm

By repeating profile scans behind the 12th row after removing upwind rows, we simulated to measure less deep in the farm. The only difference between the 2 measurements is the depth in the farm. Apart from that the environment of the measurement has been unchanged then. Removing the downwind rows shows the possible upwind effect of turbine rows through the farm.

Farm layout:

Upwind side

Position 1 Generator 1 Strain gauge 1	Position 15 <u>Generator 11</u>
Position 2 Generator 2 Strain gauge 2	Position 16 <u>Generator 12</u>
Position 3 Generator 3 Strain gauge 3	Position 17 <u>Generator 13</u>
Position 4 Generator 4	Position 18 Generator 18
Position 5 Generator 5	Position 19 <u>Generator 27</u>
Position 6 <u>Generator 25</u>	Position 20 Generator 20
Position 7 Generator 7	Position 21 Generator 21
Position 8 Generator 8	Position 22 <u>Generator 28</u>
Position 9 <u>Generator 26</u>	Position 23 Generator 23
Position 10 Generator 10	Position 24 Generator 24
Position 11 <u>Generator 15</u> <u>Strain gauge 15</u>	Position 25 <u>Generator 6</u>
Position 12 <u>Generator 16</u> <u>Strain gauge 16</u>	Position 26 <u>Generator 9</u>
Position 13 <u>Generator 17</u> <u>Strain gauge 17</u>	Position 27 <u>Generator 19</u>
Position 14 Generator 14	Position 28 <u>Generator 22</u>

Width spacing: 4D
Depth spacing: 4D
Space between tunnel side walls and outer columns: 4D
(Spacing concerns rotor centers, $D = 250 \text{ mm}$, i.e. the rotor diameter)

Schildknecht: $\approx ?D$ upwind from position 1 (uncalibrated)

Control of all generators: 1 Ω , 0 diodes

Boundary layer: offshore

Downwind side

Measured voltage signals (in order of appearance in scl-files):

- Utunnel: Wind speed (10x amplified and 10 Hz filtered Schildknecht output)
- Fax1, Fax2, ...: Strain gauge: 1 to 3, 15 to 17
- Gen1, Gen2, ...: Generator: 1 to 24
(generator 25 to 28 are not measured due to limited number of channels)
- Multi_p: Rotor speed of generator 1 (frequency to voltage signal)

File name (scl)	Accompanying scan files	Comments
Farm 14x2 pitch 00 reprod		All turbines pitch 0.0 ² (reproduction)
Farm 14x2 pitch 00 ex row14		
Farm 14x2 pitch 00 ex row14 13		
Farm 14x2 ex row 13to14 1st meas	Ecn022a Ecn022b Ecn022c Ecn023	
Farm 14x2 ex row 13to14 2nd meas		
Farm 14x2 ex row 13to14 3rd meas		
Farm 14x2 ex row 1to5	Ecn024a Ecn024b Ecn024c	All turbines pitch 0.0 ² , ex in filename indicates removed turbine rows (whole turbines out of the tunnel)
Farm 14x2 ex row 1to9	Ecn025a Ecn025b Ecn025c	
Farm 14x2 ex row 1to11	Ecn026a Ecn026b Ecn026c	
Farm 14x2 ex row 1to12	Ecn027a Ecn027b Ecn027c	

First row = upwind

² Last 2 rows pitch 2.5 due to too less rotors with pitch 0.0



Figure 15: A farm of 14 rows of 2 model turbines on scale 1:400 in the boundary layer wind tunnel

Scan file descriptions:

- Tunnel wind speed = 8 m/s
- (x, y, z) is defined by:
 - $x = 0$ halfway through row 12 and 13, x is positive in the direction of the flow
 - $y = 0$ in the middle of the tunnel (side to side), the positive y -direction is from generator 1 to generator 11.
 - $z = 0$ on hub height, z is positive in upwards direction
- Ecn022# and Ecn024# to Ecn027# concern vertical profiles on:

Scan file name	x/D	y/D
Ecn###a	0	0
Ecn###b	0	-1
Ecn###c	0	-2

The profiles are measured on $z/D = 0.2, 0.4, \dots, 2.8$

- Ecn023 concerns one scan just in front of position 12 at $(x, y, z)/D = (-2.14, -2, 0.4)$, i.e. $0.14D = 35$ mm in front of the top of the rotor area of turbine 16. This measurement is performed to determine the vertical component of the flow.

Circumstances measured using standard tunnel instruments (after the measurements):

- Temperature: 9.4 °C
- Rel. humidity: 64 %
- Air pressure: 1007 mbar
- Wind speed: 1.8 m/s
- Wind direction: 182 [°]

4.1.5 Farm 3x3: a farm far upwind in the tunnel

Experiments: wind profile scans on several farm diameters behind the farm
reference scans in the empty tunnel (on the same tunnel co-ordinates)

Aim: the wind speed recovery behind a farm

Farm layout:

Upwind side

Position 4 Generator 22	Position 1 Generator 1 Strain gauge 1	Position 7 Generator 19
Position 5 Generator 15 Strain gauge 15	Position 2 Generator 2 Strain gauge 2	Position 8 Generator 16 Strain gauge 16
Position 6 Generator 6	Position 3 Generator 3 Strain gauge 3	Position 9 Generator 17 Strain gauge 17

Downwind side

Width spacing: 3.5D

Depth spacing: 4.25D

Space between tunnel side walls and outer columns: 2.5D

(Spacing concerns rotor centers, $D=250$ mm, i.e. the rotor diameter)

Schildknecht: $\approx 4.5D$ upwind from position 4

Control of all generators: 1 Ω , 0 diodes

Boundary layer: offshore

Measured voltage signals (in order of appearance in scl-files):

- Utunnel: Wind speed (10x amplified and 10 Hz filtered Schildknecht output)
- Fax1, Fax2, ...: Strain gauge: 1 to 3, 15 to 17
- Gen1, Gen2, ...: Generator: 1 to 3, 15 to 17
(other generators are not measured (not important; these experiments are for scanning purposes))
- Multi_p: Rotor speed of generator 1 (frequency to voltage signal)

File name (scl)	Accompanying scan files	Comments
Farm 3x3 during scan	Ecn030	The Schildknecht had been placed only 5.6 m behind the barrier that creates the offshore boundary layer. Here the boundary layer is not accomplished completely and the tunnel diameter is still growing in upwind direction. Therefore the Schildknecht output is only useful as a reference value. It does not represent the tunnel wind speed by the usual 0.01 (m/s)/V .
Farm 3x3 zeroing signals		

We also recorded scan file Ecn031, which is the empty tunnel reference for scan file Ecn030.

Scan file descriptions:

- Tunnel wind speed = 8 m/s
- The TNO measurement system based the average wind speed and turbulence on 5 series of 2048 samples while the sampling frequency was 500 Hz.
- (x, y, z) is defined by:
 - $x = 0$ on 26D behind position 3, 6 and 9, x is positive in the direction of the flow
 - $y = 0$ on position 1,2 and 3, y is positive from position 1 to 4
 - $z = 0$ on hub height, z is positive in upwards direction
- Ecn030 and Ecn031 concern vertical profiles on:

Scan file name	x/D	y/D
Ecn030	0	0
	0	-0.875
	0	-1.75
	12	0
	12	-1.75
	24	0
	24	-1.75
	34	0
	34	-1.75
Ecn031	0	0
	12	0
	24	0
	34	0

The profiles are measured on $z/D = -0.5, 0, 0.5, 1, 1.5, 2, 2.4$ for Ecn 030
 $z/D = -0.5, 0, 0.5, 1.5, 2.4$ for Ecn 031

Circumstances measured using standard tunnel instruments (during the measurements):

- Temperature: 7.4 °C
- Rel. humidity: 95 %
- Air pressure: 999 mbar
- Wind speed: 0.2 m/s

- Wind direction: 307 [?]

4.1.6 Empty tunnel reference measurements

We also recorded scan files while the tunnel was empty. Those files serve as a reference. Under 'farm 3x3' we already mentioned Ecn031. Other empty tunnel scan files are:

- Ecn008, Ecn009, Ecn016: offshore boundary layer
- Ecn014, Ecn015: onshore boundary layer

Those scan-files are recorded in appendix B as well.

4.2 Analysis

In this paragraph we consider two farm layouts: 8x3 and 14x2. The hotwire traverse system measured the wind speed by 200 Hz during 2 periods of 10.24 seconds per adjusted co-ordinate. From that the average wind speeds and turbulence intensities are calculated. We defined the turbulence intensity by $I_x = \sigma/V$, in which V is the ambient wind speed on axis height. All frequencies were taken into account, though low pass filtered by 200 Hz.

Figure 16 shows the measured wind speed and turbulence profiles in the middle column of the 8x3 farm. The co-ordinate x indicates the depth in the farm. The first row is placed on $x = 0D$, the second on $x = 5D$ and so on. Co-ordinate z indicates the altitude with $z = 0D$ on axis height.

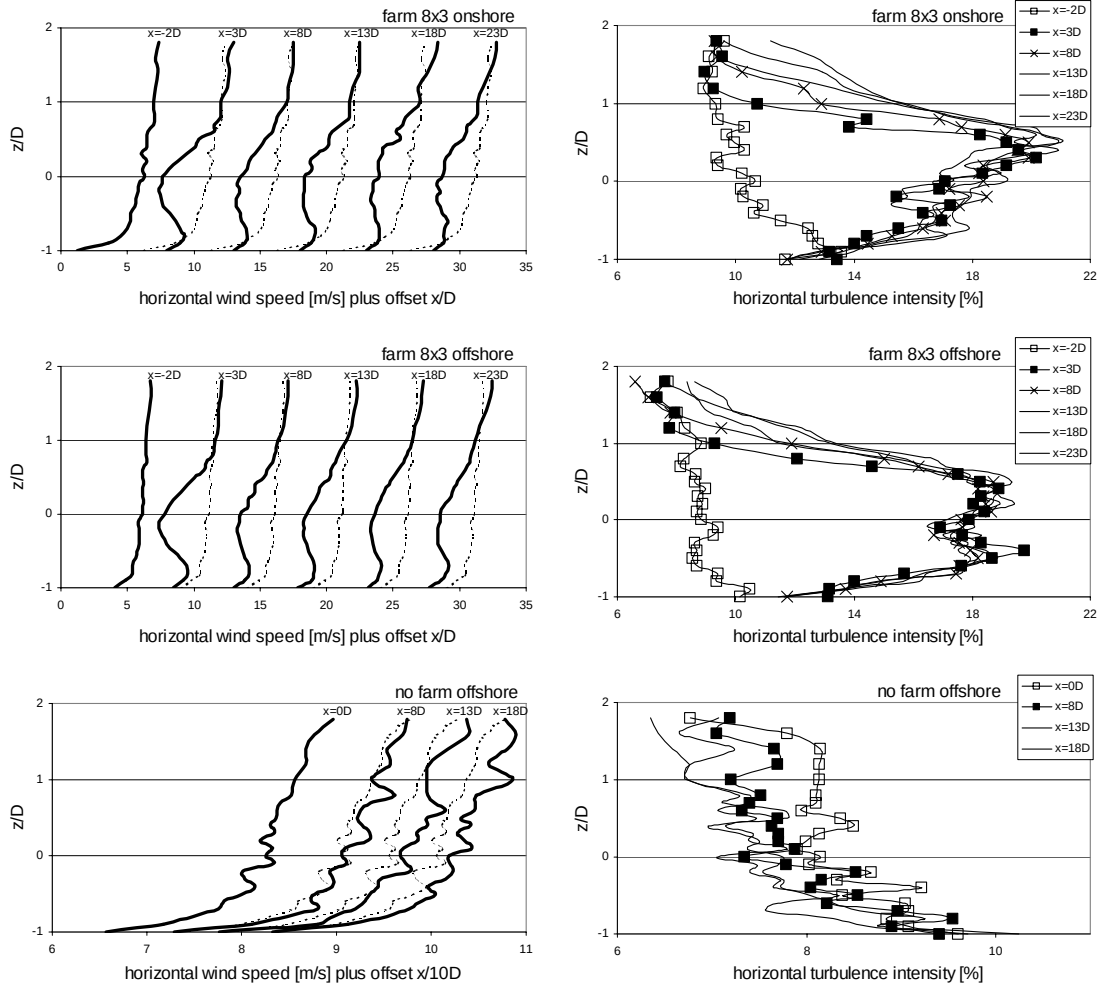


Figure 16: wind speed and turbulence profiles above the 8x3 farm in the boundary layer wind tunnel, the turbulence intensity is defined as σ/V_t in which V_t is the ambient tunnel wind speed.

The upper plots show the influence of the farm on the onshore boundary layer, the middle plots show the influence on the offshore boundary layer. The lower plots show the reference situation for the scaled offshore boundary layer without a farm in the tunnel. Those reference plots show speeding up of the flow and fading out of turbulence for increasing x in the applicable tunnel area. Those effects are negligible in comparison to the influence of the farms on the boundary layer.

The wind speed profiles are plotted with an offset that depends on the x co-ordinate where it is measured. The profiles are plotted more to the right as they are measured deeper in the farm. Remark that the lower plot applies a different offset. The profile at $x = -2D$ must be seen as the undisturbed ambient profile. For each profile in the farm the ambient profile is repeated by a dotted line. The turbulence plots show the turbulence intensity as a function of the altitude. Of course the profile at $x = -2D$ is the ambient profile for the turbulence as well.

For both the onshore and offshore farm it can be seen that the flow on axis height does not change much behind the 3rd row. Though the interesting thing happens at a higher altitude. Above the farms turbulence increases and speed decreases for increasing x . In particular the decrease of speed will be important for large farms. That forecasts that the inflow of momentum deeper in a farm is fading out because:

- the source is running short
- the speed difference per altitude decreases, what takes away the driving mechanism for the inflow of momentum

Further we notice some slight differences between the offshore and onshore farm. The onshore farm shows a slope in the turbulence intensity at rotor height and the offshore farm does not. The steep speed profile close to the ground of the onshore farm seems to be mixed away by the farm.

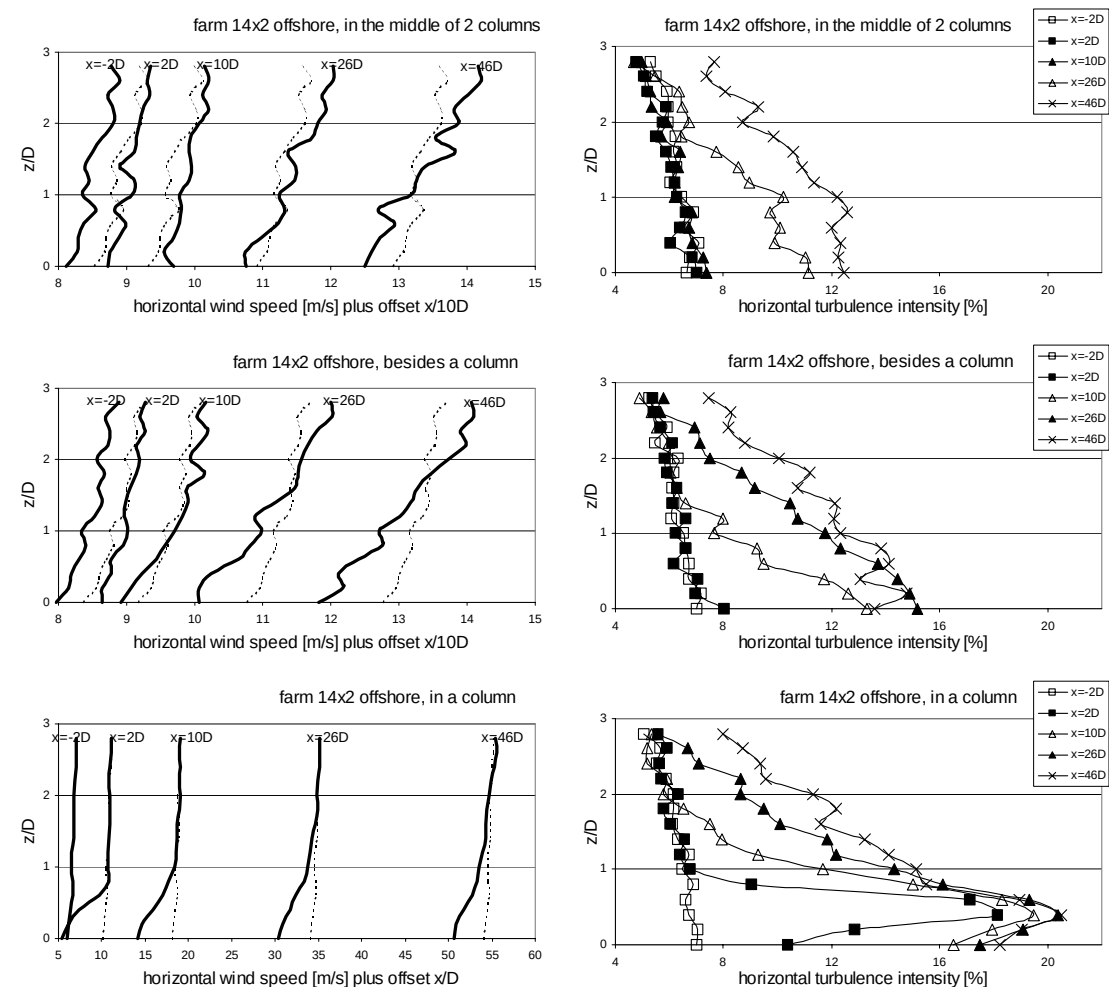


Figure 17: wind speed and turbulence profiles above the 14x2 farm in the boundary layer wind tunnel, the turbulence intensity is defined as σV_0 in which V_0 is the ambient tunnel wind speed.

The measured wind speed and turbulence profiles in the offshore 14x2 farm are shown in figure 17. In this farm the rows are separated by $4D$. Again x indicates the depth in the farm and z the altitude, in which $x = 0D$ on the first row and $z = 0D$ on axis height. Although all measurements are carried out between the 12th and 13th row, still x concerns the depth in the farm. This is realised by applying a variable number of rows in front of row 12 per measurement and defining $x = 0D$ at the first row being present. As an example the measurement at $x = 10D$ concerns the measurement that only row 10 to 14 were placed in the tunnel. Then $x = 0D$ at row 10 and the measured profile concerns a farm depth of $(12.5-10) \cdot 4D = 10D$.

The upper plots show the influence of the farm on the offshore boundary layer in the middle of the 2 columns. The plots in the middle show the influence on a distance of $1D$ and $3D$ of the respective columns. The lower plots show the influence precisely in a column.

The lower plots are comparable to the plots of the 8x3 farm in the offshore boundary layer. The differences in the turbulence profiles are because of measuring more close behind the rotors now. One rotor diameter deeper this will probably be mixed away. From the upper and middle plots we see that the influence of the columns is spreading out in the width of the farm when x increases. The increase of speed above $z = D$ is caused by the continuity of the flow through the tunnel area and will not occur in the field.

In the 14x2 farm we also established the amount of power P that is extracted from the wind per row of turbines by $P = F_{ax} \cdot V \cdot (1-a)$. Axial force F_{ax} and supplying 'ambient' wind speed V follow from the measured generator voltage and a is the axial induction factor of the rotor. The induction factor a is calculated by using $C_t = 4a(1-a) = F_{ax} / (0.5 \cdot \rho \cdot A \cdot V^2)$, in which ρ is the air density and A is the rotor area. Those results are plotted in figure 18. We only plotted the results for row 1 to 12. Due to a lack of pitch 0.0 rotors different rotors were used on row 13 and 14. Moreover those rows were placed close to the sucking tunnel fan at the end of the tunnel. Probably that close that they are influenced by the contraction of flow. Therefore those rows are not taken into account.

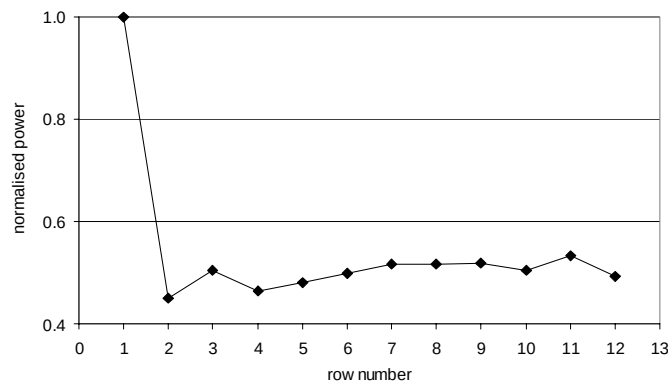


Figure 18: wind power extraction by the 14x2 farm in the boundary layer wind tunnel

5. Conclusions / Recommendations

5.1 Conclusions

The overall conclusion has to be that the entire set-up has functioned very well during the measurements and that those experiments have been the most accurate measurements with wind farms in a wind tunnel ever. Reasons have been:

- The great effort spent on the design of the rotor.
- The choice to use 5 rotor types (for 5 pitch angles) out of one piece of plastic instead of choosing for an adjustable pitch system.
- The idea to measure only the generator voltage and to derive 4 relevant signals from this measurement by calibration (torque, rotor speed, axial force and wind speed). This trick reduced the number of signals to be measured to acceptable quantities.

Other conclusions are that we have to deal with some uncertainties that are difficult to reduce. We need to set-up coming experiments in such a way that the results are not affected by the following uncertainties:

- The wind speed measurement is not more accurate than 0.1 m/s
- The hotwire system increases the wind speed at the position of the hot wire by about 0.3 m/s.
- In the tunnel there will be a pressure gradient in the direction of the flow, this is a principal difference from wind farms in the field.
- In the tunnel the influence of Coriolis effects due to earth rotation are negligible. In the field these effects may be significant.

Thanks to the representative design of the turbines the tunnel measurements showed to be of great value to increase understanding of the behaviour of wind farms. Up to now no experimental data on velocity profiles above wind farms have been available. We present those data and we find that it takes far more than 5 rows in a farm before the boundary layer above the farm has reached equilibrium. After 5 rows the momentum above the farm continues to decrease. So the source of momentum for the farm is running short. Furthermore the speed difference per altitude decreases, what takes away the driving mechanism for the inflow of momentum. We conclude that many models of wind farms are too optimistic regarding the farm efficiency in the downwind part of large farms.

5.2 Recommendation for a Third Tunnel Entry

1. Smoke experiments do not give quantitative information but the qualitative information may give reason to change the measurement set-up. Therefore it makes sense to check the flow with smoke in the beginning of new measurement campaigns.
2. We need to further check the differences in results between the campaign of May and that of November.
3. All hotwire measurements should become available as rough data. We need to check how TNO calculates the turbulence intensity from the rough data. Are all low frequencies included in the turbulence? Is this correct?
4. The turbulence level calculated by $I_x = [\ln(z/z_0)]^{-1}$ wherein z_0 is estimated from the velocity profile is 12.5% less than the turbulence level measured by the hot wire. However the

pressure gradient in the tunnel will speed up the flow at the ground more than at higher altitude. Therefore the velocity profile converts to profiles for lower z_0 -values. This means that the real z_0 is larger than that derived from the velocity profile which may explain the difference.

5. The modelling of a wind farm as surface roughness is not correct in several aspects. A more or less uniform roughness may introduce the same *average* turbulence level, but turbines will produce a very uniform turbulence field: high behind the turbines, ambient between the turbines. So the turbulence distribution for turbines and uniform roughness are very different.

6. We should measure the dependency of the power coefficient C_p on the Reynoldsnumber at constant tip speed ratio λ . With this information we can correct the power changes due to Reynolds-dependencies which may be significant in the tunnel and won't have significance in the field.

7. We need to measure the wake behind a single turbine for different turbulence intensities and for different axial force coefficients.

8. We need to measure the wake behind a cascade of two turbines to see if our wind farm design program does produce correct results in this aspect.

9. The turbine power P is largely affected by Reynolds effects in the case of small rotors, therefore the experiments are at least in absolute sense not accurate regarding the power. At the same time the measurement of the axial force D is very Reynolds independent. For large commercial turbines there will be a relation for $P/D = V(1-a)$, wherein the last relation is valid for actuator disc theory. If we measure the relation $P/D = f(V,D)$ for a large commercial wind turbine than we use this to calculate P for our model turbines. The P we get with this procedure minus the power measured from torque x rotor speed is an estimate for the losses due to Reynolds effects.

10. The mostly applied turbines should be characterised in the tunnel one by one, to improve the accuracy of the characterisation.

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- [1] Miley, S.J., *A Catalog of Low Reynolds Number Airfoil Data for Wind Turbine Applications*, RFP-3387 UC-60, Department of Aerospace Engineering, Texas A&M University, College Station, Texas 77843, February 1982.
- [2] Vermeulen, P.E.J., Builtjes, P.J.H., *A Wind Tunnel Study of the Wake of A Horizontal Axis Wind Turbine*, ref.nr. 78-09674, file nr. 8710-6719, TNO, Division of Technology for Society, Apeldoorn, September 1978.
- [3] Vermeulen, P.E.J., Builtjes, P.J.H., *Turbulence Measurements in Simulated Wind Turbine Clusters*, ref.nr. 82-03003, file nr. 8724-76140, TNO, Division of Technology for Society, Apeldoorn, February 1982.

Appendix A: Measurement Set-up

The set-up of the tunnel measurement is sketched in figure A.1. For clarity only wind turbine 1 is depicted.

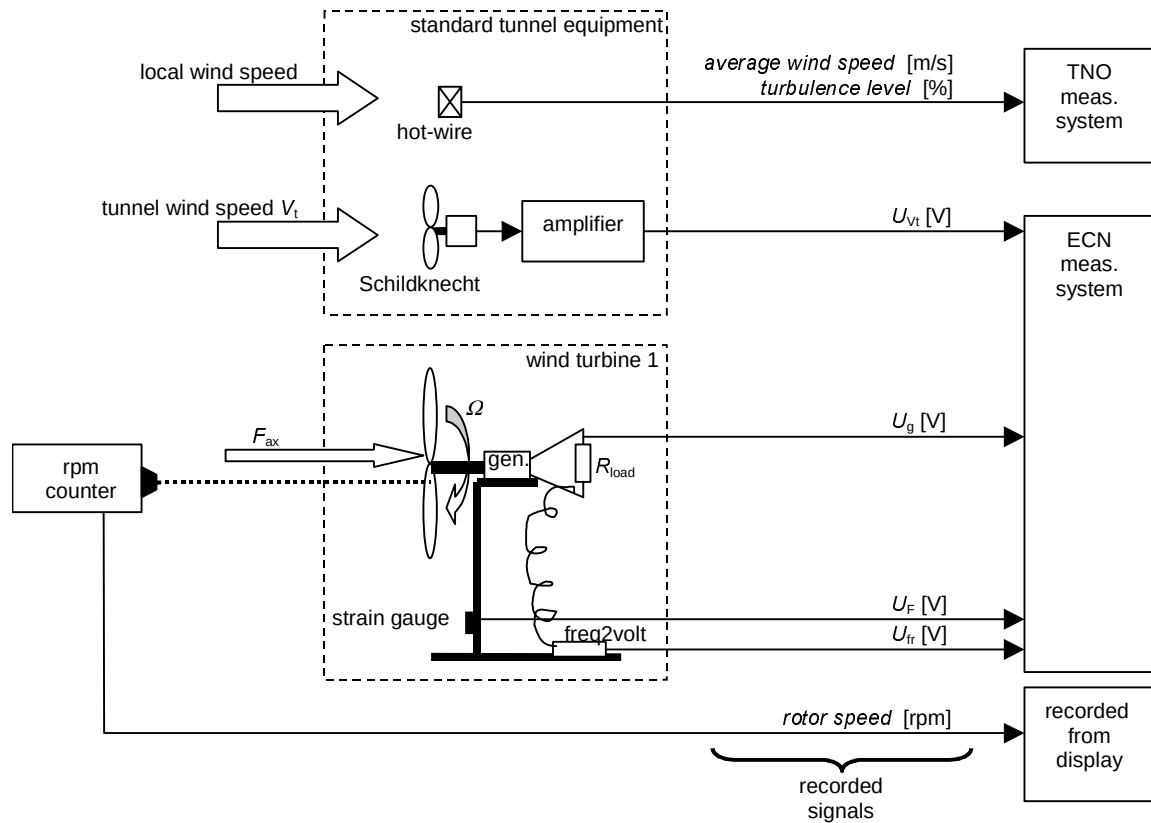


Figure A.1: Measurement set-up

Table A.1: Measured signals using the ECN measurement system

Input of the ECN measurement system	Represented variable	
U_{Vt} [V]	$V_t = 10 \cdot U_{Vt}$	[m/s]
U_g [V]	$U_g = U_g$	[V]
U_F [V]	$F_{ax} = c_F \cdot U_F$ *)	[N]
U_{fr} [V]	$\Omega = 1200 \cdot U_{fr}$	[rpm]

*) see table Ta2

During the tunnel measurements we recorded voltage signals using a sampling frequency of 16 Hz on the ECN measurement system. The voltage signals represented:

- the tunnel wind speed
- 24 generator voltages (wind turbine 1 to 24)
- 5 or 6 axial forces (May: wind turbine 1 to 5; November: 1 to 3 and 15 to 17)
- 1 rotor speed (only November: wind turbine 1)

We also measured:

- the average wind speed and turbulence using a hot wire somewhere in the tunnel
- the rotor speed of a turbine using a hand held laser rpm counter

The tunnel wind speed V_t is measured using the Schildknecht, that is part of the basic tunnel instrumentation (see figure A.2). The output of the Schildknecht represents 0.01 (m/s)/V. The amplifier between the Schildknecht amplifies by a factor 10 and filters with a cut-off frequency of 10 Hz. The resulting voltage U_{Vt} is fed into the ECN measurement system and represents 10 (m/s)/V.

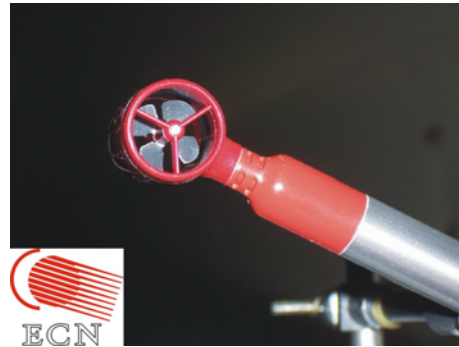


Figure A.2: Schildknecht wind speed meter

The generator voltage U_g , i.e. the voltage over the load resistor at the generator output, is fed into the ECN measurement system directly.

The axial force is measured by a strain gauge at the tower. The strain gauge output U_F represents c_F N/V, with c_F as in table A.2 (source: appendix D). This measurement is performed to identify the relations between axial force and generator voltage per combination of pitch angle and generator control (see chapter 3). During the experiments with the wind farms the axial force measurements are only used for checking purposes.

Table A.2: $F_{ax} = c_F \cdot U_F$

Wind turbine number	Month of measuring	c_F
1..5	May	0.477
1	November	1.616
2		1.591
3		1.635
15		1.642
16		1.628
17		1.664

During the experiments in November turbine 1 was equipped with a frequency-to-voltage device (freq2volt). The device measured the frequency of the generator current and converted that into DC-voltage U_{fr} that is fed into the ECN measurement system. U_{fr} represents 1200 rpm/V.

The rotor speed of each turbine could be measured by pointing the laser of a hand held laser rpm counter at a reflective spot on one of the rotor blades. The rotor speed was read from the display of the rpm counter. This measurement is performed to identify the relations between

rotor speed and generator voltage per combination of pitch angle and generator control (see chapter 3). During the experiments with the wind farms the rotor speeds are checked only incidentally.

A hot wire (see figure A.3) that could be placed on tunnel co-ordinates by a traverse system performs a second wind speed measurement. This is a standard tunnel measurement that results in the average wind speed U and turbulence intensity I in 2 directions (x, z).

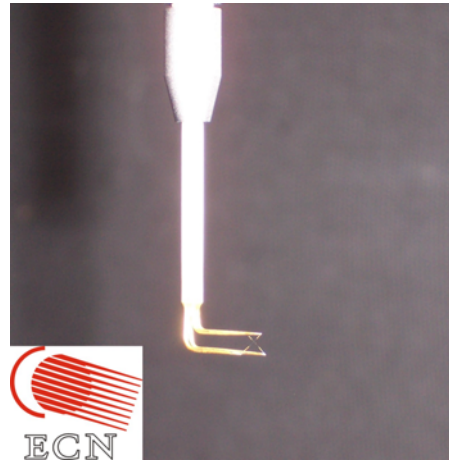


Figure A.3: Hot wire wind speed meter

Unless specified differently in a measurement description, these values follow from 2 series of 2048 samples while the sampling frequency is 200 Hz. The wind speed measurement is filtered with a cut-off frequency of 200 Hz. The turbulence intensity is defined by:

$$I = \sigma^2/U \quad (\text{A.1})$$

In which σ^2 is the variance of the wind speed for $N = 4096$ samples:

$$\sigma^2 = \frac{1}{N} \sum_{n=1}^N (u(n) - U)^2 \quad (\text{A.2})$$

With $u(n)$ the wind speed of the n^{th} sample.

Appendix B: Farm Measurements

Scan files

The TNO measurement system delivers scan files with average wind speeds and turbulence intensities per tunnel co-ordinate. Speeds and intensities are given in the direction of the flow x and in vertical direction z . Averages concern two periods of 10.24 seconds, unless specified differently. The tunnel co-ordinates are relative to the co-ordinate $(x,y,z) = (0,0,0)$ in which x , y and z are perpendicular. The co-ordinate $(0,0,0)$ is no absolute reference, but is adjusted with respect to the tunnel arrangement.

The bold names in the left upper corners of the tables refer to the scan files. The columns of the tables are defined by:

- NR is an arbitrary reference number
- X, Y and Z form the tunnel co-ordinates
- Ux and Uz are the average wind speed in respectively x and z direction
- Ix and Iz are the average turbulence intensity in respectively x and z direction
- SSTR is the friction velocity
- Hoek is the angle between the tunnel floor and the direction of the flow in the x,y plane, $\pm \arctan(U_z/U_x)$ in degrees
- Psnel is the tunnel wind speed that is also measured with the ECN measurement system
- Ptemp is the temperature in the tunnel

Ec008

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)	Psnel (m/s)	Ptemp (Gr C.)
1	250	0	-250	4.85	0.23	12.6	6.4	0.084	2.7	5.98	16.4
2	250	0	-225	5.58	0.29	10.6	6.6	0.084	3	5.86	16.4
3	250	0	-200	5.75	0.29	9.9	6.6	0.07	2.9	5.83	16.2
4	250	0	-175	5.87	0.28	9.7	7	0.08	2.8	5.95	16.2
5	250	0	-150	5.94	0.34	9.5	7.2	0.084	3.3	5.88	16.2
6	250	0	-125	6.1	0.39	8.6	7.5	0.073	3.6	5.99	16.2
7	250	0	-100	6	0.34	9	8	0.091	3.3	5.9	16.2
8	250	0	-75	6.14	0.41	8.4	8.1	0.073	3.8	5.83	16.2
9	250	0	-50	6.1	0.4	8.7	7.8	0.075	3.7	5.99	16.2
10	250	0	-25	6.24	0.41	8.6	8.3	0.091	3.7	5.92	16.4
11	250	0	0	6.13	0.38	9.2	8.9	0.11	3.6	6.07	16.4
12	250	0	25	6.21	0.45	8.5	8.6	0.094	4.2	6	16.4
13	250	0	50	6.47	0.47	8	8.2	0.074	4.2	5.83	16.4
14	250	0	75	6.29	0.46	7.6	8.3	0.069	4.2	5.95	16.2
15	250	0	100	6.29	0.44	8.5	8.7	0.105	4	5.97	16.2
16	250	0	125	6.36	0.47	8.3	8.2	0.091	4.3	6.13	16.2
17	250	0	150	6.39	0.53	7.8	8.8	0.085	4.8	5.97	16
18	250	0	175	6.33	0.51	7.7	8.4	0.091	4.6	5.86	16
19	250	0	200	6.33	0.49	7.7	8.2	0.061	4.4	6.14	16
20	250	0	225	6.28	0.51	7.7	8.9	0.096	4.6	6.08	16
21	250	0	250	6.4	0.51	8	8.4	0.091	4.6	6.09	16
1	500	0	-250	4.82	0.2	13.1	6.8	0.078	2.4	5.89	16
2	500	0	-225	5.38	0.24	11.3	6.7	0.077	2.6	5.99	16
3	500	0	-200	5.5	0.29	9.6	6.6	0.061	3	6.31	15.8
4	500	0	-175	5.82	0.33	9.5	7.1	0.067	3.2	6.04	16
5	500	0	-150	6.05	0.36	9.2	6.9	0.069	3.4	5.9	15.8
6	500	0	-125	6.13	0.38	9.8	7.7	0.074	3.5	5.86	15.8

Ecn008 continued											
7	500	0	-100	6.2	0.38	8.9	7.6	0.067	3.5	5.83	15.6
8	500	0	-75	6.17	0.38	8.6	8.1	0.089	3.6	5.95	15.6
9	500	0	-50	6.19	0.42	8.5	8.3	0.064	3.9	5.91	15.6
10	500	0	-25	6.14	0.41	7.9	8.1	0.064	3.8	6.16	15.6
11	500	0	0	6.2	0.4	8.7	8.4	0.081	3.7	6	15.4
12	500	0	25	6.2	0.44	8.5	8.1	0.071	4.1	6.2	15.4
13	500	0	50	6.34	0.55	8.1	8.1	0.077	4.9	5.99	15.4
14	500	0	75	6.18	0.42	8.8	8.4	0.102	3.9	6.1	15.4
15	500	0	100	6.35	0.5	7.7	8.6	0.086	4.5	5.99	15.4
16	500	0	125	6.43	0.56	8.1	8.5	0.085	5	5.91	15.4
17	500	0	150	6.43	0.54	7.8	8.2	0.095	4.8	6.05	15.4
18	500	0	175	6.39	0.51	7.6	8.3	0.072	4.5	6.01	15.4
19	500	0	200	6.54	0.56	7.5	7.8	0.067	4.9	5.93	15.4
20	500	0	225	6.42	0.57	7.5	8	0.064	5	6.1	15.4
21	500	0	250	6.51	0.58	7.6	7.8	0.087	5.1	5.87	15.4
1	750	0	-250	4.84	0.23	14.3	7.2	0.09	2.7	6.01	15.4
2	750	0	-225	5.39	0.27	10.8	6.7	0.072	2.8	6.06	15.4
3	750	0	-200	5.71	0.31	10.1	6.8	0.077	3.1	5.99	15.4
4	750	0	-175	5.68	0.28	9.8	7	0.067	2.8	6.06	15.4
5	750	0	-150	6.1	0.37	8.5	7	0.059	3.5	5.87	15.4
6	750	0	-125	6.09	0.35	8.1	7.3	0.059	3.3	6.07	15.4
7	750	0	-100	5.94	0.33	8.4	7.4	0.081	3.2	6.09	15.4
8	750	0	-75	6.21	0.43	9	7.9	0.088	4	6.06	15.4
9	750	0	-50	6.17	0.38	8.4	8.2	0.07	3.6	5.84	15.4
10	750	0	-25	6.05	0.4	8.3	8	0.054	3.8	6.09	15.2
11	750	0	0	6.31	0.45	8	8	0.067	4.1	5.94	15.2
12	750	0	25	6.26	0.45	8.1	8.5	0.088	4.2	5.97	15.2
13	750	0	50	6.35	0.46	7.7	8.3	0.072	4.1	5.91	15.2
14	750	0	75	6.34	0.5	7.7	8.7	0.066	4.5	5.92	15.2
15	750	0	100	6.38	0.49	8.2	8	0.072	4.4	6.05	15.2
16	750	0	125	6.43	0.54	7.4	7.3	0.074	4.8	5.98	15.2
17	750	0	150	6.45	0.52	7.5	8.2	0.09	4.6	5.88	15.2
18	750	0	175	6.39	0.55	7.7	8	0.068	4.9	6.13	15.2
19	750	0	200	6.57	0.61	7.7	7.5	0.087	5.3	5.96	15.2
20	750	0	225	6.54	0.58	7.5	8	0.089	5	5.91	15.2
21	750	0	250	6.52	0.59	7.5	8.1	0.1	5.2	6.07	15.2
22	750	0	275	6.52	0.6	7.7	7.6	0.082	5.2	5.99	15.2
23	750	0	300	6.53	0.63	6.9	7.6	0.059	5.5	6.16	15.2
25	750	0	350	6.57	0.61	7.1	8.1	0.064	5.3	5.88	15.2
26	750	0	375	6.77	0.64	6.1	7.3	0.076	5.4	5.99	15.2
27	750	0	400	6.69	0.63	6.8	8	0.09	5.4	6.01	15.2
1	1250	0	-250	4.87	0.2	12.3	6.5	0.076	2.3	6.07	15.2
2	1250	0	-225	5.39	0.27	10.5	6.5	0.079	2.8	6	15.2
3	1250	0	-200	5.76	0.33	9.5	7	0.072	3.3	6.03	15.2
4	1250	0	-175	5.98	0.32	9.3	6.5	0.058	3.1	6.11	15.2
5	1250	0	-150	6.01	0.35	8.8	7.3	0.069	3.3	6.13	15
6	1250	0	-125	6.12	0.33	9.3	7.5	0.093	3.1	5.83	15
7	1250	0	-100	5.98	0.38	8.6	7.7	0.075	3.6	6.12	15
8	1250	0	-75	6.08	0.38	9	7.7	0.08	3.6	5.94	15
9	1250	0	-50	6.1	0.37	8.8	8	0.087	3.5	6.01	15
10	1250	0	-25	6.15	0.4	7.7	8.3	0.06	3.8	5.99	15.2
11	1250	0	0	6.27	0.44	8.6	8.1	0.102	4	5.89	15.2
12	1250	0	25	6.37	0.47	8.5	7.9	0.081	4.2	6.06	15.2
13	1250	0	50	6.26	0.42	7.7	8.2	0.084	3.8	6.08	15.2

Ecn008 continued											
14	1250	0	75	6.35	0.47	7.8	8.3	0.069	4.2	5.88	15.2
15	1250	0	100	6.38	0.51	8.6	8.2	0.083	4.5	6.01	15.2
16	1250	0	125	6.39	0.54	7.6	7.7	0.083	4.8	5.91	15.2
17	1250	0	150	6.43	0.49	7.6	8.4	0.076	4.3	5.98	15.2
18	1250	0	175	6.45	0.55	7.6	7.8	0.091	4.9	6.02	15.2
19	1250	0	200	6.47	0.5	7.6	8.2	0.069	4.4	5.99	15.2
20	1250	0	225	6.55	0.54	7.3	7.8	0.065	4.7	6	15.2
21	1250	0	250	6.58	0.57	6.8	7.7	0.075	4.9	5.98	15.2
22	1250	0	275	6.61	0.57	7.2	7.8	0.088	4.9	5.91	15.2
23	1250	0	300	6.65	0.59	8	8	0.12	5.1	5.9	15.2
24	1250	0	325	6.66	0.63	7.2	7.4	0.08	5.4	6.05	15.2
25	1250	0	350	6.72	0.6	6.9	7.3	0.07	5.1	5.93	15.2
26	1250	0	375	6.75	0.6	6.6	7.4	0.064	5	6.07	15.2
27	1250	0	400	6.64	0.59	6.8	7	0.077	5.1	6.06	15.2
28	1250	0	425	6.75	0.65	6.5	7.3	0.076	5.5	6.01	15.2
29	1250	0	450	6.77	0.64	6.3	7	0.065	5.4	5.86	15.2
1	2500	0	-250	4.97	0.17	11.8	6	0.071	2	6.04	15.2
2	2500	0	-225	5.57	0.24	10.2	6.1	0.074	2.5	5.97	15.2
3	2500	0	-200	5.83	0.24	10.4	6.5	0.077	2.4	6.05	15.2
4	2500	0	-175	5.99	0.3	8.6	6.8	0.058	2.8	5.99	15.2
5	2500	0	-150	6	0.31	8.1	7	0.053	3	6.03	15.2
6	2500	0	-125	6.15	0.34	8.9	7.3	0.079	3.1	6.04	15.2
7	2500	0	-100	6.09	0.31	8.5	7.4	0.07	2.9	6.02	15.2
8	2500	0	-75	6.24	0.39	7.7	7.3	0.053	3.6	6.01	15.4
9	2500	0	-50	6.31	0.4	7.8	7.8	0.09	3.7	6.13	15.4
10	2500	0	-25	6.4	0.42	8.4	7.6	0.059	3.7	6.05	15.4
11	2500	0	0	6.36	0.39	7.6	7.6	0.096	3.5	5.99	15.2
12	2500	0	25	6.47	0.47	7.4	7.1	0.067	4.1	5.87	15.2
13	2500	0	50	6.41	0.46	7.5	7.6	0.082	4.1	5.96	15.2
14	2500	0	75	6.43	0.51	7.5	7.5	0.068	4.5	6.08	15.2
15	2500	0	100	6.61	0.5	7	7.4	0.074	4.3	5.82	15.2
16	2500	0	125	6.48	0.49	7.4	7.3	0.059	4.3	5.99	15.2
17	2500	0	150	6.56	0.54	7.4	7.6	0.081	4.7	6.01	15.2
18	2500	0	175	6.58	0.5	6.9	7.5	0.078	4.3	5.98	15.2
19	2500	0	200	6.68	0.55	6.6	7.6	0.061	4.7	5.98	15.2
20	2500	0	225	6.64	0.56	6.6	7.3	0.07	4.8	5.99	15.2
21	2500	0	250	6.37	0.73	7.7	8.5	0.039	6.5	5.96	15
22	2500	0	275	6.53	0.63	6.9	7.2	0.067	5.5	6.07	15
23	2500	0	300	6.48	0.73	7	7.6	0.076	6.4	6.04	15
24	2500	0	325	6.56	0.64	7.2	7.8	0.114	5.6	5.92	15
25	2500	0	350	6.54	0.79	6.9	6.8	0.069	6.9	6.06	15
26	2500	0	375	6.71	0.75	6.5	7.1	0.083	6.3	5.86	15
27	2500	0	400	6.74	0.68	6.3	6.7	0.064	5.7	5.98	15
28	2500	0	425	6.81	0.74	5.8	6.7	0.06	6.2	5.93	15
29	2500	0	450	6.69	0.7	6.9	7.3	0.087	5.9	5.99	15

Ecn009

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)	Psnel (m/s)	Ptemp (Gr C.)
1	0	-1000	0	6.14	0.32	8.9	9.2	0.088	3	5.84	12.8
2	0	-900	0	6.07	0.33	9.2	8.9	0.124	3.1	5.99	12.8
3	0	-800	0	6.1	0.38	9	8.7	0.089	3.6	5.93	12.8
4	0	-700	0	6.2	0.34	9.1	9	0.113	3.1	5.9	12.8
5	0	-600	0	6.16	0.42	8.7	9.1	0.087	3.9	5.85	12.8
6	0	-500	0	6.2	0.45	8	8.1	0.057	4.2	6.06	12.8
7	0	-400	0	6.27	0.47	8.3	8.5	0.086	4.3	5.81	12.8
8	0	-300	0	6.19	0.45	8.3	8.1	0.057	4.1	5.91	12.8
9	0	-200	0	6.2	0.44	8.5	8.5	0.084	4.1	5.9	12.8
10	0	-100	0	6.12	0.45	8	8.6	0.045	4.2	5.97	12.8
11	0	0	0	6.24	0.48	8.2	8.1	0.08	4.4	6.06	12.8
12	0	100	0	6.17	0.44	7.8	8.7	0.072	4.1	5.96	12.8
13	0	200	0	6.14	0.44	8.4	8.7	0.084	4.1	5.8	12.8
14	0	300	0	6.19	0.46	8.8	8.5	0.079	4.2	5.92	12.8
15	0	400	0	6.41	0.5	7.8	8.2	0.072	4.5	5.88	12.8
16	0	500	0	6.23	0.48	8.2	8.4	0.079	4.4	5.96	12.8
17	0	600	0	6.15	0.45	7.9	8.3	0.079	4.2	5.96	12.8
18	0	700	0	6.17	0.41	7.6	8.4	0.083	3.8	6.01	12.8
19	0	800	0	6.13	0.46	8.4	8.1	0.074	4.3	6.03	12.8
20	0	900	0	6.01	0.41	7.9	7.9	0.039	3.9	6.05	12.8
21	0	1000	0	5.92	0.42	9.1	8.1	0.079	4	6.03	12.8
1	0	-1000	-100	5.76	0.33	9.4	8.7	0.064	3.2	5.88	12.8
2	0	-900	-100	5.9	0.29	9.2	8.2	0.081	2.9	6.05	12.8
3	0	-800	-100	5.92	0.3	9.5	8.3	0.086	2.9	6.04	12.8
4	0	-700	-100	5.86	0.3	8.7	8	0.08	2.9	5.99	12.8
5	0	-600	-100	5.95	0.28	9	8.6	0.094	2.7	5.95	12.8
6	0	-500	-100	6.03	0.31	8.9	8.2	0.085	2.9	6.03	12.8
7	0	-400	-100	5.97	0.34	8.9	8	0.081	3.3	5.86	12.8
8	0	-300	-100	5.94	0.36	9.1	7.9	0.066	3.5	5.93	12.8
9	0	-200	-100	5.89	0.34	9.7	8.4	0.095	3.3	6.01	12.8
10	0	-100	-100	5.83	0.33	9.7	8.4	0.087	3.3	5.9	12.8
11	0	0	-100	6.04	0.4	9.3	8.3	0.066	3.8	5.85	12.8
12	0	100	-100	5.86	0.35	9.1	8.5	0.075	3.5	5.98	13
13	0	200	-100	6.01	0.39	8.1	8.2	0.072	3.7	5.96	13
14	0	300	-100	6.18	0.41	9	7.7	0.063	3.8	5.92	13
15	0	400	-100	6.07	0.41	9.5	8.3	0.111	3.8	5.98	13
16	0	500	-100	6.18	0.46	8.4	7.5	0.067	4.2	5.84	13
17	0	600	-100	6.06	0.42	7.8	8	0.057	4	6.03	13
18	0	700	-100	6.08	0.38	9.3	7.7	0.093	3.6	5.82	13
19	0	800	-100	6.03	0.35	9.3	7.9	0.087	3.3	5.78	13
20	0	900	-100	5.95	0.35	9.1	7.8	0.054	3.4	5.98	13
21	0	1000	-100	5.8	0.31	9.6	7.8	0.064	3.1	5.91	13
1	0	-1000	100	6.25	0.39	8.1	8.6	0.078	3.6	5.9	13
2	0	-900	100	6.27	0.47	8.1	8.9	0.081	4.3	5.94	13
3	0	-800	100	6.19	0.45	9.2	8.8	0.117	4.2	6.06	13
4	0	-700	100	6.06	0.4	8.5	8.8	0.093	3.8	6.06	13
5	0	-600	100	6.26	0.44	7.6	9	0.071	4	6.04	13
6	0	-500	100	6.24	0.46	7.9	9.1	0.082	4.2	6	13
7	0	-400	100	6.3	0.45	8.2	8.3	0.083	4.1	6	13
8	0	-300	100	6.19	0.49	8.4	8.4	0.073	4.5	6.03	13
9	0	-200	100	6.21	0.47	8.8	8.1	0.088	4.4	5.99	13
10	0	-100	100	6.32	0.49	8.1	8.1	0.085	4.4	6.03	13

Ecn009 continued											
11	0	0	100	6.32	0.49	8.5	8	0.086	4.4	6.01	13
12	0	100	100	6.32	0.53	8.2	8.4	0.078	4.8	5.88	13
13	0	200	100	6.42	0.51	8.5	8.6	0.104	4.5	5.88	13
14	0	300	100	6.42	0.53	7.8	8.3	0.085	4.7	6.05	13
15	0	400	100	6.26	0.48	7.6	8.4	0.067	4.4	6.11	13
16	0	500	100	6.37	0.51	7.7	8.2	0.081	4.6	6.08	13
17	0	600	100	6.2	0.44	8.4	8.9	0.104	4.1	6.1	13
18	0	700	100	6.33	0.48	8	7.9	0.083	4.3	6.04	13
19	0	800	100	6.37	0.46	7.6	8.2	0.091	4.1	5.97	13.2
20	0	900	100	6.13	0.46	8.2	7.9	0.085	4.3	5.95	13.2
21	0	1000	100	6.01	0.45	9	8.9	0.071	4.3	5.97	13.2
1	2500	-1000	0	6.06	0.32	8	7.9	0.07	3	6	13
2	2500	-900	0	6.13	0.28	7.9	7.8	0.059	2.6	5.95	13
3	2500	-800	0	6.19	0.31	7.6	7.6	0.063	2.8	5.91	13
4	2500	-700	0	6.15	0.3	7.9	7.4	0.075	2.8	6.09	13
5	2500	-600	0	6.36	0.36	8.3	7.6	0.076	3.2	6.05	13.2
6	2500	-500	0	6.45	0.36	7.1	7.5	0.08	3.2	5.95	13.2
7	2500	-400	0	6.11	0.34	7.8	7.5	0.058	3.2	6.05	13
8	2500	-300	0	6.34	0.39	7.5	7.3	0.066	3.5	6	13.2
9	2500	-200	0	6.31	0.4	7.8	7.3	0.061	3.7	6.1	13.2
10	2500	-100	0	6.26	0.46	7.3	6.9	0.05	4.2	6.1	13.2
11	2500	0	0	6.43	0.45	7.3	7.6	0.05	4	5.88	13.2
12	2500	100	0	6.4	0.43	7.2	7.3	0.045	3.9	5.89	13.2
13	2500	200	0	6.3	0.4	7.5	7.7	0.057	3.7	6.01	13.2
14	2500	300	0	6.29	0.41	7.1	7.9	0.058	3.8	6.12	13.2
15	2500	400	0	6.36	0.42	7.2	6.9	0.052	3.7	5.99	13.2
16	2500	500	0	6.47	0.43	7.1	7.1	0.06	3.8	6.05	13.2
17	2500	600	0	6.39	0.38	7.7	6.9	0.057	3.4	6	13.2
18	2500	700	0	6.25	0.38	8	7.8	0.089	3.4	5.97	13.2
19	2500	800	0	6.25	0.36	7.4	7	0.061	3.3	6.02	13.2
20	2500	900	0	6.14	0.35	7.4	7.2	0.066	3.3	6.04	13.2
21	2500	1000	0	6.06	0.33	7.7	7	0.049	3.1	5.92	13.2

Ecn010

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)	Psnel (m/s)	Ptemp (Gr C.)
1	-500	0	-250	6.1	0.17	13.3	5.5	0.1	1.6	7.98	19.2
2	-500	0	-225	6.89	0.18	12.2	5.9	0.104	1.5	7.93	19.2
3	-500	0	-200	7.42	0.23	10.1	6	0.097	1.8	7.9	19.2
4	-500	0	-175	7.37	0.24	10.2	6.3	0.102	1.9	8	19
5	-500	0	-150	7.64	0.27	9.1	6.5	0.061	2	7.94	19.2
6	-500	0	-125	7.76	0.33	8.8	7.1	0.061	2.4	7.99	19.2
7	-500	0	-100	7.89	0.33	8.8	6.9	0.096	2.4	8.01	19
8	-500	0	-75	7.93	0.37	8.7	7.5	0.09	2.6	7.86	19.2
9	-500	0	-50	7.87	0.3	9.4	7.7	0.122	2.2	8.02	19
10	-500	0	-25	7.77	0.34	9.7	8	0.117	2.5	8.22	18.8
11	-500	0	0	8.12	0.38	8.7	7.5	0.102	2.7	7.99	19.2
12	-500	0	25	8.1	0.37	8.6	8	0.111	2.6	8.02	19.2
13	-500	0	50	8.18	0.38	8.7	7.8	0.109	2.7	8.08	19.2
14	-500	0	75	8.11	0.38	8.6	8	0.138	2.7	7.93	19.2
15	-500	0	100	8.26	0.38	8.7	7.6	0.102	2.6	7.84	19.2
16	-500	0	125	8.12	0.46	8.5	7.5	0.105	3.2	8.1	19.2
17	-500	0	150	8.16	0.43	8.5	7.7	0.13	3	8.17	19.4
18	-500	0	175	8.47	0.47	7.7	7.8	0.085	3.2	7.85	19.6
19	-500	0	200	8.35	0.5	7.9	7.5	0.114	3.4	7.97	19.6
20	-500	0	250	8.42	0.51	8.4	7.6	0.116	3.5	7.91	19.6
21	-500	0	300	8.48	0.5	7.8	7.7	0.144	3.4	8.05	19.6
22	-500	0	350	8.67	0.52	7.4	7.2	0.143	3.4	8.06	19.8
23	-500	0	400	8.76	0.56	6.5	6.9	0.095	3.7	8.06	19.8
24	-500	0	450	8.7	0.58	7.1	6.7	0.097	3.8	8.13	19.8
1	750	0	-250	5.48	0.2	19.2	9.1	0.078	2.1	7.92	19.4
2	750	0	-225	6.23	0.16	16.9	11.4	0.051	1.4	7.81	19.6
3	750	0	-200	6.52	0.11	17.2	13.3	-0.064	1	7.86	19.6
4	750	0	-175	6.42	0.07	19.6	15.9	-0.343	0.6	8.01	19.6
5	750	0	-150	5.98	0.02	23.6	19	-0.552	0.2	7.99	19.6
6	750	0	-125	5.58	-0.03	26.8	20.8	-0.711	-0.3	7.96	19.4
7	750	0	-100	4.95	0.06	32	23.9	-0.775	0.7	7.89	19.4
8	750	0	-75	4.66	0.07	31.5	25.1	-0.629	0.8	7.69	19.4
9	750	0	-50	4.42	0.26	32	26.3	-0.367	3.3	7.97	19.4
10	750	0	-25	4.39	0.37	30.9	25.6	-0.076	4.9	8.06	19.4
11	750	0	0	4.78	0.34	30	26.1	-0.04	4.1	8.05	19.2
12	750	0	25	5.11	0.44	28.9	24.2	0.176	4.9	7.92	19.2
13	750	0	50	5.43	0.54	26.6	23.3	0.419	5.6	7.99	19.2
14	750	0	75	6.06	0.61	24.2	22	0.632	5.8	7.91	19.2
15	750	0	100	6.55	0.66	23.1	19.6	0.803	5.7	8.11	19.2
16	750	0	125	7.07	0.71	20.7	16.3	0.732	5.8	8.14	19.2
17	750	0	150	7.8	0.74	18	13.8	0.624	5.5	7.87	19.2
18	750	0	175	7.96	0.64	14.7	11.9	0.459	4.6	8.13	19.2
19	750	0	200	8.42	0.68	11.5	9.7	0.265	4.6	8.07	19.2
20	750	0	250	8.63	0.62	8.6	7.6	0.16	4.1	8	19.2
21	750	0	300	8.89	0.69	7	6.5	0.075	4.4	7.9	19
22	750	0	350	8.82	0.63	7.2	6.7	0.078	4.1	8.33	19.2
23	750	0	400	9.05	0.7	6.5	6.2	0.078	4.4	7.93	19.2
24	750	0	450	9.08	0.67	6.7	6.2	0.108	4.2	8.04	19
1	2000	0	-250	5.03	0.14	18.7	9.3	0.071	1.5	7.89	19.2
2	2000	0	-225	5.81	0.1	18.9	11.4	0.028	0.9	7.94	19.2
3	2000	0	-200	6.22	0.06	19.2	13	-0.117	0.6	8.07	19.2
4	2000	0	-175	6.18	0.03	22.6	15	-0.321	0.2	7.95	19

Ecn010 continued											
5	2000	0	-150	5.86	0	24	17.2	-0.36	0	8.03	18.8
6	2000	0	-125	5.67	-0.03	25.7	19.6	-0.515	-0.3	8	18.8
7	2000	0	-100	5.5	0.01	26.1	22.1	-0.538	0.1	7.92	18.8
8	2000	0	-75	5.35	0.07	26.3	23	-0.438	0.8	7.88	18.8
9	2000	0	-50	5.31	0.24	25.2	25	-0.195	2.6	7.85	18.8
10	2000	0	-25	5.42	0.19	26.1	23.8	-0.062	2	7.82	18.8
11	2000	0	0	5.56	0.34	25.4	23.6	0.183	3.5	7.97	19
12	2000	0	25	6.1	0.45	24.5	22.1	0.475	4.2	7.78	19
13	2000	0	50	6.14	0.42	24.1	21.4	0.512	3.9	8.03	19
14	2000	0	75	6.57	0.49	22.4	19.6	0.692	4.2	7.89	19
15	2000	0	100	6.63	0.53	22	18.3	0.719	4.6	8.11	19
16	2000	0	125	7.25	0.57	20.7	16.5	0.713	4.5	7.93	19
17	2000	0	150	7.49	0.58	18.4	14.5	0.606	4.5	8.05	19
18	2000	0	175	7.96	0.63	16.3	12.1	0.498	4.6	8	19.2
19	2000	0	200	8.08	0.61	14.9	11.2	0.416	4.3	8.06	19.2
20	2000	0	250	8.36	0.6	11.4	9	0.257	4.1	8.04	19.2
21	2000	0	300	8.75	0.61	8.7	7	0.147	4	8.06	19.2
22	2000	0	350	8.92	0.64	7	6.2	0.084	4.1	8.17	19.2
23	2000	0	400	9.09	0.64	6.2	6.5	0.097	4	7.97	19.2
24	2000	0	450	9.12	0.68	5.8	5.6	0.061	4.3	8.03	19.2
1	3250	0	-250	4.85	0.13	18.9	9.1	0.09	1.6	7.89	19.2
2	3250	0	-225	5.87	0.17	18.5	10.9	0.042	1.7	7.97	19.2
3	3250	0	-200	6	0.15	20.9	12.8	-0.156	1.4	8.13	19.2
4	3250	0	-175	6.1	0.05	21.4	14.6	-0.216	0.5	8.04	19.2
5	3250	0	-150	5.87	0.05	24.4	17.7	-0.39	0.5	8.11	19.2
6	3250	0	-125	5.69	0.05	26.2	19.2	-0.418	0.5	7.96	19.2
7	3250	0	-100	5.52	0.08	26.8	21.8	-0.552	0.8	7.91	19.2
8	3250	0	-75	5.28	0.08	26.2	23.8	-0.378	0.9	8.18	19
9	3250	0	-50	5.35	0.28	27.4	24.2	-0.123	3	8.02	19
10	3250	0	-25	5.23	0.3	25.3	24.4	-0.034	3.2	8.18	19.2
11	3250	0	0	5.47	0.38	25.1	23.4	0.325	4	7.98	19.2
12	3250	0	25	5.86	0.52	24.4	22.7	0.509	5	8.05	19.2
13	3250	0	50	6.14	0.55	24.7	22	0.743	5.1	7.87	19
14	3250	0	75	6.44	0.58	22.9	19.6	0.629	5.1	8.14	19
15	3250	0	100	6.69	0.66	22.4	19	0.821	5.7	8.02	19
16	3250	0	125	7.24	0.69	19.7	16.2	0.684	5.5	7.99	19.2
17	3250	0	150	7.32	0.68	19.6	15.4	0.682	5.3	8.04	19.2
18	3250	0	175	7.68	0.6	17.4	14	0.594	4.5	8.07	19.2
19	3250	0	200	7.9	0.65	15.6	12	0.457	4.7	7.97	19
20	3250	0	250	8.5	0.69	10.9	9	0.251	4.6	8.07	19
21	3250	0	300	8.9	0.68	9.6	8.2	0.221	4.3	7.93	19
22	3250	0	350	9.04	0.71	8.1	7.4	0.149	4.5	8.02	19
23	3250	0	400	9.33	0.75	7.4	6.7	0.127	4.6	7.97	19.2
24	3250	0	450	9.2	0.73	6.6	6	0.087	4.5	8.17	19
1	4500	0	-250	5.11	0.15	18.3	8.6	0.077	1.7	7.96	19
2	4500	0	-225	5.78	0.15	18.9	11.1	0.051	1.5	7.92	19
3	4500	0	-200	6.01	0.11	19.7	12.7	-0.087	1.1	8.06	19
4	4500	0	-175	6.13	0.06	23	14.3	-0.246	0.5	8.04	19
5	4500	0	-150	5.89	0.02	24.2	17.1	-0.373	0.2	8.1	19
6	4500	0	-125	5.66	0.05	26.7	19	-0.462	0.5	8.1	19
7	4500	0	-100	5.48	0.02	26.6	21	-0.397	0.2	8.02	19
8	4500	0	-75	5.42	0.13	25.8	23.7	-0.289	1.4	8.03	19
9	4500	0	-50	5.3	0.14	26.1	24	-0.158	1.5	8.08	19.2
10	4500	0	-25	5.4	0.32	26.2	24.3	0.155	3.3	7.97	19.2

Ecn010 continued											
11	4500	0	0	5.61	0.4	25.7	24.7	0.301	4	8.04	19.2
12	4500	0	25	5.8	0.41	24.9	23.3	0.449	4	8.05	19.2
13	4500	0	50	6.05	0.51	24.7	21.7	0.664	4.8	8.1	19
14	4500	0	75	6.31	0.58	23.8	20.9	0.792	5.3	8.04	19
15	4500	0	100	6.72	0.69	22.6	17.9	0.724	5.9	8.07	19
16	4500	0	125	6.95	0.6	20.9	16.6	0.719	5	8.01	19.2
17	4500	0	150	7.38	0.67	18.3	15.2	0.599	5.2	8.09	19.2
18	4500	0	175	7.82	0.76	16.6	13.1	0.583	5.5	8.02	19.2
19	4500	0	200	8.04	0.73	15.7	12.7	0.535	5.2	7.88	19.2
20	4500	0	250	8.42	0.69	12.6	10.4	0.364	4.7	7.97	19.2
21	4500	0	300	8.65	0.67	10.9	9	0.284	4.4	8.09	19
22	4500	0	350	9	0.73	9	7.7	0.176	4.7	7.99	19
23	4500	0	400	9.1	0.72	7.6	6.8	0.138	4.6	8.03	19.2
24	4500	0	450	9.27	0.79	7.2	6.8	0.117	4.8	7.97	19
1	5750	0	-250	4.73	0.12	19.7	9.4	0.091	1.4	8.08	19
2	5750	0	-225	5.62	0.15	19.8	10.7	0.044	1.6	8.06	19.2
3	5750	0	-200	5.93	0.12	21.9	12.4	-0.008	1.2	8.08	19.2
4	5750	0	-175	6.21	0.05	21.2	14.6	-0.177	0.5	8.1	19.2
5	5750	0	-150	5.93	0.05	23.9	16.6	-0.318	0.5	7.9	19.2
6	5750	0	-125	5.68	0.05	25.3	19.4	-0.397	0.6	8.12	19.2
7	5750	0	-100	5.4	0.06	26	21.3	-0.357	0.6	7.85	19.2
8	5750	0	-75	5.38	0.12	26.6	22.1	-0.253	1.3	8.18	19.2
9	5750	0	-50	5.36	0.2	25.4	23.9	-0.123	2.2	8.19	19.2
10	5750	0	-25	5.53	0.34	26.2	23.8	0.18	3.5	7.88	19.2
11	5750	0	0	5.56	0.42	25.4	23.9	0.356	4.3	8.06	19.2
12	5750	0	25	5.81	0.44	25.3	22.8	0.557	4.4	8.14	19
13	5750	0	50	6.2	0.65	25.1	21.1	0.793	6	8.09	19
14	5750	0	75	6.43	0.58	23.6	19.7	0.754	5.2	8.06	19
15	5750	0	100	6.8	0.62	22.2	18.4	0.77	5.2	8.09	19.2
16	5750	0	125	7.02	0.67	22.1	16.9	0.815	5.4	8.12	19
17	5750	0	150	7.43	0.73	20.4	15.3	0.791	5.6	8.08	19
18	5750	0	175	7.79	0.73	17.6	14.1	0.62	5.3	7.93	19
19	5750	0	200	7.83	0.65	17.1	13	0.534	4.7	8.05	19
20	5750	0	250	8.15	0.65	13.2	10.9	0.358	4.6	8.16	19
21	5750	0	300	8.53	0.7	11.5	9.6	0.302	4.7	8.06	19.2
22	5750	0	350	9.03	0.74	8.9	7.6	0.203	4.7	8.06	19.2
23	5750	0	400	9.36	0.76	8.2	7	0.198	4.7	7.91	19.2
24	5750	0	450	9.46	0.79	7.3	6.7	0.14	4.7	7.97	19.2

