# PARK - Main Result

## Calculation: AEP_Enercon_Normal

### Setup

AEP scaled to a full year based on number of samples
Scaling factor from 31.0 years to 1 year: 0.032

Calculation performed in UTM (north)-WGS84 Zone: 32
At the site centre the difference between grid north and true north is: 0.6°

### Wake

Wake Model: N.O. Jensen (RISØ/EMD) Park 2 2018

Wake decay constant

Wake decay constant: 0.085 Mixed farmland Hub height dependent
Reference WTG: 01_ENERCON E-147 EP5 E2 5000 147.0 !O! hub: 126.0 m (TOT: 199.5 m) (12)

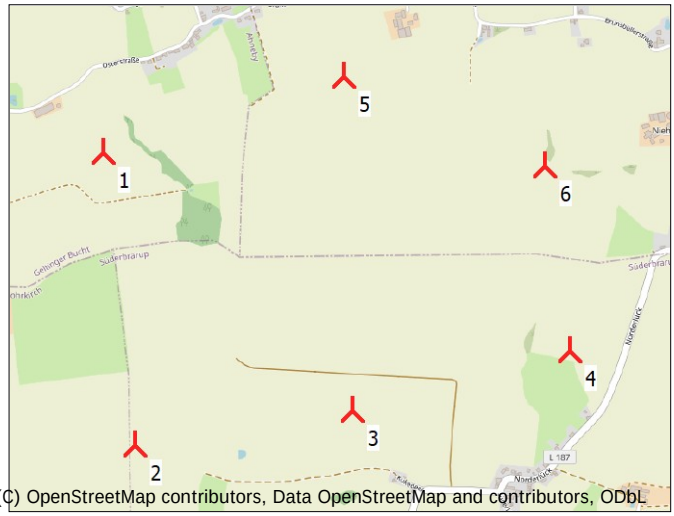
### Scaler / wind data

| | |
|---|---|
| Name | EMD Default Measurement Mast Scaler |
| Terrain scaling | Measured Data Scaling (WAsP Stability / A-Parameter) |
| Micro terrain flow model | WAsP IBZ from Site Data |
| Used period | 1/1/1994 1:00:00 AM - 1/1/2025 |
| Meteo object(s) | MCP LT - MCP session (1) - [Neural Network] (3), 125.00m - MCP LT - MCP session (1) - [Neural Network] |
| Displacement height | Omnidirectional from objects |
| WAsP version | WAsP 11 Version 11.04.0026 |

### Power correction

Power curve correction (adjusted IEC method, improved to match turbine control)

| | | Min | Max | Avg | Corr. [%] | Neg. corr. [%] | Pos. corr. [%] |
|---|---|---|---|---|---|---|---|
| Air density | | | | | | | |
| From air density settings | [°C] | 7.6 | 7.6 | 7.6 | | | |
| From air density settings | [hPa] | 990.6 | 990.6 | 990.6 | | | |
| Resulting air density | [kg/m³] | 1.229 | 1.229 | 1.229 | | | |
| Relative to 15°C at sea level | [