Ecn011

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)	Psnel (m/s)	Ptemp (Gr C.)
1	-500	0	-250	3.26	0.02	28.7	13.3	0.146	0.3	7.94	20.2
2	-500	0	-225	5.58	0.2	19.5	9.1	0.215	2	8.05	20.2
3	-500	0	-200	6.45	0.23	15.9	9	0.238	2.1	7.85	20.4
4	-500	0	-175	7.01	0.28	14.4	8.4	0.231	2.3	8.2	20.4
5	-500	0	-150	7.22	0.29	13.8	8.3	0.208	2.3	7.82	20.4
6	-500	0	-125	7.26	0.32	12.7	8.9	0.205	2.5	8.22	20.4
7	-500	0	-100	7.59	0.37	11.2	8.4	0.186	2.8	8.05	20.4
8	-500	0	-75	7.6	0.36	11.5	8.5	0.214	2.7	8.07	20.2
9	-500	0	-50	7.82	0.35	10.5	8.9	0.191	2.6	8.04	20.2
10	-500	0	-25	7.92	0.36	10.3	8.3	0.174	2.6	8.2	20.4
11	-500	0	0	8.3	0.48	10.3	7.9	0.184	3.3	7.97	20.4
12	-500	0	25	8.1	0.42	10.1	8.3	0.19	3	7.9	20.4
13	-500	0	50	8.46	0.5	8.9	7.7	0.146	3.4	8.08	20.4
14	-500	0	75	8.05	0.46	9.3	7.9	0.131	3.2	8.16	20.4
15	-500	0	100	8.5	0.52	9.7	8	0.201	3.5	7.95	20.4
16	-500	0	125	8.49	0.47	9.4	8.3	0.197	3.1	7.85	20.4
17	-500	0	150	8.52	0.5	9.1	7.8	0.178	3.3	7.92	20.4
18	-500	0	175	8.96	0.53	9.2	7.9	0.205	3.4	7.86	20.4
19	-500	0	200	9.07	0.54	8.3	7.5	0.188	3.4	7.84	20.4
20	-500	0	250	9	0.58	8.3	7.4	0.161	3.7	8	20.4
21	-500	0	300	9.13	0.57	7.8	7.3	0.161	3.6	8.07	20.4
22	-500	0	350	9.33	0.64	7.9	7.1	0.17	3.9	8.07	20.6
23	-500	0	400	9.12	0.64	8	7.2	0.193	4	8.39	20.4
24	-500	0	450	9.39	0.67	8.2	7	0.203	4.1	8.03	20.6
1	750	0	-250	5	0.17	21.5	10.2	0.166	1.9	7.95	20.8
2	750	0	-225	5.96	0.11	17.7	12.1	0.078	1.1	8.07	20.8
3	750	0	-200	6.3	0.1	17.8	13.4	-0.036	0.9	7.63	20.8
4	750	0	-175	5.92	0.03	19.5	15.7	-0.211	0.3	7.93	20.6
5	750	0	-150	5.62	0	22.1	18.4	-0.44	0	7.88	20.6
6	750	0	-125	5.18	0	26.2	20.7	-0.501	0	8.11	20.6
7	750	0	-100	4.72	0.06	27.7	23.6	-0.511	0.8	7.83	20.8
8	750	0	-75	4.56	0.1	30.3	24.1	-0.502	1.2	7.96	20.8
9	750	0	-50	4.37	0.21	28.3	25.7	-0.187	2.7	8	20.8
10	750	0	-25	4.65	0.26	29.1	24.9	-0.105	3.2	7.91	20.8
11	750	0	0	4.67	0.45	29.3	25	0.139	5.5	8.14	21
12	750	0	25	5.12	0.36	28.7	24.1	0.359	4.1	8.07	21
13	750	0	50	5.81	0.5	26.4	21.7	0.514	4.9	7.86	21.2
14	750	0	75	6.44	0.6	25.1	20.7	0.844	5.3	7.78	21.2
15	750	0	100	7.1	0.66	22.1	18.7	0.894	5.3	7.47	21.2
16	750	0	125	7.35	0.67	20.9	16.2	0.854	5.2	8.17	21
17	750	0	150	8.5	0.81	17.2	13.2	0.746	5.4	7.57	21
18	750	0	175	8.51	0.72	13	10.5	0.344	4.8	7.87	21.2
19	750	0	200	9.02	0.7	12.8	9.7	0.391	4.5	8.03	21.4
20	750	0	250	9.04	0.7	9.5	7.7	0.2	4.4	8.06	21.4
21	750	0	300	9.5	0.75	7.8	6.8	0.173	4.5	7.98	21.4
22	750	0	350	9.69	0.78	7.4	6.5	0.172	4.6	7.93	21.2
23	750	0	400	9.54	0.72	8	6.9	0.212	4.3	8.06	21.2
24	750	0	450	9.98	0.82	7.5	6.3	0.17	4.7	7.88	21
1	2000	0	-250	5.03	0.14	18.7	9.4	0.107	1.6	7.68	21.2
2	2000	0	-225	5.83	0.1	17.7	11.5	0.038	1	7.9	21.2
3	2000	0	-200	6.04	0.07	19.2	12.9	-0.095	0.7	7.99	21.2
4	2000	0	-175	5.94	0.08	20.6	14.8	-0.193	0.8	7.88	21.4

Ecn011 continued											
5	2000	0	-150	5.61	0.04	23.3	17	-0.251	0.4	7.81	21.4
6	2000	0	-125	5.49	-0.04	24.9	18.6	-0.382	-0.4	8.22	21.4
7	2000	0	-100	5.17	0.03	26.3	22	-0.374	0.3	7.82	21.4
8	2000	0	-75	5.21	0.04	27	21.7	-0.287	0.5	7.77	21.6
9	2000	0	-50	5.45	0.19	27.2	23.7	-0.083	2	7.69	21.6
10	2000	0	-25	5.23	0.32	26.4	23.5	0.108	3.5	7.92	21.6
11	2000	0	0	5.51	0.47	26.7	23.4	0.374	4.9	7.77	21.6
12	2000	0	25	5.99	0.37	24.4	22.4	0.527	3.6	7.87	21.6
13	2000	0	50	6.21	0.45	23.7	21.2	0.618	4.1	7.83	21.6
14	2000	0	75	6.56	0.47	24.3	20.3	0.764	4.1	7.83	21.4
15	2000	0	100	7.05	0.59	22.2	17.9	0.811	4.8	8.01	21.4
16	2000	0	125	7.35	0.59	21.7	16	0.803	4.6	7.7	21.2
17	2000	0	150	7.9	0.64	19.4	14	0.723	4.6	7.93	21.4
18	2000	0	175	8.11	0.64	17.4	12.9	0.681	4.5	8.05	21.4
19	2000	0	200	8.25	0.8	16.4	11.7	0.578	5.5	7.89	21.4
20	2000	0	250	8.97	0.7	11.5	8.8	0.296	4.5	8.01	21.4
21	2000	0	300	9.05	0.73	10.9	7.9	0.277	4.6	8.09	21.6
22	2000	0	350	9.4	0.82	8.7	7	0.197	5	8.09	21.4
23	2000	0	400	9.48	0.78	7.9	6.7	0.167	4.7	8.19	21.4
24	2000	0	450	9.53	0.67	7.8	6.7	0.159	4	8.1	21.4
1	3250	0	-250	4.97	0.16	19	8.6	0.089	1.9	7.88	21.4
2	3250	0	-225	5.8	0.35	17.6	10.7	0.074	3.5	7.78	21.2
3	3250	0	-200	6.1	0.15	20.2	12.6	-0.137	1.4	7.92	21.4
4	3250	0	-175	6.12	0.14	22.4	15.2	-0.229	1.3	7.9	21.2
5	3250	0	-150	5.63	0.14	23.4	16.7	-0.211	1.4	7.96	21.2
6	3250	0	-125	5.39	0.17	24.9	19	-0.227	1.8	7.79	21.2
7	3250	0	-100	5.27	0.06	25.5	21.4	-0.34	0.7	7.93	21.4
8	3250	0	-75	5.24	0.17	25.5	22.3	-0.197	1.8	7.76	21.4
9	3250	0	-50	5.37	0.07	26.7	22.3	-0.232	0.7	7.95	21.2
10	3250	0	-25	5.35	0.31	25.4	24.4	0.179	3.4	7.95	21.2
11	3250	0	0	5.33	0.3	25.1	23.7	0.29	3.2	7.91	21.4
12	3250	0	25	5.91	0.48	25.7	22.5	0.577	4.7	7.84	21.4
13	3250	0	50	5.76	0.45	24.7	22.2	0.578	4.4	8.34	21.4
14	3250	0	75	6.36	0.59	24.2	19.8	0.762	5.3	8	21.4
15	3250	0	100	7.04	0.62	23.8	19.1	0.951	5	7.91	21.4
16	3250	0	125	7.13	0.65	21.8	17	0.802	5.2	8.2	21.6
17	3250	0	150	7.44	0.79	21.7	15.5	0.855	6.1	7.73	21.6
18	3250	0	175	8.08	0.72	19	13.7	0.733	5.1	7.66	21.6
19	3250	0	200	8.72	0.8	16.9	12.2	0.706	5.2	7.63	21.6
20	3250	0	250	8.73	0.77	14.1	10.1	0.429	5.1	8.19	21.6
21	3250	0	300	8.97	0.74	11.9	8.7	0.332	4.7	8.08	21.6
22	3250	0	350	9.5	0.84	9.2	7.5	0.212	5.1	8.04	21.6
23	3250	0	400	9.48	1.04	7.9	6.8	0.165	6.3	7.82	21.8
24	3250	0	450	9.49	0.99	7.9	6.9	0.176	6	8.01	21.8
1	4500	0	-250	4.96	0.15	19.6	9.1	0.106	1.7	7.87	22
2	4500	0	-225	5.8	0.18	18.8	11.2	0.036	1.7	8.07	22
3	4500	0	-200	6	0.14	19.5	12.1	-0.109	1.4	8.02	22
4	4500	0	-175	5.97	0.09	21.2	14.3	-0.223	0.8	7.83	22
5	4500	0	-150	5.76	0.04	22.5	15.9	-0.34	0.4	8.19	22
6	4500	0	-125	5.63	0.06	23.2	18.5	-0.368	0.6	7.8	22
7	4500	0	-100	5.54	0.03	24.1	19	-0.395	0.3	8.07	22
8	4500	0	-75	5.28	0.06	23.2	21	-0.3	0.6	8.05	21.8
9	4500	0	-50	5.51	0.16	23	21.9	-0.161	1.7	7.71	22
10	4500	0	-25	5.47	0.27	22.9	22.2	0.134	2.8	7.86	22

Ecn011 continued											
11	4500	0	0	5.93	0.31	23.4	22.2	0.22	3	7.88	22
12	4500	0	25	5.85	0.4	23.1	21.9	0.499	3.9	7.98	22
13	4500	0	50	5.92	0.37	23.6	20.8	0.527	3.6	7.98	22
14	4500	0	75	6.24	0.51	22.9	19.4	0.647	4.7	8.24	22
15	4500	0	100	6.29	0.54	23.2	17.9	0.726	4.9	8.37	22
16	4500	0	125	7.54	0.65	22.3	16.9	0.979	4.9	7.62	22.2
17	4500	0	150	7.24	0.6	22.6	16	0.896	4.7	7.94	22.2
18	4500	0	175	7.74	0.58	20	14.4	0.779	4.3	8.02	22.2
19	4500	0	200	7.98	0.63	17.7	13.1	0.633	4.5	8.13	22.2
20	4500	0	250	9.03	0.74	14	10.4	0.475	4.7	7.99	22.2
21	4500	0	300	8.91	0.69	12.4	9.7	0.387	4.5	8.29	22.2
22	4500	0	350	9.6	0.81	10.8	8.2	0.28	4.8	7.91	22.2
23	4500	0	400	10.15	0.86	8.6	7.4	0.213	4.9	8	22.2
24	4500	0	450	10.35	0.85	7.4	6.2	0.176	4.7	7.86	22.4
1	5750	0	-250	5.03	0.05	20.4	9.1	0.111	0.6	7.62	22.2
2	5750	0	-225	5.74	0.22	19.5	11.3	0.121	2.2	7.92	22.4
3	5750	0	-200	5.76	0.18	20.6	12.4	-0.002	1.8	8.22	22.2
4	5750	0	-175	5.87	0.05	23	14.6	-0.15	0.4	7.81	22.2
5	5750	0	-150	6.12	0.02	23.4	15.9	-0.308	0.2	7.71	22.2
6	5750	0	-125	5.69	0.06	24.5	18.1	-0.342	0.6	8.12	22.2
7	5750	0	-100	5.49	0.06	25.3	19.7	-0.206	0.7	7.82	22.2
8	5750	0	-75	5.31	0.14	26.6	22.7	-0.222	1.5	7.83	22.2
9	5750	0	-50	5.51	0.19	26.1	23.2	-0.025	2	7.94	22.2
10	5750	0	-25	5.31	0.31	27.1	24.1	0.263	3.3	7.9	22.4
11	5750	0	0	5.71	0.37	26.9	23	0.486	3.7	7.95	22.4
12	5750	0	25	5.89	0.4	25.7	22.3	0.43	3.9	7.8	22.4
13	5750	0	50	5.88	0.52	25.2	20.8	0.68	5.1	8.02	22.2
14	5750	0	75	6.27	0.59	24.1	19.3	0.67	5.4	8.25	22.2
15	5750	0	100	6.53	0.57	24.1	18.4	0.817	5	8.12	22.2
16	5750	0	125	7.25	0.83	23.1	17.5	0.98	6.5	7.93	22.4
17	5750	0	150	7.51	0.83	21.7	15.6	0.86	6.3	7.88	22.2
18	5750	0	175	7.62	0.79	21.1	14.3	0.799	5.9	7.88	22.4
19	5750	0	200	8.23	0.88	17.4	12.3	0.651	6.1	7.94	22.2
20	5750	0	250	8.37	0.82	15	11.7	0.514	5.6	8.05	22.2
21	5750	0	300	8.77	0.68	13.1	10.5	0.418	4.4	7.82	22.2
22	5750	0	350	9.27	0.81	11.6	9	0.355	5	7.98	22.2
23	5750	0	400	9.65	0.79	10.5	7.9	0.286	4.7	7.91	22.2
24	5750	0	450	9.75	0.8	9.2	7	0.212	4.7	7.88	22.2

Ecn012

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)	Psnel (m/s)	Ptemp (Gr C.)
1	750	0	0	4.86	0.38	28	24.5	0.059	4.5	8.02	23.4
2	750	25	0	5.04	0.24	29.2	23.7	-0.027	2.7	7.85	23.6
3	750	50	0	5.32	0.17	28.4	23.2	0.006	1.8	7.94	23.6
4	750	75	0	5.6	0.13	29	22.2	-0.003	1.3	7.96	23.4
5	750	100	0	6.02	0.03	27.4	18.9	0.003	0.3	8.11	23.4
6	750	125	0	6.51	0.05	25.3	17.8	0.181	0.4	7.95	23.2
7	750	175	0	7.52	0.21	17.5	12.6	0.175	1.6	8.07	23.2
8	750	250	0	8.41	0.41	9.4	8.4	0.121	2.8	8.06	23.2
9	750	375	0	8.47	0.45	7.9	6.9	0.092	3	8.24	23.2
10	750	0	125	7.29	0.72	19.9	16.5	0.834	5.6	8.02	23
11	750	25	125	7.21	0.64	19.6	16.6	0.722	5.1	8.02	23.2
12	750	50	125	7.32	0.76	19	15.2	0.659	5.9	8.06	23.2
13	750	75	125	7.55	0.68	17.9	14.2	0.55	5.1	8.04	23.4
14	750	100	125	7.82	0.63	15.5	12.8	0.423	4.6	8.01	23.6
15	750	125	125	8.01	0.66	14	11	0.316	4.7	8.04	23.6
16	750	175	125	8.6	0.61	11.1	9.2	0.276	4.1	8.02	23.6
17	750	250	125	8.66	0.51	7.8	7.5	0.12	3.4	7.97	23.6
18	750	375	125	8.67	0.52	7	7	0.106	3.4	8	23.4
19	750	0	250	8.55	0.63	8.6	7.9	0.154	4.2	8.2	23.4
20	750	25	250	8.87	0.7	8.2	7.5	0.134	4.5	7.96	23.2
21	750	50	250	8.79	0.67	8	6.9	0.115	4.4	8.07	23.2
22	750	75	250	8.89	0.7	7.1	6.6	0.062	4.5	7.94	23
23	750	100	250	8.85	0.66	7.8	6.9	0.087	4.3	8.07	23
24	750	125	250	8.77	0.62	7.3	7	0.111	4	8.28	23
25	750	175	250	8.84	0.64	7.1	6.7	0.079	4.1	8.12	23
26	750	250	250	8.67	0.57	7.6	7.2	0.132	3.7	8.13	23
27	750	375	250	8.66	0.64	6.9	7	0.119	4.2	8.11	22.8
1	2000	0	0	5.62	0.45	24.6	22.7	0.354	4.6	8.11	22.8
2	2000	25	0	5.73	0.35	25	21.9	0.262	3.5	8.07	22.6
3	2000	50	0	5.91	0.31	24.6	21.7	0.129	3	8.1	22.6
4	2000	75	0	6.04	0.34	25.6	20.7	0.216	3.2	8.08	22.6
5	2000	100	0	6.29	0.19	24.5	19.4	0.191	1.8	8.17	22.6
6	2000	125	0	6.73	0.22	22.8	17	0.143	1.9	8.07	22.6
7	2000	175	0	7.16	0.28	20.9	15.2	0.319	2.3	8.25	22.6
8	2000	250	0	7.77	0.54	14.3	11.1	0.245	4	8.14	22.6
9	2000	375	0	8.22	0.51	9.6	8.1	0.122	3.6	8.02	22.6
10	2000	0	125	7.06	0.67	20.1	15.8	0.717	5.4	8.24	22.6
11	2000	25	125	7.17	0.65	19.3	15.1	0.611	5.2	8.18	22.8
12	2000	50	125	7.44	0.7	18.8	14.8	0.617	5.4	7.97	23
13	2000	75	125	7.68	0.64	18.6	13.8	0.566	4.8	8.06	23
14	2000	100	125	7.54	0.54	18.2	13.9	0.514	4.1	8.17	23
15	2000	125	125	7.76	0.59	17	13	0.458	4.4	7.89	22.8
16	2000	175	125	8.19	0.59	13.7	10.9	0.319	4.1	7.96	22.8
17	2000	250	125	8.44	0.5	9.7	8.9	0.165	3.4	8.2	22.8
18	2000	375	125	8.72	0.49	8.6	7.9	0.143	3.2	8.03	22.6
19	2000	0	250	8.65	0.71	9.6	8.3	0.189	4.7	8.1	22.6
20	2000	25	250	8.71	0.65	10.2	8.3	0.182	4.3	8.08	22.6
21	2000	50	250	8.67	0.67	10.8	8.2	0.251	4.4	7.99	22.4
22	2000	75	250	8.71	0.65	9.9	8.5	0.206	4.3	8	22.4
23	2000	100	250	8.71	0.62	9.3	7.9	0.151	4.1	8.05	22.4
24	2000	125	250	8.71	0.62	9.6	7.9	0.19	4	8.09	22.4
25	2000	175	250	8.71	0.6	8.9	7.9	0.167	3.9	8.2	22.4
26	2000	250	250	8.9	0.65	7.5	7.1	0.124	4.2	8.02	22.4

Ecn012 continued											
27	2000	375	250	8.82	0.72	7.2	6.8	0.119	4.7	8.17	22.4
1	3250	0	0	5.59	0.46	25.2	23.1	0.396	4.7	8.02	22.4
2	3250	25	0	5.75	0.44	24.6	22.9	0.285	4.3	7.92	22.4
3	3250	50	0	5.84	0.26	26.1	22.1	0.188	2.6	8.1	22.4
4	3250	75	0	6.04	0.28	27	21	0.301	2.7	8.15	22.4
5	3250	100	0	6.35	0.18	26.2	19.7	0.162	1.7	8.06	22.4
6	3250	125	0	6.41	0.25	25.7	18	0.296	2.3	8.16	22.4
7	3250	175	0	7.08	0.3	22.5	15.3	0.435	2.4	8.09	22.6
8	3250	250	0	7.74	0.54	15.5	12.4	0.292	4	8.06	22.8
9	3250	375	0	8.18	0.57	10.7	9.6	0.164	4	8.1	23
10	3250	0	125	6.97	0.79	19.7	15.8	0.677	6.5	8.07	23
11	3250	25	125	7.28	0.77	19.7	15.8	0.7	6.1	8.12	23
12	3250	50	125	7.31	0.63	18.8	15.4	0.598	4.9	8.13	23
13	3250	75	125	7.47	0.6	19.1	14.9	0.588	4.6	8.11	23
14	3250	100	125	7.63	0.59	18.3	14.4	0.603	4.4	7.94	22.8
15	3250	125	125	7.65	0.55	17.2	13.6	0.428	4.1	8.14	22.8
16	3250	175	125	8.15	0.57	14.9	11.8	0.403	4	8.21	22.8
17	3250	250	125	8.26	0.5	12	10.8	0.324	3.5	8.23	22.6
18	3250	375	125	8.5	0.58	10.2	8.7	0.194	3.9	8.15	22.6
19	3250	0	250	8.59	0.73	12.2	9.5	0.327	4.8	8.09	22.8
20	3250	25	250	8.55	0.73	11.2	9.4	0.262	4.9	8.14	22.6
21	3250	50	250	8.42	0.65	12.5	10.2	0.332	4.4	8.12	22.6
22	3250	75	250	8.71	0.76	10.4	8.8	0.22	5	7.92	22.6
23	3250	100	250	8.67	0.71	11.2	8.9	0.264	4.7	7.96	22.6
24	3250	125	250	8.88	0.7	10	8.7	0.207	4.5	8.08	22.6
25	3250	175	250	8.81	0.69	9.8	8.4	0.222	4.5	8.04	22.6
26	3250	250	250	8.77	0.6	8.8	8.2	0.192	3.9	8.22	22.6
27	3250	375	250	9.04	0.67	7.5	7.3	0.111	4.2	8.12	22.6
1	5750	0	0	5.65	0.38	25.8	22.9	0.471	3.9	8.24	22.6
2	5750	25	0	5.68	0.34	25.9	22.5	0.33	3.4	8.11	22.6
3	5750	50	0	5.96	0.28	25.5	21.4	0.253	2.7	8.01	22.6
4	5750	75	0	5.95	0.34	25.1	20.9	0.341	3.3	8.15	22.6
5	5750	100	0	6.38	0.35	25.2	19.6	0.365	3.2	7.97	22.6
6	5750	125	0	6.6	0.37	23.5	18.8	0.441	3.2	7.9	22.6
7	5750	175	0	6.75	0.33	21.8	16.8	0.411	2.8	8.07	22.6
8	5750	250	0	7.51	0.49	17.4	13.8	0.453	3.8	8.11	22.6
9	5750	375	0	7.69	0.55	13.3	11.4	0.263	4.1	8.04	22.6
10	5750	0	125	7.01	0.69	21.1	16.3	0.757	5.6	8.02	22.6
11	5750	25	125	7.08	0.62	21.1	16.5	0.751	5	8.06	22.8
12	5750	50	125	7.14	0.61	20.2	16.1	0.675	4.9	8.12	22.8
13	5750	75	125	7.23	0.64	19.4	15.1	0.642	5.1	8.13	22.8
14	5750	100	125	7.28	0.56	19.5	15.4	0.637	4.4	8.1	23
15	5750	125	125	7.45	0.62	19.1	14.7	0.616	4.8	7.9	23
16	5750	175	125	7.5	0.92	15.5	13.3	0.466	7	7.99	23
17	5750	250	125	7.92	0.79	13.9	11.4	0.405	5.7	7.93	23
18	5750	375	125	8.1	0.91	12.7	11	0.395	6.4	8.07	23.2
19	5750	0	250	8.26	0.88	13.5	11.1	0.419	6	8.01	23
20	5750	25	250	8.33	0.88	12.5	10.6	0.402	6	8.14	23
21	5750	50	250	8.33	0.75	13	10	0.38	5.2	8.06	23
22	5750	75	250	8.43	0.76	12.2	10.1	0.338	5.1	8.06	22.8
23	5750	100	250	8.47	0.7	13.2	10.3	0.366	4.7	8.03	22.8
24	5750	125	250	8.75	0.89	11.6	9.9	0.312	5.8	7.9	22.8
25	5750	175	250	8.77	0.84	10.3	9	0.288	5.5	7.97	22.8
26	5750	250	250	8.72	0.82	10	9	0.27	5.4	8.09	22.8
27	5750	375	250	8.63	0.8	10.5	9	0.281	5.3	8.05	22.8

Ecn014

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)	Psnel (m/s)	Ptemp (Gr C.)
1	0	0	-250	6.57	0.3	12	5.5	0.121	2.7	7.7	23.4
2	0	0	-225	7.17	0.34	10.4	5.6	0.116	2.7	7.82	23.4
3	0	0	-200	7.49	0.38	9.7	6.2	0.109	2.9	7.64	23.4
4	0	0	-175	7.76	0.44	9.6	6.3	0.123	3.2	7.98	23.4
5	0	0	-150	7.81	0.46	9.5	6.3	0.131	3.4	7.94	23.4
6	0	0	-125	8	0.45	8.6	7.1	0.138	3.2	8.06	23.4
7	0	0	-100	8.14	0.54	9.3	6.9	0.129	3.8	7.98	23.6
8	0	0	-75	8.04	0.55	8.5	7.5	0.094	3.9	8.06	23.6
9	0	0	-50	8.01	0.47	8.9	7.7	0.152	3.4	8	23.6
10	0	0	-25	8.34	0.56	7.9	6.9	0.096	3.9	7.96	23.8
11	0	0	0	8.25	0.57	8.1	7.3	0.096	3.9	8.06	23.8
12	0	0	25	8.32	0.63	7.8	7.2	0.108	4.3	8.16	23.8
13	0	0	50	8.2	0.65	8	7.6	0.136	4.5	8	23.8
14	0	0	75	8.35	0.64	8	7.9	0.151	4.4	7.87	24
15	0	0	100	8.3	0.65	8.4	7.8	0.134	4.5	8.02	24
16	0	0	125	8.36	0.64	8.2	7.9	0.159	4.4	8.12	24.2
17	0	0	150	8.37	0.65	7.8	7.9	0.142	4.4	8.04	24.2
18	0	0	175	8.41	0.69	7.9	7.4	0.136	4.7	8.29	24.4
19	0	0	200	8.52	0.67	7.8	7.5	0.151	4.5	8.07	24.4
20	0	0	250	8.56	0.73	7.8	7.7	0.146	4.9	8.08	24.2
21	0	0	300	8.67	0.73	7.7	7.4	0.159	4.8	8.01	24.2
22	0	0	350	8.68	0.76	7.7	7.3	0.162	5	8	24
23	0	0	400	8.77	0.83	7.3	6.9	0.142	5.4	8.02	24
24	0	0	450	8.97	0.88	6.2	5.9	0.1	5.6	8.07	24
1	2000	0	-250	6.49	0.24	11.9	5.1	0.104	2.1	8.02	23.8
2	2000	0	-225	7.31	0.33	10	5.6	0.113	2.6	8.05	23.8
3	2000	0	-200	7.68	0.36	10.2	5.8	0.132	2.7	7.93	23.8
4	2000	0	-175	8	0.41	9.2	6	0.104	2.9	7.96	23.8
5	2000	0	-150	7.93	0.46	8.5	6	0.085	3.3	8.08	23.6
6	2000	0	-125	7.97	0.45	8.8	6.4	0.113	3.2	8.01	23.8
7	2000	0	-100	8.15	0.43	8.1	6.4	0.107	3	8.13	23.8
8	2000	0	-75	8.17	0.5	8.2	6.5	0.111	3.5	8.06	23.8
9	2000	0	-50	8.13	0.51	8.6	7	0.121	3.6	8.17	23.8
10	2000	0	-25	8.3	0.52	7.7	6.7	0.121	3.6	7.99	23.8
11	2000	0	0	8.26	0.49	7.3	6.7	0.094	3.4	8.04	23.8
12	2000	0	25	8.29	0.49	7.8	7.2	0.115	3.4	8	23.6
13	2000	0	50	8.54	0.62	7.4	6.7	0.123	4.2	8.02	23.6
14	2000	0	75	8.55	0.61	7.4	7.2	0.13	4.1	7.84	23.8
15	2000	0	100	8.47	0.6	7.4	7.4	0.137	4.1	8.08	23.8
16	2000	0	125	8.42	0.58	7.5	7.1	0.115	4	8.03	23.8
17	2000	0	150	8.46	0.68	7.1	7.2	0.091	4.6	8.02	23.8
18	2000	0	175	8.56	0.62	7.1	7.3	0.138	4.2	7.99	23.8
19	2000	0	200	8.82	0.72	7	6.9	0.13	4.7	7.85	24
20	2000	0	250	8.57	0.72	6.9	6.9	0.123	4.8	8.01	24
21	2000	0	300	8.77	0.72	7.2	6.7	0.155	4.7	7.95	24.2
22	2000	0	350	8.73	0.75	7.2	6.6	0.128	4.9	8.03	24.2
23	2000	0	400	8.9	0.77	6.5	6.6	0.134	5	7.9	24.2
24	2000	0	450	8.94	0.81	6.6	6.9	0.144	5.2	8.09	24.2
1	3250	0	-250	6.47	0.31	13	5.2	0.132	2.7	7.91	24.2
2	3250	0	-225	7.5	0.39	9.6	5.1	0.1	3	7.95	24.2
3	3250	0	-200	7.67	0.39	9.9	5.7	0.131	2.9	7.96	24.2

Ecn014 continued											
4	3250	0	-175	7.9	0.45	8.9	5.9	0.11	3.3	7.89	24.2
5	3250	0	-150	8	0.5	8.5	5.9	0.106	3.6	8.05	24.4
6	3250	0	-125	8.05	0.5	8.2	6.1	0.105	3.5	7.99	24.4
7	3250	0	-100	8.14	0.51	7.8	6.2	0.108	3.6	7.94	24.4
8	3250	0	-75	8.17	0.48	7.8	6.7	0.127	3.4	7.96	24.4
9	3250	0	-50	8.48	0.6	7.3	6.3	0.113	4.1	7.88	24.4
10	3250	0	-25	8.43	0.58	7.5	6.3	0.109	3.9	7.87	24.6
11	3250	0	0	8.37	0.59	7.6	6.7	0.115	4	7.87	24.6
12	3250	0	25	8.41	0.61	7.2	6.6	0.116	4.2	8.11	24.8
13	3250	0	50	8.56	0.64	7.2	6.4	0.106	4.3	8	24.6
14	3250	0	75	8.55	0.65	7	6.9	0.117	4.3	7.93	24.6
15	3250	0	100	8.67	0.71	6.6	6.2	0.083	4.7	7.97	24.8
16	3250	0	125	8.65	0.67	7.4	7.4	0.166	4.4	7.93	24.8
17	3250	0	150	8.85	0.72	7.2	6.4	0.124	4.6	7.87	24.8
18	3250	0	175	8.73	0.71	6.7	6.4	0.105	4.6	8.02	24.6
19	3250	0	200	8.67	0.71	6.9	6.7	0.137	4.7	8.01	24.6
20	3250	0	250	8.65	0.78	6.4	6.7	0.106	5.1	8.02	24.6
21	3250	0	300	8.68	0.78	6.4	6.5	0.112	5.1	8.06	24.8
22	3250	0	350	8.87	0.79	6.7	6.7	0.15	5.1	8.07	24.8
23	3250	0	400	9.1	0.85	6	6.1	0.097	5.3	7.87	24.8
24	3250	0	450	9.07	0.86	6.4	5.9	0.119	5.4	8.07	24.8
1	4500	0	-250	6.53	0.29	12.2	5.3	0.115	2.5	7.89	24.8
2	4500	0	-225	7.32	0.38	9.7	5.1	0.107	3	7.91	24.8
3	4500	0	-200	7.73	0.4	8.8	5.5	0.114	3	8.11	24.8
4	4500	0	-175	7.97	0.43	7.8	5.6	0.101	3.1	7.97	24.8
5	4500	0	-150	8.11	0.5	7.8	5.4	0.091	3.5	7.98	24.8
6	4500	0	-125	8.25	0.53	8.3	6.1	0.119	3.7	7.97	24.6
7	4500	0	-100	8.16	0.53	7.7	5.8	0.091	3.7	8.1	24.6
8	4500	0	-75	8.35	0.54	7.6	6.3	0.112	3.7	7.99	24.6
9	4500	0	-50	8.43	0.55	7.2	6.1	0.103	3.7	8.03	24.6
10	4500	0	-25	8.4	0.6	7.3	5.9	0.106	4.1	8	24.6
11	4500	0	0	8.39	0.57	6.9	6.2	0.091	3.9	7.98	24.6
12	4500	0	25	8.63	0.62	7.4	6.3	0.135	4.1	7.94	24.8
13	4500	0	50	8.55	0.62	7.1	6.3	0.118	4.1	8.19	24.6
14	4500	0	75	8.48	0.6	7.2	6.3	0.141	4.1	8.02	24.6
15	4500	0	100	8.62	0.67	6.8	6.2	0.117	4.5	8.06	24.6
16	4500	0	125	8.51	0.58	7.2	6.7	0.14	3.9	7.96	24.6
17	4500	0	150	8.65	0.68	6.7	6.5	0.109	4.5	7.9	24.8
18	4500	0	175	8.67	0.67	7	6.2	0.133	4.4	7.95	24.8
19	4500	0	200	8.68	0.68	7	6.5	0.131	4.5	8.02	24.8
20	4500	0	250	9.06	0.84	6.1	6	0.103	5.3	7.79	24.8
21	4500	0	300	8.8	0.78	6.3	6.4	0.099	5	7.9	24.8
22	4500	0	350	9	0.79	6	6	0.115	5	7.95	24.8
23	4500	0	400	9.1	0.85	5.8	6	0.113	5.3	7.85	24.8
24	4500	0	450	8.98	0.81	5.8	6	0.108	5.2	8.14	24.8

Ecn016

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)	Psnel (m/s)	Ptemp (Gr C.)
1	0	1200	0	7.7	-0.57	8.5	7.1	-0.114	-4.2	7.94	11.2
2	0	1100	0	7.58	-0.38	7.7	6.9	-0.014	-2.9	8.16	11.2
3	0	1000	0	7.7	-0.37	8.4	7.9	-0.109	-2.7	8.04	11.2
4	0	500	0	8.19	-0.55	8.4	7	-0.144	-3.9	8.15	11.2
5	0	0	0	8.21	-0.53	8.1	7.3	-0.128	-3.7	7.94	11.2
6	0	-500	0	8	-0.45	8.4	7.7	-0.132	-3.2	8.18	11.2
7	0	-1000	0	7.92	-0.4	8.8	7.8	-0.14	-2.9	8.04	11.2
8	0	-1100	0	7.66	-0.4	8.5	7.9	-0.115	-3	8.2	11.2
9	0	-1200	0	7.53	-0.42	9.2	8	-0.123	-3.2	8.15	11.4
1	4000	1200	0	7.78	-0.46	6.5	5.8	-0.056	-3.4	8.17	11.2
2	4000	1100	0	7.87	-0.42	7.5	5.9	-0.069	-3.1	8.22	11.8
3	4000	1000	0	8.08	-0.45	7.2	6.3	-0.092	-3.2	7.94	11.8
4	4000	500	0	8.43	-0.58	7	6.2	-0.118	-3.9	8.11	11.8
5	4000	0	0	8.43	-0.59	6.9	6	-0.076	-4	8.18	11.2
6	4000	-500	0	8.4	-0.53	6.7	6.5	-0.085	-3.6	8.03	11.8
7	4000	-1000	0	7.88	-0.43	8.2	7.2	-0.136	-3.1	8.08	11.2
8	4000	-1100	0	7.82	-0.41	7.1	6.8	-0.096	-3	8.04	11.8
9	4000	-1200	0	7.84	-0.47	7.5	6.5	-0.088	-3.4	7.97	11.2

Ecn022a

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)	Psnel (m/s)	Ptemp (Gr C.)
1	0	0	0	7.7	-0.57	14.2	12.3	-0.434	-4.2	8.07	6.6
2	0	0	50	7.91	-0.59	13.6	12	-0.334	-4.2	7.97	6.6
3	0	0	100	7.9	-0.61	13.9	12.5	-0.488	-4.4	8.09	6.6
4	0	0	150	8.21	-0.78	12.3	11.7	-0.451	-5.4	8.04	6.5
5	0	0	200	8.23	-0.68	11.9	11.3	-0.377	-4.7	8.18	6.6
6	0	0	250	8.7	-0.8	11.1	11	-0.347	-5.2	7.87	6.5
7	0	0	300	8.74	-0.77	11.1	10	-0.368	-5	7.88	6.5
8	0	0	350	8.7	-0.79	10.3	9.5	-0.272	-5.2	8.17	6.5
9	0	0	400	8.89	-0.8	9.8	9.3	-0.316	-5.2	8.08	6.5
10	0	0	450	9.06	-0.86	8.9	8.5	-0.247	-5.4	8.14	6.5
11	0	0	500	8.85	-0.75	10.2	9.4	-0.343	-4.9	8.18	6.5
12	0	0	550	9.37	-0.85	7.5	7	-0.127	-5.2	8.06	6.5
13	0	0	600	9.15	-0.8	7.9	8	-0.204	-5	8.14	6.5
14	0	0	650	9.29	-0.83	6.6	6.9	-0.134	-5.1	8.24	6.5
15	0	0	700	9.55	-0.86	5.8	5.4	-0.075	-5.1	8.16	6.5

Ecn022b

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)	Psnel (m/s)	Ptemp (Gr C.)
1	0	-250	0	7.16	-0.43	18.2	15.1	-0.459	-3.4	8.04	6.5
2	0	-250	50	7.26	-0.51	17.8	15	-0.494	-4	8.07	6.5
3	0	-250	100	7.46	-0.56	15.5	14.3	-0.439	-4.3	8.12	6.5
4	0	-250	150	7.89	-0.67	15.1	13.4	-0.514	-4.9	8.09	6.5
5	0	-250	200	7.71	-0.61	14.3	12.9	-0.403	-4.6	8.11	6.5
6	0	-250	250	8.27	-0.76	13.8	11.7	-0.469	-5.3	7.85	6.5
7	0	-250	300	8.4	-0.77	12.9	11.1	-0.425	-5.2	7.88	6.5
8	0	-250	350	8.47	-0.78	12.1	10.2	-0.326	-5.3	7.98	6.5
9	0	-250	400	8.43	-0.68	10.8	10.5	-0.319	-4.6	8.3	6.5
10	0	-250	450	9.09	-0.8	9.9	9.1	-0.289	-5.1	8.12	6.5
11	0	-250	500	8.88	-0.73	9.9	8.5	-0.281	-4.7	7.95	6.5
12	0	-250	550	9.14	-0.81	9.8	8.5	-0.221	-5.1	8.01	6.5
13	0	-250	600	9.3	-0.8	8.3	7.5	-0.204	-4.9	8.18	6.5
14	0	-250	650	9.27	-0.78	7.7	7.2	-0.189	-4.8	8.01	6.5
15	0	-250	700	9.45	-0.85	6.2	6.4	-0.11	-5.1	7.88	6.5

Ecn022c

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)	Psnel (m/s)	Ptemp (Gr C.)
1	0	-250	0	4.53	-0.17	34.6	30	-0.368	-2.1	8.06	6.5
2	0	-250	50	4.98	-0.4	34.1	27.3	-0.997	-4.6	7.98	6.5
3	0	-250	100	5.83	-0.63	30.1	22.3	-1.112	-6.1	8.04	6.5
4	0	-250	150	6.69	-0.65	25	17	-0.973	-5.6	7.99	6.5
5	0	-250	200	7.4	-0.72	18.8	14.6	-0.683	-5.6	7.91	6.5
6	0	-250	250	7.65	-0.66	16.7	13.9	-0.613	-4.9	8.09	6.6
7	0	-250	300	8.2	-0.74	14.6	12.2	-0.482	-5.2	7.83	6.6
8	0	-250	350	8.05	-0.63	14.1	11.9	-0.511	-4.5	8.18	6.6
9	0	-250	400	8.3	-0.71	12.9	10.6	-0.434	-4.9	8.3	6.6
10	0	-250	450	8.73	-0.74	10.7	9.8	-0.276	-4.8	8.11	6.5
11	0	-250	500	8.82	-0.74	10.2	9.4	-0.246	-4.8	8.04	6.5
12	0	-250	550	9.04	-0.76	10.3	8.7	-0.29	-4.8	7.98	6.5
13	0	-250	600	9.05	-0.77	7.9	7.2	-0.155	-4.9	8.23	6.6
14	0	-250	650	9.15	-0.73	8.6	7.7	-0.224	-4.6	7.97	6.6
15	0	-250	700	9.31	-0.77	8.7	7.3	-0.225	-4.7	8.01	6.6

Ecn023

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)	Psnel (m/s)	Ptemp (Gr C.)
1	-535	-500	100	5.59	0.38	24.8	20.1	-0.534	3.9	8.19	6.7

Ecn024a

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)	Psnel (m/s)	Ptemp (Gr C.)
1	0	0	0	8.16	-0.61	11.8	10.2	-0.261	-4.3	8.04	8.7
2	0	0	50	8.14	-0.67	11.7	10.3	-0.248	-4.7	8.09	8.7
3	0	0	100	8.38	-0.66	10.2	10.3	-0.3	-4.5	8.22	8.7
4	0	0	150	8.62	-0.72	10.1	9.6	-0.245	-4.8	7.81	8.6
5	0	0	200	8.73	-0.73	9.6	9	-0.213	-4.8	8.04	8.6
6	0	0	250	8.64	-0.69	10.2	9.2	-0.31	-4.6	8.2	8.6
7	0	0	300	8.86	-0.76	8.7	8.3	-0.187	-4.9	7.84	8.6
8	0	0	350	8.89	-0.7	8.3	8	-0.163	-4.5	8.11	8.7
9	0	0	400	8.77	-0.72	7.6	7.2	-0.122	-4.7	8.31	8.7
10	0	0	450	9.12	-0.78	6.1	6.4	-0.092	-4.9	8.27	8.7
11	0	0	500	9.2	-0.8	6.3	5.9	-0.08	-5	8.01	8.7
12	0	0	550	9.33	-0.8	6	5.7	-0.099	-4.9	7.86	8.7
13	0	0	600	9.27	-0.87	5.9	5.3	-0.062	-5.3	8.05	8.7
14	0	0	650	9.44	-0.84	5	5	-0.071	-5.1	8.03	8.7
15	0	0	700	9.44	-0.87	4.3	4.5	-0.038	-5.3	8.05	8.7

Ecn024b

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)	Psnel (m/s)	Ptemp (Gr C.)
1	0	-250	0	7.47	-0.44	17.5	13.3	-0.323	-3.4	8	8.8
2	0	-250	50	7.46	-0.5	17.2	13.6	-0.405	-3.9	8.3	8.7
3	0	-250	100	7.64	-0.6	16.3	13.6	-0.442	-4.5	8.19	8.8
4	0	-250	150	8.04	-0.61	14.7	12.3	-0.382	-4.4	7.93	8.8
5	0	-250	200	8.23	-0.64	12.9	11.2	-0.315	-4.4	7.91	8.8
6	0	-250	250	8.38	-0.71	12.1	10.5	-0.353	-4.9	8.05	8.9
7	0	-250	300	8.28	-0.66	11.2	10.2	-0.289	-4.6	8.36	8.9
8	0	-250	350	8.6	-0.72	10.5	8.9	-0.245	-4.8	8.28	8.8
9	0	-250	400	8.86	-0.74	8.9	8.1	-0.181	-4.8	8.02	8.8
10	0	-250	450	8.92	-0.72	8.4	7.6	-0.189	-4.6	8.08	8.7
11	0	-250	500	8.96	-0.77	7.2	6.6	-0.12	-4.9	8.04	8.8
12	0	-250	550	9.06	-0.79	6.8	6.6	-0.108	-5	8.04	8.8
13	0	-250	600	9.19	-0.75	6.5	6	-0.123	-4.6	8.08	8.8
14	0	-250	650	9.41	-0.79	5.2	5.2	-0.06	-4.8	8.14	8.8
15	0	-250	700	9.4	-0.82	5.3	5.4	-0.068	-5	8.03	8.8

Ecn024c

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)	Psnel (m/s)	Ptemp (Gr C.)
1	0	-500	0	4.35	-0.16	34.7	30.3	-0.227	-2.1	8.22	8.8
2	0	-500	50	4.8	-0.38	34.3	26.7	-0.76	-4.5	8.13	8.9
3	0	-500	100	5.76	-0.68	30.5	21.8	-1.149	-6.7	7.88	9
4	0	-500	150	6.41	-0.62	26	18.3	-0.956	-5.5	8.02	9
5	0	-500	200	7.42	-0.73	18.7	14.1	-0.612	-5.6	8.09	9
6	0	-500	250	7.77	-0.66	15.9	12.5	-0.54	-4.9	7.91	9
7	0	-500	300	8.01	-0.72	13.1	11.6	-0.373	-5.2	7.95	9
8	0	-500	350	8.25	-0.67	12.4	10.3	-0.355	-4.6	7.95	9
9	0	-500	400	8.61	-0.68	10.1	9.4	-0.271	-4.5	7.99	9
10	0	-500	450	8.91	-0.74	9.2	8.1	-0.226	-4.7	7.95	9
11	0	-500	500	8.77	-0.7	8.5	7.8	-0.219	-4.6	8.14	9
12	0	-500	550	8.86	-0.74	8.4	7.2	-0.183	-4.8	8.17	9
13	0	-500	600	9.12	-0.75	6.7	6.1	-0.101	-4.7	8.06	9
14	0	-500	650	9.15	-0.78	6.3	5.9	-0.11	-4.9	8.07	9
15	0	-500	700	9.2	-0.8	5.2	5.1	-0.07	-5	8.34	9.1

Ecn025a

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)	Psnel (m/s)	Ptemp (Gr C.)
1	0	0	0	8.69	-0.54	7.3	6.2	-0.082	-3.6	7.98	9.8
2	0	0	50	8.55	-0.55	7.3	6.9	-0.111	-3.7	8.23	9.5
3	0	0	100	8.7	-0.57	6.8	6.6	-0.103	-3.7	8.06	9.3
4	0	0	150	8.77	-0.58	6.6	6.4	-0.084	-3.8	7.95	9.2
5	0	0	200	8.8	-0.64	6.7	6.8	-0.1	-4.2	8.01	9.2
6	0	0	250	8.77	-0.63	6.1	6.2	-0.08	-4.1	8.11	9.2
7	0	0	300	8.92	-0.71	6	6.2	-0.087	-4.6	8.04	9.2
8	0	0	350	8.95	-0.68	6.1	6.4	-0.104	-4.4	7.95	9.3
9	0	0	400	8.92	-0.67	6.2	6.1	-0.108	-4.3	8.03	9.3
10	0	0	450	8.93	-0.72	5.5	5.8	-0.094	-4.6	8.24	9.3
11	0	0	500	9.07	-0.76	5.6	5.6	-0.086	-4.8	8.18	9.3
12	0	0	550	9.21	-0.8	5	5	-0.057	-5	8.09	9.2
13	0	0	600	9.11	-0.77	5	5.3	-0.082	-4.8	8.18	9.2
14	0	0	650	9.21	-0.83	4.8	4.7	-0.076	-5.2	8.1	9.2
15	0	0	700	9.15	-0.78	4.7	4.8	-0.067	-4.8	8.09	9.2

Ecn025b

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)	Psnel (m/s)	Ptemp (Gr C.)
1	0	-250	0	7.92	-0.43	14.5	11.2	-0.249	-3.1	7.96	9.2
2	0	-250	50	8.06	-0.6	13.5	11.1	-0.289	-4.3	8.06	9.2
3	0	-250	100	8.22	-0.56	12.3	9.7	-0.222	-3.9	8.07	9.2
4	0	-250	150	8.43	-0.66	9.7	8.6	-0.211	-4.5	8.05	9.2
5	0	-250	200	8.57	-0.67	9.3	7.7	-0.189	-4.5	8.07	9.2
6	0	-250	250	8.71	-0.66	7.6	7.2	-0.12	-4.3	8.13	9.2
7	0	-250	300	8.82	-0.66	7.8	7.1	-0.171	-4.3	8.25	9.3
8	0	-250	350	8.91	-0.68	6.4	6.2	-0.108	-4.4	7.99	9.3
9	0	-250	400	8.88	-0.7	6.1	6	-0.094	-4.5	8.08	9.3
10	0	-250	450	9.14	-0.72	5.7	5.6	-0.081	-4.5	7.87	9.3
11	0	-250	500	8.94	-0.74	5.8	5.6	-0.07	-4.7	8.02	9.3
12	0	-250	550	9.05	-0.75	5.7	5.9	-0.103	-4.7	8.19	9.3
13	0	-250	600	9.19	-0.76	5.2	5.3	-0.072	-4.7	8.11	9.3
14	0	-250	650	9.03	-0.76	5.1	5	-0.07	-4.8	8.15	9.2
15	0	-250	700	9.16	-0.81	4.6	4.7	-0.064	-5.1	8.03	9.3

Ecn025c

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)	Psnel (m/s)	Ptemp (Gr C.)
1	0	-500	0	4.16	-0.08	34.2	29.4	-0.024	-1.1	8.03	9.4
2	0	-500	50	4.69	-0.39	33	27.2	-0.812	-4.8	8.09	9.3
3	0	-500	100	5.88	-0.6	28.6	22	-1.117	-5.8	8.14	9.4
4	0	-500	150	7.05	-0.71	22.4	15.7	-0.843	-5.7	8.08	9.4
5	0	-500	200	7.71	-0.65	16.8	13	-0.602	-4.8	8.19	9.4
6	0	-500	250	8.39	-0.69	12	9.9	-0.308	-4.7	8.01	9.4
7	0	-500	300	8.59	-0.71	9.3	7.5	-0.181	-4.7	8.2	9.4
8	0	-500	350	8.67	-0.68	7.9	6.9	-0.138	-4.5	8.05	9.4
9	0	-500	400	8.72	-0.66	7.4	6.5	-0.133	-4.3	8.18	9.4
10	0	-500	450	8.92	-0.63	6.3	6	-0.099	-4	7.98	9.4
11	0	-500	500	9.06	-0.72	5.5	5.6	-0.07	-4.6	8.04	9.4
12	0	-500	550	8.93	-0.71	5.7	5.3	-0.072	-4.6	8.12	9.4
13	0	-500	600	9.1	-0.72	4.9	5.5	-0.069	-4.5	8.13	9.4
14	0	-500	650	8.95	-0.71	5	5.4	-0.088	-4.6	8.28	9.3
15	0	-500	700	9.03	-0.74	5.1	5.2	-0.068	-4.7	8.22	9.4

Ecn026a

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)	Psnel (m/s)	Ptemp (Gr C.)
1	0	0	0	8.52	-0.45	7.1	6	-0.094	-3	8.07	9.8
2	0	0	50	8.56	-0.5	6.9	6	-0.109	-3.4	8.06	9.5
3	0	0	100	8.69	-0.52	6	6.1	-0.09	-3.4	8.05	9.4
4	0	0	150	8.78	-0.57	6.3	6.3	-0.097	-3.7	8.03	9.4
5	0	0	200	8.62	-0.54	6.6	6.1	-0.115	-3.6	8.27	9.4
6	0	0	250	8.88	-0.61	6.1	6.1	-0.1	-3.9	7.98	9.4
7	0	0	300	8.92	-0.64	6	6.3	-0.124	-4.1	8	9.3
8	0	0	350	8.7	-0.64	6	6.4	-0.102	-4.2	8.2	9.4
9	0	0	400	8.91	-0.66	5.7	6	-0.089	-4.3	8.13	9.3
10	0	0	450	8.94	-0.69	5.3	5.5	-0.096	-4.4	8.06	9.3
11	0	0	500	9	-0.74	5.5	5.4	-0.071	-4.7	8.2	9.3
12	0	0	550	9.04	-0.73	5.6	5.5	-0.076	-4.6	8.11	9.3
13	0	0	600	9.14	-0.76	4.9	4.9	-0.061	-4.7	8.15	9.3
14	0	0	650	9.1	-0.78	4.8	4.9	-0.062	-4.9	8.23	9.4
15	0	0	700	9.15	-0.78	4.5	4.8	-0.059	-4.9	8.18	9.3

Ecn026b

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)	Psnel (m/s)	Ptemp (Gr C.)
1	0	-250	0	8.44	-0.39	8.2	6.9	-0.159	-2.6	7.95	9.4
2	0	-250	50	8.44	-0.48	7.1	6.4	-0.091	-3.3	8.25	9.4
3	0	-250	100	8.58	-0.54	7.1	6.5	-0.113	-3.6	8.18	9.4
4	0	-250	150	8.57	-0.54	6.2	6.5	-0.091	-3.6	8.18	9.3
5	0	-250	200	8.75	-0.56	6.5	6.1	-0.102	-3.7	8.01	9.3
6	0	-250	250	8.81	-0.61	6.1	6.3	-0.088	-4	8.17	9.3
7	0	-250	300	8.76	-0.58	6.5	6.2	-0.112	-3.8	8.16	9.4
8	0	-250	350	8.78	-0.63	6	6.2	-0.094	-4.1	8.03	9.4
9	0	-250	400	8.85	-0.62	6.1	6.2	-0.103	-4	8.07	9.4
10	0	-250	450	8.95	-0.69	5.7	5.4	-0.083	-4.4	8.16	9.3
11	0	-250	500	8.99	-0.67	5.6	5.5	-0.102	-4.3	8.1	9.3
12	0	-250	550	8.95	-0.65	5.9	5.9	-0.114	-4.2	8.03	9.3
13	0	-250	600	9.08	-0.7	5.4	5.2	-0.082	-4.4	8.07	9.3
14	0	-250	650	9	-0.71	5.2	5.1	-0.068	-4.5	8.28	9.3
15	0	-250	700	9.07	-0.74	5.1	4.6	-0.059	-4.7	8.15	9.3

Ecn026c

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)	Psnel (m/s)	Ptemp (Gr C.)
1	0	-500	0	3.37	-0.24	26.6	24.9	-0.09	-4	8.34	9.3
2	0	-500	50	4.08	-0.29	27.2	23.7	-0.299	-4	8.06	9.3
3	0	-500	100	5.36	-0.55	29.2	25.4	-1.022	-5.8	7.96	9.3
4	0	-500	150	7.66	-0.72	19.3	15.8	-0.832	-5.4	8.13	9.4
5	0	-500	200	8.77	-0.66	8.9	8	-0.178	-4.3	7.95	9.4
6	0	-500	250	8.73	-0.62	6.7	6.3	-0.1	-4	8.11	9.4
7	0	-500	300	8.75	-0.61	6.3	6	-0.089	-4	8.18	9.3
8	0	-500	350	8.83	-0.58	6.4	6.4	-0.127	-3.8	8.13	9.4
9	0	-500	400	8.94	-0.6	5.8	5.9	-0.085	-3.9	8.02	9.4
10	0	-500	450	8.9	-0.61	5.6	5.8	-0.079	-3.9	8.1	9.4
11	0	-500	500	8.91	-0.64	6.1	6.2	-0.1	-4.1	8.12	9.4
12	0	-500	550	8.78	-0.67	5.6	5.2	-0.074	-4.3	8.27	9.4
13	0	-500	600	8.96	-0.66	5.4	5.2	-0.085	-4.2	8.25	9.4
14	0	-500	650	9.11	-0.69	5.6	5.5	-0.088	-4.4	8.14	9.4
15	0	-500	700	9.11	-0.67	5.3	5.4	-0.072	-4.2	8.08	9.4

Ecn027a

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)	Psnel (m/s)	Ptemp (Gr C.)
1	0	0	0	8.31	-0.47	6.9	6.1	-0.09	-3.2	8.21	9.5
2	0	0	50	8.47	-0.51	6.9	6.2	-0.077	-3.4	7.99	9.4
3	0	0	100	8.49	-0.54	7.2	6.5	-0.113	-3.7	7.97	9.4
4	0	0	150	8.57	-0.55	6.6	6.3	-0.127	-3.7	7.91	9.4
5	0	0	200	8.75	-0.61	6.8	6.1	-0.12	-4	7.99	9.4
6	0	0	250	8.56	-0.6	6.5	6.3	-0.117	-4	8.16	9.4
7	0	0	300	8.65	-0.63	6	6.1	-0.077	-4.1	8	9.4
8	0	0	350	8.58	-0.63	6.3	6.5	-0.113	-4.2	8.25	9.4
9	0	0	400	8.7	-0.65	6.1	5.7	-0.088	-4.2	8.09	9.4
10	0	0	450	8.84	-0.69	6.1	5.8	-0.106	-4.4	8.11	9.4
11	0	0	500	9.01	-0.71	5.7	5.7	-0.093	-4.5	7.94	9.4
12	0	0	550	9.01	-0.74	5.7	5.4	-0.068	-4.7	8.04	9.4
13	0	0	600	8.92	-0.74	5.7	5.3	-0.089	-4.7	8.22	9.4
14	0	0	650	9.11	-0.78	5.2	4.5	-0.07	-4.9	8.08	9.4
15	0	0	700	8.97	-0.74	5.1	5	-0.079	-4.7	8.1	9.3

Ecn027b

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)	Psnel (m/s)	Ptemp (Gr C.)
1	0	-250	0	8.16	-0.41	7.4	6.6	-0.118	-2.9	8.26	9.3
2	0	-250	50	8.35	-0.47	7.4	6.5	-0.117	-3.2	7.98	9.3
3	0	-250	100	8.4	-0.53	6.9	6.1	-0.094	-3.6	8.2	9.3
4	0	-250	150	8.5	-0.56	6.8	6.3	-0.097	-3.7	8.19	9.3
5	0	-250	200	8.6	-0.53	6.6	6.8	-0.115	-3.6	8	9.3
6	0	-250	250	8.54	-0.58	6.6	6.2	-0.084	-3.9	8.08	9.3
7	0	-250	300	8.74	-0.63	6	6.2	-0.103	-4.1	8.09	9.3
8	0	-250	350	8.84	-0.66	6	5.8	-0.099	-4.3	8.04	9.3
9	0	-250	400	8.78	-0.63	6	5.9	-0.098	-4.1	8.1	9.3
10	0	-250	450	8.87	-0.69	6	6.1	-0.103	-4.4	8.07	9.3
11	0	-250	500	8.77	-0.64	6.2	5.7	-0.1	-4.2	8.15	9.3
12	0	-250	550	8.92	-0.69	5.3	5.3	-0.087	-4.4	8.23	9.3
13	0	-250	600	8.95	-0.71	5.7	5.7	-0.089	-4.5	8.05	9.3
14	0	-250	650	8.9	-0.7	5.3	5.6	-0.066	-4.5	8.21	9.2
15	0	-250	700	9.09	-0.74	5	4.8	-0.072	-4.7	8	9.1

Ecn027c

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)	Psnel (m/s)	Ptemp (Gr C.)
1	0	-500	0	8.04	-0.38	7.5	6.7	-0.083	-2.7	8.22	9.2
2	0	-500	50	8.19	-0.42	7.4	6.3	-0.108	-2.9	8.16	9.2
3	0	-500	100	8.38	-0.46	6.9	6.6	-0.118	-3.2	8.1	9.2
4	0	-500	150	8.63	-0.55	6.6	6.5	-0.106	-3.7	7.91	9.2
5	0	-500	200	8.6	-0.51	6.9	6.2	-0.1	-3.4	8.08	9.2
6	0	-500	250	8.49	-0.51	6.6	6.8	-0.134	-3.4	8.13	9.2
7	0	-500	300	8.52	-0.6	6.8	6.6	-0.107	-4	8.08	9.2
8	0	-500	350	8.79	-0.58	6.2	5.9	-0.086	-3.7	8.04	9.2
9	0	-500	400	8.79	-0.62	6	6	-0.088	-4	8	9.1
10	0	-500	450	8.82	-0.65	6	6.1	-0.089	-4.2	8.15	9.1
11	0	-500	500	8.72	-0.62	6.1	6	-0.111	-4.1	8.13	9.1
12	0	-500	550	8.89	-0.67	5.7	5.5	-0.093	-4.3	8.18	9.1
13	0	-500	600	8.99	-0.66	5.3	5.1	-0.082	-4.2	8.12	9.1
14	0	-500	650	9.03	-0.71	5.4	5.4	-0.102	-4.5	8.07	9.1
15	0	-500	700	9.06	-0.74	4.8	5	-0.052	-4.6	8.02	9.1

Ecn030

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)
1	0	0	-125	8.03	-0.44	10.5	8.7	-0.183	-3.2
2	0	0	0	8.3	-0.53	10.6	9.7	-0.207	-3.7
1	0	0	125	8.64	-0.62	9.8	9.7	-0.264	-4.1
2	0	0	250	8.91	-0.81	9.7	9.3	-0.254	-5.2
1	0	0	375	9.11	-0.76	9.1	8.8	-0.279	-4.8
2	0	0	500	9.41	-0.92	8.5	8.3	-0.281	-5.6
1	0	0	600	9.68	-0.93	7.6	7.1	-0.213	-5.5
2	0	-219	-125	7.95	-0.46	10.6	8.5	-0.158	-3.3
1	0	-219	0	8.23	-0.6	10.8	9.7	-0.223	-4.2
2	0	-219	125	8.68	-0.73	10.2	9.9	-0.34	-4.8
1	0	-219	250	8.89	-0.77	9.8	9.5	-0.286	-5
2	0	-219	375	9.2	-0.81	9.4	8.9	-0.365	-5
1	0	-219	500	9.45	-0.91	7.7	7.7	-0.201	-5.5
2	0	-219	600	9.52	-0.9	8.2	7.9	-0.25	-5.4
1	0	-437	-125	7.98	-0.47	10.3	8.7	-0.19	-3.4
2	0	-437	0	8.38	-0.67	10.1	9.2	-0.208	-4.6
1	0	-437	125	8.52	-0.72	9.7	9.6	-0.252	-4.8
2	0	-437	250	8.8	-0.76	10.3	9.4	-0.347	-4.9
1	0	-437	375	9.17	-0.79	9.9	9.3	-0.335	-5
2	0	-437	500	9.56	-0.88	8	8	-0.251	-5.3
1	0	-437	600	9.69	-0.94	7.2	6.9	-0.18	-5.5
2	3000	0	-125	8.38	-0.5	9.9	7.5	-0.172	-3.4
1	3000	0	0	8.63	-0.58	9.1	8.2	-0.224	-3.8
2	3000	0	125	8.97	-0.72	8.2	8.1	-0.2	-4.6
1	3000	0	250	9.1	-0.79	8.1	8.1	-0.19	-4.9
2	3000	0	375	9.26	-0.87	8.4	7.9	-0.259	-5.4
1	3000	0	500	9.5	-0.97	7.6	6.9	-0.182	-5.8
2	3000	0	600	9.74	-1.03	6.9	6.6	-0.178	-6
1	3000	-437	-125	8.36	-0.53	8.9	7.3	-0.143	-3.6
2	3000	-437	0	8.55	-0.59	9.3	8.5	-0.232	-4
1	3000	-437	125	8.79	-0.65	8.2	8.7	-0.205	-4.2
2	3000	-437	250	9.16	-0.85	8.3	7.9	-0.206	-5.3

Ecn 030 continued									
1	3000	-437	375	9.36	-0.87	8.5	8.3	-0.279	-5.3
2	3000	-437	500	9.56	-0.94	7.3	7.1	-0.185	-5.6
1	6000	0	-125	8.44	-0.58	8.4	6.5	-0.136	-3.9
2	6000	0	0	8.83	-0.69	8.3	7.4	-0.193	-4.5
1	6000	0	125	9.1	-0.78	8.1	7.4	-0.214	-4.9
2	6000	0	250	9.38	-0.91	6.9	7.1	-0.155	-5.5
1	6000	0	375	9.4	-0.92	7.7	7	-0.223	-5.6
2	6000	0	500	9.69	-1.01	6.7	6.4	-0.177	-5.9
1	6000	0	600	9.73	-1	6.3	6.3	-0.154	-5.8
2	6000	-437	-125	8.37	-0.51	8.6	6.3	-0.136	-3.5
1	6000	-437	0	8.76	-0.59	8.1	7.1	-0.152	-3.9
2	6000	-437	125	9	-0.72	8	7.9	-0.213	-4.6
1	6000	-437	250	9.16	-0.78	7.5	7.7	-0.199	-4.8
2	6000	-437	375	9.41	-0.84	7.4	7	-0.202	-5.1
1	6000	-437	500	9.52	-0.93	7.2	7.1	-0.192	-5.6
2	6000	-437	600	9.75	-1.03	6.3	6.1	-0.145	-6
1	8500	0	-125	8.63	-0.54	8.3	5.9	-0.145	-3.6
2	8500	0	0	8.92	-0.62	7.9	6.6	-0.166	-4
1	8500	0	125	9.19	-0.73	7.3	6.7	-0.151	-4.6
2	8500	0	250	9.3	-0.78	7.3	6.8	-0.167	-4.8
1	8500	0	375	9.51	-0.9	6.9	6.5	-0.162	-5.4
2	8500	0	500	9.67	-0.92	6.7	6.3	-0.164	-5.4
1	8500	0	600	9.8	-0.97	6.4	5.8	-0.126	-5.6
2	8500	-437	-125	8.47	-0.47	8.1	6.3	-0.126	-3.2
1	8500	-437	0	8.8	-0.59	7.7	7	-0.145	-3.8
2	8500	-437	125	9.16	-0.7	7.5	7	-0.181	-4.4
1	8500	-437	250	9.2	-0.73	7.3	6.9	-0.163	-4.5
2	8500	-437	375	9.51	-0.87	6.5	6.5	-0.147	-5.3
1	8500	-437	500	9.66	-0.95	6.4	6	-0.141	-5.6
2	8500	-437	600	9.71	-0.91	6.9	6.3	-0.159	-5.4
1	0	-437	600	9.73	-0.97	7	7.2	-0.182	-5.7
2	0	-219	600	9.77	-1	7.3	7.2	-0.202	-5.8
1	0	0	600	9.68	-1.03	7.4	7.7	-0.233	-6
2	0	0	600	9.78	-1.05	7	7.2	-0.201	-6.1

Ecn031

NR	X (mm)	Y (mm)	Z (mm)	Ux (m/s)	Uz (m/s)	Ix (%)	Iz (%)	SSTR	Hoek (Gr)
1	0	0	-125	8.39	-0.58	8.7	6.9	-0.114	-3.9
2	0	0	0	8.97	-0.7	8.3	7.4	-0.143	-4.4
1	0	0	125	9.02	-0.82	8.4	7.8	-0.195	-5.2
2	0	0	375	9.44	-0.96	7.4	7	-0.201	-5.8
1	0	0	600	9.67	-1.01	6.5	6.1	-0.14	-6
2	3000	0	-125	8.56	-0.55	8.3	6.2	-0.118	-3.7
1	3000	0	0	9.09	-0.68	7.2	6.5	-0.141	-4.3
2	3000	0	125	9.28	-0.76	6.9	6.8	-0.121	-4.7
1	3000	0	375	9.55	-0.91	6.4	5.8	-0.117	-5.5
2	3000	0	600	9.67	-0.96	5.5	5.2	-0.105	-5.7
1	6000	0	-125	8.75	-0.59	7.7	5.7	-0.13	-3.9
2	6000	0	0	8.9	-0.65	6.8	5.8	-0.106	-4.2
1	6000	0	125	9.18	-0.76	6.5	6.3	-0.123	-4.7
2	6000	0	375	9.51	-0.93	5.8	5.7	-0.096	-5.6
1	6000	0	600	9.85	-1.03	5	5	-0.088	-6
2	8500	0	-125	8.78	-0.52	7.3	5.3	-0.113	-3.4
1	8500	0	-125	9.01	-0.59	6.3	5.7	-0.103	-3.8
2	8500	0	0	9.29	-0.74	6.1	6	-0.11	-4.6
1	8500	0	375	9.6	-0.9	5.2	5.2	-0.098	-5.3
2	8500	0	600	9.76	-0.96	4.8	4.8	-0.08	-5.6
1	0	0	600	9.66	-1.02	5.9	5.7	-0.1	-6
2	0	0	600	9.64	-1.02	5.9	5.8	-0.115	-6.1

Characteristic averages from the scl-files.

The bold names in the left upper corners of the tables refer to the original scl-files. Further the tables are built up as explained in appendix C. The source file of all the tables is: tunnelmetingen mei en november.xls.

alles 0 ex rij 78	bin [s] 60 90																							
tunnel wind [V]:	0.005																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	0.788	0.486	0.531	0.537	0.531	0.556	0.000	0.000	0.854	0.527	0.560	0.486	0.494	0.509	0.000	0.000	0.860	0.481	0.542	0.517	0.517	0.515	0.000	0.000
strain gauge [V]:	2.955	1.778	2.045	1.869	0.018	1.922																		
wind [m/s]:	7.04	5.68	5.90	5.92	5.90	6.01	1.89	1.90	7.32	5.88	6.03	5.68	5.71	5.79	1.90	1.90	7.34	5.65	5.95	5.83	5.83	5.82	1.90	1.89
fax [N]:	1.38	0.89	0.96	0.97	0.96	1.00	0.03	0.03	1.50	0.95	1.01	0.89	0.90	0.93	0.03	0.03	1.51	0.88	0.98	0.94	0.94	0.94	0.03	0.03
torque [mNm]:	8.75	5.49	5.97	6.04	5.98	6.24	0.24	0.24	9.46	5.93	6.29	5.49	5.57	5.74	0.24	0.24	9.53	5.43	6.09	5.83	5.82	5.81	0.24	0.24
speed [rpm]:	2817	1955	2083	2100	2085	2155	568	568	3005	2072	2167	1955	1977	2022	568	568	3022	1940	2115	2044	2043	2039	568	567
Fax meas [N]:	1.41	0.85	0.98	0.89	0.01	0.92																		
speed meas [rpm]:																								
Ct [-]:	0.95	0.94	0.94	0.94	0.94	0.94	0.32	0.33	0.95	0.94	0.94	0.94	0.94	0.94	0.33	0.33	0.95	0.94	0.94	0.94	0.94	0.94	0.33	0.32
a [-]:	0.38	0.37	0.38	0.38	0.38	0.38	0.09	0.09	0.39	0.38	0.38	0.37	0.37	0.37	0.09	0.09	0.39	0.37	0.38	0.38	0.38	0.37	0.09	0.09
Lambda [-]:	5.19	4.47	4.59	4.60	4.59	4.65	3.89	3.89	5.33	4.58	4.67	4.47	4.49	4.53	3.89	3.89	5.34	4.46	4.62	4.55	4.55	4.55	3.89	3.89
P = QxN [W]:	2.58	1.12	1.30	1.33	1.30	1.41	0.01	0.01	2.98	1.29	1.43	1.12	1.15	1.22	0.01	0.01	3.01	1.10	1.35	1.25	1.25	1.24	0.01	0.01
P with Ct [W]:	6.00	3.16	3.54	3.59	3.54	3.74	0.06	0.06	6.72	3.51	3.78	3.16	3.22	3.35	0.06	0.06	6.79	3.12	3.63	3.42	3.42	3.40	0.06	0.06
Cp real [-]:	0.25	0.21	0.22	0.22	0.22	0.22	0.07	0.07	0.26	0.22	0.22	0.21	0.21	0.21	0.07	0.07	0.26	0.21	0.22	0.21	0.21	0.21	0.07	0.07
Cp with Ct [-]:	0.58	0.59	0.59	0.59	0.59	0.59	0.30	0.30	0.58	0.59	0.58	0.59	0.59	0.59	0.30	0.30	0.58	0.59	0.59	0.59	0.59	0.59	0.30	0.29

alles 0 ex rij 78	bin [s] 140 170																							
tunnel wind [V]:	0.005																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	1.031	0.631	0.660	0.694	0.702	0.749	0.000	0.000	1.086	0.690	0.737	0.650	0.657	0.686	0.000	0.000	1.105	0.662	0.708	0.684	0.685	0.624	0.000	0.000
strain gauge [V]:	3.928	2.331	2.697	2.444	0.022	2.571																		
wind [m/s]:	8.08	6.35	6.48	6.63	6.67	6.88	1.89	1.90	8.35	6.61	6.82	6.43	6.46	6.59	1.90	1.90	8.44	6.48	6.69	6.59	6.59	6.32	1.90	1.89
fax [N]:	1.82	1.12	1.17	1.23	1.24	1.31	0.03	0.03	1.95	1.22	1.30	1.15	1.16	1.21	0.03	0.03	1.99	1.17	1.25	1.21	1.21	1.11	0.03	0.03
torque [mNm]:	11.37	7.05	7.36	7.74	7.82	8.33	0.24	0.24	11.97	7.69	8.20	7.26	7.33	7.65	0.24	0.24	12.18	7.38	7.88	7.63	7.64	6.98	0.24	0.24
speed [rpm]:	3510	2369	2451	2549	2572	2706	568	568	3668	2537	2672	2423	2443	2526	568	568	3722	2456	2588	2521	2524	2350	568	568
Fax meas [N]:	1.87	1.11	1.29	1.17	0.01	1.23																		
speed meas [rpm]:																								
Ct [-]:	0.95	0.95	0.95	0.95	0.95	0.94	0.32	0.33	0.95	0.95	0.94	0.95	0.95	0.95	0.33	0.33	0.95	0.95	0.95	0.95	0.95	0.95	0.33	0.33
a [-]:	0.38	0.38	0.38	0.38	0.38	0.38	0.09	0.09	0.39	0.38	0.38	0.38	0.38	0.38	0.09	0.09	0.39	0.38	0.38	0.38	0.38	0.38	0.09	0.09
Lambda [-]:	5.64	4.85	4.91	4.99	5.01	5.11	3.89	3.89	5.70	4.98	5.08	4.89	4.91	4.97	3.89	3.89	5.73	4.92	5.02	4.97	4.97	4.83	3.89	3.89
P = QxN [W]:	4.18	1.75	1.89	2.07	2.11	2.36	0.01	0.01	4.60	2.04	2.30	1.84	1.88	2.02	0.01	0.01	4.75	1.90	2.14	2.02	2.02	1.72	0.01	0.01
P with Ct [W]:	9.07	4.39	4.66	5.01	5.09	5.60	0.06	0.06	9.99	4.97	5.47	4.57	4.64	4.93	0.06	0.06	10.32	4.68	5.15	4.91	4.92	4.33	0.06	0.06
Cp real [-]:	0.27	0.23	0.24	0.24	0.24	0.25	0.07	0.07	0.27	0.24	0.25	0.23	0.24	0.24	0.07	0.07	0.27	0.24	0.24	0.24	0.24	0.23	0.07	0.07
Cp with Ct [-]:	0.58	0.58	0.58	0.58	0.58	0.58	0.30	0.30	0.58	0.58	0.58	0.58	0.58	0.58	0.30	0.30	0.58	0.58	0.58	0.58	0.58	0.58	0.30	0.30

alles 0 ex rij 78	bin [s] 240 270																							
tunnel wind [V]:	0.005																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	1.226	0.802	0.791	0.839	0.841	0.884	0.000	0.000	1.294	0.833	0.899	0.801	0.787	0.816	0.000	0.000	1.275	0.820	0.877	0.845	0.826	0.801	0.000	0.000
strain gauge [V]:	4.857	2.962	3.335	2.989	0.026	3.094																		
wind [m/s]:	9.02	7.10	7.06	7.25	7.27	7.44	1.89	1.90	9.36	7.23	7.51	7.10	7.04	7.16	1.90	1.90	9.27	7.18	7.42	7.28	7.20	7.10	1.90	1.89
fax [N]:	2.26	1.41	1.39	1.47	1.47	1.55	0.03	0.03	2.42	1.46	1.58	1.40	1.38	1.43	0.03	0.03	2.38	1.44	1.54	1.48	1.45	1.40	0.03	0.03
torque [mNm]:	13.48	8.90	8.79	9.30	9.32	9.78	0.24	0.24	14.22	9.24	9.95	8.89	8.74	9.05	0.24	0.24	14.01	9.09	9.71	9.36	9.16	8.89	0.24	0.24
speed [rpm]:	4067	2856	2827	2962	2969	3090	568	568	4263	2947	3134	2854	2814	2896	568	568	4207	2908	3071	2979	2926	2855	568	567
Fax meas [N]:	2.32	1.41	1.59	1.43	0.01	1.48																		
speed meas [rpm]:																								
Ct [-]:	0.94	0.95	0.95	0.95	0.95	0.95	0.32	0.33	0.94	0.95	0.95	0.95	0.95	0.95	0.33	0.33	0.94	0.95	0.95	0.95	0.95	0.95	0.33	0.32
a [-]:	0.38	0.38	0.38	0.39	0.39	0.39	0.09	0.09	0.37	0.39	0.39	0.38	0.38	0.39	0.09	0.09	0.38	0.39	0.39	0.39	0.39	0.38	0.09	0.09
Lambda [-]:	5.85	5.22	5.20	5.30	5.31	5.39	3.89	3.89	5.91	5.29	5.42	5.22	5.19	5.25	3.89	3.89	5.90	5.26	5.38	5.31	5.28	5.22	3.89	3.89
P = QxN [W]:	5.74	2.66	2.60	2.88	2.90	3.17	0.01	0.01	6.35	2.85	3.26	2.66	2.57	2.75	0.01	0.01	6.17	2.77	3.12	2.92	2.81	2.66	0.01	0.01
P with Ct [W]:	12.65	6.14	6.03	6.55	6.58	7.07	0.06	0.06	14.17	6.49	7.26	6.13	5.98	6.30	0.06	0.06	13.73	6.34	6.99	6.62	6.41	6.14	0.06	0.06
Cp real [-]:	0.27	0.25	0.25	0.26	0.26	0.26	0.07	0.07	0.26	0.26	0.26	0.25	0.25	0.25	0.07	0.07	0.26	0.25	0.26	0.26	0.26	0.25	0.07	0.07
Cp with Ct [-]:	0.58	0.58	0.58	0.58	0.58	0.58	0.30	0.30	0.59	0.58	0.58	0.58	0.58	0.58	0.30	0.30	0.59	0.58	0.58	0.58	0.58	0.58	0.30	0.29

alles 0 ex rij 8		bin [s] 60 90																							
tunnel wind [V]:	0.005																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
Ugen [V]:	0.790	0.479	0.494	0.523	0.516	0.536	0.523	0.000	0.851	0.525	0.563	0.486	0.498	0.515	0.480	0.000	0.852	0.463	0.526	0.509	0.508	0.499	0.496	-0.001	
strain gauge [V]:	2.963	1.766	2.061	1.835	0.020	1.841																			
wind [m/s]:	7.05	5.64	5.71	5.86	5.82	5.92	5.86	1.89	7.31	5.87	6.04	5.68	5.74	5.82	5.65	1.90	7.31	5.57	5.87	5.79	5.78	5.74	5.73	1.89	
fax [N]:	1.39	0.88	0.90	0.95	0.94	0.97	0.95	0.03	1.49	0.95	1.01	0.89	0.91	0.93	0.88	0.03	1.49	0.85	0.95	0.92	0.92	0.91	0.90	0.03	
torque [mNm]:	8.77	5.41	5.57	5.88	5.81	6.03	5.89	0.24	9.43	5.91	6.32	5.49	5.62	5.80	5.42	0.24	9.44	5.24	5.92	5.73	5.72	5.63	5.60	0.23	
speed [rpm]:	2823	1935	1977	2059	2041	2099	2061	567	2998	2066	2176	1955	1990	2037	1937	568	3001	1891	2070	2019	2017	1992	1984	566	
Fax meas [N]:	1.41	0.84	0.98	0.88	0.01	0.88																			
speed meas [rpm]:																									
Ct [-]:	0.95	0.94	0.94	0.94	0.94	0.94	0.94	0.32	0.95	0.94	0.94	0.94	0.94	0.94	0.94	0.33	0.95	0.93	0.94	0.94	0.94	0.94	0.94	0.32	
a [-]:	0.38	0.37	0.37	0.38	0.37	0.38	0.38	0.09	0.39	0.38	0.38	0.37	0.37	0.37	0.37	0.09	0.39	0.37	0.38	0.37	0.37	0.37	0.37	0.09	
Lambda [-]:	5.20	4.45	4.49	4.57	4.55	4.60	4.57	3.89	5.33	4.57	4.67	4.47	4.50	4.55	4.46	3.89	5.33	4.41	4.58	4.53	4.53	4.51	4.50	3.89	
P = QxN [W]:	2.59	1.10	1.15	1.27	1.24	1.33	1.27	0.01	2.96	1.28	1.44	1.12	1.17	1.24	1.10	0.01	2.97	1.04	1.28	1.21	1.21	1.17	1.16	0.01	
P with Ct [W]:	6.02	3.10	3.22	3.47	3.41	3.59	3.47	0.06	6.69	3.49	3.80	3.16	3.26	3.40	3.11	0.06	6.70	2.98	3.50	3.35	3.34	3.26	3.24	0.06	
Cp real [-]:	0.25	0.21	0.21	0.21	0.21	0.22	0.21	0.07	0.26	0.21	0.22	0.21	0.21	0.21	0.21	0.07	0.26	0.20	0.22	0.21	0.21	0.21	0.21	0.07	
Cp with Ct [-]:	0.58	0.59	0.59	0.59	0.59	0.59	0.59	0.29	0.58	0.59	0.58	0.59	0.59	0.59	0.59	0.30	0.58	0.59	0.59	0.59	0.59	0.59	0.59	0.29	

alles 0 ex rij 8	bin [s] 140 170																							
tunnel wind [V]:	0.005																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	1.024	0.631	0.638	0.684	0.687	0.713	0.672	-0.001	1.093	0.686	0.739	0.632	0.641	0.670	0.632	0.000	1.067	0.636	0.684	0.658	0.675	0.601	0.644	-0.001
strain gauge [V]:	3.902	2.319	2.688	2.419	0.027	2.452																		
wind [m/s]:	8.05	6.35	6.38	6.58	6.60	6.71	6.53	1.89	8.38	6.60	6.83	6.35	6.39	6.52	6.35	1.90	8.26	6.37	6.59	6.47	6.54	6.21	6.41	1.89
fax [N]:	1.81	1.12	1.13	1.21	1.21	1.26	1.19	0.03	1.96	1.21	1.30	1.12	1.14	1.19	1.12	0.03	1.90	1.13	1.21	1.17	1.19	1.07	1.14	0.03
torque [mNm]:	11.30	7.05	7.13	7.62	7.66	7.94	7.50	0.23	12.05	7.65	8.22	7.07	7.16	7.48	7.06	0.24	11.76	7.10	7.63	7.35	7.53	6.73	7.20	0.23
speed [rpm]:	3491	2368	2388	2520	2530	2602	2487	566	3688	2526	2677	2372	2396	2481	2372	568	3612	2382	2521	2446	2494	2283	2406	566
Fax meas [N]:	1.86	1.11	1.28	1.15	0.01	1.17																		
speed meas [rpm]:																								
Ct [-]:	0.95	0.95	0.95	0.95	0.95	0.94	0.95	0.32	0.95	0.95	0.94	0.95	0.95	0.95	0.95	0.33	0.95	0.95	0.95	0.95	0.95	0.94	0.95	0.32
a [-]:	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.09	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.09	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.09
Lambda [-]:	5.63	4.85	4.86	4.97	4.98	5.03	4.94	3.89	5.71	4.97	5.09	4.85	4.87	4.94	4.85	3.89	5.68	4.86	4.97	4.91	4.95	4.77	4.88	3.89
P = QxN [W]:	4.13	1.75	1.78	2.01	2.03	2.16	1.95	0.01	4.65	2.02	2.30	1.76	1.80	1.94	1.75	0.01	4.45	1.77	2.01	1.88	1.97	1.61	1.81	0.01
P with Ct [W]:	8.96	4.39	4.46	4.90	4.94	5.20	4.79	0.06	10.11	4.93	5.49	4.41	4.48	4.77	4.40	0.06	9.65	4.44	4.91	4.65	4.81	4.12	4.52	0.06
Cp real [-]:	0.27	0.23	0.23	0.24	0.24	0.24	0.24	0.07	0.27	0.24	0.25	0.23	0.23	0.24	0.23	0.07	0.27	0.23	0.24	0.24	0.24	0.23	0.23	0.07
Cp with Ct [-]:	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.29	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.30	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.29

alles 0 ex rij 8	bin [s] 240 270																							
tunnel wind [V]:	0.005																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	1.194	0.801	0.785	0.838	0.844	0.851	0.819	0.000	1.294	0.827	0.895	0.805	0.799	0.828	0.799	0.000	1.264	0.807	0.853	0.833	0.836	0.820	0.821	-0.001
strain gauge [V]:	4.664	2.916	3.276	2.954	0.032	2.966																		
wind [m/s]:	8.87	7.10	7.03	7.25	7.28	7.31	7.17	1.89	9.36	7.21	7.49	7.11	7.09	7.21	7.09	1.90	9.21	7.12	7.32	7.23	7.24	7.18	7.18	1.89
fax [N]:	2.19	1.40	1.38	1.47	1.48	1.49	1.44	0.03	2.42	1.45	1.57	1.41	1.40	1.45	1.40	0.03	2.35	1.41	1.50	1.46	1.47	1.44	1.44	0.03
torque [mNm]:	13.13	8.89	8.72	9.29	9.36	9.43	9.08	0.24	14.21	9.17	9.90	8.94	8.87	9.18	8.87	0.24	13.89	8.96	9.45	9.24	9.27	9.10	9.10	0.23
speed [rpm]:	3976	2854	2808	2960	2978	2996	2905	567	4261	2928	3122	2866	2848	2930	2848	568	4176	2871	3003	2945	2955	2908	2910	566
Fax meas [N]:	2.22	1.39	1.56	1.41	0.02	1.41																		
speed meas [rpm]:																								
Ct [-]:	0.94	0.95	0.95	0.95	0.95	0.95	0.95	0.32	0.94	0.95	0.95	0.95	0.95	0.95	0.95	0.33	0.94	0.95	0.95	0.95	0.95	0.95	0.95	0.32
a [-]:	0.38	0.38	0.38	0.39	0.39	0.39	0.39	0.09	0.37	0.39	0.39	0.38	0.38	0.39	0.38	0.09	0.38	0.38	0.39	0.39	0.39	0.39	0.39	0.09
Lambda [-]:	5.82	5.22	5.19	5.30	5.31	5.33	5.26	3.89	5.91	5.28	5.41	5.23	5.22	5.28	5.22	3.89	5.89	5.24	5.33	5.29	5.30	5.26	5.26	3.89
P = QxN [W]:	5.47	2.66	2.56	2.88	2.92	2.96	2.76	0.01	6.34	2.81	3.24	2.68	2.64	2.82	2.65	0.01	6.08	2.69	2.97	2.85	2.87	2.77	2.77	0.01
P with Ct [W]:	12.00	6.14	5.96	6.54	6.61	6.69	6.33	0.06	14.15	6.42	7.21	6.18	6.11	6.42	6.11	0.06	13.48	6.20	6.71	6.48	6.52	6.34	6.35	0.06
Cp real [-]:	0.27	0.25	0.25	0.26	0.26	0.26	0.25	0.07	0.26	0.26	0.26	0.25	0.25	0.26	0.25	0.07	0.26	0.25	0.26	0.26	0.26	0.25	0.25	0.07
Cp with Ct [-]:	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.29	0.59	0.58	0.58	0.58	0.58	0.58	0.58	0.30	0.59	0.58	0.58	0.58	0.58	0.58	0.58	0.29

alles 0 ex turbine 13	bin [s] 70 100																							
tunnel wind [V]:	0.005																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	0.786	0.488	0.486	0.527	0.512	0.528	0.521	0.691	0.856	0.520	0.566	0.498	0.000	0.641	0.455	0.627	0.830	0.462	0.527	0.500	0.487	0.490	0.493	0.550
strain gauge [V]:	2.982	1.808	2.112	1.847	0.019	1.825																		
wind [m/s]:	7.03	5.69	5.68	5.88	5.80	5.88	5.85	6.62	7.33	5.84	6.06	5.74	1.89	6.39	5.52	6.33	7.22	5.56	5.88	5.74	5.68	5.69	5.71	5.98
fax [N]:	1.38	0.89	0.89	0.95	0.93	0.96	0.94	1.22	1.50	0.94	1.02	0.91	0.03	1.14	0.84	1.12	1.45	0.85	0.95	0.91	0.89	0.89	0.90	0.99
torque [mNm]:	8.73	5.51	5.49	5.93	5.77	5.94	5.87	7.70	9.48	5.86	6.35	5.62	0.24	7.16	5.15	7.01	9.20	5.23	5.93	5.64	5.50	5.53	5.56	6.18
speed [rpm]:	2812	1961	1955	2072	2029	2075	2055	2540	3011	2053	2183	1989	568	2398	1866	2357	2936	1888	2071	1994	1958	1966	1975	2137
Fax meas [N]:	1.42	0.86	1.01	0.88	0.01	0.87																		
speed meas [rpm]:																								
Ct [-]:	0.95	0.94	0.94	0.94	0.94	0.94	0.94	0.95	0.95	0.94	0.94	0.94	0.33	0.95	0.93	0.95	0.95	0.93	0.94	0.94	0.94	0.94	0.94	0.94
a [-]:	0.38	0.37	0.37	0.38	0.37	0.38	0.38	0.38	0.39	0.38	0.38	0.37	0.09	0.38	0.37	0.38	0.39	0.37	0.38	0.37	0.37	0.37	0.37	0.38
Lambda [-]:	5.19	4.48	4.47	4.58	4.54	4.58	4.56	4.98	5.34	4.56	4.68	4.50	3.89	4.87	4.39	4.84	5.28	4.41	4.58	4.51	4.48	4.48	4.49	4.64
P = QxN [W]:	2.57	1.13	1.12	1.29	1.23	1.29	1.26	2.05	2.99	1.26	1.45	1.17	0.01	1.80	1.01	1.73	2.83	1.03	1.29	1.18	1.13	1.14	1.15	1.38
P with Ct [W]:	5.98	3.18	3.16	3.51	3.37	3.51	3.45	4.98	6.75	3.45	3.82	3.26	0.06	4.49	2.91	4.35	6.45	2.97	3.50	3.27	3.17	3.19	3.22	3.69
Cp real [-]:	0.25	0.21	0.21	0.22	0.21	0.22	0.21	0.24	0.26	0.21	0.22	0.21	0.07	0.23	0.20	0.23	0.26	0.20	0.22	0.21	0.21	0.21	0.21	0.22
Cp with Ct [-]:	0.58	0.59	0.59	0.59	0.59	0.59	0.59	0.58	0.58	0.59	0.58	0.59	0.30	0.58	0.59	0.58	0.58	0.59	0.59	0.59	0.59	0.59	0.59	0.59

alles 0 ex turbine 13	bin [s] 140 170																							
tunnel wind [V]:	0.005																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	1.019	0.626	0.619	0.685	0.673	0.706	0.667	0.911	1.071	0.672	0.716	0.631	0.000	0.811	0.597	0.819	1.076	0.648	0.697	0.674	0.680	0.639	0.671	0.829
strain gauge [V]:	3.873	2.324	2.689	2.417	0.028	2.431																		
wind [m/s]:	8.03	6.33	6.30	6.59	6.54	6.69	6.51	7.56	8.28	6.53	6.73	6.35	1.90	7.14	6.19	7.17	8.30	6.42	6.64	6.54	6.57	6.38	6.53	7.21
fax [N]:	1.80	1.11	1.10	1.21	1.19	1.24	1.18	1.60	1.91	1.19	1.26	1.12	0.03	1.42	1.07	1.44	1.92	1.15	1.23	1.19	1.20	1.14	1.19	1.45
torque [mNm]:	11.25	7.00	6.93	7.64	7.51	7.87	7.44	10.08	11.81	7.50	7.97	7.05	0.24	9.00	6.69	9.08	11.87	7.24	7.77	7.52	7.58	7.14	7.49	9.19
speed [rpm]:	3478	2355	2335	2524	2490	2584	2471	3167	3624	2486	2611	2368	568	2883	2271	2905	3640	2417	2558	2493	2509	2392	2484	2933
Fax meas [N]:	1.85	1.11	1.28	1.15	0.01	1.16																		
speed meas [rpm]:																								
Ct [-]:	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.94	0.95	0.33	0.95	0.94	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
a [-]:	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.39	0.39	0.38	0.38	0.38	0.09	0.38	0.38	0.39	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.39
Lambda [-]:	5.63	4.83	4.82	4.97	4.95	5.02	4.93	5.44	5.69	4.94	5.04	4.85	3.89	5.24	4.76	5.26	5.69	4.89	5.00	4.95	4.96	4.87	4.94	5.28
P = QxN [W]:	4.10	1.73	1.69	2.02	1.96	2.13	1.93	3.34	4.48	1.95	2.18	1.75	0.01	2.72	1.59	2.76	4.52	1.83	2.08	1.96	1.99	1.79	1.95	2.82
P with Ct [W]:	8.89	4.35	4.29	4.92	4.80	5.14	4.73	7.41	9.73	4.78	5.24	4.39	0.06	6.24	4.09	6.33	9.82	4.55	5.04	4.81	4.87	4.47	4.78	6.44
Cp real [-]:	0.27	0.23	0.23	0.24	0.24	0.24	0.24	0.26	0.27	0.24	0.24	0.23	0.07	0.25	0.23	0.25	0.27	0.23	0.24	0.24	0.24	0.23	0.24	0.26
Cp with Ct [-]:	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.30	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58

alles 0 ex turbine 13	bin [s] 230 260																							
tunnel wind [V]:	0.005																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	1.227	0.801	0.772	0.853	0.855	0.884	0.847	1.090	1.292	0.838	0.905	0.810	0.000	0.998	0.769	1.020	1.263	0.800	0.849	0.827	0.828	0.801	0.816	0.987
strain gauge [V]:	4.832	2.932	3.318	3.016	0.031	3.094																		
wind [m/s]:	9.03	7.10	6.97	7.31	7.32	7.44	7.29	8.37	9.35	7.25	7.53	7.13	1.90	7.92	6.96	8.03	9.21	7.09	7.30	7.21	7.21	7.10	7.16	7.88
fax [N]:	2.27	1.40	1.35	1.49	1.50	1.55	1.48	1.96	2.41	1.47	1.59	1.42	0.03	1.75	1.35	1.80	2.35	1.40	1.49	1.45	1.45	1.40	1.43	1.73
torque [mNm]:	13.49	8.89	8.58	9.45	9.47	9.78	9.38	12.01	14.20	9.29	10.01	8.99	0.24	11.02	8.54	11.26	13.88	8.88	9.41	9.17	9.18	8.89	9.05	10.90
speed [rpm]:	4070	2854	2772	3002	3007	3091	2985	3679	4256	2960	3151	2880	568	3416	2762	3480	4172	2851	2991	2928	2931	2855	2897	3384
Fax meas [N]:	2.30	1.40	1.58	1.44	0.01	1.48																		
speed meas [rpm]:																								
Ct [-]:	0.94	0.95	0.94	0.95	0.95	0.95	0.95	0.95	0.94	0.95	0.95	0.95	0.33	0.94	0.94	0.95	0.94	0.95	0.95	0.95	0.95	0.95	0.95	0.94
a [-]:	0.38	0.38	0.38	0.39	0.39	0.39	0.39	0.39	0.37	0.39	0.39	0.38	0.09	0.38	0.38	0.38	0.38	0.38	0.39	0.39	0.39	0.38	0.39	0.38
Lambda [-]:	5.85	5.22	5.16	5.33	5.33	5.39	5.32	5.71	5.91	5.30	5.43	5.24	3.89	5.60	5.15	5.63	5.89	5.22	5.32	5.28	5.28	5.22	5.25	5.58
P = QxN [W]:	5.75	2.66	2.49	2.97	2.98	3.17	2.93	4.63	6.33	2.88	3.30	2.71	0.01	3.94	2.47	4.10	6.06	2.65	2.95	2.81	2.82	2.66	2.75	3.86
P with Ct [W]:	12.67	6.13	5.83	6.71	6.73	7.08	6.64	10.05	14.12	6.54	7.33	6.23	0.06	8.56	5.80	8.90	13.45	6.12	6.67	6.42	6.43	6.14	6.30	8.40
Cp real [-]:	0.27	0.25	0.25	0.26	0.26	0.26	0.26	0.27	0.26	0.26	0.26	0.25	0.07	0.27	0.25	0.27	0.26	0.25	0.26	0.26	0.26	0.25	0.25	0.27
Cp with Ct [-]:	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.59	0.58	0.58	0.58	0.30	0.58	0.58	0.58	0.59	0.58	0.58	0.58	0.58	0.58	0.58	0.58

alles 0 ex turbine 2		bin [s] 80 100																							
tunnel wind [V]:	0.005																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
Ugen [V]:	0.786	0.000	0.575	0.510	0.528	0.545	0.533	0.707	0.852	0.508	0.552	0.480	0.490	0.499	0.467	0.620	0.845	0.469	0.533	0.521	0.521	0.511	0.510	0.602	
strain gauge [V]:	2.958	0.070	2.575	1.797	0.022	1.874																			
wind [m/s]:	7.03	1.90	6.10	5.80	5.88	5.96	5.91	6.69	7.31	5.79	5.99	5.65	5.70	5.74	5.58	6.30	7.28	5.59	5.90	5.85	5.85	5.80	5.79	6.22	
fax [N]:	1.38	0.03	1.03	0.93	0.96	0.98	0.96	1.25	1.49	0.92	1.00	0.88	0.89	0.91	0.86	1.10	1.48	0.86	0.96	0.95	0.95	0.93	0.93	1.08	
torque [mNm]:	8.73	0.24	6.45	5.75	5.95	6.13	5.99	7.88	9.44	5.73	6.20	5.42	5.53	5.63	5.28	6.93	9.36	5.31	5.99	5.87	5.87	5.76	5.75	6.74	
speed [rpm]:	2811	568	2209	2025	2076	2125	2088	2587	3000	2019	2144	1937	1966	1993	1901	2336	2979	1907	2088	2056	2056	2027	2024	2286	
Fax meas [N]:	1.41	0.03	1.23	0.86	0.01	0.89																			
speed meas [rpm]:																									
Ct [-]:	0.95	0.33	0.94	0.94	0.94	0.94	0.94	0.95	0.95	0.94	0.94	0.94	0.94	0.94	0.93	0.95	0.95	0.93	0.94	0.94	0.94	0.94	0.94	0.94	
a [-]:	0.38	0.09	0.38	0.37	0.38	0.38	0.38	0.38	0.39	0.37	0.38	0.37	0.37	0.37	0.37	0.38	0.39	0.37	0.38	0.38	0.38	0.37	0.37	0.38	
Lambda [-]:	5.19	3.89	4.71	4.54	4.58	4.63	4.59	5.02	5.33	4.53	4.64	4.46	4.48	4.51	4.42	4.82	5.31	4.43	4.59	4.56	4.56	4.54	4.54	4.77	
P = QxN [W]:	2.57	0.01	1.49	1.22	1.29	1.36	1.31	2.14	2.97	1.21	1.39	1.10	1.14	1.18	1.05	1.70	2.92	1.06	1.31	1.26	1.26	1.22	1.22	1.61	
P with Ct [W]:	5.98	0.06	3.90	3.36	3.52	3.66	3.56	5.15	6.70	3.34	3.71	3.11	3.19	3.27	3.01	4.29	6.62	3.03	3.55	3.46	3.45	3.37	3.36	4.13	
Cp real [-]:	0.25	0.07	0.22	0.21	0.22	0.22	0.22	0.24	0.26	0.21	0.22	0.21	0.21	0.21	0.21	0.23	0.26	0.21	0.22	0.21	0.21	0.21	0.21	0.23	
Cp with Ct [-]:	0.58	0.30	0.58	0.59	0.59	0.59	0.59	0.58	0.58	0.59	0.59	0.59	0.59	0.59	0.59	0.58	0.58	0.59	0.59	0.59	0.59	0.59	0.59	0.58	

alles 0 ex turbine 2		bin [s] 150 180																							
tunnel wind [V]:	0.005																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
Ugen [V]:	1.013	0.000	0.810	0.663	0.688	0.708	0.657	0.896	1.088	0.662	0.719	0.632	0.635	0.658	0.619	0.811	1.069	0.628	0.681	0.664	0.680	0.629	0.665	0.825	
strain gauge [V]:	3.843	0.092	3.346	2.341	0.025	2.425																			
wind [m/s]:	8.00	1.90	7.13	6.49	6.60	6.70	6.46	7.50	8.36	6.49	6.74	6.35	6.36	6.47	6.29	7.14	8.27	6.34	6.57	6.50	6.57	6.34	6.50	7.20	
fax [N]:	1.78	0.03	1.42	1.17	1.21	1.25	1.16	1.57	1.95	1.17	1.27	1.12	1.13	1.17	1.10	1.42	1.91	1.12	1.20	1.18	1.20	1.12	1.18	1.45	
torque [mNm]:	11.18	0.24	8.99	7.40	7.67	7.89	7.33	9.92	11.99	7.39	8.01	7.06	7.09	7.35	6.92	9.00	11.78	7.02	7.59	7.41	7.59	7.04	7.42	9.15	
speed [rpm]:	3460	568	2881	2460	2531	2590	2443	3125	3673	2459	2622	2371	2379	2447	2334	2882	3618	2361	2511	2464	2510	2364	2467	2923	
Fax meas [N]:	1.83	0.04	1.60	1.12	0.01	1.16																			
speed meas [rpm]:																									
Ct [-]:	0.94	0.33	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.94	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
a [-]:	0.38	0.09	0.38	0.38	0.38	0.38	0.38	0.39	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.39	
Lambda [-]:	5.62	3.89	5.24	4.92	4.98	5.02	4.91	5.41	5.71	4.92	5.05	4.85	4.85	4.91	4.82	5.24	5.68	4.84	4.96	4.92	4.96	4.84	4.93	5.27	
P = QxN [W]:	4.05	0.01	2.71	1.91	2.03	2.14	1.88	3.25	4.61	1.90	2.20	1.75	1.77	1.88	1.69	2.71	4.46	1.74	2.00	1.91	1.99	1.74	1.92	2.80	
P with Ct [W]:	8.79	0.06	6.23	4.70	4.94	5.16	4.64	7.22	10.02	4.69	5.28	4.40	4.43	4.65	4.28	6.24	9.69	4.37	4.87	4.71	4.87	4.38	4.72	6.40	
Cp real [-]:	0.27	0.07	0.25	0.24	0.24	0.24	0.24	0.26	0.27	0.24	0.24	0.23	0.23	0.24	0.23	0.25	0.27	0.23	0.24	0.24	0.24	0.23	0.24	0.25	
Cp with Ct [-]:	0.58	0.30	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	

alles 0 ex turbine 2	bin [s] 260 290																							
tunnel wind [V]:	0.005																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	1.236	0.000	1.023	0.820	0.842	0.876	0.848	1.086	1.296	0.823	0.897	0.803	0.790	0.821	0.774	0.997	1.258	0.782	0.848	0.827	0.824	0.811	0.813	0.986
strain gauge [V]:	4.889	0.118	4.146	2.941	0.034	3.084																		
wind [m/s]:	9.07	1.90	8.04	7.18	7.27	7.41	7.29	8.35	9.37	7.19	7.50	7.11	7.05	7.18	6.98	7.92	9.18	7.01	7.29	7.21	7.19	7.14	7.15	7.87
fax [N]:	2.29	0.04	1.80	1.44	1.48	1.54	1.49	1.95	2.42	1.44	1.57	1.41	1.39	1.44	1.36	1.75	2.34	1.37	1.49	1.45	1.44	1.42	1.43	1.73
torque [mNm]:	13.59	0.24	11.29	9.10	9.34	9.70	9.40	11.97	14.24	9.13	9.92	8.91	8.78	9.11	8.60	11.01	13.82	8.68	9.40	9.17	9.14	9.00	9.02	10.89
speed [rpm]:	4095	569	3487	2909	2972	3069	2988	3669	4268	2917	3127	2861	2824	2912	2776	3413	4158	2799	2989	2928	2920	2882	2888	3382
Fax meas [N]:	2.33	0.06	1.98	1.40	0.02	1.47																		
speed meas [rpm]:																								
Ct [-]:	0.94	0.33	0.95	0.95	0.95	0.95	0.95	0.95	0.94	0.95	0.95	0.95	0.95	0.95	0.94	0.94	0.94	0.95	0.95	0.95	0.95	0.95	0.95	0.94
a [-]:	0.38	0.09	0.38	0.39	0.39	0.39	0.39	0.39	0.37	0.39	0.39	0.38	0.38	0.39	0.38	0.38	0.38	0.38	0.39	0.39	0.39	0.38	0.39	0.38
Lambda [-]:	5.86	3.89	5.63	5.26	5.31	5.38	5.32	5.70	5.91	5.27	5.42	5.23	5.20	5.27	5.16	5.60	5.88	5.18	5.32	5.28	5.27	5.24	5.25	5.58
P = QxN [W]:	5.83	0.01	4.12	2.77	2.91	3.12	2.94	4.60	6.36	2.79	3.25	2.67	2.60	2.78	2.50	3.93	6.02	2.55	2.94	2.81	2.79	2.72	2.73	3.85
P with Ct [W]:	12.86	0.06	8.94	6.34	6.59	6.99	6.66	9.99	14.21	6.38	7.23	6.16	6.02	6.36	5.85	8.54	13.34	5.93	6.66	6.42	6.38	6.24	6.26	8.39
Cp real [-]:	0.26	0.07	0.27	0.25	0.26	0.26	0.26	0.27	0.26	0.25	0.26	0.25	0.25	0.25	0.25	0.27	0.26	0.25	0.26	0.26	0.25	0.25	0.25	0.27
Cp with Ct [-]:	0.58	0.30	0.58	0.58	0.58	0.58	0.58	0.58	0.59	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58

lijn 6D alles 0	bin [s] 60 90												gen13 and further have not been applicable (ghost data)											
tunnel wind [V]:	0.710																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12												
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d												
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0												
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni												
Ugen [V]:	0.691	0.000	0.464	0.000	0.499	-0.001	0.000	0.545	0.000	0.510	-0.001	0.463												
strain gauge [V]:	2.577	0.048	1.697	0.055	0.005	0.049																		
wind [m/s]:	6.62	1.90	5.57	1.89	5.74	1.88	1.90	5.96	1.89	5.79	1.89	5.56												
fax [N]:	1.22	0.04	0.85	0.03	0.91	0.03	0.03	0.98	0.03	0.93	0.03	0.85												
torque [mNm]:	7.71	0.25	5.25	0.24	5.63	0.23	0.24	6.13	0.24	5.75	0.23	5.24												
speed [rpm]:	2541	569	1892	568	1993	565	568	2124	567	2023	566	1889												
Fax meas [N]:	1.23	0.02	0.81	0.03	0.00	0.02																		
speed meas [rpm]:																								
Ct [-]:	0.95	0.33	0.93	0.32	0.94	0.31	0.33	0.94	0.32	0.94	0.32	0.93												
a [-]:	0.38	0.09	0.37	0.09	0.37	0.08	0.09	0.38	0.09	0.37	0.09	0.37												
Lambda [-]:	4.99	3.89	4.41	3.89	4.51	3.89	3.89	4.63	3.89	4.53	3.89	4.41												
P = QxN [W]:	2.05	0.01	1.04	0.01	1.17	0.01	0.01	1.36	0.01	1.22	0.01	1.04												
P with Ct [W]:	4.98	0.06	2.99	0.06	3.27	0.06	0.06	3.66	0.06	3.36	0.06	2.98												
Cp real [-]:	0.24	0.07	0.20	0.07	0.21	0.07	0.07	0.22	0.07	0.21	0.07	0.20												
Cp with Ct [-]:	0.58	0.30	0.59	0.29	0.59	0.28	0.30	0.59	0.29	0.59	0.29	0.59												

I:\j6D alies 0		bin [s] 120 150												gen13 and further have not been applicable (ghost data)
tunnel wind [V]:	0.822													
generator load:	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12		
	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d		
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni		
Ugen [V]:	0.941	0.001	0.611	0.000	0.692	-0.002	0.001	0.729	-0.001	0.672	-0.001	0.628		
strain gauge [V]:	3.549	0.064	2.329	0.075	0.000	0.066								
wind [m/s]:	7.68	1.90	6.26	1.89	6.62	1.88	1.90	6.79	1.89	6.53	1.89	6.33		
fax [N]:	1.65	0.04	1.09	0.03	1.22	0.03	0.04	1.28	0.03	1.19	0.03	1.12		
torque [mNm]:	10.40	0.25	6.83	0.24	7.72	0.22	0.25	8.12	0.23	7.50	0.23	7.02		
speed [rpm]:	3253	570	2311	567	2544	563	570	2650	567	2486	566	2360		
Fax meas [N]:	1.69	0.03	1.11	0.04	0.00	0.03								
speed meas [rpm]:														
Ct [-]:	0.95	0.34	0.94	0.32	0.95	0.30	0.33	0.94	0.32	0.95	0.31	0.95		
a [-]:	0.38	0.09	0.38	0.09	0.38	0.08	0.09	0.38	0.09	0.38	0.09	0.38		
Lambda [-]:	5.50	3.89	4.80	3.89	4.99	3.89	3.89	5.07	3.89	4.94	3.89	4.84		
P = QxN [W]:	3.54	0.01	1.65	0.01	2.06	0.01	0.01	2.25	0.01	1.95	0.01	1.74		
P with Ct [W]:	7.79	0.06	4.21	0.06	4.99	0.05	0.06	5.38	0.06	4.79	0.06	4.37		
Cp real [-]:	0.26	0.07	0.23	0.07	0.24	0.07	0.07	0.24	0.07	0.24	0.07	0.23		
Cp with Ct [-]:	0.58	0.31	0.58	0.29	0.58	0.28	0.30	0.58	0.29	0.58	0.29	0.58		

Iijn6D alies 0		bin [s] 210 240												gen13 and further have not been applicable (ghost data)
tunnel wind [V]:	0.894													
generator load:	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12		
	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d		
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni		
Ugen [V]:	1.156	0.000	0.811	0.000	0.866	-0.001	0.000	0.907	0.000	0.873	-0.001	0.808		
strain gauge [V]:	4.486	0.082	2.972	0.088	0.005	0.084								
wind [m/s]:	8.69	1.90	7.14	1.89	7.37	1.89	1.90	7.54	1.89	7.40	1.89	7.12		
fax [N]:	2.11	0.04	1.42	0.03	1.52	0.03	0.03	1.59	0.03	1.53	0.03	1.42		
torque [mNm]:	12.73	0.24	8.99	0.24	9.59	0.23	0.24	10.04	0.24	9.67	0.23	8.96		
speed [rpm]:	3868	569	2881	567	3040	565	568	3157	567	3060	566	2874		
Fax meas [N]:	2.14	0.04	1.42	0.04	0.00	0.04								
speed meas [rpm]:														
Ct [-]:	0.95	0.33	0.95	0.32	0.95	0.31	0.33	0.95	0.32	0.95	0.32	0.95		
a [-]:	0.38	0.09	0.38	0.09	0.39	0.09	0.09	0.39	0.09	0.39	0.09	0.38		
Lambda [-]:	5.78	3.89	5.24	3.89	5.36	3.89	3.89	5.44	3.89	5.37	3.89	5.24		
P = QxN [W]:	5.16	0.01	2.71	0.01	3.05	0.01	0.01	3.32	0.01	3.10	0.01	2.70		
P with Ct [W]:	11.26	0.06	6.24	0.06	6.87	0.06	0.06	7.36	0.06	6.95	0.06	6.21		
Cp real [-]:	0.27	0.07	0.25	0.07	0.26	0.07	0.07	0.26	0.07	0.26	0.07	0.25		
Cp with Ct [-]:	0.58	0.30	0.58	0.29	0.58	0.29	0.30	0.58	0.29	0.58	0.29	0.58		

alles 0 ex turbine 2468

bin [s] 50 80

tunnel wind [V]:	0.722																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	0.767	0.000	0.660	0.000	0.672	-0.001	0.676	0.000	0.825	0.000	0.664	0.000	0.605	0.000	0.613	0.000	0.836	0.000	0.630	-0.001	0.625	0.000	0.638	-0.001
strain gauge [V]:	2.865	0.084	2.185	0.078	-0.002	0.076																		
wind [m/s]:	6.95	1.90	6.48	1.89	6.53	1.89	6.55	1.89	7.20	1.89	6.50	1.90	6.23	1.89	6.26	1.89	7.25	1.90	6.34	1.89	6.32	1.89	6.38	1.89
fax [N]:	1.35	0.03	1.17	0.03	1.19	0.03	1.20	0.03	1.45	0.03	1.18	0.03	1.08	0.03	1.09	0.03	1.47	0.03	1.12	0.03	1.11	0.03	1.13	0.03
torque [mNm]:	8.52	0.24	7.37	0.24	7.49	0.23	7.54	0.24	9.15	0.24	7.42	0.24	6.78	0.24	6.86	0.24	9.27	0.24	7.04	0.23	6.98	0.24	7.13	0.23
speed [rpm]:	2758	568	2452	568	2485	567	2498	567	2923	568	2464	568	2296	568	2316	568	2955	568	2365	566	2350	567	2388	567
Fax meas [N]:	1.37	0.04	1.04	0.04	0.04																			
speed meas [rpm]:																								
Ct [-]:	0.94	0.33	0.95	0.32	0.95	0.32	0.95	0.32	0.95	0.32	0.95	0.33	0.94	0.32	0.94	0.33	0.95	0.33	0.95	0.31	0.95	0.32	0.95	0.32
a [-]:	0.38	0.09	0.38	0.09	0.38	0.09	0.38	0.09	0.39	0.09	0.38	0.09	0.38	0.09	0.38	0.09	0.39	0.09	0.38	0.09	0.38	0.09	0.38	0.09
Lambda [-]:	5.15	3.89	4.91	3.89	4.94	3.89	4.95	3.89	5.27	3.89	4.92	3.89	4.78	3.89	4.80	3.89	5.30	3.89	4.84	3.89	4.83	3.89	4.86	3.89
P = QxN [W]:	2.46	0.01	1.89	0.01	1.95	0.01	1.97	0.01	2.80	0.01	1.91	0.01	1.63	0.01	1.66	0.01	2.87	0.01	1.74	0.01	1.72	0.01	1.78	0.01
P with Ct [W]:	5.78	0.06	4.67	0.06	4.78	0.06	4.83	0.06	6.40	0.06	4.71	0.06	4.16	0.06	4.23	0.06	6.52	0.06	4.38	0.06	4.33	0.06	4.46	0.06
Cp real [-]:	0.25	0.07	0.24	0.07	0.24	0.07	0.24	0.07	0.25	0.07	0.24	0.07	0.23	0.07	0.23	0.07	0.26	0.07	0.23	0.07	0.23	0.07	0.23	0.07
Cp with Ct [-]:	0.58	0.30	0.58	0.29	0.58	0.29	0.58	0.29	0.58	0.30	0.58	0.30	0.58	0.30	0.58	0.30	0.58	0.30	0.58	0.29	0.58	0.29	0.58	0.29

alles 0 ex turbine 2468

bin [s] 140 170

tunnel wind [V]:	0.802																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	0.938	0.000	0.822	0.000	0.814	0.000	0.835	0.000	1.000	0.000	0.838	0.000	0.742	0.000	0.763	0.000	0.977	0.000	0.776	-0.001	0.778	0.000	0.785	-0.001
strain gauge [V]:	3.557	0.105	2.794	0.093	0.002	0.093																		
wind [m/s]:	7.67	1.89	7.18	1.89	7.15	1.89	7.24	1.89	7.94	1.90	7.25	1.90	6.85	1.89	6.93	1.90	7.84	1.90	6.99	1.89	7.00	1.89	7.03	1.89
fax [N]:	1.64	0.03	1.44	0.03	1.43	0.03	1.46	0.03	1.75	0.03	1.47	0.03	1.30	0.03	1.34	0.03	1.71	0.03	1.36	0.03	1.36	0.03	1.38	0.03
torque [mNm]:	10.37	0.24	9.12	0.24	9.03	0.24	9.26	0.24	11.05	0.24	9.29	0.24	8.26	0.24	8.48	0.24	10.79	0.24	8.62	0.23	8.64	0.24	8.72	0.23
speed [rpm]:	3244	568	2914	568	2890	568	2953	567	3424	568	2961	568	2686	568	2745	568	3357	568	2782	566	2789	567	2809	566
Fax meas [N]:	1.70	0.05	1.33	0.04	0.00	0.04																		
speed meas [rpm]:																								
Ct [-]:	0.95	0.32	0.95	0.32	0.95	0.33	0.95	0.32	0.94	0.33	0.95	0.33	0.94	0.32	0.94	0.33	0.95	0.33	0.95	0.31	0.95	0.32	0.95	0.32
a [-]:	0.39	0.09	0.39	0.09	0.39	0.09	0.39	0.09	0.38	0.09	0.39	0.09	0.38	0.09	0.38	0.09	0.38	0.09	0.38	0.09	0.38	0.09	0.38	0.09
Lambda [-]:	5.49	3.89	5.27	3.89	5.25	3.89	5.29	3.89	5.60	3.89	5.30	3.89	5.10	3.89	5.14	3.89	5.56	3.89	5.17	3.89	5.17	3.89	5.19	3.89
P = QxN [W]:	3.52	0.01	2.78	0.01	2.73	0.01	2.86	0.01	3.96	0.01	2.88	0.01	2.32	0.01	2.44	0.01	3.80	0.01	2.51	0.01	2.52	0.01	2.57	0.01
P with Ct [W]:	7.75	0.06	6.36	0.06	6.27	0.06	6.51	0.06	8.60	0.06	6.54	0.06	5.52	0.06	5.74	0.06	8.27	0.06	5.87	0.06	5.89	0.06	5.97	0.06
Cp real [-]:	0.26	0.07	0.25	0.07	0.25	0.07	0.26	0.07	0.27	0.07	0.26	0.07	0.25	0.07	0.25	0.07	0.27	0.07	0.25	0.07	0.25	0.07	0.25	0.07
Cp with Ct [-]:	0.58	0.30	0.58	0.30	0.58	0.30	0.58	0.29	0.58	0.30	0.58	0.30	0.58	0.30	0.58	0.30	0.58	0.30	0.58	0.29	0.58	0.29	0.58	0.29

alles 0 ex turbine 2468

bin [s] 240 270

tunnel wind [V]:	0.900																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	1.156	0.000	1.024	0.000	1.006	-0.001	1.033	0.000	1.221	0.000	1.023	0.000	0.908	0.000	0.929	0.000	1.189	0.000	0.965	-0.001	0.967	0.000	0.966	-0.001
strain gauge [V]:	4.582	0.131	3.624	0.118	-0.002	0.119																		
wind [m/s]:	8.69	1.89	8.05	1.89	7.96	1.89	8.09	1.89	9.00	1.89	8.04	1.90	7.55	1.90	7.64	1.90	8.85	1.90	7.79	1.89	7.79	1.89	7.79	1.89
fax [N]:	2.11	0.03	1.80	0.03	1.76	0.03	1.82	0.03	2.25	0.03	1.80	0.03	1.59	0.03	1.63	0.03	2.18	0.03	1.69	0.03	1.69	0.03	1.69	0.03
torque [mNm]:	12.73	0.24	11.30	0.24	11.10	0.23	11.39	0.24	13.42	0.24	11.29	0.24	10.05	0.24	10.28	0.24	13.08	0.24	10.66	0.23	10.68	0.24	10.67	0.23
speed [rpm]:	3869	568	3490	568	3438	566	3515	567	4052	568	3487	568	3161	568	3221	568	3962	568	3322	565	3327	567	3325	567
Fax meas [N]:	2.19	0.06	1.73	0.06	0.00	0.06																		
speed meas [rpm]:																								
Ct [-]:	0.95	0.32	0.95	0.32	0.94	0.32	0.95	0.32	0.94	0.33	0.95	0.33	0.95	0.33	0.95	0.33	0.95	0.33	0.95	0.31	0.95	0.32	0.95	0.32
a [-]:	0.38	0.09	0.38	0.09	0.38	0.09	0.38	0.09	0.38	0.09	0.38	0.09	0.39	0.09	0.39	0.09	0.38	0.09	0.38	0.09	0.38	0.09	0.38	0.09
Lambda [-]:	5.78	3.89	5.63	3.89	5.61	3.89	5.64	3.89	5.85	3.89	5.63	3.89	5.44	3.89	5.48	3.89	5.82	3.89	5.54	3.89	5.54	3.89	5.54	3.89
P = QxN [W]:	5.16	0.01	4.13	0.01	4.00	0.01	4.19	0.01	5.70	0.01	4.12	0.01	3.33	0.01	3.47	0.01	5.43	0.01	3.71	0.01	3.72	0.01	3.72	0.01
P with Ct [W]:	11.26	0.06	8.96	0.06	8.68	0.06	9.10	0.06	12.54	0.06	8.94	0.06	7.38	0.06	7.64	0.06	11.90	0.06	8.11	0.06	8.13	0.06	8.12	0.06
Cp real [-]:	0.27	0.07	0.27	0.07	0.27	0.07	0.27	0.07	0.27	0.07	0.27	0.07	0.26	0.07	0.26	0.07	0.27	0.07	0.27	0.07	0.27	0.07	0.27	0.07
Cp with Ct [-]:	0.58	0.30	0.58	0.30	0.58	0.29	0.58	0.29	0.58	0.30	0.58	0.30	0.58	0.30	0.58	0.30	0.58	0.30	0.58	0.29	0.58	0.29	0.58	0.29

park 0

bin [s] 60 90

tunnel wind [V]:	0.719																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	0.725	0.458	0.511	0.491	0.503	0.514	0.485	0.627	0.815	0.489	0.533	0.458	0.476	0.474	0.442	0.580	0.800	0.436	0.506	0.476	0.472	0.466	0.463	0.545
strain gauge [V]:	2.735	1.677	1.706	1.715	0.017	1.762																		
wind [m/s]:	6.77	5.54	5.80	5.70	5.76	5.81	5.67	6.33	7.16	5.69	5.91	5.54	5.63	5.62	5.46	6.12	7.09	5.43	5.78	5.63	5.61	5.58	5.56	5.96
fax [N]:	1.28	0.84	0.93	0.90	0.92	0.93	0.89	1.12	1.43	0.89	0.96	0.84	0.87	0.87	0.82	1.04	1.40	0.81	0.92	0.87	0.87	0.86	0.85	0.98
torque [mNm]:	8.07	5.19	5.75	5.54	5.67	5.79	5.48	7.01	9.04	5.52	6.00	5.18	5.39	5.36	5.01	6.50	8.88	4.95	5.71	5.38	5.34	5.27	5.24	6.13
speed [rpm]:	2639	1875	2025	1970	2004	2035	1954	2357	2895	1965	2089	1874	1928	1921	1828	2223	2853	1813	2013	1927	1915	1897	1889	2125
Fax meas [N]:	1.30	0.80	0.81	0.82	0.01	0.84																		
speed meas [rpm]:																								
Ct [-]:	0.94	0.93	0.94	0.94	0.94	0.94	0.94	0.95	0.95	0.94	0.94	0.93	0.94	0.94	0.93	0.94	0.95	0.93	0.94	0.94	0.94	0.93	0.93	0.94
a [-]:	0.38	0.37	0.37	0.37	0.37	0.37	0.37	0.38	0.39	0.37	0.38	0.37	0.37	0.37	0.37	0.38	0.38	0.37	0.37	0.37	0.37	0.37	0.37	0.38
Lambda [-]:	5.06	4.40	4.54	4.49	4.52	4.55	4.47	4.84	5.25	4.48	4.59	4.40	4.45	4.44	4.35	4.72	5.22	4.33	4.53	4.45	4.43	4.42	4.41	4.63
P = QxN [W]:	2.23	1.02	1.22	1.14	1.19	1.23	1.12	1.73	2.74	1.14	1.31	1.02	1.09	1.08	0.96	1.51	2.65	0.94	1.20	1.09	1.07	1.05	1.04	1.36
P with Ct [W]:	5.34	2.94	3.36	3.20	3.30	3.39	3.16	4.36	6.29	3.19	3.56	2.94	3.08	3.06	2.82	3.94	6.13	2.78	3.33	3.08	3.05	3.00	2.98	3.66
Cp real [-]:	0.24	0.20	0.21	0.21	0.21	0.21	0.21	0.23	0.25	0.21	0.22	0.20	0.21	0.21	0.20	0.22	0.25	0.20	0.21	0.21	0.21	0.20	0.20	0.22
Cp with Ct [-]:	0.58	0.59	0.59	0.59	0.59	0.59	0.59	0.58	0.58	0.59	0.59	0.59	0.59	0.59	0.59	0.58	0.58	0.59	0.59	0.59	0.59	0.59	0.59	0.59

park 0	bin [s] 130 160																							
tunnel wind [V]:	0.811																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	0.952	0.573	0.658	0.629	0.641	0.661	0.634	0.840	1.028	0.638	0.677	0.594	0.611	0.611	0.597	0.780	0.991	0.577	0.644	0.578	0.623	0.591	0.598	0.762
strain gauge [V]:	3.625	2.169	2.249	2.207	0.024	2.286																		
wind [m/s]:	7.73	6.09	6.47	6.34	6.39	6.48	6.36	7.26	8.07	6.38	6.56	6.18	6.26	6.26	6.19	7.01	7.90	6.11	6.40	6.11	6.31	6.17	6.20	6.93
fax [N]:	1.67	1.03	1.17	1.12	1.14	1.17	1.13	1.47	1.81	1.13	1.20	1.06	1.09	1.09	1.07	1.37	1.74	1.04	1.14	1.04	1.11	1.06	1.07	1.34
torque [mNm]:	10.52	6.43	7.35	7.03	7.17	7.38	7.09	9.32	11.34	7.13	7.55	6.66	6.84	6.84	6.69	8.67	10.94	6.47	7.19	6.48	6.97	6.63	6.70	8.47
speed [rpm]:	3285	2205	2446	2363	2399	2455	2377	2967	3502	2390	2501	2264	2311	2313	2271	2795	3397	2215	2405	2217	2347	2256	2276	2744
Fax meas [N]:	1.73	1.03	1.07	1.05	0.01	1.09																		
speed meas [rpm]:																								
Ct [-]:	0.95	0.94	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.94	0.94	0.94	0.94	0.95	0.94	0.94	0.95	0.94	0.95	0.94	0.94	0.94
a [-]:	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
Lambda [-]:	5.52	4.70	4.91	4.84	4.87	4.92	4.85	5.30	5.64	4.86	4.95	4.75	4.80	4.80	4.76	5.18	5.59	4.71	4.88	4.71	4.83	4.75	4.77	5.14
P = QxN [W]:	3.62	1.48	1.88	1.74	1.80	1.90	1.76	2.89	4.16	1.78	1.98	1.58	1.65	1.66	1.59	2.54	3.89	1.50	1.81	1.50	1.71	1.57	1.60	2.43
P with Ct [W]:	7.94	3.89	4.65	4.37	4.49	4.68	4.42	6.57	9.03	4.46	4.84	4.07	4.21	4.22	4.09	5.92	8.47	3.92	4.51	3.93	4.32	4.04	4.10	5.73
Cp real [-]:	0.27	0.22	0.24	0.23	0.23	0.24	0.23	0.26	0.27	0.23	0.24	0.23	0.23	0.23	0.23	0.25	0.27	0.22	0.23	0.22	0.23	0.23	0.23	0.25
Cp with Ct [-]:	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58

park 0	bin [s] 240 270																							
tunnel wind [V]:	0.908																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	1.100	0.766	0.804	0.813	0.827	0.856	0.814	1.038	1.232	0.790	0.855	0.762	0.758	0.784	0.736	0.965	1.238	0.762	0.823	0.796	0.802	0.796	0.785	0.954
strain gauge [V]:	4.559	2.845	2.968	2.881	0.032	2.989																		
wind [m/s]:	8.42	6.95	7.11	7.15	7.20	7.33	7.15	8.12	9.05	7.05	7.33	6.93	6.91	7.03	6.82	7.79	9.08	6.93	7.19	7.07	7.10	7.07	7.03	7.74
fax [N]:	1.98	1.34	1.41	1.42	1.45	1.50	1.43	1.84	2.28	1.39	1.50	1.34	1.33	1.38	1.29	1.69	2.29	1.34	1.44	1.39	1.41	1.40	1.38	1.67
torque [mNm]:	12.12	8.51	8.93	9.02	9.17	9.49	9.03	11.45	13.54	8.77	9.48	8.47	8.42	8.71	8.18	10.66	13.61	8.47	9.13	8.83	8.90	8.84	8.72	10.55
speed [rpm]:	3707	2754	2864	2888	2927	3011	2890	3530	4084	2823	3010	2744	2731	2806	2667	3322	4100	2743	2917	2839	2856	2840	2808	3292
Fax meas [N]:	2.17	1.36	1.42	1.37	0.02	1.43																		
speed meas [rpm]:																								
Ct [-]:	0.95	0.94	0.95	0.95	0.95	0.95	0.95	0.95	0.94	0.95	0.95	0.94	0.94	0.95	0.94	0.95	0.94	0.94	0.95	0.95	0.95	0.95	0.95	0.95
a [-]:	0.39	0.38	0.38	0.39	0.39	0.39	0.39	0.38	0.38	0.38	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.39	0.38	0.38	0.38	0.38	0.38
Lambda [-]:	5.72	5.15	5.23	5.25	5.28	5.34	5.25	5.65	5.86	5.20	5.34	5.14	5.13	5.19	5.08	5.54	5.86	5.14	5.27	5.21	5.22	5.21	5.19	5.52
P = QxN [W]:	4.70	2.45	2.68	2.73	2.81	2.99	2.73	4.23	5.79	2.59	2.99	2.43	2.41	2.56	2.29	3.71	5.84	2.43	2.79	2.63	2.66	2.63	2.56	3.64
P with Ct [W]:	10.23	5.77	6.17	6.26	6.41	6.75	6.27	9.18	12.78	6.02	6.74	5.73	5.69	5.96	5.45	8.11	12.90	5.73	6.37	6.08	6.14	6.08	5.96	7.97
Cp real [-]:	0.27	0.25	0.25	0.25	0.26	0.26	0.25	0.27	0.26	0.25	0.26	0.25	0.25	0.25	0.24	0.27	0.26	0.25	0.25	0.25	0.25	0.25	0.25	0.27
Cp with Ct [-]:	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58

park 0 alles ruw		bin [s] 290 320																							
tunnel wind [V]:	0.714																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
Ugen [V]:	0.762	0.460	0.504	0.493	0.519	0.538	0.534	0.745	0.800	0.489	0.518	0.468	0.497	0.514	0.494	0.705	0.827	0.460	0.521	0.515	0.523	0.492	0.534	0.692	
strain gauge [V]:	2.839	1.661	1.829	1.715	0.016	1.826																			
wind [m/s]:	6.93	5.55	5.76	5.71	5.84	5.93	5.91	6.86	7.09	5.69	5.83	5.59	5.73	5.81	5.71	6.68	7.20	5.55	5.85	5.82	5.86	5.71	5.91	6.62	
fax [N]:	1.34	0.85	0.92	0.90	0.94	0.97	0.97	1.31	1.40	0.89	0.94	0.86	0.91	0.93	0.90	1.24	1.45	0.85	0.95	0.94	0.95	0.90	0.96	1.22	
torque [mNm]:	8.46	5.21	5.68	5.56	5.85	6.05	6.01	8.29	8.88	5.52	5.83	5.29	5.61	5.79	5.57	7.86	9.17	5.21	5.87	5.80	5.89	5.56	6.00	7.72	
speed [rpm]:	2742	1881	2006	1974	2050	2104	2092	2695	2851	1964	2046	1904	1988	2035	1977	2581	2928	1881	2056	2038	2060	1973	2091	2544	
Fax meas [N]:	1.35	0.79	0.87	0.82	0.01	0.87																			
speed meas [rpm]:	Ct [-]:	0.94	0.93	0.94	0.94	0.94	0.94	0.94	0.95	0.94	0.94	0.93	0.94	0.94	0.94	0.95	0.95	0.93	0.94	0.94	0.94	0.94	0.94	0.95	
a [-]:	0.38	0.37	0.37	0.37	0.38	0.38	0.38	0.38	0.38	0.37	0.38	0.37	0.37	0.37	0.37	0.38	0.39	0.37	0.38	0.37	0.38	0.37	0.38	0.38	
Lambda [-]:	5.14	4.40	4.52	4.49	4.56	4.61	4.60	5.10	5.22	4.48	4.56	4.42	4.50	4.55	4.49	5.02	5.28	4.40	4.56	4.55	4.57	4.49	4.59	4.99	
P = QxN [W]:	2.43	1.03	1.19	1.15	1.26	1.33	1.32	2.34	2.65	1.14	1.25	1.06	1.17	1.23	1.15	2.12	2.81	1.03	1.26	1.24	1.27	1.15	1.31	2.05	
P with Ct [W]:	5.72	2.95	3.30	3.21	3.44	3.60	3.57	5.55	6.12	3.18	3.43	3.02	3.25	3.39	3.22	5.12	6.42	2.96	3.45	3.40	3.47	3.21	3.56	4.99	
Cp real [-]:	0.25	0.20	0.21	0.21	0.21	0.22	0.22	0.25	0.25	0.21	0.21	0.21	0.21	0.21	0.21	0.24	0.26	0.20	0.21	0.21	0.21	0.21	0.22	0.24	
Cp with Ct [-]:	0.58	0.59	0.59	0.59	0.59	0.59	0.59	0.58	0.58	0.59	0.59	0.59	0.59	0.59	0.59	0.58	0.58	0.59	0.59	0.59	0.59	0.59	0.59	0.58	

park 0 alles ruw		bin [s] 370 400																							
tunnel wind [V]:	0.796																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
Ugen [V]:	0.956	0.588	0.664	0.660	0.681	0.691	0.680	0.941	1.025	0.616	0.687	0.607	0.643	0.675	0.645	0.905	1.039	0.569	0.625	0.636	0.661	0.615	0.690	0.875	
strain gauge [V]:	3.626	2.170	2.419	2.315	0.027	2.378																			
wind [m/s]:	7.75	6.16	6.49	6.48	6.57	6.62	6.57	7.68	8.06	6.28	6.60	6.24	6.40	6.55	6.41	7.53	8.12	6.07	6.32	6.37	6.48	6.28	6.61	7.41	
fax [N]:	1.68	1.05	1.18	1.17	1.20	1.22	1.20	1.65	1.81	1.10	1.21	1.08	1.14	1.19	1.15	1.59	1.84	1.02	1.11	1.13	1.17	1.10	1.22	1.53	
torque [mNm]:	10.57	6.59	7.41	7.37	7.60	7.71	7.59	10.40	11.31	6.89	7.66	6.79	7.18	7.53	7.21	10.01	11.47	6.39	6.98	7.11	7.37	6.89	7.69	9.69	
speed [rpm]:	3298	2246	2462	2452	2512	2541	2509	3253	3494	2326	2529	2300	2403	2496	2409	3150	3535	2193	2351	2383	2454	2324	2536	3065	
Fax meas [N]:	1.73	1.03	1.15	1.10	0.01	1.13																			
speed meas [rpm]:																									
Ct [-]:	0.95	0.94	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.94	0.95	0.95	0.95	0.95	0.95	0.94	0.95	0.95	0.95	0.95	0.95	0.95	
a [-]:	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.39	
Lambda [-]:	5.53	4.74	4.92	4.92	4.96	4.99	4.96	5.50	5.63	4.81	4.98	4.79	4.87	4.95	4.88	5.43	5.65	4.69	4.83	4.86	4.92	4.81	4.98	5.37	
P = QxN [W]:	3.65	1.55	1.91	1.89	2.00	2.05	1.99	3.54	4.14	1.68	2.03	1.64	1.81	1.97	1.82	3.30	4.24	1.47	1.72	1.77	1.89	1.68	2.04	3.11	
P with Ct [W]:	7.99	4.01	4.70	4.67	4.88	4.98	4.87	7.79	8.98	4.26	4.94	4.18	4.51	4.82	4.53	7.33	9.21	3.85	4.33	4.44	4.68	4.25	4.96	6.97	
Cp real [-]:	0.27	0.23	0.24	0.24	0.24	0.24	0.24	0.26	0.27	0.23	0.24	0.23	0.23	0.24	0.23	0.26	0.27	0.22	0.23	0.23	0.24	0.23	0.24	0.26	
Cp with Ct [-]:	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58		

park 0 ailes ruw		bin [s] 450 480																							
tunnel wind [V]:	0.900																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
Ugen [V]:	1.185	0.754	0.825	0.812	0.832	0.857	0.841	1.129	1.221	0.786	0.833	0.775	0.777	0.827	0.789	1.086	1.256	0.758	0.804	0.808	0.829	0.767	0.855	1.069	
strain gauge [V]:	4.647	2.741	3.036	2.883	0.036	2.939																			
wind [m/s]:	8.82	6.90	7.20	7.14	7.23	7.33	7.26	8.56	9.00	7.03	7.23	6.99	7.00	7.20	7.05	8.35	9.17	6.91	7.11	7.12	7.21	6.95	7.32	8.27	
fax [N]:	2.17	1.32	1.45	1.42	1.46	1.50	1.47	2.04	2.25	1.38	1.46	1.36	1.36	1.45	1.38	1.95	2.33	1.33	1.41	1.42	1.45	1.35	1.50	1.91	
torque [mNm]:	13.03	8.38	9.15	9.01	9.23	9.49	9.32	12.43	13.43	8.73	9.24	8.61	8.63	9.17	8.77	11.97	13.81	8.42	8.93	8.96	9.19	8.52	9.47	11.78	
speed [rpm]:	3949	2720	2924	2887	2943	3013	2968	3790	4054	2810	2947	2779	2786	2927	2821	3669	4153	2731	2864	2873	2934	2757	3008	3619	
Fax meas [N]:	2.22	1.31	1.45	1.38	0.02	1.40																			
speed meas [rpm]:																									
Ct [-]:	0.95	0.94	0.95	0.95	0.95	0.95	0.95	0.95	0.94	0.95	0.95	0.94	0.95	0.95	0.95	0.95	0.94	0.94	0.95	0.95	0.95	0.94	0.95	0.95	
a [-]:	0.38	0.38	0.39	0.39	0.39	0.39	0.39	0.39	0.38	0.38	0.39	0.38	0.38	0.39	0.38	0.39	0.38	0.38	0.38	0.38	0.39	0.38	0.39	0.39	
Lambda [-]:	5.81	5.12	5.27	5.25	5.29	5.34	5.31	5.75	5.85	5.19	5.29	5.17	5.17	5.28	5.20	5.70	5.88	5.13	5.23	5.24	5.28	5.15	5.33	5.68	
P = QxN [W]:	5.39	2.39	2.80	2.73	2.84	2.99	2.90	4.93	5.70	2.57	2.85	2.50	2.52	2.81	2.59	4.60	6.01	2.41	2.68	2.70	2.82	2.46	2.98	4.47	
P with Ct [W]:	11.81	5.65	6.40	6.26	6.48	6.75	6.58	10.75	12.56	5.97	6.49	5.86	5.89	6.41	6.01	9.99	13.31	5.69	6.17	6.21	6.44	5.78	6.74	9.69	
Cp real [-]:	0.27	0.25	0.25	0.25	0.26	0.26	0.26	0.27	0.27	0.25	0.26	0.25	0.25	0.26	0.25	0.27	0.26	0.25	0.25	0.25	0.26	0.25	0.26	0.27	
Cp with Ct [-]:	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	

park ex rij1		bin [s] 60 90																							
tunnel wind [V]:	0.682																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
Ugen [V]:	-0.001	0.832	0.512	0.549	0.544	0.556	0.524	0.699	0.000	0.849	0.503	0.492	0.488	0.507	0.471	0.638	-0.001	0.810	0.503	0.542	0.534	0.528	0.524	0.550	
strain gauge [V]:	0.136	2.634	1.826	1.868	0.028	1.821																			
wind [m/s]:	1.89	7.23	5.80	5.98	5.96	6.01	5.86	6.65	1.90	7.30	5.76	5.71	5.69	5.78	5.60	6.38	1.88	7.13	5.76	5.95	5.91	5.88	5.86	5.98	
fax [N]:	0.03	1.46	0.93	0.99	0.98	1.00	0.95	1.23	0.03	1.49	0.92	0.90	0.89	0.92	0.87	1.13	0.03	1.42	0.92	0.98	0.97	0.96	0.95	0.99	
torque [mNm]:	0.23	9.22	5.77	6.17	6.12	6.24	5.90	7.78	0.24	9.41	5.67	5.55	5.51	5.72	5.33	7.13	0.23	8.99	5.67	6.09	6.01	5.95	5.90	6.18	
speed [rpm]:	566	2942	2029	2136	2122	2155	2064	2562	568	2992	2004	1972	1961	2015	1914	2389	565	2880	2004	2114	2093	2076	2065	2138	
Fax meas [N]:	0.06	1.26	0.87	0.89	0.01	0.87																			
speed meas [rpm]:																									
Ct [-]:	0.31	0.95	0.94	0.94	0.94	0.94	0.94	0.95	0.33	0.95	0.94	0.94	0.94	0.94	0.94	0.95	0.31	0.95	0.94	0.94	0.94	0.94	0.94	0.94	
a [-]:	0.09	0.39	0.37	0.38	0.38	0.38	0.38	0.38	0.09	0.39	0.37	0.37	0.37	0.37	0.37	0.38	0.08	0.38	0.37	0.38	0.38	0.38	0.38	0.38	
Lambda [-]:	3.89	5.29	4.54	4.64	4.62	4.65	4.57	5.00	3.89	5.32	4.52	4.49	4.48	4.53	4.43	4.86	3.89	5.24	4.52	4.62	4.60	4.58	4.57	4.64	
P = QxN [W]:	0.01	2.84	1.23	1.38	1.36	1.41	1.27	2.09	0.01	2.95	1.19	1.15	1.13	1.21	1.07	1.78	0.01	2.71	1.19	1.35	1.32	1.29	1.28	1.38	
P with Ct [W]:	0.06	6.47	3.37	3.69	3.65	3.74	3.48	5.05	0.06	6.67	3.30	3.21	3.18	3.33	3.04	4.46	0.06	6.23	3.30	3.63	3.57	3.52	3.48	3.70	
Cp real [-]:	0.07	0.26	0.21	0.22	0.22	0.22	0.21	0.24	0.07	0.26	0.21	0.21	0.21	0.21	0.21	0.23	0.07	0.25	0.21	0.22	0.22	0.22	0.21	0.22	
Cp with Ct [-]:	0.29	0.58	0.59	0.59	0.59	0.59	0.59	0.58	0.30	0.58	0.59	0.59	0.59	0.59	0.59	0.58	0.28	0.58	0.59	0.59	0.59	0.59	0.59	0.59	

park ex rij1		bin [s] 130 160																							
tunnel wind [V]:	0.787																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
Ugen [V]:	0.000	1.087	0.690	0.746	0.752	0.762	0.697	0.936	0.000	1.115	0.689	0.686	0.673	0.694	0.640	0.876	-0.001	1.057	0.631	0.693	0.685	0.667	0.673	0.844	
strain gauge [V]:	0.184	3.619	2.490	2.549	0.031	2.504																			
wind [m/s]:	1.89	8.35	6.61	6.86	6.89	6.93	6.64	7.67	1.89	8.49	6.61	6.59	6.54	6.63	6.39	7.41	1.88	8.21	6.35	6.62	6.59	6.51	6.54	7.28	
fax [N]:	0.03	1.95	1.22	1.31	1.32	1.34	1.23	1.64	0.03	2.01	1.22	1.21	1.19	1.22	1.14	1.53	0.03	1.88	1.12	1.22	1.21	1.18	1.19	1.48	
torque [mNm]:	0.24	11.98	7.69	8.30	8.37	8.46	7.77	10.35	0.24	12.28	7.69	7.64	7.51	7.73	7.15	9.70	0.23	11.65	7.05	7.72	7.64	7.44	7.51	9.36	
speed [rpm]:	567	3669	2536	2698	2715	2742	2558	3240	568	3749	2536	2525	2488	2549	2394	3067	565	3584	2369	2545	2523	2471	2489	2978	
Fax meas [N]:	0.09	1.73	1.19	1.22	0.01	1.19																			
speed meas [rpm]:																									
Ct [-]:	0.32	0.95	0.95	0.94	0.94	0.94	0.95	0.95	0.32	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.31	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
a [-]:	0.09	0.39	0.38	0.38	0.38	0.38	0.38	0.39	0.09	0.39	0.38	0.38	0.38	0.38	0.38	0.39	0.08	0.38	0.38	0.38	0.38	0.38	0.38	0.39	
Lambda [-]:	3.89	5.71	4.98	5.10	5.12	5.14	5.00	5.49	3.89	5.74	4.98	4.97	4.94	4.99	4.87	5.37	3.89	5.67	4.85	4.99	4.97	4.93	4.94	5.31	
P = QxN [W]:	0.01	4.60	2.04	2.34	2.38	2.43	2.08	3.51	0.01	4.82	2.04	2.02	1.96	2.06	1.79	3.12	0.01	4.37	1.75	2.06	2.02	1.93	1.96	2.92	
P with Ct [W]:	0.06	10.00	4.96	5.57	5.63	5.72	5.04	7.73	0.06	10.49	4.96	4.92	4.79	5.01	4.48	6.98	0.06	9.49	4.39	4.99	4.92	4.74	4.80	6.62	
Cp real [-]:	0.07	0.27	0.24	0.25	0.25	0.25	0.24	0.26	0.07	0.27	0.24	0.24	0.24	0.24	0.23	0.26	0.07	0.27	0.23	0.24	0.24	0.24	0.24	0.26	
Cp with Ct [-]:	0.29	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.30	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.28	0.58	0.58	0.58	0.58	0.58	0.58	0.58	

park ex rij1		bin [s] 200 230																							
tunnel wind [V]:	0.876																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
Ugen [V]:	-0.001	1.256	0.825	0.882	0.881	0.882	0.829	1.075	0.000	1.307	0.836	0.830	0.811	0.834	0.780	1.025	-0.001	1.240	0.821	0.861	0.852	0.841	0.837	1.026	
strain gauge [V]:	0.220	4.194	2.965	2.935	0.041	2.912																			
wind [m/s]:	1.88	9.17	7.20	7.44	7.43	7.44	7.21	8.30	1.90	9.42	7.25	7.22	7.14	7.23	7.01	8.06	1.89	9.10	7.18	7.35	7.31	7.26	7.25	8.06	
fax [N]:	0.03	2.33	1.45	1.54	1.54	1.55	1.45	1.92	0.03	2.45	1.47	1.46	1.42	1.46	1.37	1.81	0.03	2.30	1.44	1.51	1.49	1.47	1.47	1.81	
torque [mNm]:	0.23	13.80	9.15	9.76	9.75	9.76	9.19	11.86	0.24	14.35	9.27	9.21	9.00	9.25	8.66	11.31	0.23	13.64	9.11	9.54	9.44	9.32	9.28	11.33	
speed [rpm]:	565	4153	2923	3084	3081	3085	2933	3638	569	4298	2956	2938	2884	2948	2793	3495	566	4108	2912	3025	2999	2968	2958	3498	
Fax meas [N]:	0.11	2.00	1.41	1.40	0.02	1.39																			
speed meas [rpm]:																									
Ct [-]:	0.31	0.94	0.95	0.95	0.95	0.95	0.95	0.95	0.33	0.94	0.95	0.95	0.95	0.95	0.95	0.95	0.32	0.94	0.95	0.95	0.95	0.95	0.95	0.95	
a [-]:	0.09	0.38	0.39	0.39	0.39	0.39	0.39	0.39	0.09	0.37	0.39	0.39	0.38	0.39	0.38	0.38	0.09	0.38	0.39	0.39	0.39	0.39	0.39	0.38	
Lambda [-]:	3.89	5.88	5.27	5.39	5.38	5.39	5.28	5.69	3.89	5.92	5.30	5.28	5.24	5.29	5.18	5.63	3.89	5.86	5.27	5.35	5.33	5.31	5.30	5.63	
P = QxN [W]:	0.01	6.00	2.80	3.15	3.15	3.15	2.82	4.52	0.01	6.46	2.87	2.83	2.72	2.85	2.53	4.14	0.01	5.87	2.78	3.02	2.96	2.90	2.88	4.15	
P with Ct [W]:	0.06	13.30	6.40	7.05	7.04	7.05	6.44	9.81	0.06	14.45	6.52	6.46	6.25	6.49	5.91	8.98	0.06	12.96	6.35	6.80	6.70	6.57	6.54	9.00	
Cp real [-]:	0.07	0.26	0.25	0.26	0.26	0.26	0.26	0.27	0.07	0.26	0.26	0.26	0.25	0.26	0.25	0.27	0.07	0.26	0.25	0.26	0.26	0.26	0.26	0.27	
Cp with Ct [-]:	0.28	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.30	0.59	0.58	0.58	0.58	0.58	0.58	0.58	0.29	0.58	0.58	0.58	0.58	0.58	0.58	0.58	

park ex rij12		bin [s] 60 90																							
tunnel wind [V]:	0.706																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
Ugen [V]:	-0.001	0.000	0.884	0.504	0.567	0.573	0.543	0.728	0.000	0.000	0.913	0.482	0.544	0.527	0.489	0.663	-0.001	0.000	0.790	0.491	0.548	0.524	0.519	0.549	
strain gauge [V]:	0.144	0.135	3.041	1.788	0.026	1.907																			
wind [m/s]:	1.89	1.90	7.44	5.76	6.06	6.09	5.95	6.78	1.90	1.90	7.57	5.66	5.96	5.88	5.69	6.49	1.89	1.90	7.05	5.70	5.97	5.86	5.84	5.98	
fax [N]:	0.03	0.03	1.55	0.92	1.02	1.03	0.98	1.28	0.03	0.04	1.60	0.88	0.98	0.96	0.89	1.18	0.03	0.03	1.39	0.90	0.99	0.95	0.94	0.99	
torque [mNm]:	0.23	0.24	9.78	5.68	6.36	6.43	6.10	8.10	0.24	0.24	10.11	5.44	6.12	5.94	5.52	7.41	0.23	0.24	8.77	5.54	6.15	5.90	5.85	6.16	
speed [rpm]:	565	568	3090	2006	2186	2203	2118	2646	568	569	3175	1943	2121	2073	1964	2462	566	568	2823	1970	2131	2065	2050	2134	
Fax meas [N]:	0.07	0.06	1.45	0.85	0.01	0.91																			
speed meas [rpm]:																									
Ct [-]:	0.31	0.33	0.95	0.94	0.94	0.94	0.94	0.94	0.33	0.33	0.95	0.94	0.94	0.94	0.94	0.95	0.32	0.33	0.95	0.94	0.94	0.94	0.94	0.94	
a [-]:	0.09	0.09	0.39	0.37	0.38	0.38	0.38	0.38	0.09	0.09	0.39	0.37	0.38	0.38	0.37	0.38	0.09	0.09	0.38	0.37	0.38	0.38	0.38	0.38	
Lambda [-]:	3.89	3.89	5.39	4.52	4.68	4.70	4.62	5.07	3.89	3.89	5.45	4.46	4.62	4.58	4.48	4.92	3.89	3.89	5.20	4.49	4.63	4.57	4.56	4.63	
P = QxN [W]:	0.01	0.01	3.17	1.19	1.46	1.48	1.35	2.24	0.01	0.01	3.36	1.11	1.36	1.29	1.14	1.91	0.01	0.01	2.59	1.14	1.37	1.28	1.25	1.38	
P with Ct [W]:	0.06	0.06	7.07	3.31	3.83	3.88	3.64	5.37	0.06	0.06	7.44	3.13	3.65	3.51	3.19	4.70	0.06	0.06	6.02	3.20	3.68	3.48	3.44	3.68	
Cp real [-]:	0.07	0.07	0.26	0.21	0.22	0.22	0.22	0.24	0.07	0.07	0.26	0.21	0.22	0.22	0.21	0.24	0.07	0.07	0.25	0.21	0.22	0.21	0.21	0.22	
Cp with Ct [-]:	0.29	0.30	0.58	0.59	0.58	0.58	0.59	0.58	0.30	0.30	0.58	0.59	0.59	0.59	0.59	0.58	0.29	0.30	0.58	0.59	0.59	0.59	0.59	0.59	

park ex rij12		bin [s] 130 160																							
tunnel wind [V]:	0.795																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
Ugen [V]:	0.000	0.000	1.099	0.666	0.748	0.750	0.695	0.931	0.000	0.000	1.128	0.627	0.698	0.706	0.648	0.888	-0.001	0.000	1.007	0.636	0.724	0.684	0.693	0.868	
strain gauge [V]:	0.181	0.169	3.837	2.334	0.028	2.494																			
wind [m/s]:	1.89	1.90	8.41	6.50	6.87	6.88	6.63	7.64	1.89	1.90	8.55	6.33	6.65	6.68	6.43	7.46	1.89	1.90	7.97	6.37	6.76	6.59	6.63	7.38	
fax [N]:	0.03	0.03	1.98	1.18	1.31	1.32	1.23	1.63	0.03	0.03	2.04	1.12	1.23	1.24	1.15	1.56	0.03	0.03	1.77	1.13	1.27	1.21	1.22	1.52	
torque [mNm]:	0.24	0.24	12.11	7.43	8.32	8.34	7.74	10.29	0.24	0.24	12.43	7.01	7.78	7.86	7.24	9.83	0.23	0.24	11.11	7.11	8.06	7.63	7.73	9.62	
speed [rpm]:	567	568	3705	2468	2704	2708	2551	3225	568	568	3789	2357	2560	2583	2418	3104	566	568	3441	2383	2634	2521	2547	3046	
Fax meas [N]:	0.09	0.08	1.83	1.11	0.01	1.19																			
speed meas [rpm]:																									
Ct [-]:	0.32	0.33	0.95	0.95	0.94	0.94	0.95	0.95	0.32	0.33	0.95	0.95	0.95	0.95	0.95	0.95	0.32	0.33	0.94	0.95	0.94	0.95	0.95	0.95	
a [-]:	0.09	0.09	0.39	0.38	0.38	0.38	0.38	0.39	0.09	0.09	0.39	0.38	0.38	0.38	0.38	0.39	0.09	0.09	0.38	0.38	0.38	0.38	0.38	0.39	
Lambda [-]:	3.89	3.89	5.72	4.93	5.11	5.11	4.99	5.48	3.89	3.89	5.75	4.84	5.00	5.02	4.89	5.40	3.89	3.89	5.61	4.86	5.06	4.97	4.99	5.36	
P = QxN [W]:	0.01	0.01	4.70	1.92	2.36	2.36	2.07	3.48	0.01	0.01	4.93	1.73	2.08	2.13	1.83	3.20	0.01	0.01	4.00	1.77	2.22	2.01	2.06	3.07	
P with Ct [W]:	0.06	0.06	10.21	4.73	5.59	5.60	5.02	7.66	0.06	0.06	10.74	4.35	5.05	5.13	4.56	7.13	0.06	0.06	8.69	4.44	5.32	4.91	5.00	6.89	
Cp real [-]:	0.07	0.07	0.27	0.24	0.25	0.25	0.24	0.26	0.07	0.07	0.27	0.23	0.24	0.24	0.23	0.26	0.07	0.07	0.27	0.23	0.24	0.24	0.24	0.26	
Cp with Ct [-]:	0.29	0.30	0.58	0.58	0.58	0.58	0.58	0.58	0.30	0.30	0.58	0.58	0.58	0.58	0.58	0.58	0.29	0.30	0.58	0.58	0.58	0.58	0.58	0.58	

park ex rij12		bin [s] 200 230																							
tunnel wind [V]:	0.896																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
Ugen [V]:	0.000	0.000	1.265	0.851	0.927	0.930	0.887	1.139	0.000	0.000	1.356	0.799	0.845	0.871	0.820	1.065	-0.001	0.000	1.276	0.818	0.908	0.885	0.864	1.066	
strain gauge [V]:	0.227	0.211	4.511	2.932	0.034	3.059																			
wind [m/s]:	1.89	1.90	9.22	7.31	7.63	7.64	7.46	8.61	1.89	1.90	9.66	7.09	7.28	7.39	7.18	8.25	1.89	1.90	9.27	7.17	7.55	7.45	7.36	8.25	
fax [N]:	0.03	0.03	2.35	1.49	1.62	1.63	1.55	2.07	0.03	0.03	2.56	1.40	1.48	1.53	1.44	1.90	0.03	0.03	2.38	1.43	1.59	1.55	1.51	1.90	
torque [mNm]:	0.24	0.24	13.90	9.43	10.25	10.29	9.82	12.55	0.24	0.24	14.89	8.87	9.37	9.64	9.10	11.74	0.23	0.24	14.02	9.07	10.05	9.80	9.57	11.76	
speed [rpm]:	567	568	4179	2997	3213	3223	3101	3820	567	568	4439	2850	2980	3053	2909	3607	566	568	4209	2902	3160	3095	3033	3612	
Fax meas [N]:	0.11	0.10	2.15	1.40	0.02	1.46																			
speed meas [rpm]:																									
Ct [-]:	6952. 08	6818. 35	85.26	143.8 5	131.9 8	131.4 9	137.8 9	99.63	6925. 53	6819. 39	77.13	153.2 5	144.8 8	140.5 6	149.3 5	110.6 1	7224. 17	6830. 66	84.24	149.7 5	134.6 9	138.2 1	141.7 4	110.3 5	
a [-]:	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	
Lambda [-]:	0.04	0.04	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
P = QxN [W]:	0.01	0.01	0.94	0.44	0.01	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
P with Ct [W]:	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	
Cp real [-]:	5553. 46	4922. 56	2.45	4.49	0.04	3.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Cp with Ct [-]:	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	#NUM !	

park ex rij123		bin [s] 60 90																							
tunnel wind [V]:	0.689																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
Ugen [V]:	0.000	0.000	0.000	0.846	0.496	0.553	0.523	0.703	0.000	0.000	0.000	0.818	0.465	0.518	0.476	0.649	-0.001	0.000	0.000	0.803	0.496	0.536	0.518	0.549	
strain gauge [V]:	0.137	0.127	0.122	2.890	0.033	1.858																			
wind [m/s]:	1.90	1.90	1.89	7.29	5.72	6.00	5.86	6.67	1.89	1.90	1.90	7.17	5.57	5.84	5.63	6.43	1.89	1.90	1.89	7.10	5.72	5.92	5.83	5.98	
fax [N]:	0.03	0.04	0.03	1.48	0.90	1.00	0.95	1.24	0.03	0.03	0.03	1.43	0.86	0.94	0.87	1.15	0.03	0.03	0.03	1.41	0.90	0.97	0.94	0.99	
torque [mNm]:	0.24	0.24	0.24	9.38	5.59	6.21	5.89	7.84	0.24	0.24	0.24	9.07	5.26	5.84	5.38	7.24	0.23	0.24	0.24	8.91	5.60	6.02	5.83	6.17	
speed [rpm]:	569	569	567	2984	1983	2146	2061	2576	568	568	568	2902	1895	2048	1926	2419	565	568	568	2859	1983	2097	2046	2135	
Fax meas [N]:	0.07	0.06	0.06	1.38	0.02	0.89																			
speed meas [rpm]:																									
Ct [-]:	0.33	0.33	0.32	0.95	0.94	0.94	0.94	0.95	0.32	0.33	0.33	0.95	0.93	0.94	0.94	0.95	0.31	0.33	0.32	0.95	0.94	0.94	0.94	0.94	
a [-]:	0.09	0.09	0.09	0.39	0.37	0.38	0.38	0.38	0.09	0.09	0.09	0.39	0.37	0.38	0.37	0.38	0.09	0.09	0.09	0.38	0.37	0.38	0.38	0.38	
Lambda [-]:	3.89	3.89	3.89	5.32	4.50	4.65	4.57	5.01	3.89	3.89	3.89	5.26	4.42	4.56	4.45	4.89	3.89	3.89	3.89	5.23	4.50	4.60	4.56	4.64	
P = QxN [W]:	0.01	0.01	0.01	2.93	1.16	1.40	1.27	2.11	0.01	0.01	0.01	2.76	1.04	1.25	1.08	1.84	0.01	0.01	0.01	2.67	1.16	1.32	1.25	1.38	
P with Ct [W]:	0.06	0.06	0.06	6.64	3.24	3.72	3.47	5.10	0.06	0.06	0.06	6.32	2.99	3.43	3.08	4.56	0.06	0.06	0.06	6.15	3.24	3.58	3.43	3.69	
Cp real [-]:	0.07	0.07	0.07	0.26	0.21	0.22	0.21	0.24	0.07	0.07	0.07	0.25	0.20	0.21	0.21	0.23	0.07	0.07	0.07	0.25	0.21	0.22	0.21	0.22	
Cp with Ct [-]:	0.30	0.30	0.29	0.58	0.59	0.59	0.59	0.58	0.30	0.30	0.30	0.58	0.59	0.59	0.59	0.58	0.29	0.30	0.30	0.58	0.59	0.59	0.59	0.59	

park ex rij123		bin [s] 120 150																							
tunnel wind [V]:	0.797																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
Ugen [V]:	0.000	0.000	0.000	1.093	0.654	0.734	0.668	0.929	0.000	0.000	0.000	1.075	0.624	0.698	0.622	0.860	-0.001	0.000	0.000	1.040	0.660	0.713	0.694	0.870	
strain gauge [V]:	0.181	0.169	0.159	3.769	0.044	2.438																			
wind [m/s]:	1.90	1.90	1.89	8.38	6.45	6.81	6.52	7.63	1.90	1.90	1.90	8.30	6.32	6.65	6.31	7.34	1.89	1.90	1.89	8.13	6.48	6.72	6.63	7.39	
fax [N]:	0.03	0.04	0.03	1.96	1.16	1.29	1.18	1.63	0.03	0.03	0.03	1.92	1.11	1.23	1.11	1.51	0.03	0.03	0.03	1.84	1.17	1.26	1.23	1.52	
torque [mNm]:	0.24	0.24	0.24	12.05	7.31	8.17	7.46	10.27	0.24	0.24	0.24	11.85	6.98	7.78	6.95	9.52	0.23	0.24	0.24	11.48	7.37	7.94	7.74	9.64	
speed [rpm]:	568	569	567	3689	2436	2663	2476	3219	568	568	568	3637	2349	2561	2342	3021	566	568	568	3538	2451	2604	2549	3051	
Fax meas [N]:	0.09	0.08	0.08	1.80	0.02	1.16																			
speed meas [rpm]:																									
Ct [-]:	0.33	0.33	0.32	0.95	0.95	0.94	0.95	0.95	0.33	0.33	0.33	0.95	0.95	0.95	0.95	0.95	0.31	0.33	0.32	0.95	0.95	0.94	0.95	0.95	
a [-]:	0.09	0.09	0.09	0.39	0.38	0.38	0.38	0.39	0.09	0.09	0.09	0.39	0.38	0.38	0.38	0.39	0.09	0.09	0.09	0.38	0.38	0.38	0.38	0.39	
Lambda [-]:	3.89	3.89	3.89	5.71	4.90	5.08	4.93	5.48	3.89	3.89	3.89	5.69	4.83	5.00	4.82	5.34	3.89	3.89	3.89	5.65	4.91	5.03	4.99	5.36	
P = QxN [W]:	0.01	0.01	0.01	4.65	1.86	2.28	1.93	3.46	0.01	0.01	0.01	4.51	1.72	2.09	1.71	3.01	0.01	0.01	0.01	4.25	1.89	2.17	2.06	3.08	
P with Ct [W]:	0.06	0.06	0.06	10.11	4.61	5.43	4.75	7.63	0.06	0.06	0.06	9.80	4.33	5.05	4.31	6.79	0.06	0.06	0.06	9.22	4.67	5.21	5.01	6.91	
Cp real [-]:	0.07	0.07	0.07	0.27	0.24	0.24	0.24	0.26	0.07	0.07	0.07	0.27	0.23	0.24	0.23	0.26	0.07	0.07	0.07	0.27	0.24	0.24	0.24	0.26	
Cp with Ct [-]:	0.30	0.30	0.29	0.58	0.58	0.58	0.58	0.58	0.30	0.30	0.30	0.58	0.58	0.58	0.58	0.58	0.29	0.30	0.30	0.58	0.58	0.58	0.58	0.58	

park ex rij123		bin [s] 200 230																							
tunnel wind [V]:	0.881																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
Ugen [V]:	0.000	0.000	0.000	1.306	0.830	0.908	0.856	1.114	0.000	0.000	0.000	1.269	0.761	0.845	0.778	1.039	-0.001	0.000	0.000	1.236	0.814	0.865	0.841	1.039	
strain gauge [V]:	0.223	0.208	0.198	4.364	0.055	2.986																			
wind [m/s]:	1.90	1.90	1.89	9.42	7.22	7.54	7.33	8.48	1.90	1.90	1.90	9.24	6.93	7.28	7.00	8.12	1.89	1.90	1.89	9.07	7.15	7.37	7.27	8.12	
fax [N]:	0.03	0.04	0.03	2.44	1.45	1.59	1.50	2.01	0.03	0.03	0.03	2.36	1.34	1.48	1.36	1.84	0.03	0.03	0.03	2.29	1.43	1.52	1.47	1.84	
torque [mNm]:	0.24	0.24	0.24	14.34	9.20	10.04	9.49	12.27	0.24	0.24	0.24	13.94	8.46	9.37	8.64	11.46	0.23	0.24	0.24	13.59	9.04	9.58	9.33	11.47	
speed [rpm]:	568	569	567	4295	2936	3159	3012	3747	568	568	568	4189	2741	2981	2787	3534	566	568	568	4095	2893	3037	2969	3535	
Fax meas [N]:	0.11	0.10	0.09	2.08	0.03	1.42																			
speed meas [rpm]:																									
Ct [-]:	0.33	0.33	0.32	0.94	0.95	0.95	0.95	0.95	0.33	0.33	0.33	0.94	0.94	0.95	0.95	0.95	0.32	0.33	0.32	0.94	0.95	0.95	0.95	0.95	
a [-]:	0.09	0.09	0.09	0.37	0.39	0.39	0.39	0.39	0.09	0.09	0.09	0.38	0.38	0.39	0.38	0.38	0.09	0.09	0.09	0.38	0.39	0.39	0.39	0.38	
Lambda [-]:	3.89	3.89	3.89	5.92	5.28	5.44	5.34	5.74	3.89	3.89	3.89	5.89	5.14	5.31	5.17	5.65	3.89	3.89	3.89	5.86	5.25	5.35	5.31	5.65	
P = QxN [W]:	0.01	0.01	0.01	6.45	2.83	3.32	2.99	4.81	0.01	0.01	0.01	6.12	2.43	2.93	2.52	4.24	0.01	0.01	0.01	5.83	2.74	3.05	2.90	4.24	
P with Ct [W]:	0.06	0.06	0.06	14.43	6.45	7.37	6.75	10.48	0.06	0.06	0.06	13.59	5.72	6.63	5.89	9.21	0.06	0.06	0.06	12.86	6.28	6.85	6.58	9.21	
Cp real [-]:	0.07	0.07	0.07	0.26	0.26	0.26	0.26	0.27	0.07	0.07	0.07	0.26	0.25	0.26	0.25	0.27	0.07	0.07	0.07	0.26	0.25	0.26	0.26	0.27	
Cp with Ct [-]:	0.30	0.30	0.29	0.59	0.58	0.58	0.58	0.58	0.30	0.30	0.30	0.59	0.58	0.58	0.58	0.58	0.29	0.30	0.30	0.58	0.58	0.58	0.58	0.58	

park ex rij1234		bin [s] 40 70																							
tunnel wind [V]:	0.709																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
Ugen [V]:	-0.001	0.000	0.000	0.000	0.904	0.526	0.543	0.742	0.000	0.000	0.000	0.000	0.848	0.500	0.517	0.691	-0.001	0.000	0.000	0.000	0.874	0.525	0.555	0.554	
strain gauge [V]:	0.144	0.137	0.132	0.126	0.003	1.806																			
wind [m/s]:	1.89	1.89	1.90	1.89	7.53	5.87	5.96	6.84	1.89	1.90	1.89	1.90	7.30	5.75	5.83	6.62	1.89	1.90	1.89	1.90	7.40	5.87	6.01	6.00	
fax [N]:	0.03	0.03	0.03	0.03	1.58	0.95	0.98	1.30	0.03	0.03	0.03	0.03	1.49	0.91	0.94	1.22	0.03	0.03	0.03	0.03	1.53	0.95	1.00	1.00	
torque [mNm]:	0.23	0.24	0.24	0.24	10.00	5.92	6.11	8.25	0.24	0.24	0.24	0.24	9.40	5.64	5.82	7.71	0.23	0.24	0.24	0.24	9.67	5.92	6.24	6.22	
speed [rpm]:	567	568	568	568	3148	2070	2119	2685	568	569	568	568	2990	1996	2043	2541	566	568	568	568	3061	2068	2153	2148	
Fax meas [N]:	0.07	0.07	0.06	0.06	0.00	0.86																			
speed meas [rpm]:																									
Ct [-]:	0.32	0.33	0.33	0.33	0.95	0.94	0.94	0.94	0.32	0.33	0.33	0.33	0.95	0.94	0.94	0.95	0.31	0.33	0.32	0.33	0.95	0.94	0.94	0.94	
a [-]:	0.09	0.09	0.09	0.09	0.39	0.38	0.38	0.38	0.09	0.09	0.09	0.09	0.39	0.37	0.37	0.38	0.09	0.09	0.09	0.09	0.39	0.38	0.38	0.38	
Lambda [-]:	3.89	3.89	3.89	3.89	5.43	4.58	4.62	5.09	3.89	3.89	3.89	3.89	5.32	4.51	4.55	4.99	3.89	3.89	3.89	3.89	5.37	4.57	4.65	4.65	
P = QxN [W]:	0.01	0.01	0.01	0.01	3.30	1.28	1.36	2.32	0.01	0.01	0.01	0.01	2.94	1.18	1.25	2.05	0.01	0.01	0.01	0.01	3.10	1.28	1.41	1.40	
P with Ct [W]:	0.06	0.06	0.06	0.06	7.32	3.50	3.64	5.52	0.06	0.06	0.06	0.06	6.66	3.28	3.42	4.98	0.06	0.06	0.06	0.06	6.95	3.49	3.74	3.73	
Cp real [-]:	0.07	0.07	0.07	0.07	0.26	0.22	0.22	0.25	0.07	0.07	0.07	0.07	0.26	0.21	0.21	0.24	0.07	0.07	0.07	0.07	0.26	0.21	0.22	0.22	
Cp with Ct [-]:	0.29	0.30	0.30	0.30	0.58	0.59	0.59	0.58	0.30	0.30	0.30	0.30	0.58	0.59	0.59	0.58	0.29	0.30	0.30	0.30	0.58	0.59	0.59	0.59	

park ex rij1234		bin [s] 105 135																							
tunnel wind [V]:	0.789																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
Ugen [V]:	0.000	0.000	0.000	0.000	1.105	0.686	0.693	0.936	0.000	0.000	0.000	0.000	1.034	0.623	0.650	0.875	-0.001	0.000	0.000	0.000	1.065	0.636	0.707	0.871	
strain gauge [V]:	0.180	0.170	0.164	0.158	0.002	2.329																			
wind [m/s]:	1.89	1.90	1.89	1.90	8.44	6.59	6.63	7.67	1.89	1.90	1.89	1.90	8.10	6.31	6.43	7.41	1.89	1.90	1.89	1.90	8.25	6.37	6.69	7.39	
fax [N]:	0.03	0.03	0.03	0.03	1.99	1.21	1.22	1.64	0.03	0.03	0.03	0.03	1.83	1.11	1.15	1.53	0.03	0.03	0.03	0.03	1.90	1.13	1.25	1.53	
torque [mNm]:	0.24	0.24	0.24	0.24	12.17	7.65	7.72	10.35	0.24	0.24	0.24	0.24	11.40	6.97	7.25	9.69	0.23	0.24	0.24	0.24	11.74	7.11	7.87	9.65	
speed [rpm]:	567	568	568	568	3721	2525	2546	3241	568	568	568	568	3519	2346	2422	3066	566	568	568	568	3607	2384	2585	3054	
Fax meas [N]:	0.09	0.08	0.08	0.08	0.00	1.11																			
speed meas [rpm]:																									
Ct [-]:	0.32	0.33	0.33	0.33	0.95	0.95	0.95	0.95	0.32	0.33	0.33	0.33	0.95	0.95	0.95	0.95	0.31	0.33	0.33	0.33	0.95	0.95	0.95	0.95	
a [-]:	0.09	0.09	0.09	0.09	0.39	0.38	0.38	0.39	0.09	0.09	0.09	0.09	0.38	0.38	0.38	0.39	0.09	0.09	0.09	0.09	0.39	0.38	0.38	0.39	
Lambda [-]:	3.89	3.89	3.89	3.89	5.73	4.97	4.99	5.49	3.89	3.89	3.89	3.89	5.64	4.83	4.89	5.37	3.89	3.89	3.89	3.89	5.68	4.86	5.02	5.37	
P = QxN [W]:	0.01	0.01	0.01	0.01	4.74	2.02	2.06	3.51	0.01	0.01	0.01	0.01	4.20	1.71	1.84	3.11	0.01	0.01	0.01	0.01	4.43	1.78	2.13	3.09	
P with Ct [W]:	0.06	0.06	0.06	0.06	10.31	4.92	5.00	7.73	0.06	0.06	0.06	0.06	9.12	4.32	4.57	6.97	0.06	0.06	0.06	0.06	9.63	4.44	5.14	6.92	
Cp real [-]:	0.07	0.07	0.07	0.07	0.27	0.24	0.24	0.26	0.07	0.07	0.07	0.07	0.27	0.23	0.23	0.26	0.07	0.07	0.07	0.07	0.27	0.23	0.24	0.26	
Cp with Ct [-]:	0.29	0.30	0.30	0.30	0.58	0.58	0.58	0.58	0.30	0.30	0.30	0.30	0.58	0.58	0.58	0.58	0.29	0.30	0.30	0.30	0.58	0.58	0.58	0.58	

park ex rij1234		bin [s] 205 235																							
tunnel wind [V]:	0.895																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
Ugen [V]:	0.000	0.000	0.000	0.000	1.340	0.877	0.890	1.157	0.000	0.000	0.000	0.000	1.250	0.816	0.836	1.089	-0.001	0.000	0.000	0.000	1.304	0.857	0.906	1.108	
strain gauge [V]:	0.231	0.217	0.212	0.203	0.002	2.971																			
wind [m/s]:	1.89	1.90	1.90	1.90	9.58	7.41	7.47	8.69	1.89	1.90	1.89	1.90	9.14	7.16	7.24	8.36	1.89	1.90	1.89	1.89	9.41	7.33	7.54	8.45	
fax [N]:	0.03	0.03	0.03	0.03	2.52	1.54	1.56	2.11	0.03	0.03	0.03	0.03	2.32	1.43	1.46	1.95	0.03	0.03	0.03	0.03	2.44	1.50	1.59	2.00	
torque [mNm]:	0.24	0.24	0.24	0.24	14.71	9.71	9.85	12.74	0.24	0.24	0.24	0.24	13.74	9.06	9.26	12.00	0.23	0.24	0.24	0.24	14.32	9.50	10.03	12.20	
speed [rpm]:	567	568	568	568	4392	3070	3107	3871	568	568	568	568	4136	2898	2953	3676	566	568	568	568	4289	3015	3155	3730	
Fax meas [N]:	0.11	0.10	0.10	0.10	0.00	1.42																			
speed meas [rpm]:																									
Ct [-]:	0.32	0.33	0.33	0.33	0.93	0.95	0.95	0.95	0.32	0.33	0.33	0.33	0.94	0.95	0.95	0.95	0.32	0.33	0.32	0.32	0.94	0.95	0.95	0.95	
a [-]:	0.09	0.09	0.09	0.09	0.37	0.39	0.39	0.38	0.09	0.09	0.09	0.09	0.38	0.39	0.39	0.39	0.09	0.09	0.09	0.09	0.37	0.39	0.39	0.39	
Lambda [-]:	3.89	3.89	3.89	3.89	5.95	5.38	5.40	5.78	3.89	3.89	3.89	3.89	5.87	5.26	5.30	5.71	3.89	3.89	3.89	3.89	5.92	5.34	5.43	5.73	
P = QxN [W]:	0.01	0.01	0.01	0.01	6.77	3.12	3.20	5.16	0.01	0.01	0.01	0.01	5.95	2.75	2.87	4.62	0.01	0.01	0.01	0.01	6.43	3.00	3.31	4.77	
P with Ct [W]:	0.06	0.06	0.06	0.06	15.24	6.99	7.15	11.28	0.06	0.06	0.06	0.06	13.17	6.30	6.52	10.04	0.06	0.06	0.06	0.06	14.38	6.76	7.35	10.37	
Cp real [-]:	0.07	0.07	0.07	0.07	0.26	0.26	0.26	0.27	0.07	0.07	0.07	0.07	0.26	0.25	0.26	0.27	0.07	0.07	0.07	0.07	0.26	0.26	0.26	0.27	
Cp with Ct [-]:	0.29	0.30	0.30	0.30	0.59	0.58	0.58	0.58	0.30	0.30	0.30	0.30	0.58	0.58	0.58	0.58	0.29	0.30	0.30	0.30	0.59	0.58	0.58	0.58	

park ex rij12345		bin [s] 45 75																							
tunnel wind [V]:	0.709																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
Ugen [V]:	-0.001	0.000	0.000	0.000	0.000	0.902	0.454	0.753	0.000	0.000	0.000	0.000	0.000	0.869	0.423	0.702	0.000	0.000	0.000	0.000	0.000	0.846	0.458	0.552	
strain gauge [V]:	0.138	0.134	0.128	0.123	0.005	2.980																			
wind [m/s]:	1.89	1.90	1.90	1.90	1.89	7.52	5.52	6.90	1.90	1.90	1.90	1.90	1.89	7.38	5.37	6.67	1.89	1.90	1.90	1.90	1.90	7.28	5.54	5.99	
fax [N]:	0.03	0.03	0.04	0.03	0.03	1.58	0.84	1.32	0.03	0.04	0.03	0.03	0.03	1.52	0.79	1.24	0.03	0.03	0.03	0.03	0.03	1.48	0.84	0.99	
torque [mNm]:	0.23	0.24	0.24	0.24	0.24	9.98	5.15	8.37	0.24	0.24	0.24	0.24	0.24	9.63	4.81	7.83	0.23	0.24	0.24	0.24	0.24	9.37	5.19	6.20	
speed [rpm]:	565	568	569	568	567	3141	1864	2718	568	569	568	568	567	3049	1775	2573	567	568	568	568	568	2982	1876	2143	
Fax meas [N]:	0.07	0.06	0.06	0.06	0.00	1.42																			
speed meas [rpm]:																									
Ct [-]:	0.31	0.33	0.33	0.33	0.32	0.95	0.93	0.94	0.33	0.33	0.33	0.33	0.32	0.95	0.93	0.95	0.32	0.33	0.33	0.33	0.33	0.95	0.93	0.94	
a [-]:	0.09	0.09	0.09	0.09	0.09	0.39	0.37	0.38	0.09	0.09	0.09	0.09	0.09	0.39	0.37	0.38	0.09	0.09	0.09	0.09	0.09	0.39	0.37	0.38	
Lambda [-]:	3.89	3.89	3.89	3.89	3.89	5.42	4.39	5.12	3.89	3.89	3.89	3.89	3.89	5.36	4.29	5.01	3.89	3.89	3.89	3.89	3.89	5.32	4.40	4.64	
P = QxN [W]:	0.01	0.01	0.01	0.01	0.01	3.28	1.00	2.38	0.01	0.01	0.01	0.01	0.01	3.07	0.89	2.11	0.01	0.01	0.01	0.01	0.01	2.93	1.02	1.39	
P with Ct [W]:	0.06	0.06	0.06	0.06	0.06	7.29	2.91	5.64	0.06	0.06	0.06	0.06	0.06	6.90	2.68	5.09	0.06	0.06	0.06	0.06	0.06	6.63	2.94	3.71	
Cp real [-]:	0.07	0.07	0.07	0.07	0.07	0.26	0.20	0.25	0.07	0.07	0.07	0.07	0.07	0.26	0.20	0.24	0.07	0.07	0.07	0.07	0.07	0.26	0.20	0.22	
Cp with Ct [-]:	0.29	0.30	0.30	0.30	0.29	0.58	0.59	0.58	0.30	0.30	0.30	0.30	0.29	0.58	0.59	0.58	0.29	0.30	0.30	0.30	0.30	0.58	0.59	0.59	

park ex rij12345		bin [s] 105 135																							
tunnel wind [V]:	0.812																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
Ugen [V]:	-0.001	0.000	0.000	0.000	0.000	1.167	0.619	1.004	0.000	0.000	0.000	0.000	0.000	1.102	0.586	0.940	0.000	0.000	0.000	0.000	0.000	1.104	0.649	0.944	
strain gauge [V]:	0.192	0.181	0.172	0.167	0.005	4.019																			
wind [m/s]:	1.89	1.90	1.90	1.90	1.89	8.74	6.29	7.95	1.90	1.90	1.90	1.90	1.89	8.42	6.15	7.68	1.89	1.90	1.90	1.90	1.90	8.43	6.43	7.70	
fax [N]:	0.03	0.03	0.03	0.03	0.03	2.13	1.10	1.76	0.03	0.03	0.03	0.03	0.03	1.98	1.05	1.65	0.03	0.03	0.03	0.03	0.03	1.99	1.15	1.65	
torque [mNm]:	0.23	0.24	0.24	0.24	0.24	12.85	6.93	11.08	0.24	0.24	0.24	0.24	0.24	12.14	6.57	10.39	0.24	0.24	0.24	0.24	0.24	12.16	7.25	10.44	
speed [rpm]:	566	568	568	568	567	3900	2335	3434	568	569	568	568	568	3712	2240	3250	567	568	568	568	568	3718	2420	3262	
Fax meas [N]:	0.09	0.09	0.08	0.08	0.00	1.92																			
speed meas [rpm]:																									
Ct [-]:	0.32	0.33	0.33	0.33	0.32	0.95	0.95	0.94	0.33	0.33	0.33	0.33	0.32	0.95	0.94	0.95	0.32	0.33	0.33	0.33	0.33	0.95	0.95	0.95	
a [-]:	0.09	0.09	0.09	0.09	0.09	0.38	0.38	0.38	0.09	0.09	0.09	0.09	0.09	0.39	0.38	0.38	0.09	0.09	0.09	0.09	0.09	0.39	0.38	0.38	
Lambda [-]:	3.89	3.89	3.89	3.89	3.89	5.79	4.82	5.61	3.89	3.89	3.89	3.89	3.89	5.72	4.73	5.50	3.89	3.89	3.89	3.89	3.89	5.72	4.89	5.50	
P = QxN [W]:	0.01	0.01	0.01	0.01	0.01	5.25	1.69	3.99	0.01	0.01	0.01	0.01	0.01	4.72	1.54	3.54	0.01	0.01	0.01	0.01	0.01	4.73	1.84	3.57	
P with Ct [W]:	0.06	0.06	0.06	0.06	0.06	11.48	4.29	8.65	0.06	0.06	0.06	0.06	0.06	10.26	3.99	7.78	0.06	0.06	0.06	0.06	0.06	10.29	4.56	7.83	
Cp real [-]:	0.07	0.07	0.07	0.07	0.07	0.27	0.23	0.27	0.07	0.07	0.07	0.07	0.07	0.27	0.23	0.26	0.07	0.07	0.07	0.07	0.07	0.27	0.23	0.27	
Cp with Ct [-]:	0.29	0.30	0.30	0.30	0.29	0.58	0.58	0.58	0.30	0.30	0.30	0.30	0.29	0.58	0.58	0.58	0.29	0.30	0.30	0.30	0.30	0.58	0.58	0.58	

park ex rij12345		bin [s] 180 210																							
tunnel wind [V]:	0.896																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
Ugen [V]:	-0.001	0.000	0.000	0.000	0.000	1.341	0.798	1.171	0.000	0.000	0.000	0.000	0.000	0.000	1.277	0.717	1.098	-0.001	0.000	0.000	0.000	0.000	1.288	0.799	1.113
strain gauge [V]:	0.229	0.216	0.206	0.200	0.008	4.609																			
wind [m/s]:	1.89	1.90	1.90	1.90	1.89	9.59	7.09	8.76	1.90	1.90	1.90	1.90	1.89	9.28	6.73	8.41	1.89	1.90	1.90	1.90	1.90	9.33	7.09	8.48	
fax [N]:	0.03	0.03	0.04	0.03	0.03	2.52	1.40	2.14	0.03	0.04	0.03	0.03	0.03	2.38	1.26	1.97	0.03	0.03	0.03	0.03	0.03	2.40	1.40	2.01	
torque [mNm]:	0.23	0.24	0.24	0.24	0.23	14.72	8.86	12.89	0.24	0.24	0.24	0.24	0.24	14.03	7.99	12.10	0.23	0.24	0.24	0.24	0.24	14.15	8.87	12.27	
speed [rpm]:	565	569	569	569	567	4395	2847	3911	569	569	568	568	567	4213	2615	3703	567	568	568	568	568	4244	2849	3746	
Fax meas [N]:	0.11	0.10	0.10	0.10	0.00	2.20																			
speed meas [rpm]:																									
Ct [-]:	0.31	0.33	0.33	0.33	0.32	0.93	0.95	0.95	0.33	0.33	0.33	0.33	0.32	0.94	0.94	0.95	0.32	0.33	0.33	0.33	0.33	0.94	0.95	0.95	
a [-]:	0.09	0.09	0.09	0.09	0.09	0.37	0.38	0.38	0.09	0.09	0.09	0.09	0.09	0.38	0.38	0.39	0.09	0.09	0.09	0.09	0.09	0.37	0.38	0.39	
Lambda [-]:	3.89	3.89	3.89	3.89	3.89	5.95	5.22	5.80	3.89	3.89	3.89	3.89	3.89	5.90	5.04	5.72	3.89	3.89	3.89	3.89	3.89	5.91	5.22	5.74	
P = QxN [W]:	0.01	0.01	0.01	0.01	0.01	6.77	2.64	5.28	0.01	0.01	0.01	0.01	0.01	6.19	2.19	4.69	0.01	0.01	0.01	0.01	0.01	6.29	2.65	4.81	
P with Ct [W]:	0.06	0.06	0.06	0.06	0.06	15.26	6.11	11.55	0.06	0.06	0.06	0.06	0.06	13.77	5.25	10.20	0.06	0.06	0.06	0.06	0.06	14.02	6.11	10.47	
Cp real [-]:	0.07	0.07	0.07	0.07	0.07	0.26	0.25	0.27	0.07	0.07	0.07	0.07	0.07	0.26	0.24	0.27	0.07	0.07	0.07	0.07	0.07	0.26	0.25	0.27	
Cp with Ct [-]:	0.29	0.30	0.30	0.30	0.29	0.59	0.58	0.58	0.30	0.30	0.30	0.30	0.29	0.59	0.58	0.58	0.29	0.30	0.30	0.30	0.30	0.59	0.58	0.58	

park ex rij123456	bin [s] 60 90																							
tunnel wind [V]:	0.692																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	-0.001	0.000	0.000	0.000	0.000	0.000	0.918	0.717	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.862	0.653	-0.001	0.000	0.000	0.000	0.000	0.880	0.547
strain gauge [V]:	0.140	0.134	0.129	0.126	0.004	0.125																		
wind [m/s]:	1.89	1.89	1.90	1.90	1.90	1.90	7.59	6.74	1.90	1.90	1.90	1.90	1.89	1.89	7.35	6.45	1.89	1.90	1.90	1.90	1.90	1.90	7.43	5.97
fax [N]:	0.03	0.03	0.04	0.03	0.03	0.04	1.61	1.26	0.03	0.04	0.03	0.03	0.03	0.03	1.51	1.16	0.03	0.03	0.03	0.03	0.03	0.03	1.54	0.99
torque [mNm]:	0.23	0.24	0.24	0.24	0.24	0.24	10.16	7.99	0.24	0.24	0.24	0.24	0.24	0.24	9.55	7.30	0.23	0.24	0.24	0.24	0.24	0.24	9.74	6.15
speed [rpm]:	567	568	569	568	568	569	3189	2616	568	569	568	568	568	568	3028	2433	566	568	568	568	568	568	3079	2129
Fax meas [N]:	0.07	0.06	0.06	0.06	0.00	0.06																		
speed meas [rpm]:																								
Ct [-]:	0.32	0.33	0.33	0.33	0.33	0.33	0.95	0.94	0.33	0.33	0.33	0.33	0.32	0.32	0.95	0.95	0.32	0.33	0.33	0.33	0.33	0.33	0.95	0.94
a [-]:	0.09	0.09	0.09	0.09	0.09	0.09	0.39	0.38	0.09	0.09	0.09	0.09	0.09	0.09	0.39	0.38	0.09	0.09	0.09	0.09	0.09	0.09	0.39	0.38
Lambda [-]:	3.89	3.89	3.89	3.89	3.89	3.89	5.46	5.04	3.89	3.89	3.89	3.89	3.89	3.89	5.35	4.90	3.89	3.89	3.89	3.89	3.89	3.89	5.38	4.63
P = QxN [W]:	0.01	0.01	0.01	0.01	0.01	0.01	3.39	2.19	0.01	0.01	0.01	0.01	0.01	0.01	3.03	1.86	0.01	0.01	0.01	0.01	0.01	0.01	3.14	1.37
P with Ct [W]:	0.06	0.06	0.06	0.06	0.06	0.06	7.50	5.25	0.06	0.06	0.06	0.06	0.06	0.06	6.82	4.61	0.06	0.06	0.06	0.06	0.06	0.06	7.03	3.67
Cp real [-]:	0.07	0.07	0.07	0.07	0.07	0.07	0.26	0.24	0.07	0.07	0.07	0.07	0.07	0.07	0.26	0.24	0.07	0.07	0.07	0.07	0.07	0.07	0.26	0.22
Cp with Ct [-]:	0.29	0.30	0.30	0.30	0.30	0.30	0.58	0.58	0.30	0.30	0.30	0.30	0.30	0.30	0.58	0.58	0.29	0.30	0.30	0.30	0.30	0.30	0.58	0.59

park ex rij123456	bin [s] 120 150																							
tunnel wind [V]:	0.793																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	0.000	0.000	0.000	0.000	0.000	0.000	1.151	0.925	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.095	0.852	0.000	0.000	0.000	0.000	0.000	1.120	0.864
strain gauge [V]:	0.182	0.176	0.169	0.164	0.001	0.164																		
wind [m/s]:	1.89	1.89	1.90	1.89	1.90	1.90	8.66	7.62	1.89	1.90	1.90	1.90	1.89	1.90	8.39	7.31	1.89	1.90	1.90	1.90	1.90	1.89	8.51	7.36
fax [N]:	0.03	0.03	0.04	0.03	0.03	0.04	2.09	1.62	0.03	0.03	0.03	0.03	0.03	0.03	1.97	1.49	0.03	0.03	0.03	0.03	0.03	0.03	2.02	1.51
torque [mNm]:	0.24	0.24	0.24	0.24	0.24	0.24	12.67	10.23	0.24	0.24	0.24	0.24	0.24	0.24	12.07	9.45	0.24	0.24	0.24	0.24	0.24	0.24	12.34	9.58
speed [rpm]:	567	567	569	568	569	569	3853	3208	568	568	568	568	568	568	3694	3001	567	568	569	568	568	568	3766	3035
Fax meas [N]:	0.09	0.08	0.08	0.08	0.00	0.08																		
speed meas [rpm]:																								
Ct [-]:	0.32	0.32	0.33	0.33	0.33	0.33	0.95	0.95	0.32	0.33	0.33	0.33	0.33	0.33	0.95	0.95	0.32	0.33	0.33	0.33	0.33	0.33	0.95	0.95
a [-]:	0.09	0.09	0.09	0.09	0.09	0.09	0.38	0.39	0.09	0.09	0.09	0.09	0.09	0.09	0.39	0.39	0.09	0.09	0.09	0.09	0.09	0.09	0.39	0.39
Lambda [-]:	3.89	3.89	3.89	3.89	3.89	3.89	5.78	5.47	3.89	3.89	3.89	3.89	3.89	3.89	5.71	5.33	3.89	3.89	3.89	3.89	3.89	3.89	5.74	5.35
P = QxN [W]:	0.01	0.01	0.01	0.01	0.01	0.01	5.11	3.44	0.01	0.01	0.01	0.01	0.01	0.01	4.67	2.97	0.01	0.01	0.01	0.01	0.01	0.01	4.87	3.04
P with Ct [W]:	0.06	0.06	0.06	0.06	0.06	0.06	11.16	7.59	0.06	0.06	0.06	0.06	0.06	0.06	10.15	6.71	0.06	0.06	0.06	0.06	0.06	0.06	10.59	6.85
Cp real [-]:	0.07	0.07	0.07	0.07	0.07	0.07	0.27	0.26	0.07	0.07	0.07	0.07	0.07	0.07	0.27	0.26	0.07	0.07	0.07	0.07	0.07	0.07	0.27	0.26
Cp with Ct [-]:	0.29	0.29	0.30	0.30	0.30	0.30	0.58	0.58	0.30	0.30	0.30	0.30	0.30	0.30	0.58	0.58	0.29	0.30	0.30	0.30	0.30	0.30	0.58	0.58

park ex rij123456		bin [s] 200 230																							
tunnel wind [V]:	0.886																								
generator load:	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
pitch [dg]:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
macro:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Ugen [V]:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
strain gauge [V]:	-0.001	0.000	0.001	0.000	0.000	0.001	1.338	1.101	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.301	1.039	-0.001	0.000	0.000	0.000	0.000	1.338	1.061	
wind [m/s]:	0.225	0.214	0.206	0.199	0.003	0.202																			
fax [N]:	1.89	1.89	1.90	1.90	1.90	1.90	9.57	8.42	1.90	1.90	1.90	1.90	1.89	1.89	9.39	8.12	1.89	1.90	1.90	1.90	1.90	1.89	9.57	8.23	
torque [mNm]:	0.03	0.03	0.04	0.03	0.03	0.04	2.52	1.98	0.03	0.04	0.03	0.03	0.03	0.03	2.43	1.84	0.03	0.03	0.03	0.03	0.03	0.03	2.52	1.89	
speed [rpm]:	0.23	0.24	0.25	0.24	0.24	0.25	14.69	12.13	0.24	0.25	0.24	0.24	0.24	0.24	14.29	11.46	0.23	0.24	0.24	0.24	0.24	0.24	14.69	11.70	
Fax meas [N]:	566	567	570	568	568	570	4386	3709	568	569	568	568	568	567	4281	3533	567	568	569	568	568	568	4387	3597	
speed meas [rpm]:	0.11	0.10	0.10	0.10	0.00	0.10																			
Ct [-]:	0.31	0.32	0.33	0.33	0.33	0.34	0.93	0.95	0.33	0.33	0.33	0.33	0.32	0.32	0.94	0.95	0.32	0.33	0.33	0.33	0.33	0.32	0.93	0.95	
a [-]:	0.09	0.09	0.09	0.09	0.09	0.09	0.37	0.39	0.09	0.09	0.09	0.09	0.09	0.09	0.37	0.38	0.09	0.09	0.09	0.09	0.09	0.09	0.37	0.38	
Lambda [-]:	3.89	3.89	3.89	3.89	3.89	3.89	5.95	5.72	3.89	3.89	3.89	3.89	3.89	3.89	5.92	5.65	3.89	3.89	3.89	3.89	3.89	3.89	5.95	5.68	
P = QxN [W]:	0.01	0.01	0.01	0.01	0.01	0.01	6.75	4.71	0.01	0.01	0.01	0.01	0.01	0.01	6.41	4.24	0.01	0.01	0.01	0.01	0.01	0.01	6.75	4.41	
P with Ct [W]:	0.06	0.06	0.06	0.06	0.06	0.06	15.19	10.24	0.06	0.06	0.06	0.06	0.06	0.06	14.31	9.20	0.06	0.06	0.06	0.06	0.06	0.06	15.20	9.56	
Cp real [-]:	0.07	0.07	0.07	0.07	0.07	0.07	0.26	0.27	0.07	0.07	0.07	0.07	0.07	0.07	0.26	0.27	0.07	0.07	0.07	0.07	0.07	0.07	0.26	0.27	
Cp with Ct [-]:	0.29	0.29	0.30	0.30	0.30	0.31	0.59	0.58	0.30	0.30	0.30	0.30	0.30	0.30	0.29	0.59	0.58	0.29	0.30	0.30	0.30	0.30	0.59	0.58	

park ex rij1234567		bin [s] 50 80																							
tunnel wind [V]:	0.716																								
generator load:	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
Ugen [V]:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.070	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.024	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.993	
strain gauge [V]:	0.143	0.138	0.134	0.130	0.000	0.131																			
wind [m/s]:	1.89	1.89	1.90	1.89	1.90	1.90	1.89	8.27	1.89	1.90	1.90	1.90	1.89	1.89	1.90	8.05	1.89	1.90	1.90	1.89	1.90	1.90	1.89	7.90	
fax [N]:	0.03	0.03	0.03	0.03	0.03	0.03	0.03	1.91	0.03	0.03	0.03	0.03	0.03	0.03	0.03	1.80	0.03	0.03	0.03	0.03	0.03	0.03	0.03	1.74	
torque [mNm]:	0.24	0.24	0.24	0.24	0.24	0.24	0.24	11.79	0.24	0.24	0.24	0.24	0.24	0.24	0.24	11.30	0.23	0.24	0.24	0.24	0.24	0.24	0.24	10.97	
speed [rpm]:	567	567	569	568	568	568	568	3621	567	568	568	568	568	568	568	3490	566	568	568	568	568	568	568	3403	
Fax meas [N]:	0.07	0.07	0.06	0.06	0.00	0.06																			
speed meas [rpm]:																									
Ct [-]:	0.32	0.32	0.33	0.32	0.33	0.33	0.32	0.95	0.32	0.33	0.33	0.33	0.32	0.32	0.33	0.95	0.32	0.33	0.33	0.32	0.33	0.33	0.33	0.94	
a [-]:	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.39	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.38	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.38	
Lambda [-]:	3.89	3.89	3.89	3.89	3.89	3.89	3.89	5.69	3.89	3.89	3.89	3.89	3.89	3.89	3.89	5.63	3.89	3.89	3.89	3.89	3.89	3.89	3.89	5.59	
P = QxN [W]:	0.01	0.01	0.01	0.01	0.01	0.01	0.01	4.47	0.01	0.01	0.01	0.01	0.01	0.01	0.01	4.13	0.01	0.01	0.01	0.01	0.01	0.01	0.01	3.91	
P with Ct [W]:	0.06	0.06	0.06	0.06	0.06	0.06	0.06	9.70	0.06	0.06	0.06	0.06	0.06	0.06	0.06	8.96	0.06	0.06	0.06	0.06	0.06	0.06	0.06	8.49	
Cp real [-]:	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.27	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.27	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.27	
Cp with Ct [-]:	0.29	0.29	0.30	0.30	0.30	0.30	0.30	0.58	0.29	0.30	0.30	0.30	0.30	0.30	0.30	0.58	0.29	0.30	0.30	0.30	0.30	0.30	0.30	0.58	

park ex rij1234567	bin [s] 120 150																							
	tunnel wind [V]: 0.809																							
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.304	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.238	-0.001	0.000	0.000	0.000	0.000	0.000	1.217
strain gauge [V]:	0.187	0.178	0.173	0.167	0.000	0.169																		
wind [m/s]:	1.89	1.89	1.90	1.90	1.90	1.90	1.89	9.41	1.89	1.90	1.90	1.90	1.89	1.89	1.90	9.08	1.89	1.90	1.90	1.89	1.90	1.90	1.90	8.98
fax [N]:	0.03	0.03	0.03	0.03	0.03	0.03	0.03	2.44	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	2.29	0.03	0.03	0.03	0.03	0.03	0.03	2.24
torque [mNm]:	0.24	0.24	0.24	0.24	0.24	0.24	0.24	14.32	0.24	0.24	0.24	0.24	0.24	0.24	0.24	13.61	0.23	0.24	0.24	0.24	0.24	0.24	0.24	13.39
speed [rpm]:	567	567	569	568	568	569	568	4289	567	568	568	568	567	568	568	4101	566	568	568	568	568	568	568	4042
Fax meas [N]:	0.09	0.09	0.08	0.08	0.00	0.08																		
speed meas [rpm]:																								
Ct [-]:	0.32	0.32	0.33	0.33	0.33	0.33	0.32	0.94	0.32	0.33	0.33	0.33	0.32	0.32	0.33	0.94	0.32	0.33	0.33	0.32	0.33	0.33	0.33	0.94
a [-]:	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.37	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.38	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.38
Lambda [-]:	3.89	3.89	3.89	3.89	3.89	3.89	3.89	5.92	3.89	3.89	3.89	3.89	3.89	3.89	3.89	5.86	3.89	3.89	3.89	3.89	3.89	3.89	3.89	5.84
P = QxN [W]:	0.01	0.01	0.01	0.01	0.01	0.01	0.01	6.43	0.01	0.01	0.01	0.01	0.01	0.01	0.01	5.84	0.01	0.01	0.01	0.01	0.01	0.01	0.01	5.67
P with Ct [W]:	0.06	0.06	0.06	0.06	0.06	0.06	0.06	14.38	0.06	0.06	0.06	0.06	0.06	0.06	0.06	12.91	0.06	0.06	0.06	0.06	0.06	0.06	0.06	12.47
Cp real [-]:	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.26	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.26	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.27
Cp with Ct [-]:	0.29	0.29	0.30	0.30	0.30	0.30	0.29	0.59	0.29	0.30	0.30	0.30	0.29	0.30	0.30	0.58	0.29	0.30	0.30	0.30	0.30	0.30	0.30	0.58

park ex rij1234567		bin [s] 200 230																							
tunnel wind [V]:	0.897																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	
Ugen [V]:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.465	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.454	-0.001	0.000	0.000	0.000	0.000	0.000	1.417	
strain gauge [V]:	0.222	0.211	0.206	0.200	-0.001	0.205																			
wind [m/s]:	1.90	1.89	1.90	1.89	1.90	1.90	1.89	10.20	1.89	1.90	1.90	1.90	1.89	1.89	1.90	10.14	1.89	1.90	1.90	1.89	1.90	1.90	1.89	9.96	
fax [N]:	0.03	0.03	0.03	0.03	0.03	0.03	0.03	2.81	0.03	0.03	0.03	0.03	0.03	0.03	0.03	2.78	0.03	0.03	0.03	0.03	0.03	0.03	0.03	2.70	
torque [mNm]:	0.24	0.24	0.24	0.24	0.24	0.24	0.24	16.06	0.24	0.24	0.24	0.24	0.24	0.24	0.24	15.94	0.23	0.24	0.24	0.24	0.24	0.24	0.24	15.54	
speed [rpm]:	568	567	568	568	569	568	568	4749	567	568	568	568	567	568	568	4717	566	568	568	568	568	568	568	4612	
Fax meas [N]:	0.11	0.10	0.10	0.10	0.00	0.10																			
speed meas [rpm]:																									
Ct [-]:	0.33	0.32	0.33	0.32	0.33	0.33	0.32	0.92	0.32	0.33	0.33	0.33	0.32	0.33	0.33	0.92	0.32	0.33	0.33	0.32	0.33	0.33	0.33	0.92	
a [-]:	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.35	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.36	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.36	
Lambda [-]:	3.89	3.89	3.89	3.89	3.89	3.89	3.89	6.05	3.89	3.89	3.89	3.89	3.89	3.89	3.89	6.04	3.89	3.89	3.89	3.89	3.89	3.89	3.89	6.01	
P = QxN [W]:	0.01	0.01	0.01	0.01	0.01	0.01	0.01	7.99	0.01	0.01	0.01	0.01	0.01	0.01	0.01	7.87	0.01	0.01	0.01	0.01	0.01	0.01	0.01	7.51	
P with Ct [W]:	0.06	0.06	0.06	0.06	0.06	0.06	0.06	18.46	0.06	0.06	0.06	0.06	0.06	0.06	0.06	18.15	0.06	0.06	0.06	0.06	0.06	0.06	0.06	17.18	
Cp real [-]:	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.26	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.26	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.26	
Cp with Ct [-]:	0.30	0.29	0.30	0.30	0.30	0.30	0.30	0.59	0.29	0.30	0.30	0.30	0.29	0.30	0.30	0.59	0.29	0.30	0.30	0.30	0.30	0.30	0.30	0.59	

zigzag 0 ruw	bin [s] 50 80																							
tunnel wind [V]:	0.715																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	0.737	0.503	0.484	0.426	0.442	0.439	0.442	0.435	0.818	0.542	0.538	0.475	0.490	0.871	0.496	0.452	0.834	0.513	0.504	0.469	0.458	0.837	0.529	0.452
strain gauge [V]:	2.834	1.866	1.756	1.510	1.523	1.166																		
wind [m/s]:	6.82	5.76	5.67	5.38	5.46	5.44	5.46	5.43	7.17	5.95	5.93	5.62	5.70	7.39	5.73	5.51	7.23	5.81	5.76	5.59	5.54	7.25	5.89	5.51
fax [N]:	1.29	0.92	0.89	0.79	0.82	0.81	0.82	0.81	1.43	0.98	0.97	0.87	0.90	1.53	0.91	0.83	1.46	0.93	0.92	0.86	0.84	1.47	0.96	0.83
torque [mNm]:	8.20	5.67	5.47	4.84	5.01	4.98	5.01	4.94	9.08	6.09	6.05	5.37	5.54	9.65	5.60	5.12	9.24	5.78	5.68	5.31	5.19	9.28	5.96	5.12
speed [rpm]:	2671	2002	1949	1785	1829	1820	1830	1811	2904	2114	2103	1924	1968	3055	1985	1857	2948	2031	2005	1907	1876	2958	2079	1858
Fax meas [N]:	1.35	0.89	0.84	0.72	0.73	0.56																		
speed meas [rpm]:																								
Ct [-]:	0.94	0.94	0.94	0.93	0.93	0.93	0.93	0.93	0.95	0.94	0.94	0.94	0.94	0.95	0.94	0.93	0.95	0.94	0.94	0.93	0.93	0.95	0.94	0.93
a [-]:	0.38	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.39	0.38	0.38	0.37	0.37	0.39	0.37	0.37	0.39	0.37	0.37	0.37	0.37	0.39	0.38	0.37
Lambda [-]:	5.08	4.52	4.47	4.30	4.35	4.34	4.35	4.33	5.26	4.62	4.60	4.44	4.48	5.37	4.50	4.38	5.29	4.54	4.52	4.43	4.40	5.30	4.58	4.38
P = QxN [W]:	2.29	1.19	1.12	0.91	0.96	0.95	0.96	0.94	2.76	1.35	1.33	1.08	1.14	3.09	1.16	1.00	2.85	1.23	1.19	1.06	1.02	2.88	1.30	1.00
P with Ct [W]:	5.46	3.30	3.14	2.70	2.82	2.79	2.82	2.77	6.32	3.63	3.60	3.07	3.20	6.93	3.25	2.89	6.49	3.38	3.30	3.03	2.94	6.53	3.53	2.89
Cp real [-]:	0.25	0.21	0.21	0.20	0.20	0.20	0.20	0.20	0.25	0.22	0.22	0.21	0.21	0.26	0.21	0.20	0.26	0.21	0.21	0.21	0.20	0.26	0.22	0.20
Cp with Ct [-]:	0.58	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.58	0.59	0.59	0.59	0.59	0.58	0.59	0.59	0.58	0.59	0.59	0.59	0.59	0.58	0.59	0.59

zigzag 0 ruw	bin [s] 130 160																							
tunnel wind [V]:	0.804																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	0.977	0.679	0.630	0.571	0.579	0.575	0.564	0.562	1.017	0.693	0.678	0.583	0.606	1.075	0.643	0.594	1.022	0.657	0.618	0.591	0.595	1.071	0.694	0.608
strain gauge [V]:	3.581	2.445	2.287	1.985	1.992	1.585																		
wind [m/s]:	7.84	6.56	6.34	6.08	6.11	6.10	6.05	6.04	8.01	6.63	6.56	6.13	6.24	8.30	6.40	6.18	8.04	6.46	6.29	6.17	6.19	8.28	6.63	6.24
fax [N]:	1.71	1.20	1.12	1.02	1.04	1.03	1.01	1.01	1.79	1.22	1.20	1.05	1.08	1.92	1.14	1.06	1.80	1.16	1.10	1.06	1.07	1.91	1.23	1.09
torque [mNm]:	10.79	7.58	7.05	6.40	6.49	6.46	6.33	6.31	11.22	7.72	7.57	6.54	6.79	11.85	7.19	6.66	11.28	7.34	6.92	6.62	6.67	11.81	7.74	6.80
speed [rpm]:	3357	2507	2367	2197	2221	2211	2177	2173	3469	2546	2504	2233	2298	3636	2405	2264	3486	2443	2333	2254	2268	3626	2549	2303
Fax meas [N]:	1.71	1.17	1.09	0.95	0.95	0.76																		
speed meas [rpm]:																								
Ct [-]:	0.95	0.95	0.95	0.94	0.94	0.94	0.94	0.94	0.95	0.95	0.95	0.94	0.94	0.95	0.95	0.94	0.95	0.95	0.95	0.94	0.94	0.95	0.95	0.94
a [-]:	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.39	0.38	0.38
Lambda [-]:	5.56	4.96	4.84	4.69	4.72	4.71	4.68	4.67	5.62	4.99	4.96	4.73	4.78	5.69	4.88	4.76	5.63	4.91	4.82	4.75	4.76	5.69	4.99	4.79
P = QxN [W]:	3.79	1.99	1.75	1.47	1.51	1.49	1.44	1.44	4.08	2.06	1.98	1.53	1.63	4.51	1.81	1.58	4.12	1.88	1.69	1.56	1.58	4.48	2.07	1.64
P with Ct [W]:	8.27	4.86	4.39	3.87	3.94	3.91	3.81	3.80	8.84	5.00	4.85	3.97	4.17	9.80	4.51	4.07	8.93	4.64	4.28	4.04	4.08	9.74	5.01	4.18
Cp real [-]:	0.27	0.24	0.23	0.22	0.22	0.22	0.22	0.22	0.27	0.24	0.24	0.22	0.23	0.27	0.23	0.23	0.27	0.24	0.23	0.23	0.23	0.27	0.24	0.23
Cp with Ct [-]:	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58

zigzag 0 ruw	bin [s] 200 230																							
tunnel wind [V]:	0.919																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	1.179	0.845	0.773	0.696	0.697	0.690	0.698	0.689	1.248	0.873	0.861	0.786	0.777	1.255	0.803	0.733	1.218	0.833	0.786	0.740	0.735	1.231	0.841	0.733
strain gauge [V]:	4.086	3.094	2.833	2.448	2.425	1.969																		
wind [m/s]:	8.80	7.28	6.98	6.64	6.64	6.61	6.65	6.61	9.13	7.40	7.35	7.03	7.00	9.17	7.10	6.80	8.99	7.23	7.03	6.84	6.81	9.05	7.26	6.80
fax [N]:	2.16	1.48	1.36	1.23	1.23	1.22	1.23	1.22	2.31	1.53	1.51	1.38	1.36	2.33	1.41	1.29	2.25	1.46	1.38	1.30	1.29	2.28	1.47	1.29
torque [mNm]:	12.97	9.37	8.59	7.75	7.77	7.69	7.78	7.68	13.72	9.67	9.54	8.73	8.63	13.80	8.91	8.16	13.39	9.24	8.73	8.23	8.17	13.54	9.32	8.15
speed [rpm]:	3932	2980	2776	2553	2558	2536	2561	2535	4130	3060	3025	2810	2786	4151	2860	2660	4044	2945	2811	2681	2665	4083	2968	2659
Fax meas [N]:	1.95	1.48	1.35	1.17	1.16	0.94																		
speed meas [rpm]:																								
Ct [-]:	0.95	0.95	0.94	0.95	0.95	0.95	0.95	0.95	0.94	0.95	0.95	0.95	0.95	0.94	0.95	0.94	0.94	0.95	0.95	0.94	0.94	0.94	0.95	0.94
a [-]:	0.38	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.39	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.39	0.38	0.38	0.38	0.38	0.39	0.38
Lambda [-]:	5.80	5.31	5.16	5.00	5.00	4.98	5.00	4.98	5.87	5.37	5.35	5.19	5.17	5.88	5.23	5.08	5.84	5.29	5.19	5.09	5.08	5.86	5.31	5.08
P = QxN [W]:	5.34	2.92	2.50	2.07	2.08	2.04	2.09	2.04	5.93	3.10	3.02	2.57	2.52	6.00	2.67	2.27	5.67	2.85	2.57	2.31	2.28	5.79	2.90	2.27
P with Ct [W]:	11.69	6.62	5.85	5.02	5.04	4.96	5.05	4.96	13.13	6.95	6.80	5.97	5.88	13.29	6.16	5.42	12.48	6.48	5.97	5.50	5.44	12.77	6.58	5.42
Cp real [-]:	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.24	0.26	0.26	0.26	0.25	0.25	0.26	0.25	0.24	0.27	0.26	0.25	0.25	0.24	0.26	0.26	0.24
Cp with Ct [-]:	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58

zigzag 0	bin [s] 60 90																							
tunnel wind [V]:	0.723																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	0.771	0.503	0.393	0.419	0.420	0.817	0.446	0.410	0.838	0.541	0.545	0.456	0.456	0.890	0.502	0.451	0.829	0.515	0.505	0.452	0.427	0.789	0.519	0.443
strain gauge [V]:	2.847	1.852	1.828	1.458	1.436	0.823																		
wind [m/s]:	6.97	5.76	5.22	5.35	5.35	7.16	5.48	5.30	7.25	5.94	5.96	5.53	5.53	7.47	5.75	5.50	7.22	5.82	5.77	5.51	5.39	7.05	5.84	5.46
fax [N]:	1.35	0.92	0.74	0.78	0.78	1.43	0.82	0.77	1.47	0.98	0.98	0.84	0.84	1.56	0.91	0.83	1.45	0.93	0.92	0.83	0.79	1.38	0.94	0.82
torque [mNm]:	8.57	5.67	4.49	4.77	4.77	9.07	5.05	4.66	9.29	6.08	6.13	5.17	5.17	9.85	5.66	5.11	9.20	5.80	5.69	5.12	4.85	8.76	5.85	5.02
speed [rpm]:	2769	2004	1691	1765	1766	2900	1840	1737	2961	2112	2125	1871	1870	3109	2000	1855	2935	2037	2009	1859	1786	2820	2049	1831
Fax meas [N]:	1.36	0.88	0.87	0.70	0.68	0.39																		
speed meas [rpm]:																								
Ct [-]:	0.94	0.94	0.92	0.93	0.93	0.95	0.93	0.93	0.95	0.94	0.94	0.93	0.93	0.95	0.94	0.93	0.95	0.94	0.94	0.93	0.93	0.95	0.94	0.93
a [-]:	0.38	0.37	0.36	0.37	0.37	0.39	0.37	0.36	0.39	0.38	0.38	0.37	0.37	0.39	0.37	0.37	0.39	0.37	0.37	0.37	0.37	0.38	0.38	0.37
Lambda [-]:	5.16	4.52	4.20	4.28	4.29	5.26	4.36	4.25	5.30	4.61	4.63	4.39	4.39	5.40	4.51	4.38	5.28	4.55	4.52	4.38	4.31	5.20	4.56	4.35
P = QxN [W]:	2.48	1.19	0.79	0.88	0.88	2.75	0.97	0.85	2.88	1.35	1.36	1.01	1.01	3.21	1.19	0.99	2.83	1.24	1.20	1.00	0.91	2.59	1.25	0.96
P with Ct [W]:	5.82	3.30	2.48	2.66	2.66	6.31	2.85	2.59	6.54	3.62	3.66	2.93	2.93	7.15	3.29	2.88	6.44	3.40	3.32	2.90	2.71	6.01	3.44	2.82
Cp real [-]:	0.25	0.21	0.19	0.20	0.20	0.25	0.20	0.19	0.26	0.22	0.22	0.20	0.20	0.26	0.21	0.20	0.26	0.21	0.21	0.20	0.20	0.25	0.21	0.20
Cp with Ct [-]:	0.58	0.59	0.59	0.59	0.59	0.58	0.59	0.59	0.58	0.59	0.59	0.59	0.59	0.58	0.59	0.59	0.58	0.59	0.59	0.59	0.59	0.58	0.59	0.59

zigzag 0	bin [s]																							
tunnel wind [V]:	0.817																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	0.980	0.692	0.523	0.549	0.546	1.643	0.656	0.546	1.045	0.709	0.688	0.578	0.587	1.079	0.650	0.597	1.044	0.692	0.616	0.573	0.564	1.021	0.694	0.583
strain gauge [V]:	3.559	2.491	2.368	1.901	1.868	0.568																		
wind [m/s]:	7.85	6.62	5.86	5.98	5.97	11.07	6.46	5.97	8.15	6.70	6.60	6.11	6.15	8.32	6.43	6.20	8.14	6.62	6.28	6.09	6.05	8.03	6.63	6.13
fax [N]:	1.72	1.22	0.95	0.99	0.99	3.21	1.16	0.98	1.85	1.25	1.22	1.04	1.05	1.93	1.15	1.07	1.85	1.22	1.10	1.03	1.01	1.80	1.22	1.05
torque [mNm]:	10.83	7.72	5.89	6.17	6.14	17.98	7.33	6.13	11.53	7.89	7.67	6.48	6.58	11.89	7.26	6.69	11.51	7.71	6.89	6.43	6.33	11.26	7.73	6.54
speed [rpm]:	3366	2544	2062	2135	2127	5257	2441	2126	3551	2591	2532	2218	2243	3648	2423	2273	3547	2543	2326	2203	2178	3481	2548	2232
Fax meas [N]:	1.70	1.19	1.13	0.91	0.89	0.27																		
speed meas [rpm]:																								
Ct [-]:	0.95	0.95	0.94	0.94	0.94	0.89	0.95	0.94	0.95	0.95	0.95	0.94	0.94	0.95	0.95	0.94	0.95	0.95	0.95	0.94	0.94	0.95	0.95	0.94
a [-]:	0.38	0.38	0.38	0.38	0.38	0.33	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
Lambda [-]:	5.57	4.99	4.57	4.64	4.63	6.17	4.91	4.63	5.66	5.02	4.98	4.71	4.74	5.70	4.89	4.76	5.65	4.99	4.81	4.70	4.68	5.63	4.99	4.73
P = QxN [W]:	3.82	2.06	1.27	1.38	1.37	9.90	1.87	1.37	4.29	2.14	2.03	1.51	1.54	4.54	1.84	1.59	4.27	2.05	1.68	1.48	1.44	4.11	2.06	1.53
P with Ct [W]:	8.31	4.99	3.47	3.69	3.67	23.69	4.63	3.66	9.30	5.16	4.95	3.93	4.00	9.87	4.57	4.09	9.27	4.99	4.26	3.88	3.81	8.91	5.00	3.97
Cp real [-]:	0.27	0.24	0.21	0.22	0.22	0.25	0.24	0.22	0.27	0.24	0.24	0.22	0.23	0.27	0.23	0.23	0.27	0.24	0.23	0.22	0.22	0.27	0.24	0.22
Cp with Ct [-]:	0.58	0.58	0.59	0.59	0.59	0.59	0.58	0.59	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58

zigzag 0	bin [s]																							
tunnel wind [V]:	0.899																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni	My3u ni
Ugen [V]:	1.139	0.819	0.635	0.654	0.651	1.755	0.735	0.663	1.242	0.863	0.838	0.712	0.689	1.263	0.794	0.725	1.204	0.808	0.762	0.693	0.688	1.152	0.794	0.701
strain gauge [V]:	3.967	2.937	2.808	2.265	2.229	0.900																		
wind [m/s]:	8.61	7.17	6.37	6.45	6.44	11.62	6.82	6.49	9.10	7.36	7.25	6.71	6.61	9.20	7.07	6.77	8.92	7.12	6.93	6.63	6.60	8.67	7.07	6.66
fax [N]:	2.07	1.44	1.13	1.16	1.15	3.46	1.29	1.17	2.30	1.51	1.47	1.25	1.22	2.35	1.39	1.28	2.21	1.42	1.34	1.22	1.22	2.09	1.39	1.24
torque [mNm]:	12.54	9.09	7.10	7.30	7.27	19.19	8.18	7.40	13.65	9.56	9.29	7.93	7.69	13.88	8.81	8.07	13.25	8.96	8.47	7.73	7.67	12.68	8.82	7.82
speed [rpm]:	3819	2907	2380	2433	2425	5576	2666	2460	4113	3031	2961	2600	2536	4172	2833	2639	4005	2873	2743	2547	2532	3855	2835	2570
Fax meas [N]:	1.89	1.40	1.34	1.08	1.06	0.43																		
speed meas [rpm]:																								
Ct [-]:	0.95	0.95	0.95	0.95	0.95	0.87	0.94	0.95	0.94	0.95	0.95	0.94	0.95	0.94	0.95	0.94	0.94	0.95	0.94	0.95	0.95	0.95	0.95	0.95
a [-]:	0.38	0.39	0.38	0.38	0.38	0.32	0.38	0.38	0.38	0.39	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
Lambda [-]:	5.76	5.26	4.86	4.90	4.89	6.23	5.08	4.92	5.87	5.35	5.30	5.03	4.98	5.88	5.21	5.06	5.83	5.24	5.14	4.99	4.98	5.78	5.21	5.01
P = QxN [W]:	5.02	2.77	1.77	1.86	1.85	11.21	2.28	1.91	5.88	3.03	2.88	2.16	2.04	6.06	2.61	2.23	5.56	2.70	2.43	2.06	2.03	5.12	2.62	2.10
P with Ct [W]:	10.94	6.34	4.43	4.61	4.58	27.35	5.44	4.70	13.00	6.83	6.54	5.19	4.96	13.45	6.06	5.34	12.20	6.21	5.73	5.00	4.95	11.17	6.06	5.08
Cp real [-]:	0.27	0.25	0.23	0.24	0.23	0.24	0.24	0.24	0.26	0.26	0.26	0.24	0.24	0.26	0.25	0.24	0.27	0.25	0.25	0.24	0.24	0.27	0.25	0.24
Cp with Ct [-]:	0.58	0.58	0.58	0.58	0.58	0.59	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.59	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58

farm 1 00 00 see 2003 11 21				bin [s] 40 70																				
tunnel wind [V]:	0.698																							
generator:	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb15	wtb16	wtb17	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24		
pitch [dg]:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	2.5	0	0	2.5	0	0		
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl		
Ugen [V]:	0.80	0.44	0.50	0.50	0.48	0.49	0.57	0.74	0.34	0.43	0.40	0.37	0.45	0.79	0.42	0.50	0.49	0.47	0.56	0.75	0.41	0.42		
strain guage [V]:	0.87	0.50	0.55											0.78	0.48	0.52								
rotor speed [V]:	2.32																							
wind [m/s]:	6.95	5.35	5.61	5.59	5.51	5.55	5.88	6.69	4.81	5.32	5.16	4.96	5.41	6.91	5.27	5.25	5.21	5.48	5.83	6.56	5.20	5.27		
fax [N]:	1.27	0.73	0.82	0.81	0.79	0.80	0.92	1.19	0.59	0.72	0.67	0.62	0.75	1.26	0.71	0.59	0.58	0.78	0.90	0.94	0.68	0.71		
torque [mNm]:	8.84	5.01	5.68	5.61	5.41	5.52	6.36	8.24	3.91	4.91	4.54	4.18	5.15	8.76	4.80	5.60	5.51	5.35	6.25	8.36	4.62	4.80		
speed [rpm]:	2803	1809	1982	1963	1913	1939	2159	2648	1523	1783	1687	1592	1844	2782	1753	1960	1938	1895	2130	2679	1706	1753		
Fax meas [N]:	1.40	0.79	0.90											1.28	0.78	0.86								
speed meas [rpm]:																								
Ct [-]:	0.90	0.87	0.89	0.89	0.88	0.88	0.90	0.90	0.86	0.87	0.86	0.86	0.87	0.90	0.86	0.73	0.73	0.88	0.90	0.74	0.86	0.86		
a [-]:	0.34	0.32	0.33	0.33	0.33	0.33	0.34	0.34	0.31	0.32	0.31	0.31	0.32	0.34	0.31	0.24	0.24	0.33	0.34	0.25	0.31	0.31		
Lambda [-]:	5.24	4.39	4.58	4.56	4.51	4.54	4.77	5.14	4.11	4.35	4.25	4.17	4.43	5.23	4.32	4.85	4.83	4.49	4.74	5.30	4.26	4.32		
P = QxN [W]:	2.60	0.95	1.18	1.15	1.08	1.12	1.44	2.29	0.62	0.92	0.80	0.70	0.99	2.55	0.88	1.15	1.12	1.06	1.39	2.35	0.82	0.88		
P with Ct [W]:	5.85	2.68	3.09	3.04	2.92	2.98	3.54	5.21	1.94	2.62	2.39	2.12	2.76	5.76	2.55	2.36	2.30	2.88	3.47	4.64	2.44	2.55		
Cp real [-]:	0.26	0.21	0.23	0.22	0.22	0.22	0.24	0.26	0.19	0.21	0.20	0.19	0.21	0.26	0.20	0.27	0.27	0.22	0.24	0.28	0.20	0.20		
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.55	0.55	0.59	0.59	0.56	0.59	0.59		

farm 1 00 00 see 2003 11 21				bin [s] 115 145																				
tunnel wind [V]:	0.788																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb15	wtb16	wtb17	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24		
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	2.5	0	0	2.5	0	0		
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	1.06	0.61	0.69	0.69	0.68	0.70	0.73	0.98	0.48	0.61	0.59	0.53	0.58	1.05	0.60	0.69	0.66	0.67	0.72	1.02	0.56	0.61		
strain guage [V]:	1.11	0.65	0.71											1.03	0.63	0.67								
rotor speed [V]:	2.95																							
wind [m/s]:	8.05	6.06	6.43	6.46	6.41	6.47	6.65	7.72	5.50	6.05	5.96	5.74	5.95	8.02	6.01	6.25	6.11	6.34	6.57	7.86	5.86	6.04		
fax [N]:	1.74	0.98	1.10	1.11	1.10	1.11	1.17	1.60	0.78	0.98	0.95	0.87	0.94	1.73	0.96	0.85	0.81	1.07	1.15	1.33	0.91	0.97		
torque [mNm]:	11.68	6.82	7.66	7.73	7.62	7.75	8.16	10.81	5.39	6.81	6.59	6.00	6.55	11.59	6.71	7.71	7.42	7.47	7.98	11.24	6.31	6.78		
speed [rpm]:	3541	2277	2495	2515	2486	2520	2626	3315	1905	2274	2217	2065	2208	3518	2250	2509	2433	2446	2578	3425	2146	2268		
Fax meas [N]:	1.80	1.04	1.16											1.70	1.02	1.12								
speed meas [rpm]:																								
Ct [-]:	0.91	0.90	0.90	0.90	0.90	0.90	0.90	0.91	0.88	0.90	0.90	0.89	0.90	0.91	0.90	0.74	0.74	0.90	0.90	0.73	0.90	0.90		
a [-]:	0.35	0.34	0.35	0.34	0.35	0.34	0.34	0.35	0.33	0.34	0.34	0.34	0.34	0.35	0.34	0.25	0.24	0.35	0.34	0.24	0.34	0.34		
Lambda [-]:	5.71	4.88	5.04	5.05	5.03	5.06	5.13	5.58	4.50	4.88	4.83	4.67	4.82	5.70	4.86	5.21	5.17	5.01	5.10	5.66	4.76	4.87		
P = QxN [W]:	4.33	1.63	2.00	2.04	1.98	2.05	2.24	3.75	1.07	1.62	1.53	1.30	1.52	4.27	1.58	2.03	1.89	1.91	2.15	4.03	1.42	1.61		
P with Ct [W]:	9.10	3.88	4.63	4.70	4.60	4.72	5.13	8.00	2.90	3.87	3.70	3.30	3.68	8.98	3.80	4.02	3.75	4.45	4.94	7.95	3.51	3.85		
Cp real [-]:	0.28	0.25	0.26	0.26	0.26	0.26	0.26	0.28	0.22	0.25	0.24	0.23	0.24	0.28	0.25	0.28	0.28	0.25	0.26	0.28	0.24	0.25		
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.56	0.59	0.59	0.55	0.59	0.59		

farm 100 00 see 2003 11 21				bin [s] 180 210																							
tunnel wind [V]:	0.887																										
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb15	wtb16	wtb17	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24					
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d					
pitch [dg]:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	2.5	0	0	2.5	0	0					
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl					
Ugen [V]:	1.29	0.80	0.88	0.87	0.88	0.89	0.91	1.19	0.62	0.76	0.74	0.69	0.71	1.29	0.77	0.87	0.83	0.84	0.88	1.22	0.72	0.76					
strain guage [V]:	1.43	0.84	0.89											1.35	0.81	0.87											
rotor speed [V]:	3.50																										
wind [m/s]:	9.11	6.95	7.29	7.28	7.28	7.34	7.42	8.63	6.13	6.80	6.66	6.42	6.56	9.08	6.84	7.17	6.95	7.14	7.29	8.91	6.58	6.76					
fax [N]:	2.26	1.27	1.42	1.41	1.41	1.44	1.47	2.02	1.00	1.22	1.18	1.10	1.15	2.24	1.24	1.11	1.05	1.35	1.42	1.68	1.15	1.21					
torque [mNm]:	14.21	8.84	9.71	9.69	9.70	9.84	10.06	13.07	6.99	8.49	8.20	7.65	7.96	14.13	8.61	9.68	9.19	9.32	9.72	13.47	8.00	8.42					
speed [rpm]:	4198	2801	3029	3023	3026	3063	3120	3901	2321	2713	2635	2493	2574	4178	2741	3020	2893	2927	3032	4005	2584	2694					
Fax meas [N]:	2.31	1.33	1.46											2.21	1.32	1.45											
speed meas [rpm]:																											
Ct [-]:	0.92	0.90	0.90	0.90	0.90	0.91	0.91	0.92	0.90	0.90	0.90	0.90	0.90	0.92	0.90	0.73	0.74	0.90	0.90	0.72	0.90	0.90					
a [-]:	0.36	0.34	0.35	0.35	0.35	0.35	0.35	0.36	0.35	0.34	0.34	0.35	0.34	0.36	0.34	0.24	0.24	0.34	0.35	0.24	0.34	0.34					
Lambda [-]:	5.99	5.24	5.40	5.39	5.39	5.42	5.46	5.87	4.91	5.18	5.13	5.04	5.09	5.98	5.20	5.47	5.41	5.33	5.40	5.84	5.10	5.17					
P = QxN [W]:	6.25	2.59	3.08	3.07	3.07	3.16	3.29	5.34	1.70	2.41	2.26	2.00	2.15	6.18	2.47	3.06	2.78	2.86	3.09	5.65	2.16	2.38					
P with Ct [W]:	13.13	5.85	6.75	6.73	6.74	6.90	7.14	11.17	4.02	5.48	5.17	4.63	4.93	12.99	5.60	6.05	5.50	6.34	6.76	11.47	4.96	5.40					
Cp real [-]:	0.28	0.26	0.27	0.27	0.27	0.27	0.27	0.28	0.25	0.26	0.26	0.26	0.26	0.28	0.26	0.28	0.28	0.27	0.27	0.27	0.26	0.26					
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.56	0.59	0.59	0.55	0.59	0.59					

bin [s] 50 400

farm 14x2 pitch 00 scan C				strange after 440 sec.; something visable in more generators; is the hot wire moved then??																						
tunnel wind [V]:	0.892																									
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb23					
	generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d					
	pitch [dg]:	0	0	0	0	0	0	0	0	0	0	0	0	2.5	0	0	2.5	0	2.5	0	0	0				
	macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl				
	Ugen [V]:	1.17	0.73	0.76	0.75	0.77	0.83	0.92	0.81	0.93	1.20	0.73	0.78	0.93	0.93	0.86	0.92	0.74	0.88	0.78	0.65	0.99				
	strain guage [V]:	1.31	0.78	0.78											0.90	0.89	0.70									
	rotor speed [V]:	3.22																								
wind [m/s]:	8.54	6.63	6.80	6.72	6.83	7.09	7.49	6.99	7.51	8.71	6.64	6.89	7.46	7.50	7.23	7.38	6.67	7.19	6.87	6.26	7.76					
fax [N]:	1.98	1.17	1.22	1.20	1.24	1.33	1.50	1.29	1.51	2.06	1.17	1.25	1.20	1.51	1.39	1.18	1.18	1.12	1.25	1.04	1.62					
torque [mNm]:	12.84	8.13	8.50	8.32	8.58	9.20	10.22	8.94	10.28	13.25	8.15	8.70	10.32	10.27	9.57	10.16	8.20	9.73	8.66	7.27	10.93					
speed [rpm]:	3842	2617	2713	2666	2734	2897	3161	2829	3177	3948	2622	2767	3188	3173	2992	3145	2637	3033	2757	2395	3346					
Fax meas [N]:	2.12	1.24	1.28											1.47	1.45	1.17										
speed meas [rpm]:																										
Ct [-]:	0.92	0.90	0.90	0.90	0.90	0.90	0.91	0.90	0.91	0.92	0.90	0.90	0.73	0.91	0.90	0.73	0.90	0.73	0.90	0.90	0.91					
a [-]:	0.36	0.34	0.34	0.34	0.34	0.34	0.35	0.34	0.35	0.36	0.34	0.34	0.24	0.35	0.34	0.24	0.34	0.24	0.34	0.35	0.35					
Lambda [-]:	5.84	5.12	5.18	5.15	5.20	5.30	5.48	5.26	5.49	5.89	5.13	5.22	5.55	5.49	5.37	5.53	5.14	5.48	5.21	4.97	5.60					
P = QxN [W]:	5.17	2.23	2.41	2.32	2.46	2.79	3.38	2.65	3.42	5.48	2.24	2.52	3.45	3.41	3.00	3.35	2.26	3.09	2.50	1.82	3.83					
P with Ct [W]:	10.82	5.10	5.48	5.29	5.57	6.22	7.31	5.96	7.38	11.47	5.11	5.70	6.80	7.36	6.60	6.60	5.17	6.10	5.66	4.27	8.15					
Cp real [-]:	0.28	0.26	0.26	0.26	0.26	0.27	0.27	0.26	0.27	0.28	0.26	0.26	0.28	0.27	0.27	0.28	0.26	0.28	0.26	0.25	0.28					
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.56	0.59	0.56	0.59	0.59	0.59					

farm 14x2 pitch 00 scan B				bin [s]																				50	550
tunnel wind [V]:	0.888																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23			
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d			
pitch [dg]:	0	0	0	0	0	0	0	0	0	0	0	0	2.5	0	0	2.5	0	2.5	0	0	2.5	0			
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl			
Ugen [V]:	1.17	0.73	0.76	0.75	0.77	0.83	0.92	0.79	0.93	1.20	0.73	0.79	0.93	0.92	0.86	0.92	0.74	0.86	0.78	0.65	0.89	0.99			
strain guage [V]:	1.31	0.77	0.78											0.89	0.89	0.70									
rotor speed [V]:	3.22																								
wind [m/s]:	8.53	6.62	6.79	6.72	6.82	7.09	7.48	6.92	7.50	8.70	6.65	6.90	7.44	7.49	7.22	7.38	6.68	7.13	6.87	6.25	7.27	7.76			
fax [N]:	1.97	1.17	1.22	1.20	1.23	1.33	1.50	1.26	1.51	2.06	1.17	1.26	1.20	1.50	1.39	1.18	1.19	1.10	1.25	1.04	1.14	1.62			
torque [mNm]:	12.83	8.10	8.49	8.32	8.56	9.21	10.20	8.78	10.26	13.23	8.15	8.73	10.29	10.22	9.54	10.15	8.24	9.58	8.68	7.25	9.90	10.93			
speed [rpm]:	3840	2611	2711	2667	2729	2898	3156	2786	3172	3943	2624	2774	3180	3162	2984	3143	2646	2995	2760	2389	3077	3345			
Fax meas [N]:	2.11	1.23	1.27											1.46	1.44	1.17									
speed meas [rpm]:																									
Ct [-]:	0.92	0.90	0.90	0.90	0.90	0.90	0.91	0.90	0.91	0.92	0.90	0.90	0.73	0.91	0.90	0.73	0.90	0.73	0.90	0.90	0.73	0.91			
a [-]:	0.36	0.34	0.34	0.34	0.34	0.34	0.35	0.34	0.35	0.36	0.34	0.34	0.24	0.35	0.34	0.24	0.34	0.24	0.34	0.35	0.24	0.35			
Lambda [-]:	5.84	5.12	5.18	5.16	5.19	5.31	5.48	5.23	5.49	5.89	5.13	5.22	5.55	5.48	5.37	5.53	5.14	5.46	5.21	4.97	5.50	5.60			
P = QxN [W]:	5.16	2.22	2.41	2.32	2.44	2.79	3.37	2.56	3.41	5.46	2.24	2.54	3.43	3.39	2.98	3.34	2.28	3.01	2.51	1.81	3.19	3.83			
P with Ct [W]:	10.80	5.07	5.47	5.29	5.54	6.23	7.29	5.78	7.36	11.44	5.12	5.73	6.76	7.32	6.57	6.59	5.21	5.94	5.67	4.26	6.30	8.14			
Cp real [-]:	0.28	0.26	0.26	0.26	0.26	0.27	0.27	0.26	0.27	0.28	0.26	0.26	0.28	0.27	0.27	0.28	0.26	0.28	0.26	0.25	0.28	0.28			
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.56	0.59	0.56	0.59	0.59	0.56	0.59			

farm 14x2 pitch 00 scan A				bin [s]																				50	550
tunnel wind [V]:	0.890																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23			
	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d			
	pitch [dg]:	0	0	0	0	0	0	0	0	0	0	0	0	2.5	0	0	2.5	0	2.5	0	2.5	2.5	0		
	macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl		
Ugen [V]:	1.16	0.73	0.76	0.75	0.77	0.83	0.93	0.78	0.93	1.20	0.74	0.79	0.93	0.93	0.86	0.92	0.74	0.86	0.78	0.65	0.89	0.9875			
strain guage [V]:	1.31	0.77	0.78																						
rotor speed [V]:	3.21																								
wind [m/s]:	8.52	6.62	6.80	6.72	6.82	7.08	7.50	6.87	7.52	8.71	6.67	6.90	7.44	7.50	7.22	7.37	6.69	7.09	6.88	6.02	7.23	7.75			
fax [N]:	1.97	1.17	1.22	1.20	1.23	1.33	1.50	1.25	1.51	2.06	1.18	1.26	1.20	1.51	1.39	1.18	1.19	1.09	1.25	0.79	1.13	1.61			
torque [mNm]:	12.80	8.10	8.50	8.31	8.56	9.18	10.25	8.67	10.31	13.25	8.20	8.74	10.28	10.26	9.54	10.13	8.25	9.50	8.69	7.21	9.81	10.91			
speed [rpm]:	3830	2611	2715	2665	2729	2892	3168	2758	3184	3949	2637	2777	3177	3171	2984	3138	2650	2973	2763	2380	3055	3339			
Fax meas [N]:	2.11	1.23	1.27																						
speed meas [rpm]:																									
Ct [-]:	0.92	0.90	0.90	0.90	0.90	0.90	0.91	0.90	0.91	0.92	0.90	0.90	0.73	0.91	0.90	0.73	0.90	0.73	0.90	0.74	0.73	0.91			
a [-]:	0.36	0.34	0.34	0.34	0.34	0.34	0.35	0.34	0.35	0.36	0.34	0.34	0.24	0.35	0.34	0.24	0.34	0.24	0.34	0.24	0.24	0.35			
Lambda [-]:	5.84	5.12	5.18	5.15	5.19	5.30	5.49	5.21	5.50	5.89	5.14	5.22	5.55	5.49	5.37	5.53	5.14	5.44	5.21	5.14	5.49	5.59			
P = QxN [W]:	5.13	2.22	2.42	2.32	2.45	2.78	3.40	2.50	3.44	5.48	2.27	2.54	3.42	3.41	2.98	3.33	2.29	2.96	2.51	1.80	3.14	3.81			
P with Ct [W]:	10.74	5.07	5.48	5.28	5.54	6.20	7.34	5.67	7.41	11.47	5.17	5.75	6.75	7.36	6.57	6.57	5.22	5.84	5.69	3.58	6.20	8.12			
Cp real [-]:	0.28	0.26	0.26	0.26	0.26	0.27	0.27	0.26	0.27	0.28	0.26	0.26	0.28	0.27	0.27	0.28	0.26	0.28	0.26	0.28	0.28	0.28			
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.56	0.59	0.56	0.59	0.56	0.56	0.59			

farm 14x2 pitch 00 reprod				bin [s]: 120 150																					
tunnel wind [V]:	0.688																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22			
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d			
pitch [dg]:	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	0	0	2.5	0	2.5	0	0	2.5			
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl			
Ugen [V]:	0.70	0.40	0.45	0.42	0.43	0.47	0.47	0.45	0.45	0.47	0.77	0.44	0.47	0.66	0.48	0.46	0.60	0.42	0.62	0.46	0.34	0.699			
strain guage [V]:	0.77	0.44	0.46	0.47 0.47 0.45																					
rotor speed [V]:	2.11																								
wind [m/s]:	6.49	5.15	5.38	5.28	5.31	5.47	5.47	5.39	5.39	5.47	6.84	5.33	5.49	6.10	5.51	5.42	5.77	5.26	5.87	5.42	4.78	6.29			
fax [N]:	1.12	0.67	0.74	0.71	0.72	0.78	0.77	0.74	0.75	0.77	1.24	0.73	0.78	0.81	0.79	0.76	0.72	0.70	0.75	0.76	0.58	0.86			
torque [mNm]:	7.81	4.53	5.08	4.83	4.89	5.32	5.31	5.09	5.11	5.31	8.59	4.96	5.37	7.40	5.41	5.19	6.69	4.77	6.90	5.18	3.87	7.79			
speed [rpm]:	2535	1682	1826	1760	1777	1889	1886	1829	1834	1884	2738	1793	1900	2429	1912	1855	2245	1746	2299	1851	1510	2530			
Fax meas [N]:	1.24	0.70	0.76	0.77 0.77 0.75																					
speed meas [rpm]:																									
Ct [-]:	0.90	0.86	0.87	0.86	0.86	0.88	0.88	0.87	0.87	0.88	0.90	0.87	0.88	0.74	0.88	0.87	0.74	0.86	0.74	0.87	0.86	0.74			
a [-]:	0.34	0.31	0.32	0.31	0.32	0.33	0.33	0.32	0.32	0.33	0.34	0.32	0.33	0.24	0.33	0.32	0.24	0.31	0.24	0.32	0.31	0.25			
Lambda [-]:	5.07	4.24	4.41	4.33	4.35	4.48	4.48	4.41	4.42	4.48	5.20	4.37	4.49	5.17	4.51	4.44	5.05	4.31	5.09	4.44	4.10	5.22			
P = QxN [W]:	2.07	0.80	0.97	0.89	0.91	1.05	1.05	0.98	0.98	1.05	2.46	0.93	1.07	1.88	1.08	1.01	1.57	0.87	1.66	1.00	0.61	2.06			
P with Ct [W]:	4.78	2.37	2.72	2.57	2.60	2.86	2.86	2.72	2.74	2.85	5.58	2.64	2.89	3.74	2.92	2.78	3.15	2.54	3.32	2.77	1.91	4.09			
Cp real [-]:	0.26	0.20	0.21	0.20	0.21	0.22	0.22	0.21	0.21	0.22	0.26	0.21	0.22	0.28	0.22	0.21	0.28	0.20	0.28	0.21	0.19	0.28			
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.56	0.59	0.56	0.59	0.59	0.56			

farm 14x2 pitch 00 reprod				bin [s]: 320 350																			
tunnel wind [V]:	0.801																						
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	0	0	2.5	0	2.5	0	0	2.5	
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	
Ugen [V]:	0.94	0.56	0.61	0.60	0.62	0.64	0.64	0.64	0.62	0.64	1.00	0.59	0.64	0.88	0.66	0.63	0.79	0.59	0.80	0.64	0.49	0.901 ₂	
strain guage [V]:	1.06	0.62	0.63	0.64 0.65 0.61																			
rotor speed [V]:	2.65																						
wind [m/s]:	7.55	5.85	6.07	6.02	6.09	6.22	6.20	6.21	6.11	6.22	7.81	5.97	6.19	7.18	6.29	6.14	6.78	5.97	6.80	6.19	5.57	7.30	
fax [N]:	1.53	0.91	0.98	0.96	0.99	1.03	1.03	1.03	1.00	1.03	1.64	0.95	1.02	1.12	1.06	1.01	1.00	0.95	1.00	1.02	0.81	1.15	
torque [mNm]:	10.39	6.30	6.85	6.72	6.90	7.18	7.15	7.17	6.94	7.19	11.05	6.60	7.11	9.70	7.35	7.01	8.83	6.59	8.87	7.12	5.57	9.97	
speed [rpm]:	3205	2141	2286	2252	2299	2371	2362	2369	2308	2374	3376	2220	2353	3027	2415	2328	2799	2218	2811	2356	1952	3097	
Fax meas [N]:	1.72	0.99	1.03	1.04 1.05 1.01																			
speed meas [rpm]:																							
Ct [-]:	0.91	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.91	0.90	0.90	0.73	0.90	0.90	0.74	0.90	0.74	0.90	0.88	0.73	
a [-]:	0.35	0.34	0.35	0.34	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.34	0.35	0.24	0.35	0.35	0.24	0.34	0.24	0.35	0.33	0.24	
Lambda [-]:	5.51	4.75	4.89	4.86	4.90	4.95	4.95	4.95	4.90	4.95	5.62	4.83	4.94	5.47	4.98	4.92	5.36	4.83	5.37	4.94	4.55	5.51	
P = QxN [W]:	3.49	1.41	1.64	1.58	1.66	1.78	1.77	1.78	1.68	1.79	3.91	1.53	1.75	3.08	1.86	1.71	2.59	1.53	2.61	1.76	1.14	3.23	
P with Ct [W]:	7.50	3.50	3.91	3.80	3.95	4.19	4.16	4.18	3.98	4.20	8.29	3.71	4.13	6.08	4.35	4.05	5.11	3.70	5.16	4.14	3.02	6.38	
Cp real [-]:	0.27	0.24	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.28	0.24	0.25	0.28	0.25	0.25	0.28	0.24	0.28	0.25	0.22	0.28	
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.56	0.59	0.56	0.59	0.59	0.56	

farm 14x2 pitch 00 reprod				bin [s]: 420 450																			
tunnel wind [V]:	0.791																						
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	0	0	2.5	0	2.5	0	0	2.5	
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	
Ugen [V]:	0.95	0.58	0.62	0.60	0.61	0.63	0.64	0.63	0.60	0.64	1.01	0.60	0.64	0.87	0.65	0.62	0.78	0.58	0.78	0.62	0.48	0.883	
strain guage [V]:	1.06	0.63	0.63																			3	
rotor speed [V]:	2.69																						
wind [m/s]:	7.60	5.93	6.10	6.00	6.08	6.14	6.20	6.16	6.01	6.20	7.85	6.01	6.18	7.13	6.23	6.12	6.71	5.95	6.68	6.10	5.53	7.22	
fax [N]:	1.55	0.93	0.99	0.96	0.99	1.01	1.02	1.01	0.96	1.03	1.65	0.96	1.02	1.10	1.04	1.00	0.98	0.94	0.97	0.99	0.80	1.13	
torque [mNm]:	10.53	6.50	6.92	6.67	6.87	7.01	7.13	7.05	6.72	7.15	11.15	6.70	7.11	9.59	7.21	6.96	8.69	6.55	8.62	6.91	5.47	9.78	
speed [rpm]:	3241	2194	2302	2240	2291	2327	2358	2336	2251	2362	3403	2246	2352	2996	2380	2314	2762	2207	2746	2302	1928	3047	
Fax meas [N]:	1.72	1.00	1.03																				
speed meas [rpm]:																							
Ct [-]:	0.91	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.91	0.90	0.90	0.90	0.73	0.90	0.90	0.74	0.90	0.74	0.90	0.88	0.73
a [-]:	0.35	0.34	0.35	0.34	0.35	0.35	0.35	0.35	0.34	0.35	0.35	0.34	0.35	0.24	0.35	0.35	0.24	0.34	0.24	0.35	0.33	0.24	
Lambda [-]:	5.53	4.80	4.90	4.85	4.89	4.92	4.94	4.93	4.86	4.95	5.63	4.85	4.94	5.46	4.96	4.91	5.35	4.82	5.34	4.90	4.52	5.48	
P = QxN [W]:	3.57	1.49	1.67	1.57	1.65	1.71	1.76	1.72	1.58	1.77	3.97	1.58	1.75	3.01	1.80	1.69	2.51	1.51	2.48	1.67	1.10	3.12	
P with Ct [W]:	7.66	3.64	3.96	3.77	3.92	4.04	4.15	4.07	3.80	4.16	8.42	3.78	4.13	5.94	4.22	4.00	4.97	3.67	4.90	3.96	2.96	6.16	
Cp real [-]:	0.28	0.24	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.28	0.25	0.25	0.28	0.25	0.25	0.28	0.24	0.28	0.25	0.22	0.28	
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.56	0.59	0.56	0.59	0.59	0.56	

farm 14x2 pitch 00 ex row14				bin [s]																				60	90
tunnel wind [V]:	0.668																								
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb23	wtb24			
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d			
pitch [dg]:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	0	2.5	0	0	0	0			
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl			
Ugen [V]:	0.70	0.40	0.43	0.43	0.43	0.45	0.44	0.44	0.41	0.47	0.76	0.41	0.46	0.47	0.45	0.60	0.40	0.59	0.43	0.321	0.441	0.422			
strain guage [V]:	0.75	0.45	0.46																						
rotor speed [V]:	2.10																								
wind [m/s]:	6.47	5.14	5.32	5.29	5.31	5.37	5.35	5.36	5.24	5.46	6.77	5.22	5.42	5.49	5.39	5.78	5.16	5.75	5.32	4.70	5.35	5.27			
fax [N]:	1.11	0.67	0.72	0.71	0.72	0.74	0.73	0.74	0.69	0.77	1.21	0.69	0.76	0.78	0.75	0.72	0.67	0.72	0.72	0.56	0.73	0.71			
torque [mNm]:	7.75	4.51	4.93	4.85	4.90	5.05	5.02	5.03	4.71	5.28	8.43	4.66	5.17	5.37	5.10	6.72	4.55	6.65	4.91	3.71	5.00	4.80			
speed [rpm]:	2518	1679	1786	1767	1778	1818	1809	1811	1731	1877	2696	1715	1850	1900	1831	2251	1688	2234	1783	1470	1806	1752			
Fax meas [N]:	1.21	0.71	0.74																						
speed meas [rpm]:																									
Ct [-]:	0.90	0.86	0.87	0.86	0.87	0.87	0.87	0.87	0.86	0.88	0.90	0.86	0.87	0.88	0.87	0.74	0.86	0.74	0.87	0.86	0.87	0.86			
a [-]:	0.34	0.31	0.32	0.32	0.32	0.32	0.32	0.32	0.31	0.32	0.34	0.31	0.32	0.33	0.32	0.24	0.31	0.24	0.32	0.31	0.32	0.31			
Lambda [-]:	5.06	4.24	4.36	4.34	4.35	4.40	4.39	4.39	4.29	4.47	5.17	4.27	4.43	4.49	4.41	5.06	4.25	5.05	4.35	4.06	4.38	4.32			
P = QxN [W]:	2.04	0.79	0.92	0.90	0.91	0.96	0.95	0.95	0.85	1.04	2.38	0.84	1.00	1.07	0.98	1.58	0.80	1.56	0.92	0.57	0.95	0.88			
P with Ct [W]:	4.72	2.36	2.62	2.58	2.61	2.70	2.68	2.68	2.50	2.84	5.41	2.47	2.77	2.89	2.73	3.17	2.39	3.12	2.62	1.81	2.67	2.55			
Cp real [-]:	0.26	0.20	0.21	0.21	0.21	0.21	0.21	0.21	0.20	0.22	0.26	0.20	0.21	0.22	0.21	0.28	0.20	0.28	0.21	0.19	0.21	0.20			
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.56	0.59	0.59	0.59	0.59			

farm 14x2 pitch 00 ex row14				bin [s] 180 210																							
tunnel wind [V]:	0.799																										
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb23	wtb24					
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d			
pitch [dg]:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	0	2.5	0	0	0	0	0	0			
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl			
Ugen [V]:	0.98	0.59	0.64	0.62	0.64	0.64	0.66	0.66	0.60	0.66	0.99	0.58	0.63	0.67	0.62	0.79	0.57	0.79	0.62	0.48	0.63	0.61					
strain guage [V]:	1.09	0.65	0.66													0.63	0.64	0.61									
rotor speed [V]:	2.75																										
wind [m/s]:	7.74	5.98	6.21	6.10	6.18	6.21	6.28	6.28	6.04	6.29	7.75	5.95	6.15	6.32	6.13	6.74	5.91	6.75	6.10	5.52	6.15	6.07					
fax [N]:	1.61	0.95	1.03	0.99	1.02	1.03	1.05	1.05	0.97	1.05	1.61	0.94	1.01	1.07	1.00	0.99	0.93	0.99	0.99	0.79	1.01	0.98					
torque [mNm]:	10.87	6.64	7.15	6.91	7.10	7.15	7.32	7.32	6.77	7.34	10.91	6.54	7.02	7.42	6.98	8.75	6.45	8.78	6.92	5.43	7.03	6.83					
speed [rpm]:	3330	2230	2364	2300	2351	2365	2407	2408	2264	2414	3341	2205	2329	2434	2319	2778	2182	2786	2304	1918	2332	2281					
Fax meas [N]:	1.76	1.03	1.08													1.04	1.03	1.01									
speed meas [rpm]:																											
Ct [-]:	0.91	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.91	0.90	0.90	0.90	0.90	0.74	0.90	0.74	0.90	0.88	0.90	0.90					
a [-]:	0.35	0.34	0.35	0.35	0.35	0.35	0.35	0.35	0.34	0.35	0.35	0.34	0.35	0.35	0.35	0.24	0.34	0.24	0.35	0.33	0.35	0.34					
Lambda [-]:	5.59	4.84	4.95	4.90	4.94	4.95	4.98	4.98	4.87	4.98	5.60	4.82	4.92	5.00	4.91	5.35	4.79	5.36	4.90	4.51	4.92	4.88					
P = QxN [W]:	3.79	1.55	1.77	1.66	1.75	1.77	1.84	1.85	1.60	1.86	3.82	1.51	1.71	1.89	1.69	2.54	1.47	2.56	1.67	1.09	1.72	1.63					
P with Ct [W]:	8.07	3.74	4.17	3.96	4.12	4.17	4.32	4.32	3.84	4.34	8.13	3.67	4.05	4.41	4.02	5.03	3.61	5.06	3.97	2.93	4.06	3.89					
Cp real [-]:	0.28	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.28	0.24	0.25	0.25	0.25	0.28	0.24	0.28	0.25	0.22	0.25	0.25					
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.56	0.59	0.59	0.59	0.59					

farm 14x2 pitch 00 ex row14				bin [s] 260 290																								
tunnel wind [V]:	0.890																											
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb23	wtb24						
	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d					
	pitch [dg]:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	0	2.5	0	0	0	0					
	macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl					
	Ugen [V]:	1.16	0.71	0.77	0.74	0.76	0.82	0.79	0.77	0.78	0.81	1.20	0.75	0.79	0.84	0.82	0.98	0.76	0.97	0.80	0.66	0.81	0.77					
strain guage [V]:	1.32	0.78	0.78													0.83	0.85	0.76										
rotor speed [V]:	3.16																											
wind [m/s]:	8.51	6.56	6.81	6.68	6.79	7.03	6.91	6.84	6.85	6.99	8.70	6.73	6.90	7.11	7.07	7.68	6.76	7.65	6.97	6.29	7.02	6.83						
fax [N]:	1.96	1.14	1.23	1.19	1.22	1.31	1.26	1.24	1.24	1.29	2.05	1.20	1.26	1.34	1.32	1.27	1.21	1.26	1.28	1.05	1.30	1.24						
torque [mNm]:	12.78	7.95	8.53	8.24	8.49	9.04	8.76	8.60	8.62	8.95	13.22	8.35	8.74	9.26	9.14	10.81	8.40	10.75	8.89	7.33	9.01	8.58						
speed [rpm]:	3826	2572	2722	2646	2712	2855	2783	2739	2745	2831	3941	2674	2776	2912	2880	3315	2689	3298	2816	2411	2847	2735						
Fax meas [N]:	2.13	1.24	1.28													1.36	1.38	1.26										
speed meas [rpm]:																												
Ct [-]:	0.92	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.92	0.90	0.90	0.90	0.90	0.73	0.90	0.73	0.90	0.90	0.90	0.90						
a [-]:	0.36	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.36	0.34	0.34	0.34	0.34	0.24	0.34	0.24	0.34	0.35	0.34	0.34						
Lambda [-]:	5.84	5.09	5.19	5.14	5.18	5.27	5.23	5.20	5.20	5.26	5.89	5.16	5.22	5.32	5.29	5.61	5.17	5.60	5.25	4.98	5.27	5.20						
P = QxN [W]:	5.12	2.14	2.43	2.28	2.41	2.70	2.55	2.47	2.48	2.65	5.46	2.34	2.54	2.83	2.76	3.75	2.37	3.71	2.62	1.85	2.69	2.46						
P with Ct [W]:	10.71	4.92	5.51	5.21	5.48	6.06	5.77	5.59	5.61	5.97	11.42	5.32	5.74	6.28	6.16	7.40	5.38	7.32	5.91	4.33	6.03	5.57						
Cp real [-]:	0.28	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.28	0.26	0.26	0.27	0.27	0.28	0.26	0.28	0.26	0.25	0.26	0.26						
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.56	0.59	0.59	0.59	0.59						

farm 14x2 pitch 00 ex row14 13					bin [s]																	40	70
tunnel wind [V]:	0.696																						
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb15	wtb16	wtb18	wtb20	wtb21	wtb23	wtb24			
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d			
pitch [dg]:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl			
Ugen [V]:	0.71	0.41	0.45	0.43	0.44	0.44	0.46	0.45	0.43	0.46	0.77	0.41	0.47	0.46	0.45	0.41	0.44	0.31	0.45	0.42			
strain guage [V]:	0.77	0.47	0.478	8 0.47 0.48																			
rotor speed [V]:	2.14																						
wind [m/s]:	6.55	5.23	5.41	5.32	5.33	5.36	5.41	5.37	5.30	5.41	6.84	5.24	5.47	5.44	5.38	5.23	5.35	4.64	5.37	5.28			
fax [N]:	1.14	0.69	0.75	0.72	0.72	0.74	0.75	0.74	0.71	0.75	1.24	0.69	0.78	0.76	0.74	0.69	0.73	0.54	0.74	0.71			
torque [mNm]:	7.94	4.70	5.14	4.92	4.94	5.03	5.16	5.06	4.86	5.16	8.60	4.72	5.32	5.24	5.07	4.68	5.01	3.60	5.06	4.82			
speed [rpm]:	2568	1726	1842	1783	1790	1814	1845	1820	1769	1847	2741	1733	1889	1866	1823	1722	1809	1442	1819	1758			
Fax meas [N]:	1.25	0.75	0.78	0.76 0.79																			
speed meas [rpm]:																							
Ct [-]:	0.90	0.86	0.87	0.87	0.87	0.87	0.87	0.87	0.86	0.87	0.90	0.86	0.88	0.88	0.87	0.86	0.87	0.86	0.87	0.86			
a [-]:	0.34	0.31	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.34	0.31	0.33	0.32	0.32	0.31	0.32	0.31	0.32	0.31			
Lambda [-]:	5.09	4.28	4.43	4.36	4.36	4.39	4.43	4.40	4.34	4.43	5.20	4.29	4.48	4.45	4.40	4.28	4.39	4.04	4.40	4.32			
P = QxN [W]:	2.14	0.85	0.99	0.92	0.93	0.96	1.00	0.96	0.90	1.00	2.47	0.86	1.05	1.02	0.97	0.84	0.95	0.54	0.96	0.89			
P with Ct [W]:	4.91	2.49	2.75	2.62	2.63	2.69	2.76	2.70	2.59	2.77	5.59	2.51	2.86	2.81	2.71	2.48	2.68	1.74	2.70	2.56			
Cp real [-]:	0.26	0.20	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.26	0.20	0.22	0.22	0.21	0.20	0.21	0.18	0.21	0.20			
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59			

farm 14x2 pitch 00 ex row14 13					bin [s] 120 150															
tunnel wind [V]:	0.803																			
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb15	wtb16	wtb18	wtb20	wtb21	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	0.93	0.56	0.60	0.58	0.62	0.65	0.64	0.63	0.62	0.64	0.99	0.59	0.64	0.66	0.63	0.60	0.63	0.48	0.63	0.61
strain guage [V]:	1.04	0.62	0.612 ₂																	
rotor speed [V]:	2.64																			
wind [m/s]:	7.53	5.84	6.02	5.95	6.09	6.23	6.21	6.15	6.09	6.20	7.77	5.99	6.21	6.29	6.16	6.01	6.15	5.52	6.18	6.08
fax [N]:	1.52	0.90	0.97	0.94	0.99	1.04	1.03	1.01	0.99	1.02	1.62	0.95	1.03	1.06	1.01	0.96	1.01	0.79	1.02	0.99
torque [mNm]:	10.33	6.27	6.74	6.54	6.90	7.22	7.16	7.04	6.90	7.13	10.95	6.65	7.16	7.35	7.05	6.72	7.02	5.44	7.09	6.87
speed [rpm]:	3191	2135	2257	2205	2298	2381	2366	2334	2298	2358	3349	2234	2366	2415	2338	2251	2330	1920	2347	2291
Fax meas [N]:	1.68	0.98	1.00																	
speed meas [rpm]:																				
Ct [-]:	0.91	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.91	0.90	0.90	0.90	0.90	0.90	0.90	0.88	0.90	0.90
a [-]:	0.35	0.34	0.34	0.34	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.34	0.35	0.35	0.35	0.34	0.35	0.33	0.35	0.35
Lambda [-]:	5.50	4.75	4.86	4.82	4.90	4.96	4.95	4.92	4.90	4.94	5.60	4.84	4.95	4.98	4.93	4.86	4.92	4.52	4.93	4.89
P = QxN [W]:	3.45	1.40	1.59	1.51	1.66	1.80	1.77	1.72	1.66	1.76	3.84	1.56	1.77	1.86	1.73	1.58	1.71	1.09	1.74	1.65
P with Ct [W]:	7.44	3.48	3.82	3.67	3.95	4.23	4.17	4.07	3.95	4.15	8.16	3.75	4.17	4.34	4.08	3.80	4.06	2.94	4.11	3.93
Cp real [-]:	0.27	0.24	0.25	0.24	0.25	0.25	0.25	0.25	0.25	0.25	0.28	0.25	0.25	0.25	0.25	0.25	0.25	0.22	0.25	0.25
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59

farm 14x2 pitch 00 ex row14 13						bin [s] 250 280															
tunnel wind [V]:	0.842																				
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb15	wtb16	wtb18	wtb20	wtb21	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	
Ugen [V]:	1.06	0.64	0.70	0.67	0.69	0.71	0.71	0.71	0.68	0.71	1.09	0.65	0.70	0.73	0.71	0.65	0.69	0.55	0.70	0.67	
strain guage [V]:	1.17	0.70	0.721 ₂																		
rotor speed [V]:	2.93																				
wind [m/s]:	8.07	6.21	6.48	6.36	6.45	6.52	6.56	6.53	6.39	6.56	8.20	6.26	6.49	6.65	6.55	6.27	6.42	5.79	6.49	6.37	
fax [N]:	1.75	1.03	1.12	1.08	1.11	1.13	1.14	1.13	1.09	1.15	1.81	1.05	1.12	1.18	1.14	1.05	1.10	0.89	1.12	1.08	
torque [mNm]:	11.72	7.15	7.77	7.50	7.70	7.87	7.95	7.89	7.56	7.96	12.04	7.28	7.80	8.17	7.94	7.30	7.64	6.15	7.79	7.52	
speed [rpm]:	3550	2364	2525	2454	2506	2550	2572	2555	2470	2574	3634	2397	2531	2629	2568	2401	2490	2103	2529	2460	
Fax meas [N]:	1.89	1.11	1.18																		
speed meas [rpm]:																					
Ct [-]:	0.91	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.92	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	
a [-]:	0.35	0.35	0.34	0.35	0.35	0.34	0.34	0.34	0.35	0.34	0.35	0.35	0.34	0.34	0.34	0.35	0.35	0.34	0.34	0.35	
Lambda [-]:	5.71	4.95	5.06	5.01	5.05	5.08	5.09	5.08	5.02	5.09	5.75	4.97	5.07	5.13	5.09	4.97	5.04	4.71	5.06	5.02	
P = QxN [W]:	4.36	1.77	2.06	1.93	2.02	2.10	2.14	2.11	1.96	2.15	4.58	1.83	2.07	2.25	2.13	1.83	1.99	1.35	2.06	1.94	
P with Ct [W]:	9.15	4.17	4.74	4.48	4.67	4.84	4.92	4.85	4.54	4.93	9.61	4.28	4.77	5.14	4.90	4.30	4.61	3.40	4.76	4.51	
Cp real [-]:	0.28	0.25	0.26	0.25	0.26	0.26	0.26	0.26	0.25	0.26	0.28	0.25	0.26	0.26	0.26	0.25	0.26	0.24	0.26	0.25	
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	

scan5		bin [s] 50 550									
tunnel wind [V]:	0.807										
	wtb6	wtb9	wtb10	wtb14	wtb15	wtb16	wtb17	wtb19	wtb22	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0	0	0	2.5	0	0	2.5	2.5	2.5	0	
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	
Ugen [V]:	0.54	0.63	1.11	0.83	0.56	0.64	0.77	0.78	0.89	1.07	
strain guage [V]:						0.16	0.66	0.59			
rotor speed [V]:											
wind [m/s]:	5.76	6.17	8.26	6.97	5.83	6.20	6.65	6.72	7.24	8.08	
fax [N]:	0.87	1.01	1.84	1.05	0.90	1.03	0.96	0.98	1.13	1.75	
torque [mNm]:	6.05	7.06	12.19	9.24	6.25	7.14	8.55	8.70	9.84	11.75	
speed [rpm]:	2079	2340	3672	2908	2130	2362	2727	2767	3061	3558	
Fax meas [N]:						0.26	1.08	0.98			
speed meas [rpm]:											
Ct [-]:	0.89	0.90	0.92	0.74	0.90	0.90	0.74	0.74	0.73	0.91	
a [-]:	0.34	0.35	0.36	0.24	0.34	0.35	0.24	0.24	0.24	0.35	
Lambda [-]:	4.69	4.93	5.77	5.41	4.74	4.95	5.33	5.35	5.49	5.72	
P = QxN [W]:	1.32	1.73	4.69	2.81	1.39	1.77	2.44	2.52	3.15	4.38	
P with Ct [W]:	3.33	4.09	9.82	5.56	3.47	4.16	4.83	4.99	6.23	9.19	
Cp real [-]:	0.23	0.25	0.28	0.28	0.24	0.25	0.28	0.28	0.28	0.28	
Cp with Ct [-]:	0.59	0.59	0.59	0.56	0.59	0.59	0.56	0.56	0.56	0.59	

scan4	bin [s] 30 430															
tunnel wind [V]:	0.807															
	wtb6	wtb7	wtb8	wtb9	wtb10	wtb14	wtb15	wtb16	wtb17	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0	0	0	0	0	2.5	0	0	2.5	2.5	0	0	2.5	0	0	
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	
Ugen [V]:	0.63	0.57	0.65	0.60	0.63	0.85	0.64	0.62	0.77	0.77	1.00	0.43	0.87	0.63	0.61	
strain guage [V]:	0.63 0.64 0.59															
rotor speed [V]:																
wind [m/s]:	6.16	5.87	6.24	6.03	6.14	7.03	6.22	6.10	6.67	6.66	7.81	5.32	7.16	6.17	6.05	
fax [N]:	1.01	0.91	1.04	0.97	1.00	1.07	1.03	0.99	0.97	0.97	1.64	0.72	1.11	1.02	0.98	
torque [mNm]:	7.04	6.34	7.23	6.76	7.00	9.37	7.20	6.92	8.60	8.58	11.07	4.93	9.66	7.08	6.80	
speed [rpm]:	2335	2154	2384	2262	2324	2940	2375	2303	2740	2735	3381	1788	3016	2346	2273	
Fax meas [N]:	1.03 1.03 0.98															
speed meas [rpm]:																
Ct [-]:	0.90	0.90	0.90	0.90	0.90	0.73	0.90	0.90	0.74	0.74	0.91	0.87	0.73	0.90	0.90	
a [-]:	0.35	0.34	0.35	0.34	0.35	0.24	0.35	0.35	0.24	0.24	0.35	0.32	0.24	0.35	0.34	
Lambda [-]:	4.92	4.76	4.96	4.87	4.92	5.43	4.96	4.90	5.34	5.33	5.62	4.36	5.47	4.93	4.88	
P = QxN [W]:	1.72	1.43	1.81	1.60	1.70	2.88	1.79	1.67	2.47	2.46	3.92	0.92	3.05	1.74	1.62	
P with Ct [W]:	4.07	3.53	4.24	3.83	4.03	5.70	4.21	3.97	4.88	4.86	8.31	2.63	6.03	4.11	3.87	
Cp real [-]:	0.25	0.24	0.25	0.25	0.25	0.28	0.25	0.25	0.28	0.28	0.28	0.21	0.28	0.25	0.25	
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.56	0.56	0.59	0.59	0.56	0.59	0.59	

scan7	bin [s] 15 75			
tunnel wind [V]:	0.810			
	wtb14	wtb17	wtb19	wtb22
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	2.5	2.5	2.5	2.5
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	0.77	1.23	1.21	0.84
strain guage [V]:	1.01			
rotor speed [V]:				
wind [m/s]:	6.65	8.94	8.85	7.02
fax [N]:	0.96	1.70	1.66	1.07
torque [mNm]:	8.56	13.54	13.34	9.34
speed [rpm]:	2730	4024	3973	2933
Fax meas [N]:				
speed meas [rpm]:				
Ct [-]:	0.74	0.72	0.72	0.74
a [-]:	0.24	0.24	0.24	0.24
Lambda [-]:	5.33	5.84	5.83	5.43
P = QxN [W]:	2.45	5.70	5.55	2.87
P with Ct [W]:	4.84	11.59	11.25	5.67
Cp real [-]:	0.28	0.27	0.27	0.28
Cp with Ct [-]:	0.56	0.55	0.55	0.56

scan6	bin [s] 50 550					
tunnel wind [V]:	0.812					
	wtb9	wtb14	wtb16	wtb17	wtb19	wtb22
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0	2.5	0	2.5	2.5	2.5
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	1.10	0.86	1.14	0.69	0.71	0.91
strain guage [V]:			1.18	0.54		
rotor speed [V]:						
wind [m/s]:	8.24	7.10	8.39	6.26	6.35	7.34
fax [N]:	1.83	1.09	1.91	0.85	0.88	1.17
torque [mNm]:	12.12	9.52	12.50	7.73	7.92	10.06
speed [rpm]:	3656	2978	3753	2513	2563	3120
Fax meas [N]:			1.92	0.90		
speed meas [rpm]:						
Ct [-]:	0.92	0.73	0.92	0.74	0.74	0.73
a [-]:	0.35	0.24	0.36	0.25	0.25	0.24
Lambda [-]:	5.76	5.45	5.81	5.22	5.24	5.52
P = QxN [W]:	4.64	2.97	4.91	2.03	2.13	3.29
P with Ct [W]:	9.73	5.87	10.29	4.03	4.21	6.49
Cp real [-]:	0.28	0.28	0.28	0.28	0.28	0.28
Cp with Ct [-]:	0.59	0.56	0.59	0.56	0.56	0.56

scan3	bin [s] 50 550																				
tunnel wind [V]:	0.796																				
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb15	wtb16	wtb18	wtb20	wtb21	wtb23	wtb24	
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	
Ugen [V]:	0.97	0.57	0.62	0.59	0.61	0.64	0.63	0.63	0.63	0.64	1.00	0.58	0.63	0.67	0.66	0.58	0.62	0.49	0.63	0.61	
strain guage [V]:	1.14	0.64	0.64											0.65	0.68						
rotor speed [V]:	2.74																				
wind [m/s]:	7.68	5.90	6.09	5.97	6.07	6.19	6.17	6.15	6.15	6.20	7.80	5.93	6.18	6.35	6.32	5.94	6.12	5.55	6.17	6.05	
fax [N]:	1.58	0.92	0.99	0.95	0.98	1.02	1.02	1.01	1.01	1.02	1.63	0.93	1.02	1.08	1.06	0.94	1.00	0.80	1.01	0.98	
torque [mNm]:	10.73	6.41	6.88	6.61	6.85	7.12	7.07	7.02	7.04	7.14	11.03	6.51	7.10	7.49	7.41	6.53	6.96	5.53	7.07	6.81	
speed [rpm]:	3294	2172	2294	2223	2286	2355	2343	2331	2334	2361	3370	2196	2349	2451	2431	2203	2315	1942	2342	2274	
Fax meas [N]:	1.84	1.01	1.04											1.06	1.11						
speed meas [rpm]:																					
Ct [-]:	0.91	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.91	0.90	0.90	0.90	0.90	0.90	0.90	0.88	0.90	0.90	
a [-]:	0.35	0.34	0.35	0.34	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.34	0.35	0.35	0.35	0.34	0.35	0.33	0.35	
Lambda [-]:	5.57	4.78	4.89	4.83	4.89	4.94	4.93	4.92	4.92	4.94	5.61	4.81	4.94	5.01	5.00	4.81	4.91	4.54	4.93	4.88	
P = QxN [W]:	3.70	1.46	1.65	1.54	1.64	1.76	1.74	1.71	1.72	1.77	3.89	1.50	1.75	1.92	1.89	1.51	1.69	1.12	1.73	1.62	
P with Ct [W]:	7.91	3.58	3.94	3.72	3.91	4.14	4.10	4.06	4.07	4.16	8.26	3.64	4.12	4.47	4.40	3.66	4.00	2.99	4.10	3.87	
Cp real [-]:	0.28	0.24	0.25	0.24	0.25	0.25	0.25	0.25	0.25	0.25	0.28	0.24	0.25	0.25	0.25	0.24	0.25	0.22	0.25	0.25	
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	

scan2	bin [s] 50 550																							
tunnel wind [V]:	0.799																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb15	wtb16	wtb18	wtb20	wtb21	wtb23	wtb24				
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d		
pitch [dg]:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl		
Ugen [V]:	0.96	0.57	0.61	0.59	0.61	0.63	0.63	0.63	0.61	0.64	1.01	0.59	0.64	0.67	0.65	0.59	0.62	0.49	0.63	0.60				
strain guage [V]:	1.09	0.63	0.63											0.64	0.67									
rotor speed [V]:	2.71																							
wind [m/s]:	7.63	5.90	6.08	5.98	6.06	6.15	6.17	6.17	6.05	6.23	7.84	5.96	6.20	6.33	6.24	5.96	6.12	5.55	6.18	6.02				
fax [N]:	1.56	0.92	0.98	0.95	0.98	1.01	1.01	1.01	0.97	1.03	1.65	0.94	1.02	1.07	1.04	0.94	1.00	0.80	1.02	0.96				
torque [mNm]:	10.59	6.42	6.86	6.63	6.81	7.02	7.07	7.06	6.79	7.21	11.14	6.57	7.14	7.44	7.24	6.58	6.96	5.53	7.08	6.73				
speed [rpm]:	3257	2173	2288	2229	2276	2329	2342	2341	2270	2378	3399	2213	2360	2439	2386	2215	2315	1942	2346	2255				
Fax meas [N]:	1.76	1.01	1.04											1.05	1.09									
speed meas [rpm]:																								
Ct [-]:	0.91	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.91	0.90	0.90	0.90	0.90	0.90	0.90	0.88	0.90	0.90				
a [-]:	0.35	0.34	0.35	0.34	0.34	0.35	0.35	0.35	0.34	0.35	0.35	0.34	0.35	0.35	0.35	0.34	0.35	0.33	0.35	0.34				
Lambda [-]:	5.54	4.78	4.89	4.84	4.88	4.92	4.93	4.93	4.87	4.96	5.63	4.82	4.94	5.00	4.96	4.83	4.91	4.54	4.93	4.86				
P = QxN [W]:	3.61	1.46	1.64	1.55	1.62	1.71	1.73	1.73	1.61	1.79	3.96	1.52	1.76	1.90	1.81	1.53	1.69	1.12	1.74	1.59				
P with Ct [W]:	7.74	3.58	3.91	3.74	3.87	4.05	4.09	4.09	3.86	4.22	8.40	3.69	4.15	4.43	4.24	3.70	4.00	2.99	4.11	3.81				
Cp real [-]:	0.28	0.24	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.28	0.24	0.25	0.25	0.25	0.24	0.25	0.22	0.25	0.25				
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59				

scan1	bin [s] 50 550																							
tunnel wind [V]:	0.798																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb15	wtb16	wtb18	wtb20	wtb21	wtb23	wtb24				
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	
Ugen [V]:	0.96	0.57	0.62	0.59	0.61	0.63	0.64	0.63	0.60	0.64	1.00	0.58	0.64	0.66	0.64	0.59	0.62	0.49	0.63	0.60				
strain guage [V]:	1.08	0.63	0.63													0.64	0.67							
rotor speed [V]:	2.71																							
wind [m/s]:	7.63	5.90	6.09	5.99	6.08	6.16	6.19	6.18	6.03	6.23	7.82	5.95	6.18	6.32	6.22	5.96	6.10	5.54	6.15	6.02				
fax [N]:	1.56	0.92	0.99	0.95	0.98	1.01	1.02	1.02	0.97	1.03	1.64	0.94	1.02	1.07	1.03	0.94	0.99	0.80	1.01	0.96				
torque [mNm]:	10.59	6.43	6.88	6.66	6.86	7.04	7.12	7.09	6.76	7.20	11.09	6.55	7.10	7.42	7.20	6.57	6.90	5.48	7.02	6.72				
speed [rpm]:	3256	2176	2294	2235	2288	2335	2356	2348	2261	2376	3388	2208	2350	2433	2375	2213	2299	1930	2330	2251				
Fax meas [N]:	1.75	1.01	1.04													1.05	1.08							
speed meas [rpm]:																								
Ct [-]:	0.91	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.91	0.90	0.90	0.90	0.90	0.90	0.90	0.88	0.90	0.90				
a [-]:	0.35	0.34	0.35	0.34	0.35	0.35	0.35	0.35	0.34	0.35	0.35	0.34	0.35	0.35	0.35	0.34	0.35	0.33	0.35	0.34				
Lambda [-]:	5.54	4.79	4.89	4.84	4.89	4.92	4.94	4.93	4.87	4.96	5.62	4.82	4.94	5.00	4.96	4.82	4.90	4.53	4.92	4.86				
P = QxN [W]:	3.61	1.46	1.65	1.56	1.64	1.72	1.76	1.74	1.60	1.79	3.94	1.52	1.75	1.89	1.79	1.52	1.66	1.11	1.71	1.58				
P with Ct [W]:	7.73	3.59	3.93	3.75	3.92	4.07	4.14	4.11	3.83	4.21	8.35	3.68	4.12	4.41	4.21	3.69	3.95	2.96	4.05	3.80				
Cp real [-]:	0.28	0.24	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.28	0.24	0.25	0.25	0.25	0.24	0.25	0.22	0.25	0.25				
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59				

farm 100 00 see 2003 11 21

bin [s] 50 80

tunnel wind [V]:	0.695																					
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb15	wtb16	wtb17	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0	0	0	0	0	0	2.5	0	0	0	0	0	2.5	0	0	0	0	0	2.5	0	0	0
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	0.86	0.48	0.55	0.54	0.53	0.54	0.58	0.78	0.37	0.47	0.45	0.41	0.48	0.85	0.46	0.54	0.52	0.52	0.56	0.80	0.44	0.47
strain guage [V]:	0.87	0.50	0.55											0.80	0.49	0.53						
rotor speed [V]:	2.49																					
wind [m/s]:	7.20	5.51	5.82	5.78	5.73	5.74	5.70	6.89	4.96	5.46	5.39	5.20	5.15	7.19	5.41	5.75	5.69	5.66	5.60	6.98	5.34	5.47
fax [N]:	1.38	0.79	0.89	0.88	0.86	0.87	0.71	1.26	0.62	0.77	0.75	0.68	0.57	1.37	0.75	0.87	0.85	0.84	0.68	1.28	0.73	0.77
torque [mNm]:	9.49	5.42	6.21	6.10	5.97	6.02	6.56	8.71	4.19	5.30	5.12	4.63	5.39	9.45	5.16	6.04	5.89	5.81	6.33	8.91	4.98	5.30
speed [rpm]:	2971	1913	2119	2091	2058	2070	2210	2770	1595	1882	1835	1707	1906	2961	1846	2076	2035	2015	2151	2820	1799	1883
Fax meas [N]:	1.41	0.80	0.90											1.32	0.80	0.87						
speed meas [rpm]:																						
Ct [-]:	0.90	0.88	0.90	0.90	0.89	0.89	0.74	0.90	0.86	0.88	0.87	0.86	0.73	0.90	0.87	0.89	0.89	0.89	0.74	0.90	0.87	0.88
a [-]:	0.34	0.33	0.34	0.34	0.34	0.34	0.24	0.34	0.31	0.33	0.32	0.31	0.24	0.34	0.32	0.34	0.34	0.33	0.24	0.34	0.32	0.33
Lambda [-]:	5.36	4.51	4.73	4.70	4.67	4.68	5.03	5.22	4.17	4.47	4.42	4.26	4.81	5.35	4.43	4.68	4.64	4.62	4.99	5.25	4.37	4.47
P = QxN [W]:	2.95	1.09	1.38	1.34	1.29	1.31	1.52	2.53	0.70	1.04	0.98	0.83	1.08	2.93	1.00	1.31	1.25	1.23	1.43	2.63	0.94	1.05
P with Ct [W]:	6.52	2.92	3.44	3.36	3.28	3.31	3.05	5.71	2.13	2.85	2.74	2.45	2.22	6.48	2.76	3.33	3.22	3.17	2.88	5.93	2.66	2.85
Cp real [-]:	0.27	0.22	0.24	0.24	0.23	0.23	0.28	0.26	0.19	0.22	0.21	0.20	0.27	0.27	0.21	0.23	0.23	0.23	0.28	0.26	0.21	0.22
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59	0.59	0.59	0.55	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59

farm 100 00 see 2003 11 21

bin [s] 120 150

tunnel wind [V]:	0.789																					
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb15	wtb16	wtb17	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0	0	0	0	0	0	2.5	0	0	0	0	0	2.5	0	0	0	0	0	2.5	0	0	0
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	1.05	0.61	0.69	0.69	0.68	0.69	0.72	0.98	0.48	0.61	0.58	0.53	0.58	1.05	0.60	0.70	0.67	0.67	0.72	1.02	0.56	0.61
strain guage [V]:	1.10	0.65	0.70											1.04	0.63	0.67						
rotor speed [V]:	2.94																					
wind [m/s]:	8.03	6.05	6.43	6.44	6.38	6.43	6.42	7.71	5.50	6.05	5.94	5.74	5.69	8.03	6.03	6.47	6.34	6.36	6.39	7.87	5.85	6.05
fax [N]:	1.73	0.98	1.10	1.11	1.08	1.10	0.90	1.60	0.78	0.98	0.94	0.87	0.70	1.73	0.97	1.11	1.07	1.08	0.89	1.66	0.91	0.97
torque [mNm]:	11.62	6.80	7.66	7.69	7.54	7.65	8.07	10.81	5.38	6.81	6.53	6.01	6.53	11.62	6.75	7.75	7.47	7.51	8.00	11.21	6.30	6.79
speed [rpm]:	3525	2273	2497	2504	2466	2494	2602	3315	1903	2275	2203	2068	2202	3524	2260	2520	2446	2456	2584	3419	2143	2271
Fax meas [N]:	1.77	1.03	1.14											1.71	1.02	1.12						
speed meas [rpm]:																						
Ct [-]:	0.91	0.90	0.90	0.90	0.90	0.90	0.74	0.91	0.88	0.90	0.90	0.89	0.74	0.91	0.90	0.90	0.90	0.90	0.74	0.91	0.90	0.90
a [-]:	0.35	0.34	0.35	0.35	0.35	0.35	0.25	0.35	0.33	0.34	0.34	0.34	0.24	0.35	0.34	0.34	0.35	0.35	0.25	0.35	0.34	0.34
Lambda [-]:	5.70	4.88	5.04	5.05	5.02	5.04	5.26	5.58	4.50	4.88	4.81	4.68	5.02	5.70	4.87	5.06	5.01	5.01	5.25	5.64	4.75	4.88
P = QxN [W]:	4.29	1.62	2.00	2.02	1.95	2.00	2.20	3.75	1.07	1.62	1.51	1.30	1.51	4.29	1.60	2.05	1.91	1.93	2.16	4.01	1.41	1.62
P with Ct [W]:	9.02	3.87	4.64	4.67	4.53	4.63	4.35	8.00	2.90	3.87	3.66	3.30	3.03	9.01	3.83	4.72	4.45	4.49	4.29	8.50	3.50	3.86
Cp real [-]:	0.28	0.25	0.26	0.26	0.25	0.26	0.28	0.28	0.22	0.25	0.24	0.23	0.28	0.28	0.25	0.26	0.25	0.25	0.28	0.28	0.24	0.25
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59

farm 1 00 00 see 2003 11 21

bin [s] 180 210

tunnel wind [V]:	0.886																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb15	wtb16	wtb17	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24		
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0	0	0	0	0	0	2.5	0	0	0	0	0	2.5	0	0	0	0	0	2.5	0	0	0		
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	1.29	0.80	0.88	0.88	0.87	0.89	0.91	1.19	0.63	0.76	0.73	0.68	0.72	1.28	0.77	0.87	0.83	0.84	0.87	1.23	0.71	0.75		
strain guage [V]:	1.42	0.84	0.90											1.35	0.81	0.87								
rotor speed [V]:	3.49																							
wind [m/s]:	9.09	6.96	7.30	7.29	7.28	7.33	7.32	8.64	6.14	6.80	6.65	6.40	6.37	9.06	6.82	7.26	7.08	7.15	7.17	8.80	6.54	6.74		
fax [N]:	2.24	1.28	1.42	1.42	1.41	1.44	1.16	2.03	1.00	1.22	1.18	1.09	0.89	2.23	1.23	1.40	1.33	1.36	1.11	2.11	1.14	1.21		
torque [mNm]:	14.16	8.88	9.74	9.72	9.68	9.83	10.02	13.09	7.00	8.50	8.17	7.60	7.97	14.11	8.55	9.64	9.18	9.34	9.67	13.48	7.92	8.38		
speed [rpm]:	4185	2812	3037	3031	3020	3059	3110	3906	2323	2713	2628	2480	2578	4171	2726	3010	2892	2934	3018	4007	2564	2682		
Fax meas [N]:	2.29	1.33	1.47											2.22	1.32	1.45								
speed meas [rpm]:																								
Ct [-]:	0.92	0.90	0.91	0.90	0.90	0.91	0.73	0.92	0.90	0.90	0.90	0.90	0.74	0.92	0.90	0.90	0.90	0.90	0.73	0.92	0.90	0.90		
a [-]:	0.36	0.34	0.35	0.35	0.35	0.35	0.24	0.36	0.35	0.34	0.34	0.35	0.25	0.36	0.34	0.35	0.34	0.34	0.24	0.36	0.34	0.34		
Lambda [-]:	5.98	5.24	5.40	5.40	5.39	5.42	5.51	5.87	4.92	5.18	5.13	5.03	5.25	5.98	5.19	5.38	5.30	5.33	5.47	5.91	5.09	5.16		
P = QxN [W]:	6.21	2.61	3.10	3.08	3.06	3.15	3.26	5.35	1.70	2.41	2.25	1.97	2.15	6.16	2.44	3.04	2.78	2.87	3.06	5.66	2.13	2.35		
P with Ct [W]:	13.04	5.90	6.79	6.76	6.72	6.88	6.44	11.21	4.03	5.48	5.14	4.58	4.27	12.94	5.53	6.68	6.20	6.37	6.04	11.85	4.89	5.35		
Cp real [-]:	0.28	0.26	0.27	0.27	0.27	0.27	0.28	0.28	0.25	0.26	0.26	0.26	0.28	0.28	0.26	0.27	0.27	0.27	0.28	0.28	0.26	0.26		
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59		

farm1 ex1

bin [s] 50 80

tunnel wind [V]:	0.713																							
	wtb1	wtb2	wtb4	wtb5	wtb6	wtb7	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24		
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0	0	0	0	0	2.5	0	0	0	0	2.5	2.5	0	0	0	0	0	0	2.5	0	0	0		
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	0.47	0.91	0.55	0.53	0.53	0.59	0.76	0.40	0.43	0.41	0.45	0.45	0.86	0.44	0.53	0.49	0.50	0.51	0.45	0.77	0.40	0.44		
strain guage [V]:	0.53	0.87											0.81	0.47	0.52									
rotor speed [V]:	1.59																							
wind [m/s]:	5.46	7.42	5.80	5.72	5.73	5.73	6.76	5.16	5.31	5.22	5.00	5.01	7.20	5.34	5.73	5.55	5.61	5.63	5.00	6.83	5.18	5.34		
fax [N]:	0.77	1.47	0.89	0.86	0.86	0.71	1.21	0.67	0.72	0.69	0.53	0.53	1.38	0.73	0.86	0.80	0.82	0.83	0.53	1.23	0.68	0.73		
torque [mNm]:	5.28	10.05	6.17	5.97	5.97	6.60	8.41	4.55	4.89	4.67	5.08	5.10	9.48	4.99	5.98	5.51	5.68	5.72	5.08	8.57	4.59	4.96		
speed [rpm]:	1878	3117	2109	2056	2057	2221	2691	1689	1776	1718	1826	1830	2968	1802	2058	1937	1982	1991	1826	2732	1698	1796		
Fax meas [N]:	0.85	1.39											1.33	0.77	0.87									
speed meas [rpm]:																								
Ct [-]:	0.88	0.91	0.90	0.89	0.89	0.74	0.90	0.86	0.86	0.86	0.72	0.72	0.90	0.87	0.89	0.88	0.89	0.89	0.72	0.90	0.86	0.87		
a [-]:	0.32	0.35	0.34	0.34	0.34	0.24	0.34	0.31	0.32	0.31	0.24	0.24	0.34	0.32	0.34	0.33	0.33	0.33	0.24	0.34	0.31	0.32		
Lambda [-]:	4.47	5.45	4.72	4.66	4.67	5.04	5.17	4.25	4.35	4.27	4.74	4.75	5.36	4.38	4.67	4.54	4.58	4.59	4.74	5.20	4.26	4.37		
P = QxN [W]:	1.04	3.28	1.36	1.28	1.29	1.54	2.37	0.81	0.91	0.84	0.97	0.98	2.95	0.94	1.29	1.12	1.18	1.19	0.97	2.45	0.82	0.93		
P with Ct [W]:	2.84	7.12	3.41	3.27	3.28	3.08	5.39	2.39	2.60	2.47	2.03	2.04	6.51	2.66	3.28	2.98	3.09	3.11	2.03	5.55	2.42	2.65		
Cp real [-]:	0.22	0.27	0.24	0.23	0.23	0.28	0.26	0.20	0.21	0.20	0.26	0.26	0.27	0.21	0.23	0.22	0.23	0.23	0.26	0.26	0.20	0.21		
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59	0.59	0.55	0.55	0.59	0.59	0.59	0.59	0.59	0.59	0.55	0.59	0.59	0.59		

farm1 ex1	bin [s] 120 150																							
tunnel wind [V]:	0.801																							
	wtb1	wtb2	wtb4	wtb5	wtb6	wtb7	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24		
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0	0	0	0	0	2.5	0	0	0	0	2.5	2.5	0	0	0	0	0	0	2.5	0	0	0		
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	0.61	1.13	0.70	0.68	0.69	0.73	0.96	0.52	0.60	0.54	0.59	0.56	1.10	0.62	0.73	0.68	0.69	0.69	0.60	0.99	0.57	0.62		
strain guage [V]:	0.70	1.15											1.09	0.65	0.71									
rotor speed [V]:	1.92																							
wind [m/s]:	6.08	8.37	6.51	6.38	6.45	6.44	7.64	5.68	6.03	5.78	5.75	5.58	8.23	6.13	6.61	6.42	6.46	6.46	5.78	7.76	5.89	6.10		
fax [N]:	0.98	1.89	1.13	1.08	1.11	0.91	1.57	0.85	0.97	0.88	0.72	0.67	1.83	1.00	1.16	1.10	1.11	1.11	0.73	1.62	0.92	0.99		
torque [mNm]:	6.86	12.43	7.85	7.55	7.70	8.12	10.63	5.84	6.76	6.12	6.66	6.29	12.12	6.99	8.07	7.63	7.74	7.74	6.73	10.93	6.40	6.91		
speed [rpm]:	2289	3737	2545	2467	2507	2615	3268	2024	2263	2096	2236	2140	3654	2321	2603	2489	2516	2517	2253	3346	2168	2301		
Fax meas [N]:	1.13	1.82											1.79	1.06	1.18									
speed meas [rpm]:																								
Ct [-]:	0.90	0.92	0.90	0.90	0.90	0.74	0.91	0.89	0.90	0.90	0.74	0.74	0.92	0.90	0.90	0.90	0.90	0.90	0.74	0.91	0.90	0.90		
a [-]:	0.35	0.36	0.34	0.35	0.35	0.25	0.35	0.33	0.34	0.34	0.24	0.24	0.35	0.35	0.34	0.35	0.34	0.34	0.24	0.35	0.34	0.35		
Lambda [-]:	4.89	5.80	5.08	5.02	5.05	5.27	5.55	4.63	4.87	4.71	5.05	4.98	5.76	4.91	5.11	5.04	5.06	5.06	5.06	5.60	4.78	4.90		
P = QxN [W]:	1.65	4.87	2.09	1.95	2.02	2.22	3.64	1.24	1.60	1.34	1.56	1.41	4.64	1.70	2.20	1.99	2.04	2.04	1.59	3.83	1.45	1.67		
P with Ct [W]:	3.92	10.19	4.82	4.53	4.67	4.40	7.79	3.19	3.83	3.38	3.13	2.85	9.72	4.02	5.04	4.61	4.71	4.71	3.18	8.15	3.57	3.96		
Cp real [-]:	0.25	0.28	0.26	0.25	0.26	0.28	0.28	0.23	0.25	0.24	0.28	0.28	0.28	0.25	0.26	0.26	0.26	0.26	0.28	0.28	0.24	0.25		
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59	0.59	0.56	0.56	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59		

farm1 ex1	bin [s] 210 240																							
tunnel wind [V]:	0.905																							
	wtb1	wtb2	wtb4	wtb5	wtb6	wtb7	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24		
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0	0	0	0	0	2.5	0	0	0	0	2.5	2.5	0	0	0	0	0	0	2.5	0	0	0		
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	0.78	1.32	0.87	0.87	0.88	0.91	1.18	0.67	0.72	0.69	0.71	0.69	1.28	0.77	0.88	0.84	0.82	0.84	0.72	1.19	0.70	0.74		
strain guage [V]:	0.93	1.41											1.33	0.80	0.88									
rotor speed [V]:	2.29																							
wind [m/s]:	6.85	9.25	7.26	7.25	7.31	7.33	8.58	6.36	6.59	6.43	6.32	6.25	9.05	6.84	7.30	7.14	7.06	7.15	6.41	8.64	6.47	6.67		
fax [N]:	1.24	2.32	1.41	1.40	1.42	1.16	2.00	1.08	1.15	1.10	0.87	0.85	2.23	1.24	1.42	1.35	1.32	1.36	0.90	2.03	1.12	1.18		
torque [mNm]:	8.61	14.55	9.65	9.61	9.76	10.04	12.93	7.49	8.02	7.67	7.86	7.70	14.07	8.59	9.75	9.34	9.12	9.34	8.06	13.08	7.76	8.22		
speed [rpm]:	2743	4286	3012	3002	3042	3115	3866	2453	2589	2499	2549	2507	4162	2738	3040	2931	2876	2933	2600	3905	2522	2640		
Fax meas [N]:	1.50	2.24											2.19	1.31	1.46									
speed meas [rpm]:																								
Ct [-]:	0.90	0.92	0.90	0.90	0.91	0.73	0.92	0.90	0.90	0.90	0.74	0.74	0.92	0.90	0.91	0.90	0.90	0.90	0.74	0.92	0.90	0.90		
a [-]:	0.34	0.36	0.35	0.34	0.35	0.24	0.36	0.35	0.34	0.35	0.25	0.25	0.36	0.34	0.35	0.34	0.34	0.34	0.25	0.36	0.34	0.34		
Lambda [-]:	5.20	6.02	5.39	5.38	5.41	5.52	5.85	5.01	5.10	5.04	5.24	5.21	5.97	5.20	5.40	5.33	5.29	5.33	5.26	5.87	5.06	5.14		
P = QxN [W]:	2.47	6.53	3.04	3.02	3.11	3.28	5.24	1.92	2.17	2.01	2.10	2.02	6.13	2.46	3.11	2.87	2.75	2.87	2.19	5.35	2.05	2.27		
P with Ct [W]:	5.60	13.75	6.68	6.64	6.81	6.46	10.96	4.48	4.98	4.64	4.16	4.01	12.87	5.58	6.80	6.36	6.14	6.37	4.35	11.20	4.73	5.18		
Cp real [-]:	0.26	0.28	0.27	0.27	0.27	0.28	0.28	0.25	0.26	0.26	0.28	0.28	0.28	0.26	0.27	0.27	0.26	0.27	0.28	0.28	0.26	0.26		
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59	0.59	0.56	0.56	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59		

farm1 ex12		bin [s] 50 80																			
tunnel wind [V]:	0.703																				
	wtb1	wtb4	wtb5	wtb6	wtb7	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0	0	0	0	2.5	0	0	0	2.5	2.5	0	0	0	0	0	0	2.5	0	0	0	
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	
Ugen [V]:	0.87	0.48	0.54	0.52	0.58	0.82	0.45	0.43	0.46	0.46	0.85	0.44	0.52	0.50	0.51	0.52	0.46	0.78	0.41	0.45	
strain guage [V]:	0.94										0.81 0.47 0.50										
rotor speed [V]:	2.51																				
wind [m/s]:	7.27	5.50	5.75	5.70	5.68	7.04	5.37	5.32	5.08	5.04	7.19	5.35	5.69	5.58	5.65	5.69	5.06	6.85	5.22	5.37	
fax [N]:	1.41	0.78	0.87	0.85	0.70	1.31	0.74	0.72	0.55	0.54	1.38	0.73	0.85	0.81	0.84	0.85	0.55	1.24	0.69	0.74	
torque [mNm]:	9.68	5.39	6.05	5.90	6.50	9.06	5.05	4.94	5.24	5.17	9.47	5.02	5.87	5.60	5.77	5.88	5.21	8.63	4.67	5.06	
speed [rpm]:	3019	1906	2077	2038	2195	2860	1819	1788	1868	1849	2966	1809	2030	1959	2004	2035	1859	2748	1718	1821	
Fax meas [N]:	1.51										1.34 0.76 0.84										
speed meas [rpm]:																					
Ct [-]:	0.90	0.88	0.89	0.89	0.74	0.90	0.87	0.87	0.72	0.72	0.90	0.87	0.89	0.89	0.89	0.89	0.72	0.90	0.86	0.87	
a [-]:	0.35	0.33	0.34	0.34	0.24	0.34	0.32	0.32	0.24	0.24	0.34	0.32	0.34	0.33	0.33	0.34	0.24	0.34	0.31	0.32	
Lambda [-]:	5.39	4.50	4.69	4.65	5.02	5.28	4.40	4.36	4.78	4.76	5.35	4.39	4.64	4.56	4.61	4.64	4.77	5.21	4.27	4.40	
P = QxN [W]:	3.06	1.08	1.31	1.26	1.49	2.71	0.96	0.92	1.03	1.00	2.94	0.95	1.25	1.15	1.21	1.25	1.01	2.48	0.84	0.97	
P with Ct [W]:	6.71	2.90	3.33	3.23	3.00	6.08	2.70	2.63	2.13	2.08	6.50	2.68	3.21	3.03	3.14	3.22	2.11	5.62	2.47	2.71	
Cp real [-]:	0.27	0.22	0.23	0.23	0.28	0.26	0.21	0.21	0.27	0.27	0.27	0.21	0.23	0.22	0.23	0.23	0.27	0.26	0.20	0.21	
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59	0.55	0.55	0.59	0.59	0.59	0.59	0.59	0.59	0.55	0.59	0.59	0.59	

farm1 ex12		bin [s] 120 150																			
tunnel wind [V]:	0.808																				
	wtb1	wtb4	wtb5	wtb6	wtb7	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0	0	0	0	2.5	0	0	0	2.5	2.5	0	0	0	0	0	0	2.5	0	0	0	
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	
Ugen [V]:	1.12	0.64	0.71	0.70	0.74	1.03	0.59	0.58	0.59	0.60	1.08	0.60	0.70	0.68	0.69	0.70	0.60	1.00	0.55	0.59	
strain guage [V]:	1.21										1.06 0.64 0.67										
rotor speed [V]:	3.09																				
wind [m/s]:	8.33	6.20	6.55	6.49	6.49	7.91	5.97	5.92	5.72	5.76	8.13	6.01	6.47	6.37	6.44	6.51	5.78	7.82	5.82	5.99	
fax [N]:	1.88	1.03	1.14	1.12	0.92	1.68	0.95	0.93	0.71	0.72	1.78	0.96	1.11	1.08	1.11	1.13	0.72	1.64	0.90	0.95	
torque [mNm]:	12.35	7.15	7.94	7.80	8.21	11.33	6.60	6.47	6.59	6.68	11.86	6.71	7.75	7.53	7.69	7.84	6.72	11.07	6.21	6.65	
speed [rpm]:	3715	2364	2569	2532	2640	3449	2221	2186	2217	2240	3586	2249	2520	2463	2503	2543	2250	3383	2120	2235	
Fax meas [N]:	1.95										1.75 1.04 1.12										
speed meas [rpm]:																					
Ct [-]:	0.92	0.90	0.90	0.90	0.74	0.91	0.90	0.90	0.74	0.74	0.91	0.90	0.90	0.90	0.90	0.90	0.74	0.91	0.90	0.90	
a [-]:	0.36	0.35	0.34	0.34	0.25	0.35	0.34	0.34	0.24	0.24	0.35	0.34	0.34	0.35	0.35	0.34	0.24	0.35	0.34	0.34	
Lambda [-]:	5.79	4.95	5.09	5.07	5.28	5.66	4.83	4.80	5.03	5.05	5.73	4.86	5.06	5.02	5.05	5.07	5.06	5.62	4.73	4.84	
P = QxN [W]:	4.81	1.77	2.14	2.07	2.27	4.09	1.53	1.48	1.53	1.57	4.45	1.58	2.05	1.94	2.02	2.09	1.58	3.92	1.38	1.56	
P with Ct [W]:	10.07	4.17	4.91	4.77	4.50	8.64	3.71	3.62	3.07	3.14	9.35	3.79	4.72	4.52	4.66	4.81	3.17	8.32	3.44	3.75	
Cp real [-]:	0.28	0.25	0.26	0.26	0.28	0.28	0.24	0.24	0.28	0.28	0.28	0.25	0.26	0.25	0.26	0.26	0.28	0.28	0.24	0.25	
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59	0.56	0.56	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59	

farm1 ex12		bin [s] 240 270																			
tunnel wind [V]:	0.915																				
	wtb1	wtb4	wtb5	wtb6	wtb7	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0	0	0	0	2.5	0	0	0	2.5	2.5	0	0	0	0	0	0	2.5	0	0	0	
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	
Ugen [V]:	1.37	0.81	0.89	0.88	0.92	1.27	0.75	0.74	0.73	0.73	1.29	0.77	0.86	0.85	0.85	0.87	0.74	1.27	0.72	0.76	
strain guage [V]:	1.59	1.36 0.81 0.85																			
rotor speed [V]:	3.68																				
wind [m/s]:	9.43	7.01	7.36	7.32	7.37	9.01	6.72	6.67	6.46	6.46	9.11	6.82	7.22	7.17	7.18	7.27	6.51	8.99	6.57	6.77	
fax [N]:	2.41	1.30	1.45	1.43	1.18	2.21	1.20	1.18	0.91	0.91	2.26	1.23	1.39	1.37	1.37	1.41	0.93	2.20	1.15	1.21	
torque [mNm]:	14.98	9.00	9.90	9.79	10.13	13.98	8.33	8.21	8.16	8.15	14.22	8.55	9.54	9.42	9.42	9.66	8.27	13.92	7.98	8.43	
speed [rpm]:	4398	2845	3079	3048	3138	4138	2669	2640	2627	2623	4201	2728	2983	2952	2954	3016	2655	4122	2580	2695	
Fax meas [N]:	2.57	2.23 1.32 1.42																			
speed meas [rpm]:																					
Ct [-]:	0.92	0.90	0.91	0.91	0.73	0.92	0.90	0.90	0.74	0.74	0.92	0.90	0.90	0.90	0.90	0.90	0.74	0.92	0.90	0.90	
a [-]:	0.36	0.34	0.35	0.35	0.24	0.36	0.34	0.34	0.25	0.25	0.36	0.34	0.34	0.34	0.34	0.35	0.25	0.36	0.34	0.34	
Lambda [-]:	6.06	5.27	5.43	5.41	5.53	5.96	5.16	5.14	5.28	5.28	5.99	5.19	5.37	5.34	5.34	5.39	5.29	5.96	5.10	5.17	
P = QxN [W]:	6.90	2.68	3.19	3.12	3.33	6.06	2.33	2.27	2.25	2.24	6.26	2.44	2.98	2.91	2.91	3.05	2.30	6.01	2.16	2.38	
P with Ct [W]:	14.58	6.02	6.96	6.83	6.57	12.71	5.30	5.18	4.45	4.43	13.15	5.54	6.57	6.44	6.45	6.70	4.55	12.61	4.95	5.41	
Cp real [-]:	0.28	0.26	0.27	0.27	0.28	0.28	0.26	0.26	0.28	0.28	0.28	0.26	0.27	0.27	0.27	0.27	0.28	0.28	0.26	0.26	
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59	0.56	0.56	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59	

farm1 ex123		bin [s] 50 80																	
tunnel wind [V]:	0.719																		
	wtb4	wtb5	wtb6	wtb7	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0	0	0	2.5	0	0	2.5	2.5	0	0	0	0	0	0	2.5	0	0	0	
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	
Ugen [V]:	0.92	0.47	0.57	0.60	0.42	0.38	0.44	0.47	0.85	0.45	0.52	0.50	0.53	0.54	0.48	0.78	0.40	0.43	
strain guage [V]:	0.81 0.47 0.51																		
rotor speed [V]:																			
wind [m/s]:	7.46	5.49	5.88	5.78	5.28	5.06	4.97	5.11	7.17	5.37	5.67	5.58	5.73	5.78	5.19	6.85	5.16	5.29	
fax [N]:	1.49	0.78	0.92	0.73	0.71	0.65	0.53	0.56	1.37	0.74	0.84	0.81	0.86	0.88	0.58	1.24	0.67	0.71	
torque [mNm]:	10.16	5.37	6.36	6.72	4.82	4.37	5.02	5.32	9.41	5.06	5.83	5.60	5.97	6.10	5.48	8.82	4.56	4.86	
speed [rpm]:	3145	1901	2159	2252	1757	1640	1810	1888	2950	1820	2022	1960	2058	2091	1928	2745	1690	1768	
Fax meas [N]:	1.33 0.77 0.84																		
speed meas [rpm]:																			
Ct [-]:	0.91	0.88	0.90	0.74	0.86	0.86	0.72	0.73	0.90	0.87	0.89	0.89	0.89	0.90	0.73	0.90	0.86	0.86	
a [-]:	0.35	0.33	0.34	0.24	0.31	0.31	0.24	0.24	0.34	0.32	0.33	0.33	0.34	0.34	0.24	0.34	0.31	0.32	
Lambda [-]:	5.47	4.49	4.77	5.06	4.32	4.21	4.73	4.79	5.34	4.40	4.63	4.56	4.67	4.70	4.83	5.20	4.25	4.34	
P = QxN [W]:	3.35	1.07	1.44	1.59	0.89	0.75	0.95	1.05	2.91	0.96	1.24	1.15	1.29	1.34	1.11	2.48	0.81	0.90	
P with Ct [W]:	7.24	2.89	3.54	3.17	2.56	2.25	1.99	2.18	6.43	2.70	3.19	3.04	3.28	3.36	2.28	5.61	2.40	2.58	
Cp real [-]:	0.27	0.22	0.24	0.28	0.20	0.20	0.26	0.27	0.27	0.21	0.23	0.22	0.23	0.24	0.27	0.26	0.20	0.21	
Cp with Ct [-]:	0.59	0.59	0.59	0.56	0.59	0.59	0.55	0.55	0.59	0.59	0.59	0.59	0.59	0.59	0.55	0.59	0.59	0.59	

farm1 ex123	bin [s] 130 160																		
tunnel wind [V]:	0.815																		
	wtb4	wtb5	wtb6	wtb7	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0	0	0	2.5	0	0	2.5	2.5	0	0	0	0	0	0	2.5	0	0	0	
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	
Ugen [V]:	1.18	0.63	0.74	0.76	0.58	0.51	0.59	0.60	1.09	0.59	0.68	0.66	0.68	0.69	0.61	1.00	0.55	0.59	
strain guage [V]:	1.09 0.62 0.67																		
rotor speed [V]:																			
wind [m/s]:	8.58	6.16	6.70	6.62	5.93	5.64	5.71	5.76	8.19	5.99	6.39	6.30	6.37	6.46	5.85	7.81	5.82	5.96	
fax [N]:	2.00	1.01	1.19	0.96	0.93	0.83	0.71	0.72	1.81	0.95	1.09	1.06	1.08	1.11	0.74	1.64	0.90	0.94	
torque [mNm]:	12.94	7.04	8.27	8.50	6.49	5.75	6.57	6.67	12.02	6.65	7.57	7.37	7.54	7.73	6.86	11.05	6.22	6.57	
speed [rpm]:	3868	2335	2654	2713	2192	1999	2214	2239	3629	2233	2473	2420	2464	2514	2288	3377	2121	2213	
Fax meas [N]:	1.78 1.01 1.11																		
speed meas [rpm]:																			
Ct [-]:	0.92	0.90	0.90	0.74	0.90	0.89	0.74	0.74	0.91	0.90	0.90	0.90	0.90	0.90	0.74	0.91	0.90	0.90	
a [-]:	0.36	0.35	0.34	0.25	0.34	0.33	0.24	0.24	0.35	0.34	0.35	0.35	0.35	0.34	0.24	0.35	0.34	0.34	
Lambda [-]:	5.86	4.93	5.15	5.32	4.80	4.60	5.03	5.05	5.75	4.84	5.03	4.99	5.02	5.05	5.08	5.62	4.73	4.82	
P = QxN [W]:	5.24	1.72	2.30	2.41	1.49	1.20	1.52	1.56	4.57	1.55	1.96	1.87	1.94	2.03	1.64	3.91	1.38	1.52	
P with Ct [W]:	10.97	4.07	5.24	4.78	3.63	3.13	3.06	3.14	9.58	3.75	4.55	4.36	4.52	4.70	3.28	8.30	3.44	3.69	
Cp real [-]:	0.28	0.25	0.26	0.28	0.24	0.23	0.28	0.28	0.28	0.25	0.26	0.25	0.25	0.26	0.28	0.28	0.24	0.24	
Cp with Ct [-]:	0.59	0.59	0.59	0.56	0.59	0.59	0.56	0.56	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59	

farm1 ex123	bin [s] 230 260																		
tunnel wind [V]:	0.911																		
	wtb4	wtb5	wtb6	wtb7	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0	0	0	2.5	0	0	2.5	2.5	0	0	0	0	0	0	2.5	0	0	0	
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	
Ugen [V]:	1.39	0.80	0.91	0.91	0.71	0.65	0.70	0.72	1.27	0.75	0.82	0.81	0.81	0.84	0.74	1.21	0.69	0.72	
strain guage [V]:	1.31 0.77 0.81																		
rotor speed [V]:																			
wind [m/s]:	9.54	6.97	7.44	7.36	6.55	6.27	6.28	6.38	9.01	6.71	7.04	7.01	7.02	7.13	6.48	8.71	6.42	6.60	
fax [N]:	2.46	1.28	1.48	1.17	1.14	1.05	0.86	0.89	2.21	1.19	1.31	1.30	1.30	1.35	0.92	2.06	1.10	1.16	
torque [mNm]:	15.24	8.90	10.09	10.10	7.94	7.30	7.78	7.99	13.99	8.29	9.06	8.99	9.03	9.31	8.19	13.26	7.65	8.06	
speed [rpm]:	4465	2819	3128	3131	2568	2401	2527	2582	4140	2661	2861	2843	2851	2925	2635	3952	2493	2599	
Fax meas [N]:	2.15 1.26 1.35																		
speed meas [rpm]:																			
Ct [-]:	0.92	0.90	0.91	0.73	0.90	0.90	0.74	0.74	0.92	0.90	0.90	0.90	0.90	0.90	0.74	0.92	0.90	0.90	
a [-]:	0.36	0.34	0.35	0.24	0.34	0.35	0.25	0.25	0.36	0.34	0.34	0.34	0.34	0.34	0.25	0.36	0.35	0.34	
Lambda [-]:	6.08	5.25	5.46	5.52	5.09	4.97	5.22	5.25	5.96	5.15	5.28	5.27	5.27	5.32	5.28	5.89	5.04	5.11	
P = QxN [W]:	7.13	2.63	3.31	3.31	2.13	1.83	2.06	2.16	6.06	2.31	2.72	2.68	2.69	2.85	2.26	5.49	2.00	2.19	
P with Ct [W]:	15.08	5.92	7.17	6.54	4.90	4.30	4.08	4.28	12.73	5.27	6.08	6.01	6.05	6.33	4.48	11.49	4.62	5.02	
Cp real [-]:	0.28	0.26	0.27	0.28	0.26	0.25	0.28	0.28	0.28	0.26	0.26	0.26	0.26	0.27	0.28	0.28	0.26	0.26	
Cp with Ct [-]:	0.59	0.59	0.59	0.56	0.59	0.59	0.56	0.56	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59	

farm1 ex1234		bin [s] 40 70															
tunnel wind [V]:	0.721																
	wtb5	wtb6	wtb7	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0	0	2.5	0	0	2.5	2.5	0	0	0	0	0	0	2.5	0	0	0
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	0.95	0.48	0.61	0.41	0.84	0.44	0.49	0.85	0.44	0.51	0.46	0.50	0.51	0.46	0.75	0.39	0.41
strain guage [V]:	0.81 0.47 0.50																
rotor speed [V]:																	
wind [m/s]:	7.60	5.49	5.81	5.21	7.13	4.94	5.21	7.18	5.33	5.65	5.45	5.58	5.62	5.09	6.72	5.09	5.23
fax [N]:	1.55	0.78	0.73	0.68	1.35	0.52	0.58	1.37	0.73	0.83	0.77	0.81	0.83	0.55	1.20	0.66	0.69
torque [mNm]:	10.53	5.37	6.78	4.64	9.30	4.96	5.52	9.44	4.95	5.76	5.26	5.59	5.70	5.26	8.32	4.43	4.69
speed [rpm]:	3240	1901	2268	1712	2923	1795	1941	2958	1793	2003	1872	1959	1988	1873	2666	1657	1724
Fax meas [N]:	1.32 0.77 0.83																
speed meas [rpm]:																	
Ct [-]:	0.91	0.88	0.74	0.86	0.90	0.72	0.73	0.90	0.87	0.89	0.88	0.89	0.89	0.72	0.90	0.86	0.86
a [-]:	0.35	0.33	0.24	0.31	0.34	0.24	0.24	0.34	0.32	0.33	0.32	0.33	0.33	0.24	0.34	0.31	0.31
Lambda [-]:	5.53	4.49	5.07	4.27	5.32	4.72	4.84	5.35	4.37	4.61	4.46	4.56	4.59	4.78	5.15	4.22	4.28
P = QxN [W]:	3.57	1.07	1.61	0.83	2.85	0.93	1.12	2.92	0.93	1.21	1.03	1.15	1.19	1.03	2.32	0.77	0.85
P with Ct [W]:	7.66	2.89	3.22	2.46	6.32	1.96	2.31	6.46	2.64	3.14	2.82	3.03	3.10	2.14	5.29	2.30	2.49
Cp real [-]:	0.28	0.22	0.28	0.20	0.27	0.26	0.27	0.27	0.21	0.23	0.22	0.22	0.23	0.27	0.26	0.20	0.20
Cp with Ct [-]:	0.59	0.59	0.56	0.59	0.59	0.55	0.55	0.59	0.59	0.59	0.59	0.59	0.59	0.55	0.59	0.59	0.59

farm1 ex1234		bin[s] 120 150															
tunnel wind [V]:	0.826																
	wtb5	wtb6	wtb7	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0	0	2.5	0	0	2.5	2.5	0	0	0	0	0	0	2.5	0	0	0
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	1.19	0.66	0.79	0.56	1.08	0.59	0.63	1.09	0.60	0.68	0.64	0.66	0.69	0.61	1.00	0.54	0.57
strain guage [V]:	1.07 0.62 0.66																
rotor speed [V]:																	
wind [m/s]:	8.65	6.30	6.74	5.87	8.16	5.73	5.95	8.18	6.00	6.37	6.20	6.29	6.45	5.82	7.82	5.76	5.88
fax [N]:	2.03	1.06	0.99	0.91	1.79	0.71	0.77	1.80	0.96	1.08	1.02	1.06	1.11	0.73	1.64	0.88	0.92
torque [mNm]:	13.11	7.36	8.76	6.33	11.94	6.60	7.08	11.99	6.67	7.54	7.14	7.35	7.71	6.80	11.08	6.07	6.36
speed [rpm]:	3912	2418	2781	2151	3608	2221	2346	3621	2239	2463	2360	2416	2508	2272	3385	2083	2158
Fax meas [N]:	1.76 1.01 1.09																
speed meas [rpm]:																	
Ct [-]:	0.92	0.90	0.74	0.90	0.91	0.74	0.74	0.91	0.90	0.90	0.90	0.90	0.90	0.74	0.91	0.89	0.90
a [-]:	0.36	0.35	0.24	0.34	0.35	0.24	0.24	0.35	0.34	0.35	0.35	0.35	0.35	0.24	0.35	0.34	0.34
Lambda [-]:	5.87	4.99	5.36	4.76	5.74	5.04	5.12	5.75	4.85	5.02	4.94	4.98	5.05	5.07	5.62	4.69	4.77
P = QxN [W]:	5.37	1.86	2.55	1.43	4.51	1.54	1.74	4.55	1.56	1.94	1.76	1.86	2.02	1.62	3.93	1.32	1.44
P with Ct [W]:	11.24	4.36	5.04	3.52	9.47	3.08	3.47	9.53	3.76	4.52	4.15	4.35	4.68	3.24	8.33	3.34	3.54
Cp real [-]:	0.28	0.25	0.28	0.24	0.28	0.28	0.28	0.28	0.25	0.25	0.25	0.25	0.26	0.28	0.28	0.23	0.24
Cp with Ct [-]:	0.59	0.59	0.56	0.59	0.59	0.56	0.56	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59

farm1 ex1234		bin [s] 180 220															
tunnel wind [V]:	0.919																
	wtb5	wtb6	wtb7	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0	0	2.5	0	0	2.5	2.5	0	0	0	0	0	0	2.5	0	0	0
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	1.39	0.82	0.94	0.71	1.29	0.70	0.75	1.28	0.75	0.82	0.78	0.79	0.84	0.73	1.22	0.69	0.72
strain guage [V]:	1.33 0.77 0.82																
rotor speed [V]:																	
wind [m/s]:	9.55	7.05	7.47	6.52	9.08	6.31	6.56	9.05	6.71	7.06	6.89	6.91	7.12	6.45	8.78	6.43	6.61
fax [N]:	2.47	1.32	1.21	1.13	2.24	0.87	0.94	2.23	1.19	1.32	1.26	1.26	1.34	0.91	2.09	1.10	1.16
torque [mNm]:	15.28	9.11	10.35	7.87	14.15	7.85	8.38	14.08	8.29	9.13	8.71	8.75	9.27	8.15	13.42	7.66	8.06
speed [rpm]:	4476	2872	3196	2549	4181	2545	2682	4165	2660	2878	2769	2779	2913	2622	3993	2496	2600
Fax meas [N]:	2.19 1.26 1.36																
speed meas [rpm]:																	
Ct [-]:	0.92	0.90	0.73	0.90	0.92	0.74	0.74	0.92	0.90	0.90	0.90	0.90	0.90	0.74	0.92	0.90	0.90
a [-]:	0.36	0.34	0.24	0.34	0.36	0.25	0.25	0.36	0.34	0.34	0.34	0.34	0.34	0.25	0.36	0.35	0.34
Lambda [-]:	6.08	5.29	5.55	5.08	5.98	5.23	5.31	5.97	5.15	5.29	5.22	5.22	5.32	5.27	5.91	5.04	5.11
P = QxN [W]:	7.16	2.74	3.47	2.10	6.19	2.09	2.35	6.14	2.31	2.75	2.53	2.55	2.83	2.24	5.61	2.00	2.20
P with Ct [W]:	15.16	6.13	6.84	4.83	13.01	4.15	4.66	12.90	5.26	6.15	5.71	5.75	6.29	4.43	11.76	4.63	5.03
Cp real [-]:	0.28	0.26	0.28	0.26	0.28	0.28	0.28	0.28	0.26	0.27	0.26	0.26	0.27	0.28	0.28	0.26	0.26
Cp with Ct [-]:	0.59	0.59	0.56	0.59	0.59	0.56	0.56	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59

farm1 ex12345		bin [s] 50 80															
tunnel wind [V]:	0.719																
	wtb6	wtb7	wtb11	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24		
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d		
pitch [dg]:	0	2.5	0	2.5	2.5	0	0	0	0	0	0	2.5	0	0	0		
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl		
Ugen [V]:	0.98	0.55	0.41	0.44	0.43	0.87	0.45	0.51	0.48	0.49	0.51	0.48	0.78	0.41	0.43		
strain guage [V]:	0.82 0.48 0.50																
rotor speed [V]:																	
wind [m/s]:	7.71	5.54	5.24	4.96	4.89	7.25	5.39	5.65	5.49	5.54	5.63	5.14	6.87	5.23	5.32		
fax [N]:	1.59	0.67	0.69	0.52	0.51	1.40	0.75	0.84	0.78	0.80	0.83	0.57	1.25	0.69	0.72		
torque [mNm]:	10.79	6.21	4.71	5.00	4.87	9.61	5.10	5.77	5.38	5.49	5.73	5.37	8.67	4.68	4.92		
speed [rpm]:	3310	2120	1729	1806	1771	3002	1830	2004	1902	1931	1994	1901	2758	1722	1783		
Fax meas [N]:	1.35 0.77 0.83																
speed meas [rpm]:																	
Ct [-]:	0.91	0.74	0.86	0.72	0.72	0.90	0.87	0.89	0.88	0.88	0.89	0.73	0.90	0.86	0.87		
a [-]:	0.35	0.24	0.31	0.24	0.24	0.35	0.32	0.33	0.33	0.33	0.33	0.24	0.34	0.31	0.32		
Lambda [-]:	5.58	4.97	4.29	4.73	4.71	5.38	4.41	4.61	4.50	4.53	4.60	4.81	5.21	4.28	4.36		
P = QxN [W]:	3.74	1.38	0.85	0.95	0.90	3.02	0.98	1.21	1.07	1.11	1.20	1.07	2.50	0.84	0.92		
P with Ct [W]:	7.98	2.79	2.50	1.98	1.90	6.64	2.73	3.14	2.90	2.96	3.12	2.21	5.66	2.48	2.62		
Cp real [-]:	0.28	0.28	0.20	0.26	0.26	0.27	0.21	0.23	0.22	0.22	0.23	0.27	0.26	0.20	0.21		
Cp with Ct [-]:	0.59	0.56	0.59	0.55	0.55	0.59	0.59	0.59	0.59	0.59	0.59	0.55	0.59	0.59	0.59		

farm1 ex12345		bin [s] 130 160															
tunnel wind [V]:	0.826																
	wtb6	wtb7	wtb11	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24		
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d		
pitch [dg]:	0	2.5	0	2.5	2.5	0	0	0	0	0	0	2.5	0	0	0		
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl		
Ugen [V]:	1.22	0.72	0.57	0.59	0.57	1.08	0.61	0.68	0.64	0.65	0.68	0.61	1.01	0.55	0.58		
strain guage [V]:							1.07	0.65	0.66								
rotor speed [V]:																	
wind [m/s]:	8.77	6.41	5.89	5.71	5.64	8.14	6.08	6.41	6.20	6.24	6.38	5.82	7.84	5.79	5.93		
fax [N]:	2.09	0.90	0.92	0.71	0.69	1.79	0.98	1.10	1.03	1.04	1.09	0.74	1.65	0.88	0.93		
torque [mNm]:	13.40	8.05	6.40	6.56	6.43	11.90	6.86	7.62	7.15	7.24	7.56	6.81	11.13	6.13	6.51		
speed [rpm]:	3988	2598	2169	2210	2176	3598	2288	2485	2363	2386	2469	2274	3398	2099	2197		
Fax meas [N]:							1.76	1.05	1.10								
speed meas [rpm]:																	
Ct [-]:	0.92	0.74	0.90	0.74	0.74	0.91	0.90	0.90	0.90	0.90	0.90	0.74	0.91	0.90	0.90		
a [-]:	0.36	0.25	0.34	0.24	0.24	0.35	0.35	0.35	0.35	0.35	0.35	0.24	0.35	0.34	0.34		
Lambda [-]:	5.90	5.26	4.78	5.03	5.01	5.74	4.89	5.03	4.95	4.96	5.02	5.07	5.63	4.71	4.81		
P = QxN [W]:	5.60	2.19	1.45	1.52	1.47	4.49	1.64	1.98	1.77	1.81	1.95	1.62	3.96	1.35	1.50		
P with Ct [W]:	11.72	4.34	3.57	3.05	2.95	9.41	3.92	4.60	4.16	4.24	4.54	3.24	8.39	3.38	3.65		
Cp real [-]:	0.28	0.28	0.24	0.28	0.28	0.28	0.25	0.26	0.25	0.25	0.25	0.28	0.28	0.24	0.24		
Cp with Ct [-]:	0.59	0.56	0.59	0.56	0.56	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59		

farm1 ex12345		bin [s] 220 250														
tunnel wind [V]:	0.926															
	wtb6	wtb7	wtb11	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	0	2.5	0	2.5	2.5	0	0	0	0	0	0	2.5	0	0	0	
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	
Ugen [V]:	1.47	0.90	0.71	0.71	0.70	1.30	0.77	0.86	0.82	0.80	0.86	0.78	1.24	0.72	0.74	
strain guage [V]:						1.36	0.81	0.86								
rotor speed [V]:																
wind [m/s]:	9.92	7.29	6.52	6.32	6.28	9.14	6.83	7.20	7.05	6.96	7.20	6.69	8.88	6.58	6.70	
fax [N]:	2.65	1.15	1.13	0.87	0.86	2.27	1.24	1.38	1.31	1.28	1.38	0.97	2.14	1.15	1.19	
torque [mNm]:	16.15	9.95	7.86	7.86	7.77	14.30	8.58	9.48	9.09	8.86	9.49	8.64	13.66	7.99	8.29	
speed [rpm]:	4701	3091	2548	2549	2525	4221	2735	2969	2869	2807	2970	2749	4056	2583	2658	
Fax meas [N]:						2.23	1.32	1.44								
speed meas [rpm]:																
Ct [-]:	0.91	0.73	0.90	0.74	0.74	0.92	0.90	0.90	0.90	0.90	0.90	0.74	0.92	0.90	0.90	
a [-]:	0.35	0.24	0.34	0.25	0.25	0.36	0.34	0.34	0.34	0.34	0.34	0.24	0.36	0.34	0.34	
Lambda [-]:	6.16	5.50	5.08	5.23	5.22	5.99	5.20	5.36	5.28	5.24	5.36	5.34	5.93	5.10	5.15	
P = QxN [W]:	7.95	3.22	2.10	2.10	2.06	6.32	2.46	2.95	2.73	2.60	2.95	2.49	5.80	2.16	2.31	
P with Ct [W]:	16.97	6.36	4.83	4.16	4.08	13.29	5.57	6.51	6.11	5.87	6.51	4.92	12.16	4.96	5.26	
Cp real [-]:	0.28	0.28	0.26	0.28	0.28	0.28	0.26	0.27	0.26	0.26	0.27	0.28	0.28	0.26	0.26	
Cp with Ct [-]:	0.59	0.56	0.59	0.56	0.56	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59	

farm1 ex123456		bin [s] 40 80													
tunnel wind [V]:	0.711														
	wtb7	wtb11	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	2.5	0	2.5	2.5	0	0	0	0	0	0	2.5	0	0	0	
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	
Ugen [V]:	0.99	0.39	0.42	0.84	0.86	0.43	0.51	0.46	0.49	0.50	0.47	0.76	0.39	0.41	
strain guage [V]:	0.82 0.47 0.50														
rotor speed [V]:															
wind [m/s]:	7.74	5.10	4.86	7.02	7.22	5.32	5.62	5.44	5.54	5.58	5.10	6.75	5.10	5.22	
fax [N]:	1.29	0.66	0.50	1.07	1.39	0.72	0.83	0.76	0.80	0.81	0.55	1.21	0.66	0.69	
torque [mNm]:	10.97	4.44	4.81	9.35	9.53	4.92	5.70	5.22	5.49	5.60	5.28	8.40	4.45	4.68	
speed [rpm]:	3356	1660	1756	2935	2981	1784	1986	1863	1932	1960	1879	2688	1661	1721	
Fax meas [N]:	1.35 0.76 0.83														
speed meas [rpm]:															
Ct [-]:	0.73	0.86	0.72	0.74	0.90	0.87	0.89	0.88	0.88	0.89	0.73	0.90	0.86	0.86	
a [-]:	0.24	0.31	0.24	0.24	0.34	0.32	0.33	0.32	0.33	0.33	0.24	0.34	0.31	0.31	
Lambda [-]:	5.63	4.23	4.70	5.43	5.36	4.36	4.59	4.45	4.53	4.56	4.79	5.17	4.23	4.28	
P = QxN [W]:	3.85	0.77	0.88	2.87	2.97	0.92	1.19	1.02	1.11	1.15	1.04	2.36	0.77	0.84	
P with Ct [W]:	7.60	2.31	1.86	5.68	6.56	2.62	3.10	2.80	2.97	3.04	2.16	5.37	2.31	2.48	
Cp real [-]:	0.28	0.20	0.26	0.28	0.27	0.21	0.23	0.22	0.22	0.22	0.27	0.26	0.20	0.20	
Cp with Ct [-]:	0.56	0.59	0.55	0.56	0.59	0.59	0.59	0.59	0.59	0.59	0.55	0.59	0.59	0.59	

farm1 ex123456		bin [s] 120 150													
tunnel wind [V]:	0.821														
	wtb7	wtb11	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	2.5	0	2.5	2.5	0	0	0	0	0	0	2.5	0	0	0	
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	
Ugen [V]:	1.22	0.55	0.57	1.09	1.08	0.60	0.68	0.64	0.64	0.65	0.59	1.02	0.55	0.58	
strain guage [V]:	1.07 0.63 0.67														
rotor speed [V]:															
wind [m/s]:	8.87	5.79	5.65	8.22	8.15	6.03	6.38	6.20	6.19	6.27	5.74	7.89	5.82	5.93	
fax [N]:	1.67	0.89	0.69	1.45	1.79	0.97	1.08	1.02	1.02	1.05	0.71	1.67	0.90	0.93	
torque [mNm]:	13.39	6.14	6.44	12.00	11.91	6.75	7.55	7.13	7.11	7.31	6.84	11.25	6.23	6.49	
speed [rpm]:	3985	2101	2180	3623	3601	2260	2466	2358	2353	2405	2230	3430	2123	2192	
Fax meas [N]:	1.75 1.03 1.11														
speed meas [rpm]:															
Ct [-]:	0.72	0.90	0.74	0.73	0.91	0.90	0.90	0.90	0.90	0.90	0.74	0.91	0.90	0.90	
a [-]:	0.24	0.34	0.24	0.24	0.35	0.34	0.35	0.35	0.35	0.35	0.24	0.35	0.34	0.34	
Lambda [-]:	5.83	4.71	5.01	5.73	5.74	4.87	5.02	4.94	4.94	4.98	5.04	5.65	4.73	4.80	
P = QxN [W]:	5.59	1.35	1.47	4.55	4.49	1.60	1.95	1.76	1.75	1.84	1.55	4.04	1.38	1.49	
P with Ct [W]:	11.33	3.39	2.96	9.06	9.42	3.83	4.53	4.15	4.13	4.31	3.11	8.55	3.45	3.63	
Cp real [-]:	0.27	0.24	0.28	0.28	0.28	0.25	0.25	0.25	0.25	0.25	0.28	0.28	0.24	0.24	
Cp with Ct [-]:	0.55	0.59	0.56	0.55	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59	

farm1 ex123456		bin [s] 230 260													
tunnel wind [V]:	0.917														
	wtb7	wtb11	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24	
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	
pitch [dg]:	2.5	0	2.5	2.5	0	0	0	0	0	0	2.5	0	0	0	
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	
Ugen [V]:	1.47	0.69	0.69	1.30	1.29	0.75	0.83	0.79	0.79	0.82	0.73	1.23	0.69	0.72	
strain guage [V]:	1.34 0.79 0.83														
rotor speed [V]:															
wind [m/s]:	10.13	6.43	6.24	9.28	9.08	6.73	7.10	6.93	6.90	7.03	6.46	8.81	6.45	6.61	
fax [N]:	2.10	1.10	0.85	1.81	2.24	1.20	1.33	1.27	1.26	1.31	0.91	2.11	1.11	1.16	
torque [mNm]:	16.07	7.65	7.70	14.26	14.14	8.34	9.22	8.81	8.72	9.04	8.15	13.49	7.72	8.06	
speed [rpm]:	4682	2494	2506	4212	4180	2672	2900	2795	2773	2855	2623	4010	2510	2601	
Fax meas [N]:	2.20 1.29 1.37														
speed meas [rpm]:															
Ct [-]:	0.69	0.90	0.74	0.71	0.92	0.90	0.90	0.90	0.90	0.90	0.74	0.92	0.90	0.90	
a [-]:	0.22	0.35	0.25	0.23	0.36	0.34	0.34	0.34	0.34	0.34	0.25	0.36	0.35	0.34	
Lambda [-]:	6.00	5.04	5.21	5.89	5.98	5.16	5.31	5.23	5.22	5.27	5.28	5.91	5.05	5.11	
P = QxN [W]:	7.88	2.00	2.02	6.29	6.19	2.33	2.80	2.58	2.53	2.70	2.24	5.66	2.03	2.20	
P with Ct [W]:	16.52	4.63	4.01	12.90	13.00	5.31	6.24	5.82	5.73	6.06	4.43	11.86	4.69	5.03	
Cp real [-]:	0.26	0.26	0.28	0.27	0.28	0.26	0.27	0.26	0.26	0.26	0.28	0.28	0.26	0.26	
Cp with Ct [-]:	0.54	0.59	0.56	0.55	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.59	

Appendix C: Data Processing

The ECN measurement system records voltage signals that represent the tunnel wind speed, generator voltages and strain gauge voltages (see appendix A). The voltage signals are recorded in files of the type 'scl'. The applicable sampling frequency has been 16 Hz.

On the basis of the equations 2 to 14 of chapter 3 we reduce the measured voltage signals to a manageable amount of characteristic average values per measurement bin. Each measurement bin covers a period of unchanged regulation of the tunnel wind speed. Usually we apply bins of 30 seconds. Here we describe the largely automated data processing from measured voltage signals to characteristic bin averages.

First the recorded voltage signals are averaged per measurement bin. For this we programmed a master slide in Excel. We obtain the average voltages as follows:

1. The scl-file with 16 Hz data is converted into a txt-file
2. The txt-file is opened using Excel
3. The 16 Hz data is copied into the master slide (cell A1 into cell A46). Now the voltage that represents the tunnel wind speed, $U_{vt} = 0.1 \cdot V_t$, is plotted in a figure automatically (see figure C.1 for an example)
4. On the basis of that figure we select 2 bins by entering their begin and end times. One bin for the wind speed that we want to analyse and one for the case that the wind speed is zero. When we want to analyse the data for tunnel wind speed $V_t = 8$ m/s for the measurement of figure Fa3, the bins could be 7 min. to 7 min. 30 sec. and 0 to 20 sec. respectively.

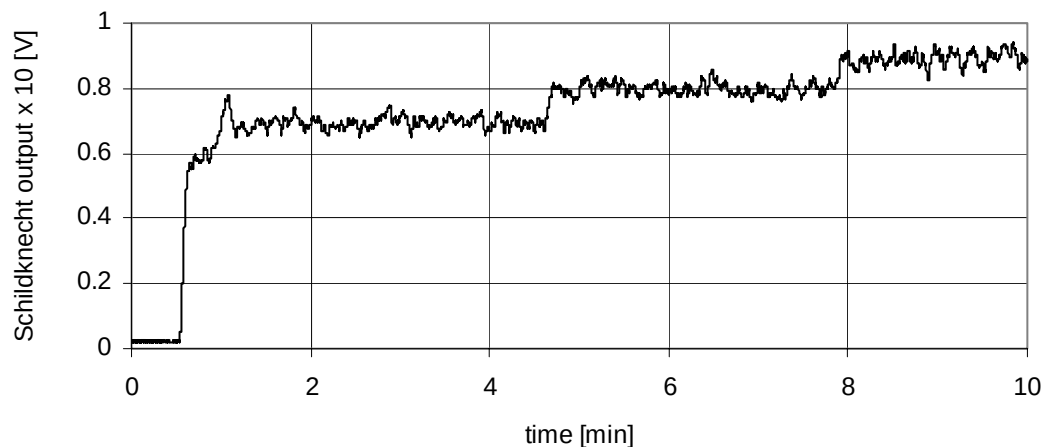


Figure C.1: Example of the voltage that represents the tunnel wind speed (source file: farm 14x2 pitch 00 reprod.xls)

After these steps we have obtained the average voltages for the selected bin (7 min. to 7 min. 30 sec.), including the compensation of offset voltages for $V_t = 0$ m/s. The average voltages are presented column-wise per wind turbine in a table like table C.1. The applicable turbine characteristics follow from the generator control (or load) and pitch angle. This information is essential for the analysis and is filled in by hand.

Table C.1: Example of automatically averaged voltages that are essential for the analysis

tunnel wind [V]:	0.791																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	2.5	0.0	2.5	0.0	2.5	0.0	2.5	0.0
macro:																								
Ugen [V]:	0.95	0.58	0.62	0.60	0.61	0.63	0.64	0.63	0.60	0.64	1.01	0.60	0.64	0.87	0.65	0.62	0.78	0.58	0.78	0.62	0.48	0.88	0.63	0.60
strain gauge [V]:	1.06	0.63	0.63												0.62	0.64	0.59							
rotor speed [V]:	2.69																							

Source file: farm 14x2 pitch 00 reprod.xls

The row 'macro' is filled in when we convert the measured voltages into characteristic aerodynamic data using the relations that we derived in chapter 3. This repeatedly performed processing depends on the turbine characteristics and demands an interpolation routine. Therefore we wrote a macro in Visual Basic that implements the equations 4 to 7 plus 2. Per turbine it calculates ambient wind speed V , axial force F_{ax} , aerodynamic torque T_a and rotor speed Ω on the basis of the generator voltage U_g , plus the measured axial force on the basis of the strain gauge voltage.

The macro is started by the selection of an Excel-cell that indicates the generator control 'x.xRyd' and then typing <ctrl-t>. It then plots output values below the average voltages for the applicable turbine and all turbines at the right, as long as the next cell contains a generator control indication as well. Further the macro fills the row 'macro' with:

- 'My3uni' for characteristics of turbines of May in a uniform flow
- 'Nv3uni' for characteristics of turbines of November in a uniform flow
- 'Nv3bl' for characteristics of turbines of November in an offshore boundary layer

Which of these is applicable is entered in the macro-code that is printed at the end of this appendix.

Below the macro output we calculate the measured rotor speed on the basis of the output of the 'frequency to voltage' measurement and the deduced aerodynamic characteristics of equation 8 to 14. These calculations are calculated easily by 'cell equations', since they are independent of the turbine characteristics and do not demand an interpolation routine. Herewith we obtain a table like table C.2, in which the measurement data is reduced to the essence.

Table C.2: example of automatically calculated data

tunnel wind [V]:	0.791																							
	wtb1	wtb2	wtb3	wtb4	wtb5	wtb6	wtb7	wtb8	wtb9	wtb10	wtb11	wtb12	wtb13	wtb14	wtb15	wtb16	wtb17	wtb18	wtb19	wtb20	wtb21	wtb22	wtb23	wtb24
generator load:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	0	0	2.5	0	2.5	0	0	2.5	0	0
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	0.95	0.58	0.62	0.60	0.61	0.63	0.64	0.63	0.60	0.64	1.01	0.60	0.64	0.87	0.65	0.62	0.78	0.58	0.78	0.62	0.48	0.88	0.63	0.60
strain gauge [V]:	1.06	0.63	0.63												0.62	0.64	0.59							
rotor speed [V]:	2.69																							
wind [m/s]:	7.60	5.93	6.10	6.00	6.08	6.14	6.20	6.16	6.01	6.20	7.85	6.01	6.18	7.13	6.23	6.12	6.71	5.95	6.68	6.10	5.53	7.22	6.15	6.03
fax [N]:	1.55	0.93	0.99	0.96	0.99	1.01	1.02	1.01	0.96	1.03	1.65	0.96	1.02	1.10	1.04	1.00	0.98	0.94	0.97	0.99	0.80	1.13	1.01	0.97
torque [mNm]:	10.53	6.50	6.92	6.67	6.87	7.01	7.13	7.05	6.72	7.15	11.15	6.70	7.11	9.59	7.21	6.96	8.69	6.55	8.62	6.91	5.47	9.78	7.01	6.75
speed [rpm]:	3113	2116	2220	2160	2208	2243	2272	2252	2170	2277	3267	2166	2267	2880	2293	2231	2658	2129	2642	2219	1863	2928	2244	2180
Fax meas [N]:	1.718	0.997	1.029												1.021	1.039	0.98							
speed meas [rpm]:	3226																							
Ct [-]:	0.91	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.91	0.90	0.90	0.90	0.73	0.90	0.90	0.74	0.90	0.74	0.90	0.88	0.73	0.90
a [-]:	0.35	0.34	0.35	0.34	0.35	0.35	0.35	0.35	0.34	0.35	0.35	0.34	0.35	0.24	0.35	0.35	0.24	0.34	0.24	0.35	0.33	0.24	0.35	0.34
Lambda [-]:	5.32	4.63	4.72	4.68	4.72	4.74	4.76	4.75	4.69	4.77	5.41	4.68	4.76	5.25	4.78	4.73	5.14	4.65	5.14	4.72	4.37	5.27	4.74	4.69
P = QxN [W]:	3.43	1.44	1.61	1.51	1.59	1.65	1.70	1.66	1.53	1.70	3.82	1.52	1.69	2.89	1.73	1.63	2.42	1.46	2.39	1.61	1.07	3.00	1.65	1.54
P with Ct [W]:	7.66	3.64	3.96	3.77	3.92	4.04	4.15	4.07	3.80	4.16	8.42	3.78	4.13	5.94	4.22	4.00	4.97	3.67	4.90	3.96	2.96	6.16	4.05	3.83
Cp real [-]:	0.26	0.23	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.27	0.24	0.24	0.27	0.24	0.24	0.27	0.24	0.27	0.24	0.21	0.27	0.24	0.24
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.56	0.59	0.59	0.56	0.59	0.56	0.59	0.56	0.59	0.56	0.59

Source file: farm 14x2 statistics out of reprod HF00.xls

Macro-code (source file: tkarakter Conclusion.xls):

Option Explicit

' Deze macro runt vanaf de cell waarin de cursur staat en kan gestart worden met Ctrl+t. De betreffende cell bevat
' het generatortype (0.1r0d, 0.5r0d, 1r0d, 1r2d of 1r5d). Indien de cell niet een van deze 5 typering bevat stopt de
' macro, als het wel zo is runt de macro en gaat hij automatisch een cell naar rechts verder. De cell onder het
' geneatortype bevat het rotortype: (1=-2.5, 2=0, 3=+2.5, 4= +5 of 5=+7.5). De cell daaronder bevat een verwijzing
' naar de gebruikte calibratie data. De macro laadt de calibratie data uit de sheet may 03 uniform, nov 03 uniform of
' nov 03 blayer. De uitvoer bestaat uit de wind m/s, de axiaalkracht N, het koppel mNm en het toerental rpm. Indien
' de uitvoer bold is weergegeven is er sprake van extrapolatie, anders van interpolatie.

Const tkar = 3 'HIER DE DATASET VERANDEREN '1 = may 03 uniform, 2 = nov 03 uniform, 3 = nov 03 blayer

Dim i As Integer: Dim j As Integer: Dim k As Integer 'tellers

Dim c As Integer 'c=aantal kolommen dat wordt verwerkt

'Dim tkar As Integer '1= may 03 uniform, 2= nov 03 uniform, 3= nov 03 blayer

Dim Tnum As Integer 'turbinennummer

Dim Generator As String

Dim Turbine As String

Dim dataset As String

Dim runsheet As String

Dim runwindow As String

Dim Ugen As Double 'generatorspanning over belastingsweerstand

Dim Urpm As Double 'spanning toerentalsensor

Dim Ufax As Double 'spanning rekstrooksensor

Dim Nfax As Double 'Fax in Newtons

Dim dVdU As Double 'afgeleide dV/dU

Dim dFdU As Double 'afgeleide dF/dU

Dim d1 As Double 'hulpparameter bij interpolatie

Dim d2 As Double 'hulpparameter bij interpolatie

Dim g As Integer 'type generator 1 t/m 5

Dim r As Integer 'type rotor, 1 = -2.5, 2=0, 3=+2.5, 4= +5.0, 5=+7.5

Dim dUdrpm As Double 'conversie van gemeten spanning U naar toerental rpm [rpm/Volt]

Dim dUdfax(1 To 30) As Double 'voor 30 turbines de conversie van gemeten rekstrookspanning U naar toerental fax [N/Volt]

Dim UR(1 To 5, 1 To 2) As Double 'UR = Ugen [V]-RotationSpeed [rpm]

Dim UT(1 To 5, 1 To 2) As Double 'UT = Ugen [V]-Torque [mNm]

Dim UVF(1 To 5, 1 To 5, 0 To 10, 1 To 3, 1 To 2) As Double 'Gen, rotor, winds, (Ugen, wind, Fax), real(0) or extrapolated (1)

Sub initialize()

'alles op 0 zetten

dUdrpm = 0

For i = 1 To 30

dUdfax(i) = 0

Next i

For i = 1 To 5 'voor 5 generatoren

```

UR(i, 1) = 0: UR(i, 2) = 0
UT(i, 1) = 0: UT(i, 2) = 0
For j = 1 To 5 'voor 5 pitchhoeken
    For k = 0 To 10 'voor 9 windsnelheden
        UVF(i, j, k, 1, 1) = 0: UVF(i, j, k, 1, 2) = 0 'Ugen
        UVF(i, j, k, 2, 1) = 0: UVF(i, j, k, 2, 2) = 0 'Wind
        UVF(i, j, k, 3, 1) = 0: UVF(i, j, k, 3, 2) = 0 'Fax
    Next k
Next j
Next i
'laden gegevens uit sheets met tkarakter meetgegevens
Select Case tkar
    Case 1: dataset = "may 03 uniform" 'tkar =1
    Case 2: dataset = "nov 03 uniform" 'tkar =2
    Case 3: dataset = "nov 03 blayer" 'tkar = 3
End Select
Sheets(dataset).Select 'may 03 uniform / nov 03 uniform / nov 03 blayer
dUdrpm = Cells(9, 4) 'van gemeten spanning naar toerental rpm
For i = 1 To 6 'voorlopig maar 6 turbines met rekstroken
    Turbine = Cells(12, 3 + i).Text
    If Mid(Turbine, 1, 3) = "wtb" Then
        Tnum = Mid(Turbine, 4, 2)
        dUdfax(Tnum) = Cells(13, 3 + i)
    End If
Next i
For i = 1 To 5 'voor 5 generatoren
    UR(i, 1) = Cells(17 + i, 5): UR(i, 2) = Cells(17 + i, 6)
    UT(i, 1) = Cells(25 + i, 5): UT(i, 2) = Cells(25 + i, 6)
    For j = 1 To 5 'voor 5 pitchhoeken
        For k = 1 To 9 'voor 9 windsnelheden
            UVF(i, j, k, 1, 1) = Cells(35 + k, 1 + i + 5 * j - 5) 'Ugen
            UVF(i, j, k, 2, 1) = Cells(45 + k, 1 + i + 5 * j - 5) 'Wind
            UVF(i, j, k, 3, 1) = Cells(55 + k, 1 + i + 5 * j - 5) 'Fax
        Next k
    Next j
Next i
End Sub

Sub extrapolate()
'extrapoleren data aan de lage kant van Ugen
For i = 1 To 5 'voor 5 generatoren
    For j = 1 To 5 'voor 5 pitchhoeken
        'hieronder extrapolatie aan de lage kant van Ugen
        k = 0
        While UVF(i, j, k, 1, 1) = 0 And k < 10 'bepaal eerste Ugen waarde
            k = k + 1
        Wend
        If k = 10 Then
            UVF(i, j, 1, 1, 2) = 2 'geen invoer
        Else
            dVdU = (UVF(i, j, k + 1, 2, 1) - UVF(i, j, k, 2, 1)) / (UVF(i, j, k + 1, 1, 1) - UVF(i, j, k, 1, 1))
            UVF(i, j, k - 1, 2, 1) = UVF(i, j, k, 2, 1) - UVF(i, j, k, 1, 1) * dVdU 'Wind bij Ugen=0
            UVF(i, j, k - 1, 2, 2) = 1 'extrapolatie wind
            UVF(i, j, k - 1, 1, 1) = 0 'Ugen
            UVF(i, j, k - 1, 1, 2) = 1 'extrapolatie Ugen
            dFdU = (UVF(i, j, k + 1, 3, 1) - UVF(i, j, k, 3, 1)) / (UVF(i, j, k + 1, 1, 1) - UVF(i, j, k, 1, 1))
            UVF(i, j, k - 1, 3, 1) = UVF(i, j, k, 3, 1) - (UVF(i, j, k, 1, 1) - UVF(i, j, k - 1, 1, 1)) * dFdU 'Fax
            UVF(i, j, k - 1, 3, 2) = 1 'extrapolatie Fax
            'hieronder extrapolatie aan de hoge kant van Ugen
            While UVF(i, j, k, 1, 1) <> 0 And k < 10 'bepaal laatste Ugen waarde
                k = k + 1
            Wend
            If k <= 10 Then
                UVF(i, j, k, 1, 1) = 5 'Ugen
                UVF(i, j, k, 1, 2) = 1 'extrapolatie Ugen
                dVdU = (UVF(i, j, k - 1, 2, 1) - UVF(i, j, k - 2, 2, 1)) / (UVF(i, j, k - 1, 1, 1) - UVF(i, j, k - 2, 1, 1))
                UVF(i, j, k, 2, 1) = UVF(i, j, k - 1, 2, 1) + (5 - UVF(i, j, k - 1, 1, 1)) * dVdU 'Wind bij Ugen=5
                UVF(i, j, k, 2, 2) = 1 'extrapolatie wind
                While UVF(i, j, k, 3, 1) = 0 'bepaal laatste Fax waarde
                    k = k - 1
                Wend
                dFdU = (UVF(i, j, k, 3, 1) - UVF(i, j, k - 1, 3, 1)) / (UVF(i, j, k, 1, 1) - UVF(i, j, k - 1, 1, 1))
                While UVF(i, j, k, 1, 1) <> 5 'bepaal eerste Ugen waarde
                    k = k + 1
                Wend
                UVF(i, j, k, 3, 1) = UVF(i, j, k - 1, 3, 1) + (UVF(i, j, k, 1, 1) - UVF(i, j, k - 1, 1, 1)) * dFdU 'Fax
                UVF(i, j, k, 3, 2) = 1 'extrapolatie Fax
            Wend
        End If
    End If
Next j
Next i
End Sub
Sub Tkarakter()
Application.ScreenUpdating = False
runsheet = ActiveSheet.Name
runwindow = ActiveWindow.Caption

```

```

Windows("Tkarakter conclusion.xls").Activate
initialize
extrapolate
Windows(runwindow).Activate
Sheets(runsheet).Select
Application.ScreenUpdating = True
'bepalen generator en rotortype en generatorspanning
c = 0
While g Or c = 0 'de c dient om in de while lus te komen
    Generator = ActiveCell.Offset(0, c).Text 'generatortype
    g = 0
    Select Case Generator
        Case "0.1r0d": g = 1
        Case "0.5r0d": g = 2
        Case "1.0r0d": g = 3
        Case "1.0r2d": g = 4
        Case "1.0r5d": g = 5
    End Select
    If g Then
        r = (ActiveCell.Offset(1, c) + 5) / 2.5 'rotortype: 1=-2.5, 2=0, etc.
        Ugen = ActiveCell.Offset(3, c) 'generatorspanning
        Ufax = ActiveCell.Offset(4, c) 'rekstrooksignaal
        Urpm = ActiveCell.Offset(5, c) 'toerentalmeter
        'genereren data
        If UVF(g, r, 1, 1, 2) = 2 Then
            ActiveCell.Offset(6, c) = ""
            ActiveCell.Offset(7, c) = ""
            ActiveCell.Offset(8, c) = ""
            ActiveCell.Offset(9, c) = ""
        Else
            i = 1
            While UVF(g, r, i, 1, 1) < Ugen And i < 10
                i = i + 1
            Wend
            d1 = (Ugen - UVF(g, r, i - 1, 1, 1)) / (UVF(g, r, i, 1, 1) - UVF(g, r, i - 1, 1, 1))
            d2 = (UVF(g, r, i, 1, 1) - Ugen) / (UVF(g, r, i, 1, 1) - UVF(g, r, i - 1, 1, 1))
            ActiveCell.Offset(6, c) = d1 * UVF(g, r, i, 2, 1) + d2 * UVF(g, r, i - 1, 2, 1) 'wind
            ActiveCell.Offset(6, c).Font.Bold = (UVF(g, r, i, 2, 2) = 1 Or UVF(g, r, i - 1, 2, 2) = 1)
            ActiveCell.Offset(6, c).NumberFormat = "0.00"
            ActiveCell.Offset(7, c) = d1 * UVF(g, r, i, 3, 1) + d2 * UVF(g, r, i - 1, 3, 1) 'fax
            ActiveCell.Offset(7, c).Font.Bold = (UVF(g, r, i, 3, 2) = 1 Or UVF(g, r, i - 1, 3, 2) = 1)
            ActiveCell.Offset(7, c).NumberFormat = "0.00"
            ActiveCell.Offset(8, c) = UT(g, 1) + Ugen * UT(g, 2) 'torque
            ActiveCell.Offset(8, c).NumberFormat = "0.00"
            ActiveCell.Offset(9, c) = UR(g, 1) + Ugen * UR(g, 2) 'rpm
            ActiveCell.Offset(9, c).NumberFormat = "0"
        End If
        'hieronder wordt de rekstrookspanning omgezet naar een kracht.
        Turbine = ActiveCell.Offset(-1, c).Text
        If Mid(Turbine, 1, 3) = "wtb" Then
            Tnum = Mid(Turbine, 4, 2)
            Ufax = ActiveCell.Offset(4, c)
            Nfax = Ufax * dUdfax(Tnum)
            If (Ufax > 0 And Ufax < 5 And Nfax > 0) Then ActiveCell.Offset(10, c) = Nfax
        End If
        Select Case tkar
            Case 1: ActiveCell.Offset(2, c) = "My3uni"
            Case 2: ActiveCell.Offset(2, c) = "Nv3uni"
            Case 3: ActiveCell.Offset(2, c) = "Nv3bl"
        End Select
    End If
    c = c + 1 'stap een kolom naar rechts
Wend
End Sub

```

Appendix D: Calibration of the Axial Force Measurement

The axial force is measured by a strain gauge at the tower. The output voltage of the strain gauge depends on the applicable strain. Since an applied axial force bends the tower, it strains the gauge and is related to the strain gauge output voltage. The measured output voltage is fed into the ECN measurement system.

To determine the relations between axial force and strain gauge output voltages we loaded the turbine rotors by a known axial force using a weight and a pulley and measured the strain gauge output voltage U_F that is fed into the ECN measurement system. Herewith we measured the characteristics of table D.1 and D.2 for the turbines of May and November. The basic measurements for these characteristics are recorded in table D.3 and D.4. Notice that the relation between F_{ax} and U_F appears to be linear without an offset. Table D.3 and D.4 are corrected for the strain gauge output voltage when it is unloaded (no weight, i.e. 0 grams).

Table D.1: $F_{ax} = \text{gain} \cdot U_F$ for the turbines of May

	Fax1	Fax2	Fax3	Fax4	Fax5	Average
gain [N/V]:	0.476	0.477	0.472	0.481	0.480	0.477

Source file: Fax calibratie.xls

Table D.2: $F_{ax} = \text{gain} \cdot U_F$ for the turbines of November

	Fax1	Fax2	Fax3	Fax15	Fax16	Fax17
gain [N/V]:	1.616	1.591	1.635	1.642	1.628	1.664

Source file: Fax Calibration Conclusion.xls

The difference in characteristics in May and November is caused by using improved stiffer towers in November. The dispersion in November is because the strain gauges were placed less accurate than in May. That resulted in different positions on the tower where bending is different for equal axial forces.

Table D.3: F_{ax} calibration measurements for the turbines in May

date [d/m/j]	mass [kg]	force [N]	slope					
			Fax1 [N/V]	Fax2 [N/V]	Fax3 [N/V]	Fax4 [N/V]	Fax5 [N/V]	
5/14/03	0.050	0.490	0.477	0.470	0.466	0.516	0.470	0.478
5/14/03	0.100	0.980	0.475	0.462	0.463	0.481	0.474	
5/14/03	0.200	1.960	0.476	0.468	0.468	0.476	0.475	
5/15/03	0.050	0.490	0.479	0.476	0.470	0.478	0.494	
5/15/03	0.100	0.980	0.479	0.484	0.472	0.478	0.487	
5/15/03	0.200	1.960	0.480	0.482	0.475	0.497	0.485	
5/19/03	0.050	0.490	0.474	0.483	0.473	0.485	0.481	
5/19/03	0.100	0.980	0.477	0.485	0.483	0.486	0.477	
5/19/03	0.200	1.960	0.473	0.479	0.475	0.482	0.476	
5/27/03	0.100	0.980	0.473	0.488	0.489	0.472 -		0.477
5/27/03	0.200	1.960	0.468	0.473	0.478	0.471 -		
								Total
stdev:		[N/V]	0.0036	0.0081	0.0060	0.0076	0.0075	0.003
stdev:		[%]	0.756	1.707	1.272	1.589	1.570	0.692

Source file: Fax calibratie.xls

Table D.3 shows F_{ax} calibration measurements that are performed repeatedly in the tunnel in May. The small dispersion between the measurements justifies using an average relation between the axial force and strain gauge output voltage.

Table D.4: F_{ax} calibration measurements for turbines of November

Nov-03	calibration Fax [N]	Fax1 [V]	Fax2 [V]	Fax3 [V]	Fax15 [V]	Fax16 [V]	Fax17 [V]
	0.49	0.297	0.304	0.298	0.299	0.302	#N/A
	0.98	0.609	0.610	0.599	0.600	0.600	#N/A
	1.96	1.213	1.232	1.199	1.194	1.204	#N/A
characters:	gain [N/V]:	1.608	1.582	1.633	1.644	1.629	
	offset [N]:	0.007	0.011	0.003	-0.004	-0.001	
Jan-04	calibration Fax [N]	Fax1 [V]	Fax2 [V]	Fax3 [V]	Fax15 [V]	Fax16 [V]	Fax17 [V]
	0.98	#N/A	0.617	#N/A	0.597	#N/A	0.598
	0.98	#N/A	0.615	#N/A	0.592	#N/A	0.589
	1.96	#N/A	1.228	#N/A	1.177	#N/A	1.178
characters:	gain [N/V]:		1.602		1.684		1.676
	offset [N]:		-0.007		-0.022		-0.015

Source file: Fax Calibration Conclusion.xls

Table D.4 shows calibration measurements that are performed in the tunnel in November 2003 and measurements that are performed at ECN in January 2004. For the purpose of statistical analysis we repeated the measurement of turbine 17 several times (see table D.5). All the measurements of table D.4 and D.5 are depicted in figure D.1 and D.2 as well.

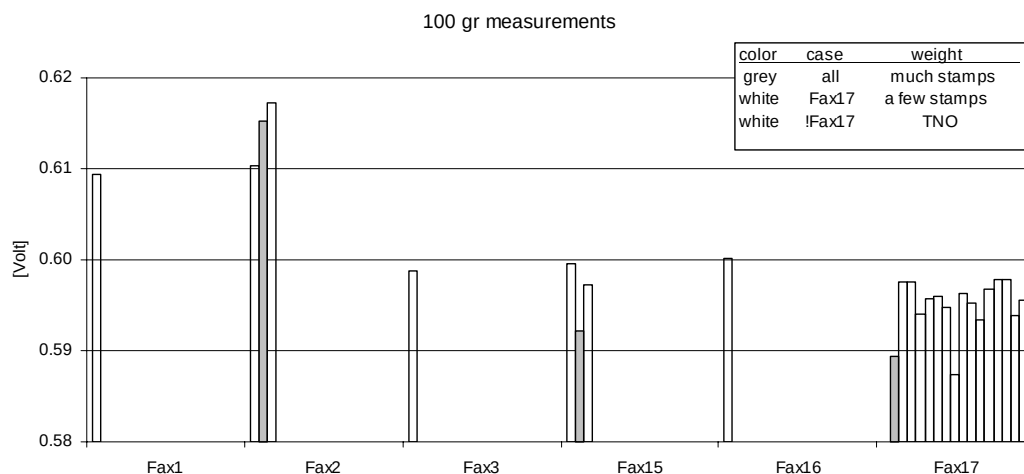


Figure D.1: F_{ax} calibration measurements with weights of 100 grams (source file: Fax Calibration Conclusion.xls).

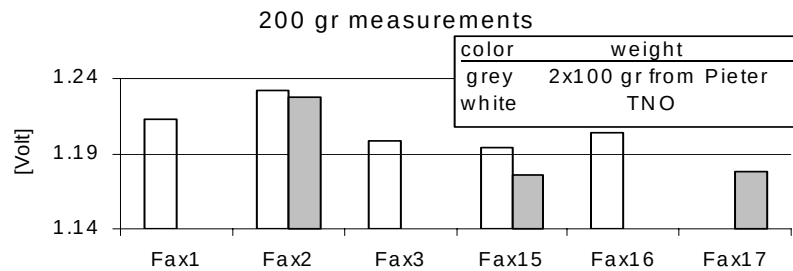


Figure D.2: F_{ax} calibration measurements with weights of 200 grams (source file: Fax Calibration Conclusion.xls).

Table D.5: Repeated F_{ax} calibration measurements for the turbine 17 of November

Jan-04	Fax17	offset (from average)		
	[V]	[%]		
	0.598	0.40	This is the calibration measurement	
	0.594	-0.20	Repeated measurements, immediately after the calibration measurement	
	0.596	0.10		
	0.596	0.15		
	0.595	-0.07	Repeated measurements, after a while	
	0.587	-1.31		
	0.596	0.19		
	0.595	0.02		
	0.593	-0.30		
	0.597	0.27	More repeated measurements, after a while, but now the tower is hit in between	
	0.598	0.45		
	0.598	0.44		
	0.594	-0.22		
	0.596	0.06		
average:		0.595		

Before the repeated measurements the turbine is removed and put back on the same position on the floor. The strain gauge is zeroed again.

Source file: Fax Calibration Conclusion.xls

In summary the measurements of table D.4 and D.5, or figure D.1 and D.2, are described by:

equipment:

weight + pulley (Dutch: katrol) to simulate Fax
 Nov-03 => red pulley from TNO
 Jan-04 => pulley = broken with gen. (maxon motor); axis=fixed, wire over house

calibration weights:

Nov-03 --> 100 gr and 200 gr weight from TNO
 Jan-04 --> 2 different 100 gr weights from Pieter (200 realised with 100+100):
 a few stamps => with a few stamps
 (Dutch: ijkjes)
 much stamps => with much stamps

We draw the following conclusions from the analysis:

- 1) **use current calibrations:** deviations < inaccuracy of real Fax affection point
- 2) Nov-03 versus Jan-04 (see Fax2+15):
 no systematic offset
 deviations as in repetitive Fax17 measurement (Jan-04)
- 3) Possible improvement: repetitive measurements + averaging for all turbines

Appendix E: Calibration of the Aerodynamic Torque Measurement

To establish the relation between aerodynamic torque and generator voltage we drove the generator by a motor, while we measured both the input torque and output voltage over the load resistor. With load resistor R_{load} and measured voltage U_g we found that the input torque equalled $10.8 \cdot U_g/R_{\text{load}} + 0.24$ [mNm] for all types of generator control. The performance of different generators appeared to be remarkably equal. It is concluded that the aerodynamic torque T_a can be derived from the generator voltage by:

$$T_a = 10.8 \cdot U_g/R_{\text{load}} + 0.24 \text{ [mNm]} \quad (\text{E.1})$$

In which U_g [V] is the generator voltage, R_{load} [Ω] the load resistor and the factor 10.8 with dimension [mNm/A] is a motor characteristic. This is in good conformance to the specifications of the generators.

Appendix F: Measurement to Characterise the Turbines

In May we measured 5 turbines besides each other per stairway regulation of the tunnel wind speed. The distance between the rotor centres was 1.6D. The distance between the outer turbines and the tunnel wall was 0.7D, see figure 6. Each of the 5 turbines had a different combination of generator control and pitch angle and was placed in a uniform flow. This is repeated until we measured all 25 combinations of generator control and pitch angle (0.1R0d, 0.5R0d, 1.0R0d, 1.0R2d, 1.0R5d and -2.5, 0.0, 2.5, 5.0, 7.5 deg). In generator control $x.xRy$ d, $x.x$ is the resistor value in Ω and y the number of diodes. The average voltages and rotor speeds measured herewith are recorded in table F.1 to F.5. The ambient wind speeds of the turbines are slightly differed from the measured tunnel wind speed during these measurements. Therefore the ambient wind speeds in the turbine characteristics of May are calculated by multiplying the tunnel wind speed by the correction factors of table F.6.

Table F.1: measurements to characterise turbines in a uniform flow in May (series tkar3)

Sch.kn.	strain gauges					generators					hand-held laser rpm counter				
Wind [M]	rek1 [M]	rek2 [M]	rek3 [M]	rek4 [M]	rek5 [M]	gen1 [M]	gen2 [M]	gen3 [M]	gen4 [M]	gen5 [M]	speed1 [rpm]	speed2 [rpm]	speed3 [rpm]	speed4 [rpm]	speed5 [rpm]
0.03	0.01	0.03	-0.02	0.09	0.02						0	0	0	0	0
0.30	0.49	0.49	0.42	0.40	0.21	0.02	0.05	0.16	0.08		702	808	1039	1384	1438
0.40	0.85	0.87	0.78	0.67	0.35	0.02	0.11	0.30	0.20		851	1075	1450	1765	1945
0.51	1.31	1.38	1.22	1.01	0.56	0.03	0.18	0.49	0.34		1038	1401	1970	2180	2354
0.61	1.87	1.98	1.73	1.38	0.80	0.04	0.26	0.67	0.51	0.20	1260	1775	2461	2651	2788
0.70	2.46	2.68	2.27	1.75	1.06	0.06	0.36	0.85	0.66	0.30	1487	2216	2923	3082	3137
0.79	3.21	3.53	2.91		1.38	0.07	0.51	1.04		0.42	1736	2890	3473	3504	3530
0.91	4.22	4.63	3.78		1.78	0.09	0.67	1.24		0.59	2026	3675	4215	4083	4008
1.01			4.63		2.24	0.11	0.80	1.45		0.72	2483	4390	4843	4541	4470
1.11					2.63	0.13	0.93	1.66		0.91					
0.81				2.30					0.87					3685	
1.01				3.45					1.23					4700	
1.10				4.23					1.34					5138	

With:

wtb ld	ctrl ld	pitch [dg]
1	0.1R0d	-2.5
2	0.5R0d	0
3	1.0R0d	2.5
4	1.0R2d	5
5	1.0R5d	7.5

Source file: tkarakter conclusie May03

Table F.2: measurements to characterise turbines in a uniform flow in May (series tkar4)

Sch.kn.	strain gauges					generators					hand-held laser rpm counter				
Wind	rek1	rek2	rek3	rek4	rek5	gen1	gen2	gen3	gen4	gen5	speed1	speed2	speed3	speed4	speed5
[V]	[V]	[V]	[V]	[V]	[V]	[V]	[V]	[V]	[V]	[V]	[rpm]	[rpm]	[rpm]	[rpm]	[rpm]
0.00	-0.06	-0.04	-0.02	0.03	-0.02						0	0	0	0	0
0.31	0.25	0.46	0.50	0.49	0.26	0.03	0.04	0.11	0.10		970	732	912	1470	1695
0.40	0.45	0.79	0.86	0.81	0.47	0.04	0.07	0.21	0.22		1250	907	1190	1840	2155
0.51	0.78	1.31	1.44	1.30	0.80	0.07	0.12	0.36	0.39		1660	1144	1623	2327	2642
0.60	1.08	1.82	2.03	1.75	1.13	0.09	0.17	0.54	0.54	0.28	2030	1360	2090	2740	3040
0.70	1.43	2.48	2.76	2.31	1.53	0.11	0.22	0.75	0.71	0.42	2415	1620	2680	3250	3521
0.80	1.86	3.35	3.67	3.03	2.05	0.13	0.29	1.00	0.91	0.59	2900	1930	3369	3795	4008
0.91	2.33	4.22	4.73	3.85	2.63	0.15	0.32	1.22	1.12	0.77	3405	2065	3997	4380	4560
1.02	2.82			4.79	3.31		0.48	1.44	1.34	0.95	3911	2762	4672	5010	5062
1.12	3.26				3.96		0.58		1.52	1.09	4386	3230	5075	5580	5473

With:

wtb ld	ctrl ld	pitch [dg]
1	0.1R0d	7.5
2	0.5R0d	-2.5
3	1.0R0d	0
4	1.0R2d	2.5
5	1.0R5d	5

Source file: tkarakter conclusie May03

Table F.3: measurements to characterise turbines in a uniform flow in May (series tkar5)

Sch.kn.	strain gauges					generators					hand-held laser rpm counter				
Wind	rek1	rek2	rek3	rek4	rek5	gen1	gen2	gen3	gen4	gen5	speed1	speed2	speed3	speed4	speed5
[V]	[V]	[V]	[V]	[V]	[V]	[V]	[V]	[V]	[V]	[V]	[rpm]	[rpm]	[rpm]	[rpm]	[rpm]
0.03	-0.04	0.00	0.01	0.03	-0.03						0	0	0	0	0
0.30	0.34	0.29	0.51	0.59	0.38	0.03	0.09	0.06	0.09		988	1002	753	1393	1739
0.40	0.58	0.51	0.86	0.98	0.69	0.05	0.16	0.12	0.19		1295	1330	950	1736	2236
0.50	0.96	0.80	1.38	1.54	1.14	0.07	0.25	0.21	0.33		1715	1736	1213	2175	2745
0.60	1.38	1.11	1.97	2.16	1.64	0.09	0.34	0.31	0.50	0.33	2130	2148	1497	2630	3205
0.70	1.86	1.45	2.70	2.91	2.22	0.12	0.44	0.43	0.68	0.48	2630	2577	1794	3150	3700
0.80	2.37	1.80	3.50	3.72	2.84	0.14	0.53	0.54	0.86	0.64	3068	3002	2102	3665	4190
0.90	2.95	2.21	4.47	4.69	3.58	0.16	0.62	0.65	1.05	0.82	3586	3480	2350	4167	4716
1.01	3.63	2.67			4.47		0.72	1.09	1.25	1.01	4140	3966	3606	4763	5245

With:

wtb ld	ctrl ld	pitch [dg]
1	0.1R0d	5
2	0.5R0d	7.5
3	1.0R0d	-2.5
4	1.0R2d	0
5	1.0R5d	2.5

Source file: tkarakter conclusie May03

Table F.4: measurements to characterise turbines in a uniform flow in May (series tkar6)

Sch.kn.	strain gauges					generators					hand-held laser rpm counter				
Wind	rek1	rek2	rek3	rek4	rek5	gen1	gen2	gen3	gen4	gen5	speed1	speed2	speed3	speed4	speed5
[V]	[V]	[V]	[V]	[V]	[V]	[V]	[V]	[V]	[V]	[V]	[rpm]	[rpm]	[rpm]	[rpm]	[rpm]
0.03	-0.05	-0.01	0.00	0.05	-0.04						0	0	0	0	0
0.31	0.43	0.38	0.31	0.68	0.54	0.03	0.10	0.17			965	1077	1033	1217	1730
0.40	0.71	0.63	0.51	1.08	0.92	0.04	0.17	0.28	0.12		1229	1381	1395	1500	2200
0.51	1.20	1.00	0.79	1.67	1.49	0.07	0.27	0.44	0.21		1660	1842	1835	1802	2695
0.60	1.67	1.38	1.05	2.26	2.06	0.09	0.35	0.58	0.28	0.30	2103	2214	2230	2017	3120
0.71	2.31	1.85	1.44	2.78	2.92	0.12	0.47	0.76	0.31	0.46	2611	2787	2736	2114	3636
0.82	3.13	2.46	1.80	4.29	3.82	0.15	0.60	0.94	0.70	0.64	3308	3345	3185	3170	4093
0.91	3.80	2.95	2.13	4.97	4.65		0.69	1.08	0.87	0.80	3773	3745	3616	3690	4611
1.00	4.56	3.49	2.50					1.23	1.05		4297	4321	4062	4142	
0.00															
0.00															
0.00															
0.00															

With:

wtb ld	ctrl ld	pitch [dg]
1	0.1R0d	2.5
2	0.5R0d	5
3	1.0R0d	7.5
4	1.0R2d	-2.5
5	1.0R5d	0

Source file: tkarakter conclusie May03

Table F.5: measurements to characterise turbines in a uniform flow in May (series tkar7)

Sch.kn.	strain gauges					generators					hand-held laser rpm counter				
Wind	rek1	rek2	rek3	rek4	rek5	gen1	gen2	gen3	gen4	gen5	speed1	speed2	speed3	speed4	speed5
[V]	[V]	[V]	[V]	[V]	[V]	[V]	[V]	[V]	[V]	[V]	[rpm]	[rpm]	[rpm]	[rpm]	[rpm]
0.03	-0.04	-0.03	0.00	0.07	-0.01						0	0	0	0	0
0.31	0.46	0.44	0.39	0.31	0.64	0.02	0.09	0.18			835	1017	1105	1308	1628
0.40	0.75	0.75	0.64	0.49	1.06	0.03	0.16	0.31	0.16		1025	1340	1465	1643	2029
0.51	1.27	1.20	1.00	0.75	1.70	0.05	0.27	0.48	0.30		1320	1820	1945	2057	2450
0.60	1.87	1.71	1.40	1.03	2.41	0.06	0.37	0.65	0.44	0.24	1644	2285	2406	2480	2920
0.70	2.59	2.30	1.85	1.34	3.22	0.08	0.49	0.84	0.59	0.37	2030	2840	2900	2886	3320
0.80	3.46	2.97	2.33	1.67	4.15	0.11	0.60	1.02	0.74	0.49	2495	3374	3424	3313	3690
0.90	4.50	3.72	2.88	2.05		0.15	0.71	1.20	0.90	0.65	3410	3913	3933	3755	4150
1.00		4.58	3.49	2.46				1.39	1.07	0.70	4355	4523	4535	4220	4332

With:

wtb ld	ctrl ld	pitch [dg]
1	0.1R0d	0
2	0.5R0d	2.5
3	1.0R0d	5
4	1.0R2d	7.5
5	1.0R5d	-2.5

Source file: tkarakter conclusie May03

Table F.6: $V = \text{factor} \cdot V_t$ for turbine characteristics of May

wind speed		wtb1	wtb2	wtb3	wtb4	wtb5
corrections	factor:	1.004	0.993	0.988	0.990	1.001

from notes bij GPC & Nov 03 => hot wire besides Sch.kn. => ~2 % higher than 1m behind Sch.kn.
(at 10 m/s) => correction 8.31/8.05 eliminated (only position dependent correction remains)

Source file: tkarakter conclusie May03

In November we measured 3 turbines besides each other with equal pitch and different generator control (0.5R0d, 1R0d and 1R5d) per stairway regulation of the tunnel wind speed. The distance between the rotor centres was 2.5D. The distance between the outer turbines and the tunnel wall was 3.5D, see figure 7. Such a measurement is performed for all applicable pitch angles (-2.5, 0.0, 2.5, 5.0, 7.5 deg). This is done for the turbines in a uniform flow and for the turbines in an offshore boundary layer. The average voltages measured herewith are recorded in table F.7 and F.8 respectively. We could suppose that the turbines did not influence each other significantly. It has been checked if this assumption was acceptabel. Therefore the ambient wind speeds in the turbine characteristics of November are copied from the tunnel wind speed without any correction.

Table F.7: measurements to characterise turbines in a uniform flow in November

	Sch.kn.	strain gauges			generators			freq. to volt meas.
Pitch [dg]	Wind [M]	0.5R0d [M]	1R0d [M]	1R5d [M]	0.5R0d [M]	1R0d [M]	1R5d [M]	0.5R0d [M]
-2.5	0.40	0.23	0.27	0.30	0.06	0.13	0.02	0.73
-2.5	0.51	0.36	0.41	0.49	0.10	0.23	0.10	0.91
-2.5	0.61	0.51	0.58	0.67	0.15	0.34	0.21	1.10
-2.5	0.70	0.69	0.78	0.88	0.21	0.46	0.33	1.32
-2.5	0.81	0.93	1.09	1.18	0.28	0.66	0.49	1.59
-2.5	0.91	1.25	1.48	1.51	0.36	0.99	0.67	1.89
0.0	0.41	0.23	0.25	0.26	0.10	0.20	0.04	0.90
0.0	0.51	0.38	0.41	0.41	0.17	0.37	0.15	1.18
0.0	0.60	0.53	0.57	0.56	0.24	0.56	0.28	1.44
0.0	0.70	0.74	0.78	0.77	0.36	0.78	0.43	1.87
0.0	0.81	0.99	1.04	1.02	0.53	1.02	0.61	2.53
0.0	0.91	1.25	1.30	1.28	0.66	1.22	0.80	3.07
2.5	0.40	0.21	0.21	0.18	0.15	0.28	0.05	1.09
2.5	0.51	0.35	0.35	0.32	0.25	0.47	0.16	1.47
2.5	0.60	0.48	0.48	0.45	0.34	0.63	0.29	1.83
2.5	0.70	0.62	0.67	0.59	0.45	0.82	0.45	2.24
2.5	0.79	0.78	0.82	0.76	0.55	0.99	0.59	2.63
2.5	0.92	1.02	1.08	1.02	0.70	1.24	0.82	3.22
5.0	0.40	0.16	0.17	0.11	0.14	0.27	0.02	1.09
5.0	0.51	0.26	0.27	0.19	0.24	0.45	0.11	1.45
5.0	0.60	0.36	0.38	0.29	0.33	0.61	0.22	1.79
5.0	0.71	0.49	0.51	0.40	0.44	0.80	0.38	2.20
5.0	0.81	0.61	0.66	0.52	0.54	0.99	0.53	2.61
5.0	0.90	0.75	0.78	0.66	0.65	1.17	0.68	3.01
7.5	0.40	0.14	0.14	0.09	0.14	0.26	0.01	1.08
7.5	0.50	0.21	0.21	0.14	0.22	0.39	0.06	1.38
7.5	0.60	0.30	0.29	0.21	0.31	0.55	0.15	1.71
7.5	0.70	0.39	0.38	0.29	0.40	0.70	0.28	2.05
7.5	0.80	0.49	0.47	0.37	0.49	0.86	0.41	2.40
7.5	0.91	0.60	0.59	0.48	0.59	1.03	0.56	2.79

Source file: tkarakter Conclusion.xls

Table F.8: measurements to characterise turbines in an offshore boundary layer in November

Sch.kn.		strain gauges			generators			freq. to volt meas.
Pitch [dg]	Wind [M]	0.5R0d [M]	1R0d [M]	1R5d [M]	0.5R0d [M]	1R0d [M]	1R5d [M]	0.5R0d [M]
-2.5	0.41	0.21	0.26	0.30	0.07	0.15	0.02	0.76
-2.5	0.50	0.35	0.39	0.46	0.11	0.24	0.09	0.93
-2.5	0.60	0.52	0.59	0.68	0.16	0.35	0.21	1.14
-2.5	0.69	0.71	0.82	0.95	0.22	0.50	0.36	1.38
-2.5	0.79	0.95	1.07	1.16	0.30	0.65	0.46	1.65
-2.5	0.89	1.26	1.48	1.51	0.38	1.01	0.65	1.97
0.0	0.41	0.23	0.26	0.26	0.11	0.22	0.05	0.94
0.0	0.52	0.40	0.43	0.42	0.19	0.41	0.17	1.25
0.0	0.60	0.56	0.61	0.61	0.27	0.60	0.30	1.59
0.0	0.70	0.74	0.81	0.79	0.39	0.80	0.44	2.02
0.0	0.80	1.03	1.09	1.05	0.56	1.06	0.63	2.65
0.0	0.91	1.35	1.43		0.71	1.30		3.25
2.5	0.41	0.21	0.22	0.19	0.15	0.29	0.05	1.11
2.5	0.50	0.32	0.34	0.29	0.24	0.45	0.14	1.44
2.5	0.59	0.46	0.48	0.43	0.34	0.62	0.28	1.84
2.5	0.71	0.65	0.68	0.62	0.48	0.85	0.46	2.37
2.5	0.79	0.77	0.85	0.77	0.56	1.03	0.60	2.69
2.5	0.90	1.04	1.08	1.00	0.71	1.25	0.81	3.27
5.0	0.41	0.18	0.18	0.12	0.15	0.29	0.02	1.10
5.0	0.49	0.26	0.27	0.18	0.23	0.44	0.09	1.41
5.0	0.60	0.38	0.37	0.27	0.33	0.60	0.21	1.79
5.0	0.79	0.63	0.66	0.51	0.53	0.97	0.51	2.56
5.0	0.79	0.64	0.66	0.50	0.55	0.98	0.51	2.61
5.0	0.90	0.78	0.80	0.66	0.65	1.17	0.68	3.02
5.0								
7.5	0.41	0.15	0.15	0.08	0.15	0.28	0.01	1.10
7.5	0.50	0.21	0.21	0.13	0.22	0.39	0.05	1.35
7.5	0.59	0.31	0.28	0.21	0.30	0.53	0.15	1.69
7.5	0.70	0.40	0.38	0.28	0.40	0.69	0.27	2.06
7.5	0.80	0.53	0.49	0.39	0.51	0.87	0.42	2.46
7.5	0.91	0.61	0.60	0.50	0.61	1.05	0.57	2.86

Source file: tkarakter Conclusion.xls

Appendix G: Rotor Equality Measurements

To check whether rotors with the same pitch angle performed equally, we measured the performance of 3 turbines with equal pitch and equal generator control besides each other in the uniform flow in the wind tunnel. The turbines were placed on the platform 1D above the tunnel floor. Again the distance between the turbines was 2.5D and the distance between the outer turbines and the tunnel wall was 3.5D. We used the most applied generator control 1.0R0d, i.e. 1 Ω and 0 diodes. As we know from appendix E, the performance spreading over the generators will not have influenced the turbine performance significantly. The measurement results are presented in table G.1. The table concerns rotor speeds measured using the hand held laser rpm counter, calculated from generator voltage U_g and measured using the frequency-to-voltage device.

Table G.1: comparison of equal rotors

Table G.11: Comparison of equal rotors															
tunnel wind [m/s]:	9.05			9.01			8.90			9.02			9.08		
generator control	1.0R0d			1.0R0d			1.0R0d			1.0R0d			1.0R0d		
pitch angle [deg]	-2.5			0.0			2.5			5.0			7.5		
turbine number	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
rotor speeds															
laser rpm counter [rpm]	2445	2710	2570	3840	3920	3950	4020	4020	4120	3730	3780	3670	3430	3410	3520
Ug character [rpm]	2459	2707	2531	3879	3964	3935	4050	4055	4086	3717	3756	3652	3426	3418	3470
freq2volt [rpm]	2456			3844			4028			3686			3406		
difference from average															
laser rpm counter [rpm]	-130	135	-5	-63	17	47	-33	-33	67	3	53	-57	-23	-43	67
Ug character [rpm]	-106	141	-35	-47	38	9	-13	-9	22	9	48	-57	-12	-20	31
laser rpm counter [%]	-5.0	5.2	-0.2	-1.6	0.4	1.2	-0.8	-0.8	1.6	0.1	1.4	-1.5	-0.7	-1.3	1.9
Ug character [%]	-4.1	5.5	-1.4	-1.2	1.0	0.2	-0.3	-0.2	0.5	0.2	1.3	-1.5	-0.3	-0.6	0.9
laser counter - Ug character															
[rpm]	-14	3	39	-39	-44	15	-30	-35	34	13	24	18	4	-8	50
[%]	-0.6	0.1	1.5	-1.0	-1.1	0.4	-0.8	-0.9	0.8	0.3	0.6	0.5	0.1	-0.2	1.4

Source file: rotor equality conclusion 1R0d all pitch.xls

Only the rotors with a pitch angle of -2.5 deg do differ significantly from each other due to the unpredictable turbulent wake behaviour. Fortunately those rotors are not relevant for our research. They are not used during the farm experiments. The differences between similar rotors for the other pitch angles are irrelevant for the flow through and around the farm (always less than 2 % from the average).

From the comparison to the laser rpm counter measurement we see that the rotor speeds that are calculated from the generator voltage do fulfil. The laser counter measurement differs maximal 1.1 % from the calculation that is based on the turbine characteristics. It thus is sufficient to characterise only one turbine for each combination of pitch angle and generator control.

Appendix H: Turbine Characteristics

In this appendix we find the complete sets of data that characterise the turbines for all possible pitch angles (-2.5, 0.0, 2.5, 5.0, 7.5 deg) in combination with the situations listed in table H.1.

Table H.1: the characterised situations per table

Month	Flow	Generator control *)	Table
May	uniform	0.5R0d	Ta20
		1.0R0d	Ta21
		1.0R5d	Ta22
November	uniform	0.5R0d	Ta23
		1.0R0d	Ta24
		1.0R5d	Ta25
	offshore boundary layer	0.5R0d	Ta26
		1.0R0d	Ta27
		1.0R5d	Ta28
*) Generator control: x.xRyd means that a turbine was controlled by a load resistor of x.x Ω and y diodes			

Tables H.2 to H.10 are subdivided in blocks per pitch angle. The first 3 rows of each block give the applicable:

1. generator control
2. pitch angle in degrees
3. situation wherefore the turbine is characterised:
 - 'My3uni' in May in a uniform flow
 - 'Nv3uni' in November in a uniform flow
 - 'Nv3bl' in November in an offshore boundary layer

Table H.2: characteristics of turbines with 0.5R0d in a uniform flow in May

generator:	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d
pitch [dg]:	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5
macro:	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	4.65	6.52	8.17	9.60	10.38	11.31	12.25	13.19	14.13	15.07	16.00	16.94	17.88	18.82	19.76
fax [N]:	0.53	1.05	1.67	3.10	4.52	5.94	7.37	8.79	10.22	11.64	13.07	14.49	15.92	17.34	18.77
torque [mNm]:	2.40	4.56	6.72	8.88	11.04	13.20	15.36	17.52	19.68	21.84	24.00	26.16	28.32	30.48	32.64
speed [rpm]:	1034	1501	1968	2435	2902	3369	3836	4303	4770	5237	5704	6171	6638	7106	7573
Ct [-]:	0.83	0.84	0.85	1.14	1.42	1.58	1.67	1.72	1.74	1.74	1.73	1.71	1.69	1.66	1.63
a [-]:	0.29	0.30	0.31	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
Lambda [-]:	2.89	2.99	3.13	3.29	3.63	3.87	4.07	4.24	4.38	4.51	4.63	4.73	4.82	4.90	4.98
P = QxN [W]:	0.26	0.72	1.39	2.26	3.36	4.66	6.17	7.90	9.83	11.98	14.34	16.91	19.69	22.68	25.88
P with Ct [W]:	1.73	4.80	9.47	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
Cp real [-]:	0.09	0.09	0.09	0.09	0.10	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.11
Cp with Ct [-]:	0.59	0.59	0.59	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
generator:	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	3.90	5.30	6.38	7.16	7.76	8.46	9.20	9.99	10.84	11.69	12.54	13.39	14.24	15.09	15.95
fax [N]:	0.40	0.73	1.08	1.39	1.65	1.96	2.29	2.61	2.94	3.26	3.59	3.91	4.24	4.56	4.88
torque [mNm]:	2.40	4.56	6.72	8.88	11.04	13.20	15.36	17.52	19.68	21.84	24.00	26.16	28.32	30.48	32.64
speed [rpm]:	1034	1501	1968	2435	2902	3369	3836	4303	4770	5237	5704	6171	6638	7106	7573
Ct [-]:	0.88	0.89	0.90	0.92	0.93	0.93	0.92	0.89	0.85	0.81	0.77	0.74	0.71	0.68	0.65
a [-]:	0.33	0.33	0.34	0.36	0.37	0.37	0.36	0.33	0.31	0.28	0.26	0.25	0.23	0.22	0.21
Lambda [-]:	3.44	3.68	4.01	4.42	4.86	5.17	5.42	5.60	5.72	5.82	5.91	5.98	6.05	6.11	6.17
P = QxN [W]:	0.26	0.72	1.39	2.26	3.36	4.66	6.17	7.90	9.83	11.98	14.34	16.91	19.69	22.68	25.88
P with Ct [W]:	1.04	2.60	4.53	6.38	8.10	10.49	13.54	17.39	22.11	27.37	33.18	39.54	46.45	53.91	61.92
Cp real [-]:	0.15	0.16	0.18	0.21	0.24	0.26	0.27	0.27	0.26	0.25	0.25	0.24	0.23	0.22	0.22
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.58	0.57	0.56	0.55	0.53	0.52
generator:	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d
pitch [dg]:	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
macro:	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	3.16	4.36	5.32	6.22	7.08	7.94	8.82	9.70	10.58	11.46	12.34	13.22	14.10	14.98	15.86
fax [N]:	0.23	0.44	0.65	0.88	1.13	1.42	1.74	2.05	2.37	2.69	3.01	3.33	3.64	3.96	4.28
torque [mNm]:	2.40	4.56	6.72	8.88	11.04	13.20	15.36	17.52	19.68	21.84	24.00	26.16	28.32	30.48	32.64
speed [rpm]:	1034	1501	1968	2435	2902	3369	3836	4303	4770	5237	5704	6171	6638	7106	7573
Ct [-]:	0.77	0.78	0.78	0.77	0.76	0.76	0.76	0.74	0.72	0.70	0.67	0.65	0.62	0.60	0.58
a [-]:	0.26	0.27	0.27	0.26	0.26	0.26	0.25	0.25	0.24	0.22	0.21	0.20	0.19	0.18	0.18
Lambda [-]:	4.25	4.47	4.80	5.08	5.32	5.51	5.65	5.76	5.86	5.94	6.00	6.06	6.12	6.16	6.20
P = QxN [W]:	0.26	0.72	1.39	2.26	3.36	4.66	6.17	7.90	9.83	11.98	14.34	16.91	19.69	22.68	25.88
P with Ct [W]:	0.53	1.40	2.54	4.05	5.94	8.37	11.42	15.03	19.19	23.91	29.20	35.05	41.46	48.44	55.97
Cp real [-]:	0.28	0.29	0.31	0.32	0.32	0.32	0.31	0.29	0.28	0.27	0.26	0.25	0.24	0.23	0.22
Cp with Ct [-]:	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.56	0.55	0.54	0.53	0.52	0.50	0.49	0.48
generator:	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d
pitch [dg]:	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
macro:	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	3.04	4.28	5.34	6.34	7.25	8.17	9.13	10.08	11.04	11.99	12.95	13.91	14.86	15.82	16.77
fax [N]:	0.18	0.35	0.54	0.74	0.94	1.18	1.44	1.70	1.96	2.22	2.47	2.73	2.99	3.25	3.51
torque [mNm]:	2.40	4.56	6.72	8.88	11.04	13.20	15.36	17.52	19.68	21.84	24.00	26.16	28.32	30.48	32.64
speed [rpm]:	1034	1501	1968	2435	2902	3369	3836	4303	4770	5237	5704	6171	6638	7106	7573
Ct [-]:	0.65	0.65	0.64	0.63	0.61	0.60	0.59	0.57	0.55	0.52	0.50	0.48	0.46	0.44	0.42
a [-]:	0.21	0.20	0.20	0.19	0.19	0.18	0.18	0.17	0.16	0.15	0.15	0.14	0.13	0.13	0.12
Lambda [-]:	4.41	4.55	4.78	4.99	5.20	5.35	5.46	5.54	5.61	5.67	5.72	5.76	5.80	5.83	5.86
P = QxN [W]:	0.26	0.72	1.39	2.26	3.36	4.66	6.17	7.90	9.83	11.98	14.34	16.91	19.69	22.68	25.88
P with Ct [W]:	0.43	1.19	2.31	3.79	5.56	7.88	10.80	14.20	18.09	22.47	27.34	32.71	38.57	44.92	51.77
Cp real [-]:	0.31	0.31	0.31	0.30	0.30	0.29	0.28	0.26	0.25	0.24	0.22	0.21	0.20	0.19	0.19
Cp with Ct [-]:	0.52	0.52	0.51	0.51	0.50	0.49	0.48	0.47	0.46	0.44	0.43	0.41	0.40	0.39	0.37
generator:	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d
pitch [dg]:	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
macro:	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	3.14	4.42	5.54	6.62	7.66	8.73	9.76	10.78	11.79	12.81	13.83	14.85	15.87	16.89	17.90
fax [N]:	0.15	0.30	0.46	0.63	0.81	1.01	1.22	1.43	1.64	1.85	2.06	2.27	2.48	2.69	2.90
torque [mNm]:	2.40	4.56	6.72	8.88	11.04	13.20	15.36	17.52	19.68	21.84	24.00	26.16	28.32	30.48	32.64
speed [rpm]:	1034	1501	1968	2435	2902	3369	3836	4303	4770	5237	5704	6171	6638	7106	7573
Ct [-]:	0.53	0.53	0.51	0.49	0.47	0.45	0.44	0.42	0.40	0.38	0.37	0.35	0.33	0.32	0.31
a [-]:	0.16	0.16	0.15	0.14	0.14	0.13	0.12	0.12	0.11	0.11	0.10	0.10	0.09	0.09	0.08
Lambda [-]:	4.28	4.41	4.62	4.78	4.92	5.01	5.11	5.19	5.25	5.31	5.36	5.40	5.43	5.46	5.49
P = QxN [W]:	0.26	0.72	1.39	2.26	3.36	4.66	6.17	7.90	9.83	11.98	14.34	16.91	19.69	22.68	25.88
P with Ct [W]:	0.41	1.13	2.17	3.58	5.36	7.70	10.45	13.60	17.18	21.18	25.61	30.46	35.73	41.43	47.56
Cp real [-]:	0.29	0.28	0.28	0.27	0.25	0.24	0.23	0.21	0.20	0.19	0.18	0.18	0.17	0.16	0.15
Cp with Ct [-]:	0.45	0.44	0.43	0.42	0.40	0.39	0.38	0.37	0.36	0.34	0.33	0.32	0.30	0.29	0.28

Source file: tkarakter Cp Ct.xls

Table H.3: characteristics of turbines with 1.0R0d in a uniform flow in May

generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5
macro:	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	3.56	4.81	5.83	6.73	7.59	8.46	9.35	10.24	11.13	12.02	12.91	13.79	14.68	15.57	16.46
fax [N]:	0.34	0.62	0.90	1.21	1.55	1.93	2.34	2.75	3.16	3.57	3.984.39	4.80	5.21	5.62	
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	853	1139	1424	1710	1995	2281	2566	2851	3137	3422	3708	3993	4278	4564	4849
Ct [-]:	0.92	0.90	0.90	0.90	0.91	0.92	0.91	0.89	0.87	0.84	0.81	0.78	0.76	0.73	0.70
a [-]:	0.36	0.35	0.34	0.35	0.35	0.35	0.35	0.33	0.32	0.30	0.28	0.27	0.25	0.24	0.23
Lambda [-]:	3.11	3.07	3.17	3.30	3.41	3.50	3.56	3.62	3.66	3.70	3.73	3.76	3.78	3.81	3.83
P = QxN [W]:	0.12	0.29	0.52	0.82	1.18	1.60	2.10	2.65	3.27	3.96	4.71	5.52	6.40	7.34	8.35
P with Ct [W]:	0.79	1.94	3.45	5.32	7.62	10.55	14.26	18.75	24.02	30.06	36.85	44.39	52.66	61.67	71.41
Cp real [-]:	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.06
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.58	0.57	0.56	0.55	0.54
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	2.90	3.91	4.63	5.25	5.74	6.21	6.66	7.09	7.51	7.93	8.428.90	9.39	9.88	10.37	
fax [N]:	0.22	0.40	0.58	0.75	0.91	1.07	1.23	1.40	1.58	1.75	1.982.20	2.43	2.66	2.89	
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	853	1139	1424	1710	1995	2281	2566	2851	3137	3422	3708	3993	4278	4564	4849
Ct [-]:	0.87	0.88	0.91	0.92	0.94	0.94	0.95	0.95	0.95	0.94	0.95	0.94	0.94	0.92	0.91
a [-]:	0.32	0.33	0.35	0.36	0.37	0.38	0.38	0.38	0.39	0.38	0.39	0.38	0.37	0.36	0.35
Lambda [-]:	3.82	3.78	3.99	4.23	4.51	4.77	5.00	5.22	5.42	5.60	5.72	5.83	5.92	6.00	6.07
P = QxN [W]:	0.12	0.29	0.52	0.82	1.18	1.60	2.10	2.65	3.27	3.96	4.71	5.52	6.40	7.34	8.35
P with Ct [W]:	0.43	1.05	1.73	2.52	3.27	4.12	5.07	6.12	7.27	8.59	10.23	12.12	14.30	16.74	19.43
Cp real [-]:	0.16	0.16	0.18	0.19	0.21	0.23	0.24	0.25	0.26	0.27	0.27	0.27	0.26	0.26	0.25
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.59	0.59	0.59
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
macro:	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	2.53	3.25	3.98	4.53	5.07	5.60	6.12	6.63	7.13	7.63	8.178.73	9.24	9.71	10.20	
fax [N]:	0.14	0.25	0.37	0.48	0.60	0.73	0.87	1.01	1.17	1.33	1.521.72	1.92	2.12	2.31	
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	853	1139	1424	1710	1995	2281	2566	2851	3137	3422	3708	3993	4278	4564	4849
Ct [-]:	0.72	0.81	0.79	0.80	0.79	0.79	0.78	0.78	0.78	0.78	0.77	0.77	0.76	0.76	0.75
a [-]:	0.23	0.28	0.27	0.28	0.27	0.27	0.27	0.27	0.27	0.26	0.26	0.26	0.26	0.26	0.25
Lambda [-]:	4.39	4.55	4.65	4.90	5.11	5.29	5.44	5.58	5.71	5.83	5.90	5.94	6.01	6.10	6.17
P = QxN [W]:	0.12	0.29	0.52	0.82	1.18	1.60	2.10	2.65	3.27	3.96	4.71	5.52	6.40	7.34	8.35
P with Ct [W]:	0.26	0.59	1.07	1.59	2.22	2.98	3.88	4.92	6.12	7.47	9.16	11.15	13.19	15.29	17.65
Cp real [-]:	0.25	0.28	0.28	0.30	0.31	0.31	0.31	0.31	0.31	0.30	0.29	0.28	0.28	0.27	0.27
Cp with Ct [-]:	0.55	0.58	0.58	0.58	0.58	0.58	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.56
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
macro:	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	2.45	3.18	3.91	4.51	5.09	5.67	6.22	6.76	7.28	7.81	8.348.87	9.40	9.94	10.47	
fax [N]:	0.11	0.20	0.30	0.40	0.50	0.61	0.72	0.84	0.96	1.09	1.231.37	1.52	1.68	1.83	
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	853	1139	1424	1710	1995	2281	2566	2851	3137	3422	3708	3993	4278	4564	4849
Ct [-]:	0.62	0.68	0.66	0.66	0.65	0.65	0.63	0.62	0.62	0.61	0.60	0.59	0.58	0.58	0.57
a [-]:	0.19	0.22	0.21	0.21	0.21	0.20	0.20	0.19	0.19	0.19	0.18	0.18	0.18	0.17	0.17
Lambda [-]:	4.52	4.65	4.73	4.93	5.09	5.22	5.35	5.48	5.59	5.69	5.77	5.85	5.91	5.96	6.01
P = QxN [W]:	0.12	0.29	0.52	0.82	1.18	1.60	2.10	2.65	3.27	3.96	4.71	5.52	6.40	7.34	8.35
P with Ct [W]:	0.22	0.51	0.92	1.41	2.02	2.76	3.62	4.57	5.68	6.93	8.37	9.95	11.77	13.75	15.89
Cp real [-]:	0.27	0.30	0.29	0.30	0.30	0.30	0.30	0.29	0.29	0.28	0.28	0.27	0.26	0.25	0.25
Cp with Ct [-]:	0.50	0.53	0.52	0.52	0.52	0.51	0.51	0.50	0.50	0.49	0.49	0.48	0.48	0.48	0.47
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
macro:	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	2.53	3.31	4.07	4.73	5.38	6.01	6.61	7.22	7.83	8.45	9.069.66	10.26	10.86	11.46	
fax [N]:	0.10	0.18	0.26	0.34	0.43	0.52	0.62	0.72	0.82	0.92	1.041.16	1.28	1.40	1.52	
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	853	1139	1424	1710	1995	2281	2566	2851	3137	3422	3708	3993	4278	4564	4849
Ct [-]:	0.52	0.54	0.52	0.52	0.50	0.49	0.48	0.47	0.45	0.44	0.43	0.42	0.41	0.40	0.39
a [-]:	0.15	0.16	0.15	0.15	0.15	0.14	0.14	0.14	0.13	0.13	0.12	0.12	0.12	0.11	0.11
Lambda [-]:	4.38	4.46	4.54	4.69	4.82	4.93	5.04	5.13	5.20	5.26	5.31	5.37	5.42	5.46	5.50
P = QxN [W]:	0.12	0.29	0.52	0.82	1.18	1.60	2.10	2.65	3.27	3.96	4.71	5.52	6.40	7.34	8.35
P with Ct [W]:	0.21	0.49	0.88	1.37	1.96	2.68	3.54	4.51	5.57	6.82	8.27	9.87	11.61	13.49	15.52
Cp real [-]:	0.25	0.27	0.26	0.26	0.26	0.25	0.25	0.24	0.23	0.22	0.21	0.21	0.20	0.19	0.19
Cp with Ct [-]:	0.44	0.46	0.44	0.44	0.43	0.42	0.42	0.41	0.39	0.38	0.38	0.37	0.36	0.36	0.35

Source file: tkarakter Cp Ct.xls

Table H.4: characteristics of turbines with 1.0R5d in a uniform flow in May

generator:	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d
pitch [dg]:	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5
macro:	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	4.99	5.76	6.53	7.30	8.07	8.70	9.34	9.97	10.61	11.24	11.88	12.51	13.15	13.78	14.42
fax [N]:	0.74	1.04	1.34	1.65	2.01	2.37	2.73	3.08	3.44	3.80	4.16	4.51	4.87	5.23	5.59
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	2525	2826	3127	3428	3729	4031	4332	4633	4934	5235	5536	5837	6138	6439	6740
Ct [-]:	1.01	1.06	1.06	1.05	1.05	1.06	1.06	1.05	1.04	1.02	1.00	0.98	0.96	0.93	0.91
a [-]:	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.49	0.43	0.40	0.37	0.35
Lambda [-]:	6.57	6.37	6.22	6.09	6.00	6.01	6.02	6.03	6.04	6.05	6.05	6.06	6.06	6.07	6.07
P = QxN [W]:	0.35	0.71	1.14	1.64	2.20	2.84	3.54	4.31	5.15	6.05	7.03	8.07	9.18	10.36	11.60
P with Ct [W]:	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	25.14	32.41	38.73	45.29	52.22
Cp real [-]:	0.10	0.13	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.13	0.13
Cp with Ct [-]:	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.51	0.56	0.58	0.59	0.59
generator:	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	4.64	5.32	6.00	6.68	7.33	7.94	8.52	9.10	9.67	10.25	10.82	11.39	11.97	12.54	13.11
fax [N]:	0.47	0.73	0.99	1.25	1.49	1.72	1.97	2.23	2.49	2.75	3.01	3.27	3.53	3.79	4.05
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	2525	2826	3127	3428	3729	4031	4332	4633	4934	5235	5536	5837	6138	6439	6740
Ct [-]:	0.74	0.88	0.93	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.87	0.85	0.84	0.82	0.80
a [-]:	0.25	0.32	0.37	0.39	0.38	0.37	0.36	0.35	0.34	0.33	0.32	0.31	0.30	0.29	0.28
Lambda [-]:	7.06	6.89	6.77	6.66	6.61	6.59	6.60	6.61	6.62	6.63	6.64	6.65	6.66	6.67	6.67
P = QxN [W]:	0.35	0.71	1.14	1.64	2.20	2.84	3.54	4.31	5.15	6.05	7.03	8.07	9.18	10.36	11.60
P with Ct [W]:	1.65	2.63	3.74	5.11	6.77	8.67	10.78	13.12	15.79	18.78	22.09	25.72	29.65	33.90	38.44
Cp real [-]:	0.12	0.16	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.18	0.18	0.17
Cp with Ct [-]:	0.56	0.59	0.59	0.58	0.58	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.58	0.58
generator:	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d
pitch [dg]:	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
macro:	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	4.58	5.22	5.87	6.52	7.16	7.75	8.34	8.91	9.47	10.03	10.59	11.14	11.70	12.26	12.82
fax [N]:	0.38	0.56	0.73	0.91	1.09	1.28	1.47	1.67	1.89	2.11	2.33	2.55	2.78	3.00	3.22
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	2525	2826	3127	3428	3729	4031	4332	4633	4934	5235	5536	5837	6138	6439	6740
Ct [-]:	0.61	0.69	0.72	0.73	0.72	0.72	0.72	0.71	0.71	0.71	0.71	0.70	0.69	0.68	0.67
a [-]:	0.19	0.22	0.24	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.22	0.22	0.21
Lambda [-]:	7.17	7.03	6.92	6.83	6.77	6.75	6.75	6.75	6.76	6.78	6.79	6.80	6.81	6.82	6.83
P = QxN [W]:	0.35	0.71	1.14	1.64	2.20	2.84	3.54	4.31	5.15	6.05	7.03	8.07	9.18	10.36	11.60
P with Ct [W]:	1.41	2.26	3.29	4.52	5.96	7.56	9.38	11.42	13.72	16.26	19.03	22.05	25.31	28.81	32.57
Cp real [-]:	0.12	0.17	0.19	0.20	0.20	0.21	0.21	0.21	0.21	0.20	0.20	0.20	0.19	0.19	0.19
Cp with Ct [-]:	0.50	0.54	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.54	0.54	0.54	0.53	0.53
generator:	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d
pitch [dg]:	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
macro:	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	4.78	5.46	6.14	6.82	7.46	8.10	8.71	9.33	9.96	10.60	11.26	11.93	12.59	13.26	13.92
fax [N]:	0.30	0.43	0.57	0.70	0.84	0.99	1.15	1.31	1.49	1.70	1.92	2.14	2.36	2.58	2.80
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	2525	2826	3127	3428	3729	4031	4332	4633	4934	5235	5536	5837	6138	6439	6740
Ct [-]:	0.44	0.49	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.50	0.50	0.49
a [-]:	0.13	0.14	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.14
Lambda [-]:	6.86	6.72	6.61	6.53	6.49	6.46	6.45	6.45	6.44	6.41	6.38	6.35	6.33	6.31	6.29
P = QxN [W]:	0.35	0.71	1.14	1.64	2.20	2.84	3.54	4.31	5.15	6.05	7.03	8.07	9.18	10.36	11.60
P with Ct [W]:	1.24	2.01	2.95	4.05	5.34	6.81	8.48	10.39	12.63	15.27	18.33	21.67	25.28	29.18	33.36
Cp real [-]:	0.11	0.15	0.17	0.18	0.18	0.18	0.18	0.18	0.18	0.17	0.17	0.16	0.16	0.15	0.15
Cp with Ct [-]:	0.38	0.42	0.43	0.43	0.44	0.44	0.43	0.43	0.43	0.44	0.44	0.43	0.43	0.43	0.42
generator:	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d
pitch [dg]:	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
macro:	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni	My3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	5.27	6.10	6.93	7.73	8.44	9.13	9.90	10.52	11.10	11.68	12.26	12.84	13.42	13.99	14.57
fax [N]:	0.27	0.39	0.50	0.63	0.74	0.86	0.97	1.08	1.19	1.30	1.41	1.52	1.63	1.75	1.86
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	2525	2826	3127	3428	3729	4031	4332	4633	4934	5235	5536	5837	6138	6439	6740
Ct [-]:	0.34	0.35	0.35	0.36	0.35	0.35	0.34	0.33	0.33	0.32	0.32	0.31	0.31	0.30	0.30
a [-]:	0.09	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08
Lambda [-]:	6.22	6.01	5.86	5.76	5.74	5.73	5.68	5.72	5.77	5.82	5.87	5.91	5.94	5.97	6.01
P = QxN [W]:	0.35	0.71	1.14	1.64	2.20	2.84	3.54	4.31	5.15	6.05	7.03	8.07	9.18	10.36	11.60
P with Ct [W]:	1.31	2.13	3.13	4.38	5.67	7.06	8.69	10.31	12.01	13.84	15.79	17.87	20.08	22.41	24.87
Cp real [-]:	0.08	0.11	0.12	0.12	0.12	0.13	0.12	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Cp with Ct [-]:	0.30	0.32	0.32	0.32	0.32	0.31	0.30	0.30	0.30	0.29	0.29	0.29	0.28	0.28	0.27

Source file: tkarakter Cp Ct.xls

Table H.5: characteristics of turbines with 0.5R0d in a uniform flow in November

generator:	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d
pitch [dg]:	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5
macro:	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	5.08	6.88	8.35	9.71	11.07	12.44	13.80	15.16	16.52	17.88	19.25	20.61	21.97	23.33	24.69
fax [N]:	0.58	1.08	1.63	2.29	2.95	3.61	4.27	4.93	5.59	6.25	6.91	7.57	8.23	8.88	9.54
torque [mNm]:	2.40	4.56	6.72	8.88	11.04	13.20	15.36	17.52	19.68	21.84	24.00	26.16	28.32	30.48	32.64
speed [rpm]:	1061	1555	2048	2542	3036	3529	4023	4517	5010	5504	5998	6492	6985	7479	7973
Ct [-]:	0.76	0.78	0.79	0.82	0.82	0.79	0.76	0.73	0.69	0.66	0.63	0.60	0.58	0.55	0.53
a [-]:	0.26	0.26	0.27	0.29	0.29	0.27	0.26	0.24	0.22	0.21	0.20	0.19	0.18	0.17	0.16
Lambda [-]:	2.71	2.93	3.18	3.40	3.56	3.69	3.79	3.87	3.94	4.00	4.05	4.09	4.13	4.16	4.19
P = QxN [W]:	0.27	0.74	1.44	2.36	3.51	4.88	6.47	8.29	10.33	12.59	15.07	17.78	20.72	23.87	27.25
P with Ct [W]:	2.19	5.49	9.90	15.79	23.33	32.68	43.85	56.84	71.66	88.29	106.73	126.97	149.01	172.86	198.51
Cp real [-]:	0.07	0.08	0.08	0.09	0.09	0.09	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.06	0.06
Cp with Ct [-]:	0.57	0.57	0.58	0.58	0.58	0.58	0.57	0.55	0.54	0.52	0.51	0.49	0.48	0.46	0.45
generator:	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	4.08	5.46	6.47	7.24	7.89	8.60	9.33	10.07	10.80	11.54	12.27	13.01	13.75	14.48	15.22
fax [N]:	0.38	0.72	1.03	1.29	1.54	1.82	2.13	2.43	2.74	3.05	3.35	3.66	3.96	4.27	4.58
torque [mNm]:	2.40	4.56	6.72	8.88	11.04	13.20	15.36	17.52	19.68	21.84	24.00	26.16	28.32	30.48	32.64
speed [rpm]:	1061	1555	2048	2542	3036	3529	4023	4517	5010	5504	5998	6492	6985	7479	7973
Ct [-]:	0.77	0.82	0.83	0.84	0.84	0.84	0.83	0.82	0.80	0.78	0.76	0.73	0.71	0.69	0.67
a [-]:	0.26	0.29	0.30	0.30	0.30	0.30	0.29	0.29	0.27	0.26	0.25	0.24	0.23	0.22	0.21
Lambda [-]:	3.37	3.69	4.11	4.56	5.00	5.33	5.60	5.83	6.02	6.19	6.35	6.48	6.60	6.71	6.80
P = QxN [W]:	0.27	0.74	1.44	2.36	3.51	4.88	6.47	8.29	10.33	12.59	15.07	17.78	20.72	23.87	27.25
P with Ct [W]:	1.15	2.80	4.68	6.58	8.50	11.00	14.03	17.52	21.48	25.89	30.76	36.09	41.87	48.11	54.80
Cp real [-]:	0.13	0.15	0.18	0.21	0.24	0.26	0.27	0.28	0.28	0.28	0.28	0.27	0.27	0.27	0.26
Cp with Ct [-]:	0.57	0.58	0.59	0.59	0.59	0.59	0.59	0.58	0.58	0.57	0.56	0.56	0.55	0.54	0.53
generator:	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d
pitch [dg]:	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
macro:	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	3.54	4.62	5.62	6.55	7.44	8.30	9.14	9.98	10.82	11.66	12.50	13.34	14.18	15.02	15.86
fax [N]:	0.24	0.46	0.68	0.90	1.13	1.39	1.64	1.90	2.15	2.41	2.66	2.92	3.17	3.43	3.69
torque [mNm]:	2.40	4.56	6.72	8.88	11.04	13.20	15.36	17.52	19.68	21.84	24.00	26.16	28.32	30.48	32.64
speed [rpm]:	1061	1555	2048	2542	3036	3529	4023	4517	5010	5504	5998	6492	6985	7479	7973
Ct [-]:	0.66	0.73	0.73	0.71	0.69	0.68	0.67	0.65	0.62	0.60	0.58	0.56	0.54	0.52	0.50
a [-]:	0.21	0.24	0.24	0.23	0.22	0.22	0.21	0.20	0.19	0.18	0.18	0.17	0.16	0.15	0.15
Lambda [-]:	3.89	4.37	4.73	5.04	5.30	5.52	5.72	5.88	6.01	6.13	6.23	6.32	6.40	6.47	6.53
P = QxN [W]:	0.27	0.74	1.44	2.36	3.51	4.88	6.47	8.29	10.33	12.59	15.07	17.78	20.72	23.87	27.25
P with Ct [W]:	0.69	1.61	2.92	4.52	6.53	8.99	11.83	15.09	18.78	22.90	27.45	32.44	37.85	43.69	49.96
Cp real [-]:	0.20	0.26	0.28	0.29	0.29	0.29	0.29	0.28	0.28	0.27	0.26	0.25	0.25	0.24	0.23
Cp with Ct [-]:	0.52	0.56	0.56	0.55	0.54	0.53	0.53	0.52	0.50	0.49	0.48	0.46	0.45	0.44	0.42
generator:	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d
pitch [dg]:	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
macro:	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	3.45	4.60	5.70	6.69	7.65	8.60	9.53	10.46	11.39	12.32	13.24	14.17	15.10	16.03	16.96
fax [N]:	0.18	0.36	0.53	0.71	0.90	1.11	1.33	1.56	1.78	2.01	2.24	2.46	2.69	2.91	3.14
torque [mNm]:	2.40	4.56	6.72	8.88	11.04	13.20	15.36	17.52	19.68	21.84	24.00	26.16	28.32	30.48	32.64
speed [rpm]:	1061	1555	2048	2542	3036	3529	4023	4517	5010	5504	5998	6492	6985	7479	7973
Ct [-]:	0.52	0.57	0.56	0.54	0.52	0.51	0.50	0.48	0.47	0.45	0.43	0.42	0.40	0.38	0.37
a [-]:	0.15	0.17	0.17	0.16	0.15	0.15	0.15	0.14	0.13	0.13	0.12	0.12	0.11	0.11	0.10
Lambda [-]:	3.99	4.39	4.67	4.93	5.15	5.33	5.48	5.61	5.71	5.80	5.88	5.95	6.01	6.06	6.10
P = QxN [W]:	0.27	0.74	1.44	2.36	3.51	4.88	6.47	8.29	10.33	12.59	15.07	17.78	20.72	23.87	27.25
P with Ct [W]:	0.54	1.35	2.53	4.01	5.81	8.09	10.84	14.00	17.57	21.55	25.95	30.77	36.01	41.67	47.74
Cp real [-]:	0.22	0.26	0.26	0.27	0.27	0.26	0.25	0.25	0.24	0.23	0.22	0.21	0.20	0.20	0.19
Cp with Ct [-]:	0.44	0.47	0.46	0.45	0.44	0.43	0.43	0.42	0.40	0.39	0.38	0.37	0.35	0.34	0.33
generator:	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d	0.5r0d
pitch [dg]:	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
macro:	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	3.49	4.76	5.94	7.03	8.09	9.17	10.24	11.32	12.39	13.47	14.55	15.62	16.70	17.77	18.85
fax [N]:	0.16	0.31	0.47	0.63	0.80	0.99	1.18	1.37	1.56	1.76	1.95	2.14	2.33	2.52	2.71
torque [mNm]:	2.40	4.56	6.72	8.88	11.04	13.20	15.36	17.52	19.68	21.84	24.00	26.16	28.32	30.48	32.64
speed [rpm]:	1061	1555	2048	2542	3036	3529	4023	4517	5010	5504	5998	6492	6985	7479	7973
Ct [-]:	0.46	0.46	0.45	0.43	0.42	0.40	0.38	0.36	0.35	0.33	0.31	0.30	0.28	0.27	0.26
a [-]:	0.13	0.13	0.13	0.12	0.12	0.11	0.11	0.10	0.10	0.09	0.09	0.08	0.08	0.07	0.07
Lambda [-]:	3.94	4.24	4.48	4.69	4.87	5.00	5.10	5.18	5.25	5.31	5.35	5.40	5.43	5.46	5.49
P = QxN [W]:	0.27	0.74	1.44	2.36	3.51	4.88	6.47	8.29	10.33	12.59	15.07	17.78	20.72	23.87	27.25
P with Ct [W]:	0.50	1.27	2.44	3.89	5.71	8.06	10.82	13.97	17.54	21.52	25.90	30.70	35.91	41.53	47.55
Cp real [-]:	0.21	0.23	0.23	0.23	0.22	0.22	0.20	0.19	0.18	0.17	0.17	0.16	0.15	0.14	0.14
Cp with Ct [-]:	0.40	0.40	0.39	0.38	0.37	0.36	0.34	0.33	0.31	0.30	0.29	0.27	0.26	0.25	0.24

Source file: tkarakter Cp Ct.xls

Table H.6: characteristics of turbines with 1.0R0d in a uniform flow in November

generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5
macro:	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	3.66	4.75	5.70	6.52	7.20	7.77	8.22	8.54	8.85	9.17	9.489.80		10.11	10.43	10.74
fax [N]:	0.35	0.58	0.82	1.08	1.34	1.59	1.81	1.99	2.18	2.36	2.552.73		2.91	3.10	3.28
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	849	1129	1410	1690	1971	2252	2532	2813	3093	3374	3655	3935	4216	4496	4777
Ct [-]:	0.88	0.87	0.86	0.86	0.87	0.89	0.91	0.93	0.94	0.95	0.96	0.96	0.97	0.97	0.96
a [-]:	0.33	0.32	0.31	0.32	0.32	0.34	0.35	0.37	0.38	0.39	0.40	0.41	0.41	0.41	0.41
Lambda [-]:	3.01	3.09	3.21	3.37	3.55	3.76	4.00	4.28	4.54	4.78	5.00	5.22	5.41	5.60	5.77
P = QxN [W]:	0.12	0.28	0.51	0.81	1.16	1.58	2.07	2.62	3.23	3.90	4.64	5.44	6.30	7.23	8.22
P with Ct [W]:	0.86	1.87	3.23	4.82	6.52	8.18	9.69	10.79	11.94	13.16	14.47	15.88	17.43	19.11	20.95
Cp real [-]:	0.08	0.09	0.09	0.10	0.11	0.11	0.13	0.14	0.16	0.17	0.18	0.20	0.21	0.22	0.23
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.58	0.58	0.58	0.57	0.57	0.57	0.57
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	3.46	4.07	4.69	5.24	5.68	6.12	6.60	7.07	7.53	7.98	8.468.95		9.44	9.93	10.42
fax [N]:	0.24	0.40	0.55	0.69	0.82	0.96	1.12	1.29	1.46	1.62	1.822.02		2.22	2.43	2.63
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	849	1129	1410	1690	1971	2252	2532	2813	3093	3374	3655	3935	4216	4496	4777
Ct [-]:	0.69	0.81	0.85	0.86	0.86	0.87	0.88	0.87	0.87	0.87	0.86	0.86	0.85	0.84	0.82
a [-]:	0.22	0.28	0.30	0.31	0.32	0.32	0.32	0.32	0.32	0.32	0.31	0.31	0.30	0.30	0.29
Lambda [-]:	3.19	3.60	3.91	4.19	4.51	4.78	4.98	5.17	5.34	5.49	5.61	5.71	5.80	5.88	5.95
P = QxN [W]:	0.12	0.28	0.51	0.81	1.16	1.58	2.07	2.62	3.23	3.90	4.64	5.44	6.30	7.23	8.22
P with Ct [W]:	0.65	1.16	1.79	2.51	3.19	4.00	5.02	6.17	7.43	8.85	10.55	12.48	14.61	16.94	19.48
Cp real [-]:	0.10	0.14	0.17	0.19	0.22	0.23	0.24	0.25	0.26	0.26	0.26	0.26	0.25	0.25	0.25
Cp with Ct [-]:	0.54	0.58	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.58
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
macro:	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	2.98	3.56	4.14	4.72	5.29	5.85	6.38	6.90	7.42	7.95	8.458.94		9.44	9.94	10.44
fax [N]:	0.13	0.24	0.36	0.48	0.60	0.73	0.88	1.03	1.18	1.32	1.481.65		1.82	1.98	2.15
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	849	1129	1410	1690	1971	2252	2532	2813	3093	3374	3655	3935	4216	4496	4777
Ct [-]:	0.48	0.65	0.71	0.73	0.73	0.72	0.73	0.74	0.72	0.71	0.71	0.70	0.69	0.68	0.67
a [-]:	0.14	0.20	0.23	0.24	0.24	0.24	0.24	0.24	0.24	0.23	0.23	0.23	0.22	0.22	0.21
Lambda [-]:	3.70	4.12	4.42	4.65	4.84	5.00	5.16	5.29	5.41	5.51	5.62	5.71	5.80	5.87	5.94
P = QxN [W]:	0.12	0.28	0.51	0.81	1.16	1.58	2.07	2.62	3.23	3.90	4.64	5.44	6.30	7.23	8.22
P with Ct [W]:	0.32	0.69	1.14	1.71	2.41	3.25	4.25	5.40	6.66	8.06	9.66	11.42	13.34	15.43	17.68
Cp real [-]:	0.15	0.21	0.25	0.26	0.27	0.27	0.27	0.27	0.27	0.26	0.26	0.26	0.25	0.25	0.25
Cp with Ct [-]:	0.41	0.52	0.55	0.55	0.55	0.55	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.53	0.53
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
macro:	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	2.92	3.53	4.15	4.76	5.37	5.96	6.53	7.09	7.63	8.17	8.699.22		9.74	10.27	10.79
fax [N]:	0.10	0.20	0.29	0.39	0.49	0.60	0.70	0.81	0.94	1.06	1.171.28		1.39	1.50	1.62
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	849	1129	1410	1690	1971	2252	2532	2813	3093	3374	3655	3935	4216	4496	4777
Ct [-]:	0.41	0.54	0.58	0.58	0.58	0.57	0.56	0.55	0.55	0.54	0.53	0.51	0.50	0.48	0.47
a [-]:	0.12	0.16	0.18	0.18	0.18	0.17	0.17	0.16	0.16	0.16	0.16	0.15	0.15	0.14	0.14
Lambda [-]:	3.78	4.15	4.41	4.61	4.77	4.91	5.04	5.15	5.27	5.37	5.46	5.54	5.62	5.69	5.75
P = QxN [W]:	0.12	0.28	0.51	0.81	1.16	1.58	2.07	2.62	3.23	3.90	4.64	5.44	6.30	7.23	8.22
P with Ct [W]:	0.26	0.59	1.01	1.53	2.17	2.94	3.82	4.83	5.99	7.28	8.60	10.04	11.60	13.27	15.06
Cp real [-]:	0.16	0.22	0.24	0.25	0.26	0.25	0.25	0.25	0.25	0.24	0.24	0.24	0.23	0.23	0.22
Cp with Ct [-]:	0.36	0.45	0.48	0.48	0.48	0.47	0.47	0.46	0.46	0.45	0.44	0.44	0.43	0.42	0.41
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
macro:	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	2.91	3.62	4.33	5.04	5.71	6.36	7.00	7.63	8.25	8.87	9.4810.10		10.71	11.33	11.95
fax [N]:	0.10	0.17	0.25	0.33	0.42	0.51	0.60	0.70	0.80	0.90	1.011.12		1.22	1.33	1.44
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	849	1129	1410	1690	1971	2252	2532	2813	3093	3374	3655	3935	4216	4496	4777
Ct [-]:	0.39	0.45	0.46	0.44	0.44	0.43	0.42	0.41	0.40	0.39	0.38	0.37	0.36	0.35	0.34
a [-]:	0.11	0.13	0.13	0.13	0.13	0.12	0.12	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.09
Lambda [-]:	3.79	4.05	4.23	4.36	4.49	4.60	4.70	4.79	4.87	4.94	5.00	5.06	5.11	5.15	5.19
P = QxN [W]:	0.12	0.28	0.51	0.81	1.16	1.58	2.07	2.62	3.23	3.90	4.64	5.44	6.30	7.23	8.22
P with Ct [W]:	0.25	0.55	0.95	1.45	2.10	2.85	3.71	4.70	5.83	7.13	8.56	10.11	11.80	13.61	15.56
Cp real [-]:	0.16	0.20	0.21	0.21	0.21	0.21	0.20	0.20	0.20	0.19	0.18	0.18	0.17	0.17	0.16
Cp with Ct [-]:	0.34	0.39	0.40	0.39	0.38	0.38	0.37	0.36	0.35	0.35	0.34	0.33	0.33	0.32	0.31

Source file: tkarakter Cp Ct.xls

Table H.7: characteristics of turbines with 1.0R5d in a uniform flow in November

generator:	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d
pitch [dg]:	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5
macro:	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50	
wind [m/s]:	5.07	5.99	6.76	7.46	8.13	8.74	9.35	9.96	10.57	11.18	11.79	12.40	13.01	13.62	14.23	
fax [N]:	0.78	1.08	1.36	1.66	1.96	2.27	2.58	2.90	3.21	3.52	3.83	4.15	4.46	4.77	5.08	
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44	
speed [rpm]:	2530	2836	3142	3449	3755	4061	4367	4673	4980	5286	5592	5898	6204	6511	6817	
Ct [-]:	1.03	1.02	1.01	1.01	1.00	1.01	1.00	0.99	0.97	0.96	0.94	0.91	0.89	0.87	0.85	
a [-]:	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.45	0.42	0.39	0.37	0.35	0.34	0.32	0.31	
Lambda [-]:	6.49	6.14	6.04	6.00	5.99	6.03	6.06	6.09	6.12	6.14	6.16	6.18	6.19	6.21	6.22	
P = QxN [W]:	0.35	0.71	1.15	1.65	2.22	2.86	3.57	4.35	5.19	6.11	7.10	8.15	9.28	10.47	11.74	
P with Ct [W]:	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	15.87	19.70	23.84	28.35	33.22	38.47	44.10	50.11	
Cp real [-]:	0.09	0.11	0.13	0.13	0.14	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.14	0.14	0.14	
Cp with Ct [-]:	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.54	0.57	0.58	0.59	0.59	0.59	0.59	0.59	
generator:	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50	
wind [m/s]:	4.61	5.43	6.10	6.74	7.37	8.00	8.55	9.09	9.64	10.18	10.72	11.27	11.81	12.35	12.89	
fax [N]:	0.55	0.76	0.96	1.18	1.40	1.63	1.87	2.11	2.34	2.58	2.82	3.06	3.30	3.54	3.77	
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44	
speed [rpm]:	2530	2836	3142	3449	3755	4061	4367	4673	4980	5286	5592	5898	6204	6511	6817	
Ct [-]:	0.88	0.88	0.88	0.88	0.88	0.87	0.87	0.86	0.86	0.85	0.83	0.82	0.80	0.79	0.77	
a [-]:	0.33	0.33	0.33	0.33	0.32	0.32	0.32	0.32	0.31	0.30	0.30	0.29	0.28	0.27	0.26	
Lambda [-]:	7.12	6.79	6.69	6.64	6.61	6.59	6.63	6.67	6.71	6.74	6.77	6.80	6.82	6.85	6.87	
P = QxN [W]:	0.35	0.71	1.15	1.65	2.22	2.86	3.57	4.35	5.19	6.11	7.10	8.15	9.28	10.47	11.74	
P with Ct [W]:	1.71	2.79	3.97	5.36	7.00	8.92	10.90	13.11	15.57	18.31	21.31	24.58	28.12	31.92	35.98	
Cp real [-]:	0.12	0.15	0.17	0.18	0.19	0.19	0.19	0.20	0.20	0.20	0.20	0.19	0.19	0.19	0.19	
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.58	0.58	0.57	0.57
generator:	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d
pitch [dg]:	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
macro:	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50	
wind [m/s]:	4.53	5.38	6.06	6.70	7.33	7.93	8.50	9.06	9.62	10.18	10.74	11.31	11.87	12.43	12.99	
fax [N]:	0.40	0.58	0.74	0.90	1.07	1.26	1.44	1.63	1.82	2.00	2.19	2.38	2.56	2.75	2.94	
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44	
speed [rpm]:	2530	2836	3142	3449	3755	4061	4367	4673	4980	5286	5592	5898	6204	6511	6817	
Ct [-]:	0.66	0.68	0.68	0.68	0.68	0.68	0.68	0.67	0.67	0.66	0.64	0.63	0.62	0.60	0.59	
a [-]:	0.21	0.22	0.22	0.22	0.22	0.22	0.22	0.21	0.21	0.21	0.20	0.20	0.19	0.19	0.18	
Lambda [-]:	7.25	6.85	6.73	6.68	6.66	6.65	6.67	6.70	6.72	6.74	6.76	6.77	6.79	6.80	6.81	
P = QxN [W]:	0.35	0.71	1.15	1.65	2.22	2.86	3.57	4.35	5.19	6.11	7.10	8.15	9.28	10.47	11.74	
P with Ct [W]:	1.44	2.44	3.50	4.71	6.16	7.82	9.61	11.60	13.79	16.19	18.79	21.60	24.62	27.85	31.29	
Cp real [-]:	0.13	0.16	0.17	0.19	0.19	0.19	0.20	0.20	0.20	0.20	0.19	0.19	0.19	0.19	0.18	
Cp with Ct [-]:	0.52	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.52	0.51	0.51	0.50	0.49	0.48	
generator:	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d
pitch [dg]:	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
macro:	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50	
wind [m/s]:	4.93	5.81	6.54	7.23	7.90	8.54	9.16	9.78	10.40	11.02	11.64	12.26	12.88	13.50	14.12	
fax [N]:	0.30	0.44	0.57	0.69	0.82	0.96	1.11	1.26	1.41	1.56	1.72	1.87	2.02	2.17	2.32	
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44	
speed [rpm]:	2530	2836	3142	3449	3755	4061	4367	4673	4980	5286	5592	5898	6204	6511	6817	
Ct [-]:	0.42	0.44	0.45	0.45	0.44	0.45	0.45	0.45	0.44	0.44	0.43	0.42	0.41	0.40	0.40	
a [-]:	0.12	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.12	0.11	0.11	
Lambda [-]:	6.67	6.34	6.24	6.19	6.17	6.18	6.19	6.21	6.22	6.23	6.24	6.25	6.26	6.26	6.27	
P = QxN [W]:	0.35	0.71	1.15	1.65	2.22	2.86	3.57	4.35	5.19	6.11	7.10	8.15	9.28	10.47	11.74	
P with Ct [W]:	1.31	2.23	3.23	4.35	5.63	7.15	8.86	10.76	12.83	15.09	17.53	20.15	22.96	25.95	29.13	
Cp real [-]:	0.10	0.12	0.14	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.15	0.15	0.15	0.14	0.14	
Cp with Ct [-]:	0.37	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.38	0.38	0.37	0.36	0.36	0.35	
generator:	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d
pitch [dg]:	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
macro:	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni	Nv3uni
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50	
wind [m/s]:	5.46	6.41	7.19	7.95	8.65	9.35	10.04	10.73	11.43	12.12	12.82	13.51	14.20	14.90	15.59	
fax [N]:	0.28	0.39	0.50	0.60	0.72	0.83	0.95	1.07	1.18	1.30	1.42	1.53	1.65	1.77	1.88	
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44	
speed [rpm]:	2530	2836	3142	3449	3755	4061	4367	4673	4980	5286	5592	5898	6204	6511	6817	
Ct [-]:	0.31	0.33	0.33	0.32	0.32	0.32	0.32	0.31	0.31	0.30	0.29	0.29	0.28	0.27	0.26	
a [-]:	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.07	0.07	
Lambda [-]:	6.02	5.75	5.67	5.63	5.63	5.64	5.65	5.65	5.66	5.66	5.67	5.67	5.67	5.68	5.68	
P = QxN [W]:	0.35	0.71	1.15	1.65	2.22	2.86	3.57	4.35	5.19	6.11	7.10	8.15	9.28	10.47	11.74	
P with Ct [W]:	1.38	2.30	3.26	4.35	5.64	7.09	8.70	10.46	12.38	14.47	16.71	19.11	21.67	24.40	27.28	
Cp real [-]:	0.07	0.09	0.10	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.11	
Cp with Ct [-]:	0.29	0.30	0.30	0.29	0.30	0.29	0.29	0.29	0.28	0.28	0.27	0.26	0.26	0.25	0.24	

Source file: tkarakter Cp Ct.xls

Table H.8: characteristics of turbines with 0.5R0d in an offshore boundary layer in Nov.

generator:	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d
pitch [dg]:	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	4.83	6.57	7.94	9.13	10.32	11.51	12.70	13.89	15.08	16.27	17.46	18.65	19.84	21.03	22.22
fax [N]:	0.53	1.04	1.57	2.16	2.75	3.34	3.93	4.52	5.11	5.70	6.29	6.88	7.47	8.06	8.65
torque [mNm]:	2.40	4.56	6.72	8.88	11.04	13.20	15.36	17.52	19.68	21.84	24.00	26.16	28.32	30.48	32.64
speed [rpm]:	1061	1555	2048	2542	3036	3529	4023	4517	5010	5504	5998	6492	6985	7479	7973
Ct [-]:	0.77	0.82	0.84	0.88	0.87	0.85	0.83	0.79	0.76	0.73	0.70	0.67	0.64	0.62	0.59
a [-]:	0.26	0.29	0.30	0.32	0.32	0.31	0.29	0.27	0.26	0.24	0.23	0.21	0.20	0.19	0.18
Lambda [-]:	2.86	3.07	3.35	3.61	3.82	3.98	4.11	4.22	4.31	4.39	4.46	4.52	4.57	4.62	4.66
P = QxN [W]:	0.27	0.74	1.44	2.36	3.51	4.88	6.47	8.29	10.33	12.59	15.07	17.78	20.72	23.87	27.25
P with Ct [W]:	1.88	4.87	8.69	13.30	19.20	26.54	35.35	45.61	57.31	70.44	84.99	100.95	118.32	137.11	157.31
Cp real [-]:	0.08	0.09	0.10	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.08
Cp with Ct [-]:	0.57	0.58	0.59	0.59	0.59	0.59	0.59	0.58	0.57	0.55	0.54	0.53	0.51	0.50	0.49
generator:	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	4.04	5.34	6.23	7.05	7.69	8.36	9.09	9.82	10.55	11.27	12.00	12.73	13.45	14.18	14.91
fax [N]:	0.36	0.69	0.97	1.23	1.50	1.81	2.16	2.50	2.85	3.20	3.55	3.89	4.24	4.59	4.94
torque [mNm]:	2.40	4.56	6.72	8.88	11.04	13.20	15.36	17.52	19.68	21.84	24.00	26.16	28.32	30.48	32.64
speed [rpm]:	1061	1555	2048	2542	3036	3529	4023	4517	5010	5504	5998	6492	6985	7479	7973
Ct [-]:	0.75	0.82	0.85	0.84	0.86	0.88	0.89	0.88	0.87	0.85	0.84	0.82	0.80	0.77	0.75
a [-]:	0.25	0.29	0.31	0.30	0.32	0.33	0.33	0.33	0.32	0.31	0.30	0.29	0.27	0.26	0.25
Lambda [-]:	3.41	3.78	4.27	4.68	5.13	5.48	5.75	5.97	6.17	6.34	6.49	6.62	6.74	6.85	6.94
P = QxN [W]:	0.27	0.74	1.44	2.36	3.51	4.88	6.47	8.29	10.33	12.59	15.07	17.78	20.72	23.87	27.25
P with Ct [W]:	1.09	2.62	4.21	6.07	7.92	10.21	13.12	16.53	20.46	24.92	29.90	35.42	41.45	48.00	55.06
Cp real [-]:	0.14	0.17	0.20	0.23	0.26	0.28	0.29	0.30	0.30	0.30	0.30	0.29	0.29	0.28	0.28
Cp with Ct [-]:	0.56	0.58	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.58	0.57	0.56
generator:	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d
pitch [dg]:	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	3.61	4.64	5.56	6.40	7.28	8.21	8.98	9.74	10.50	11.27	12.03	12.80	13.56	14.32	15.09
fax [N]:	0.24	0.44	0.66	0.88	1.10	1.37	1.67	1.97	2.28	2.58	2.89	3.19	3.49	3.80	4.10
torque [mNm]:	2.40	4.56	6.72	8.88	11.04	13.20	15.36	17.52	19.68	21.84	24.00	26.16	28.32	30.48	32.64
speed [rpm]:	1061	1555	2048	2542	3036	3529	4023	4517	5010	5504	5998	6492	6985	7479	7973
Ct [-]:	0.62	0.70	0.72	0.73	0.70	0.69	0.70	0.71	0.70	0.69	0.68	0.66	0.64	0.63	0.61
a [-]:	0.19	0.23	0.24	0.24	0.23	0.22	0.23	0.23	0.23	0.22	0.22	0.21	0.20	0.20	0.19
Lambda [-]:	3.82	4.35	4.78	5.16	5.42	5.58	5.82	6.02	6.19	6.34	6.47	6.59	6.69	6.78	6.86
P = QxN [W]:	0.27	0.74	1.44	2.36	3.51	4.88	6.47	8.29	10.33	12.59	15.07	17.78	20.72	23.87	27.25
P with Ct [W]:	0.70	1.60	2.79	4.27	6.18	8.74	11.57	14.82	18.50	22.64	27.23	32.28	37.80	43.78	50.23
Cp real [-]:	0.19	0.25	0.28	0.31	0.31	0.30	0.30	0.30	0.30	0.30	0.29	0.29	0.28	0.28	0.27
Cp with Ct [-]:	0.50	0.54	0.55	0.55	0.54	0.54	0.54	0.54	0.54	0.54	0.53	0.52	0.51	0.51	0.50
generator:	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d
pitch [dg]:	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	3.60	4.63	5.68	6.64	7.57	8.49	9.51	10.52	11.53	12.54	13.55	14.57	15.58	16.59	17.60
fax [N]:	0.20	0.37	0.55	0.75	0.95	1.15	1.38	1.60	1.83	2.06	2.28	2.51	2.73	2.96	3.18
torque [mNm]:	2.40	4.56	6.72	8.88	11.04	13.20	15.36	17.52	19.68	21.84	24.00	26.16	28.32	30.48	32.64
speed [rpm]:	1061	1555	2048	2542	3036	3529	4023	4517	5010	5504	5998	6492	6985	7479	7973
Ct [-]:	0.52	0.58	0.58	0.58	0.56	0.54	0.52	0.49	0.47	0.44	0.42	0.40	0.38	0.36	0.35
a [-]:	0.15	0.18	0.18	0.17	0.17	0.16	0.15	0.14	0.14	0.13	0.12	0.11	0.11	0.10	0.10
Lambda [-]:	3.83	4.36	4.68	4.97	5.21	5.40	5.50	5.58	5.64	5.70	5.75	5.79	5.82	5.85	5.88
P = QxN [W]:	0.27	0.74	1.44	2.36	3.51	4.88	6.47	8.29	10.33	12.59	15.07	17.78	20.72	23.87	27.25
P with Ct [W]:	0.61	1.41	2.58	4.11	5.98	8.21	11.11	14.45	18.25	22.51	27.22	32.38	38.01	44.09	50.62
Cp real [-]:	0.19	0.25	0.27	0.27	0.27	0.27	0.26	0.24	0.23	0.22	0.21	0.20	0.19	0.18	0.17
Cp with Ct [-]:	0.44	0.48	0.48	0.48	0.47	0.45	0.44	0.42	0.40	0.39	0.37	0.36	0.34	0.33	0.31
generator:	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d	0.5R0d
pitch [dg]:	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	3.52	4.80	5.85	6.96	7.89	9.05	10.22	11.40	12.58	13.76	14.94	16.12	17.30	18.47	19.65
fax [N]:	0.16	0.32	0.48	0.64	0.84	0.98	1.12	1.25	1.39	1.52	1.66	1.79	1.92	2.06	2.19
torque [mNm]:	2.40	4.56	6.72	8.88	11.04	13.20	15.36	17.52	19.68	21.84	24.00	26.16	28.32	30.48	32.64
speed [rpm]:	1061	1555	2048	2542	3036	3529	4023	4517	5010	5504	5998	6492	6985	7479	7973
Ct [-]:	0.44	0.47	0.48	0.45	0.46	0.41	0.36	0.33	0.30	0.27	0.25	0.23	0.22	0.20	0.19
a [-]:	0.13	0.14	0.14	0.13	0.13	0.11	0.10	0.09	0.08	0.07	0.07	0.06	0.06	0.05	0.05
Lambda [-]:	3.91	4.21	4.55	4.74	5.00	5.07	5.11	5.14	5.17	5.19	5.21	5.23	5.24	5.26	5.27
P = QxN [W]:	0.27	0.74	1.44	2.36	3.51	4.88	6.47	8.29	10.33	12.59	15.07	17.78	20.72	23.87	27.25
P with Ct [W]:	0.49	1.31	2.44	3.88	5.76	7.86	10.26	12.99	16.03	19.38	23.06	27.05	31.36	35.98	40.92
Cp real [-]:	0.21	0.23	0.24	0.24	0.24	0.22	0.21	0.19	0.18	0.16	0.15	0.14	0.14	0.13	0.12
Cp with Ct [-]:	0.38	0.40	0.41	0.39	0.40	0.36	0.33	0.30	0.27	0.25	0.23	0.22	0.21	0.19	0.18

Source file: tkarakter Cp Ct.xls

Table H.9: characteristics of turbines with 1.0R0d in an offshore boundary layer in Nov.

generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	3.66	4.62	5.51	6.27	6.92	7.58	8.04	8.32	8.60	8.88	9.169.44		9.72	10.00	10.28
fax [N]:	0.31	0.54	0.80	1.06	1.32	1.57	1.79	1.97	2.16	2.34	2.522.71		2.89	3.08	3.26
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	849	1129	1410	1690	1971	2252	2532	2813	3093	3374	3655	3935	4216	4496	4777
Ct [-]:	0.78	0.87	0.89	0.91	0.93	0.93	0.94	0.97	0.99	1.01	1.02	1.03	1.04	1.04	1.05
a [-]:	0.26	0.32	0.33	0.35	0.37	0.37	0.38	0.41	0.45	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
Lambda [-]:	3.01	3.18	3.32	3.50	3.70	3.86	4.09	4.39	4.67	4.94	5.18	5.42	5.63	5.84	6.04
P = QxN [W]:	0.12	0.28	0.51	0.81	1.16	1.58	2.07	2.62	3.23	3.90	4.64	5.44	6.30	7.23	8.22
P with Ct [W]:	0.83	1.71	2.91	4.29	5.75	7.54	8.94	9.66	10.15	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
Cp real [-]:	0.08	0.10	0.10	0.11	0.12	0.12	0.14	0.15	0.17	0.19	0.21	0.22	0.23	0.25	0.26
Cp with Ct [-]:	0.57	0.59	0.59	0.59	0.59	0.59	0.58	0.57	0.54	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	3.39	3.98	4.57	5.16	5.60	6.02	6.49	6.96	7.38	7.80	8.248.69		9.14	9.59	10.04
fax [N]:	0.23	0.38	0.53	0.67	0.82	0.96	1.12	1.28	1.46	1.64	1.832.05		2.27	2.49	2.71
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	849	1129	1410	1690	1971	2252	2532	2813	3093	3374	3655	3935	4216	4496	4777
Ct [-]:	0.69	0.81	0.86	0.86	0.89	0.90	0.90	0.90	0.91	0.91	0.92	0.92	0.92	0.92	0.91
a [-]:	0.22	0.28	0.31	0.31	0.33	0.34	0.34	0.34	0.35	0.35	0.35	0.36	0.36	0.36	0.35
Lambda [-]:	3.25	3.69	4.00	4.25	4.57	4.86	5.07	5.24	5.44	5.61	5.76	5.88	5.99	6.09	6.18
P = QxN [W]:	0.12	0.28	0.51	0.81	1.16	1.58	2.07	2.62	3.23	3.90	4.64	5.44	6.30	7.23	8.22
P with Ct [W]:	0.62	1.08	1.66	2.40	3.06	3.80	4.77	5.90	7.02	8.28	9.72	11.39	13.25	15.33	17.62
Cp real [-]:	0.10	0.15	0.18	0.20	0.23	0.25	0.26	0.26	0.27	0.28	0.28	0.28	0.28	0.28	0.28
Cp with Ct [-]:	0.54	0.58	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	3.01	3.58	4.15	4.72	5.27	5.78	6.29	6.80	7.30	7.78	8.278.78		9.29	9.80	10.30
fax [N]:	0.14	0.25	0.36	0.48	0.60	0.72	0.86	1.01	1.15	1.30	1.471.64		1.81	1.99	2.16
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	849	1129	1410	1690	1971	2252	2532	2813	3093	3374	3655	3935	4216	4496	4777
Ct [-]:	0.51	0.66	0.71	0.73	0.73	0.74	0.74	0.74	0.73	0.73	0.73	0.72	0.71	0.70	0.69
a [-]:	0.15	0.21	0.23	0.24	0.24	0.24	0.25	0.24	0.24	0.24	0.24	0.24	0.23	0.23	0.22
Lambda [-]:	3.66	4.09	4.41	4.65	4.86	5.06	5.23	5.37	5.51	5.63	5.74	5.82	5.89	5.96	6.02
P = QxN [W]:	0.12	0.28	0.51	0.81	1.16	1.58	2.07	2.62	3.23	3.90	4.64	5.44	6.30	7.23	8.22
P with Ct [W]:	0.35	0.71	1.16	1.72	2.39	3.17	4.10	5.17	6.37	7.69	9.25	11.00	12.93	15.04	17.31
Cp real [-]:	0.15	0.21	0.24	0.26	0.27	0.28	0.28	0.28	0.28	0.28	0.28	0.27	0.27	0.26	0.26
Cp with Ct [-]:	0.43	0.52	0.55	0.55	0.55	0.56	0.56	0.56	0.56	0.56	0.55	0.55	0.55	0.54	0.54
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	3.07	3.63	4.18	4.74	5.36	6.00	6.51	7.01	7.52	8.03	8.589.13		9.68	10.23	10.78
fax [N]:	0.10	0.20	0.30	0.40	0.50	0.60	0.72	0.84	0.96	1.07	1.191.31		1.43	1.55	1.66
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	849	1129	1410	1690	1971	2252	2532	2813	3093	3374	3655	3935	4216	4496	4777
Ct [-]:	0.36	0.51	0.58	0.60	0.59	0.56	0.58	0.58	0.58	0.56	0.55	0.53	0.52	0.50	0.49
a [-]:	0.10	0.15	0.17	0.18	0.18	0.17	0.17	0.18	0.17	0.17	0.16	0.16	0.15	0.15	0.14
Lambda [-]:	3.59	4.04	4.38	4.63	4.78	4.87	5.05	5.21	5.34	5.45	5.53	5.60	5.66	5.71	5.76
P = QxN [W]:	0.12	0.28	0.51	0.81	1.16	1.58	2.07	2.62	3.23	3.90	4.64	5.44	6.30	7.23	8.22
P with Ct [W]:	0.28	0.61	1.03	1.53	2.18	2.98	3.86	4.85	5.95	7.14	8.53	10.05	11.70	13.48	15.39
Cp real [-]:	0.14	0.20	0.24	0.26	0.26	0.25	0.25	0.26	0.26	0.26	0.25	0.24	0.24	0.23	0.22
Cp with Ct [-]:	0.33	0.44	0.48	0.49	0.48	0.47	0.48	0.48	0.48	0.47	0.46	0.45	0.44	0.43	0.42
generator:	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d	1.0r0d
pitch [dg]:	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	2.75	3.53	4.31	5.08	5.72	6.38	7.04	7.56	8.13	8.82	9.5110.20		10.89	11.58	12.27
fax [N]:	0.09	0.17	0.26	0.34	0.42	0.51	0.61	0.71	0.81	0.90	1.001.09		1.18	1.28	1.37
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	849	1129	1410	1690	1971	2252	2532	2813	3093	3374	3655	3935	4216	4496	4777
Ct [-]:	0.41	0.47	0.47	0.45	0.44	0.43	0.42	0.42	0.42	0.42	0.39	0.37	0.36	0.34	0.31
a [-]:	0.12	0.14	0.14	0.13	0.13	0.12	0.12	0.12	0.12	0.12	0.11	0.10	0.10	0.09	0.08
Lambda [-]:	4.01	4.15	4.25	4.32	4.48	4.58	4.67	4.83	4.94	4.97	4.99	5.01	5.03	5.04	5.06
P = QxN [W]:	0.12	0.28	0.51	0.81	1.16	1.58	2.07	2.62	3.23	3.90	4.64	5.44	6.30	7.23	8.22
P with Ct [W]:	0.22	0.53	0.96	1.50	2.12	2.88	3.77	4.73	5.81	7.09	8.49	10.03	11.69	13.49	15.41
Cp real [-]:	0.19	0.22	0.22	0.21	0.21	0.21	0.20	0.21	0.20	0.19	0.18	0.17	0.17	0.16	0.15
Cp with Ct [-]:	0.36	0.41	0.40	0.39	0.39	0.38	0.37	0.37	0.37	0.35	0.34	0.32	0.31	0.29	0.28

Source file: tkarakter Cp Ct.xls

Table H.10: characteristics of turbines with 1.0R5d in an offshore boundary layer in Nov.

generator:	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d
pitch [dg]:	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	5.01	5.88	6.54	7.31	8.10	8.62	9.14	9.66	10.18	10.70	11.22	11.74	12.26	12.78	13.31
fax [N]:	0.77	1.09	1.39	1.70	2.01	2.31	2.60	2.90	3.19	3.49	3.79	4.08	4.38	4.67	4.97
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	2530	2836	3142	3449	3755	4061	4367	4673	4980	5286	5592	5898	6204	6511	6817
Ct [-]:	1.04	1.07	1.10	1.08	1.04	1.05	1.06	1.05	1.05	1.03	1.02	1.00	0.99	0.97	0.95
a [-]:	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.44	0.41	0.39
Lambda [-]:	6.56	6.26	6.24	6.13	6.02	6.12	6.20	6.28	6.35	6.41	6.47	6.52	6.57	6.61	6.65
P = QxN [W]:	0.35	0.71	1.15	1.65	2.22	2.86	3.57	4.35	5.19	6.11	7.10	8.15	9.28	10.47	11.74
P with Ct [W]:	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	29.82	35.02	40.26
Cp real [-]:	0.09	0.12	0.14	0.14	0.14	0.15	0.16	0.16	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Cp with Ct [-]:	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.55	0.57	0.58
generator:	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d
pitch [dg]:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	4.56	5.40	6.00	6.67	7.29	7.85	8.42	8.98	9.54	10.11	10.67	11.23	11.80	12.36	12.93
fax [N]:	0.53	0.76	0.99	1.20	1.42	1.64	1.87	2.09	2.32	2.55	2.77	3.00	3.22	3.45	3.68
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	2530	2836	3142	3449	3755	4061	4367	4673	4980	5286	5592	5898	6204	6511	6817
Ct [-]:	0.87	0.88	0.93	0.91	0.90	0.90	0.89	0.88	0.86	0.85	0.83	0.81	0.79	0.77	0.75
a [-]:	0.32	0.33	0.37	0.35	0.35	0.34	0.34	0.33	0.32	0.30	0.29	0.28	0.27	0.26	0.25
Lambda [-]:	7.20	6.82	6.80	6.71	6.69	6.72	6.74	6.76	6.78	6.79	6.80	6.82	6.83	6.84	6.85
P = QxN [W]:	0.35	0.71	1.15	1.65	2.22	2.86	3.57	4.35	5.19	6.11	7.10	8.15	9.28	10.47	11.74
P with Ct [W]:	1.65	2.75	3.73	5.18	6.76	8.45	10.41	12.64	15.15	17.92	20.96	24.26	27.82	31.63	35.71
Cp real [-]:	0.13	0.15	0.18	0.19	0.19	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.19	0.19	0.18
Cp with Ct [-]:	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.58	0.57	0.56
generator:	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d
pitch [dg]:	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	4.57	5.38	6.05	6.71	7.34	7.94	8.46	8.98	9.51	10.03	10.55	11.08	11.60	12.12	12.65
fax [N]:	0.40	0.57	0.74	0.91	1.09	1.26	1.44	1.63	1.81	2.00	2.18	2.36	2.55	2.73	2.91
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	2530	2836	3142	3449	3755	4061	4367	4673	4980	5286	5592	5898	6204	6511	6817
Ct [-]:	0.64	0.67	0.69	0.69	0.68	0.68	0.68	0.68	0.68	0.67	0.66	0.65	0.64	0.63	0.62
a [-]:	0.20	0.21	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.21	0.21	0.21	0.20	0.20	0.19
Lambda [-]:	7.19	6.84	6.75	6.68	6.64	6.64	6.70	6.76	6.80	6.84	6.88	6.91	6.95	6.97	7.00
P = QxN [W]:	0.35	0.71	1.15	1.65	2.22	2.86	3.57	4.35	5.19	6.11	7.10	8.15	9.28	10.47	11.74
P with Ct [W]:	1.44	2.42	3.50	4.77	6.23	7.84	9.54	11.42	13.48	15.73	18.17	20.79	23.61	26.62	29.82
Cp real [-]:	0.12	0.16	0.18	0.19	0.19	0.19	0.20	0.20	0.21	0.21	0.20	0.20	0.20	0.20	0.20
Cp with Ct [-]:	0.51	0.53	0.54	0.54	0.53	0.53	0.53	0.53	0.53	0.53	0.52	0.52	0.51	0.51	0.50
generator:	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d
pitch [dg]:	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	5.02	5.92	6.57	7.20	7.83	8.50	9.16	9.81	10.46	11.12	11.77	12.43	13.08	13.73	14.39
fax [N]:	0.30	0.43	0.56	0.69	0.83	0.96	1.11	1.27	1.43	1.58	1.74	1.90	2.05	2.21	2.37
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	2530	2836	3142	3449	3755	4061	4367	4673	4980	5286	5592	5898	6204	6511	6817
Ct [-]:	0.40	0.42	0.44	0.45	0.46	0.45	0.45	0.45	0.44	0.43	0.43	0.42	0.41	0.40	0.39
a [-]:	0.11	0.12	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.11	0.11	0.11
Lambda [-]:	6.55	6.22	6.21	6.22	6.23	6.20	6.19	6.19	6.18	6.17	6.17	6.16	6.16	6.16	6.15
P = QxN [W]:	0.35	0.71	1.15	1.65	2.22	2.86	3.57	4.35	5.19	6.11	7.10	8.15	9.28	10.47	11.74
P with Ct [W]:	1.33	2.25	3.23	4.35	5.62	7.08	8.87	10.86	13.04	15.41	17.99	20.77	23.76	26.94	30.33
Cp real [-]:	0.09	0.12	0.14	0.15	0.16	0.16	0.16	0.16	0.15	0.15	0.15	0.14	0.14	0.14	0.13
Cp with Ct [-]:	0.36	0.37	0.39	0.40	0.40	0.39	0.39	0.39	0.39	0.38	0.37	0.37	0.36	0.35	0.35
generator:	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d	1.0r5d
pitch [dg]:	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
macro:	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl	Nv3bl
Ugen [V]:	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
wind [m/s]:	5.42	6.35	7.19	7.84	8.59	9.36	10.13	10.91	11.68	12.45	13.23	14.00	14.77	15.55	16.32
fax [N]:	0.28	0.39	0.49	0.62	0.73	0.85	0.96	1.07	1.19	1.30	1.42	1.53	1.64	1.76	1.87
torque [mNm]:	1.32	2.40	3.48	4.56	5.64	6.72	7.80	8.88	9.96	11.04	12.12	13.20	14.28	15.36	16.44
speed [rpm]:	2530	2836	3142	3449	3755	4061	4367	4673	4980	5286	5592	5898	6204	6511	6817
Ct [-]:	0.32	0.33	0.32	0.34	0.34	0.33	0.32	0.31	0.30	0.28	0.27	0.26	0.26	0.25	0.24
a [-]:	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.06
Lambda [-]:	6.06	5.80	5.68	5.71	5.68	5.63	5.60	5.56	5.54	5.51	5.49	5.47	5.45	5.44	5.42
P = QxN [W]:	0.35	0.71	1.15	1.65	2.22	2.86	3.57	4.35	5.19	6.11	7.10	8.15	9.28	10.47	11.74
P with Ct [W]:	1.37	2.25	3.23	4.37	5.70	7.20	8.88	10.73	12.75	14.96	17.33	19.88	22.61	25.51	28.59
Cp real [-]:	0.07	0.09	0.10	0.12	0.12	0.12	0.12	0.11	0.11	0.11	0.10	0.10	0.10	0.09	0.09
Cp with Ct [-]:	0.29	0.30	0.29	0.31	0.31	0.30	0.29	0.28	0.27	0.26	0.25	0.25	0.24	0.23	0.22

Source file: tkarakter Cp Ct.xls

Appendix I: Wind Speed in the Tunnel versus the Field

Due to the continuity of the flow in the tunnel the increase of the wind speed besides the decreased flow amounts:

$$\Delta u = \frac{A_w}{A_t} \Delta w \quad (\text{I.1})$$

In which A_w is the area of the decreased flow, A_t is the area besides that and Δw is the wind speed decrease. In case of 3 turbines in a row, A_w appears to amount up to about 3 times 4 rotor areas $\approx 0.6 \text{ m}^2$ for the measurements. Assuming that the increase of speed is limited to the area enclosed by the boundary layers of the floor, walls and ceiling, we estimate that $A_t \approx 1.6 \cdot 2.6 - 0.6 \approx 3.6 \text{ m}^2$. From the measurements it can be seen that the measured $\Delta w \approx 2 \text{ m/s}$. Using (I.1) we find $\Delta u \approx 0.33 \text{ m/s}$.

The amount of additional pressure Δp over the row of turbines follows from the relation of Bernoulli:

$$\Delta p = \frac{1}{2} \rho (U_a + \Delta u)^2 - \frac{1}{2} \rho U_a^2 \approx \rho U_a \cdot \Delta u \quad (\text{I.2})$$

In which the density of the air $\rho \approx 1.2 \text{ kg/m}^3$. Filling in values in (I.2) we find $\Delta p \approx 3.2 \text{ Pa}$. This additional drop of pressure causes an additional recovery of decreased wind speeds that does not occur in the field. The additional recovery follows by the relation of Bernoulli as well:

$$\Delta p = \frac{1}{2} \rho (U_a - \Delta w)^2 - \frac{1}{2} \rho (U_a - \Delta w_f)^2 \quad (\text{I.3})$$

It follows that the speed of the wake in the field $U_a - \Delta w_f \approx 5.5 \text{ m/s}$. That is approximately 8 % lower than the comparable speed in the tunnel ($U_a - \Delta w \approx 6 \text{ m/s}$).

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Abstract

The project "Turbine Interaction in Large Offshore Wind Farms" aims at the development of a model to quantify the effects of large wind farms on the atmospheric boundary layer. The actual model and the validation are reported in ECN paper ECN-C-04-033. This reports describes the measurements that were set up for the validation in detail.

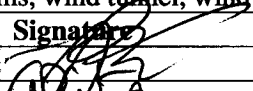
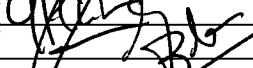
The validation was carried out in the atmospheric boundary layer wind tunnel of TNO in Apeldoorn, The Netherlands. This tunnel of 3 metres width and 2 metres height models the boundary layer at a scale of approximately 1:400. ECN had to develop models of wind turbines on a scale of 1:400 with characteristics very similar to those of 100m full-scale commercial wind turbines. The turbines were designed with great care.

Using the model turbines large model wind farms of different dimensions are placed in the wind tunnel. Scaled boundary layers were created for onshore and offshore situations by placing standard tunnel barriers far upstream in the tunnel. We measured the influence on the wind speed and turbulence around large wind farms. Reference measurements in the scaled boundary layers in absence of a farm are included. We measured many farm characteristics for several different layouts. The measurements were carried out in two campaigns. The first campaign of May 2003 was already very successful. We learned much from this campaign and further improved the turbines and the measurement system for our second campaign in November 2003.

The tunnel measurements showed to be of great value to increase understanding of the behaviour of wind farms. The measurements turned out to be of such value thanks to the accurate and therefore representative design of the turbines. For this reason many more measurements with the same farm are foreseen.

Keywords

atmospheric boundary layer, wind energy, wind farms, wind tunnel, wind turbines

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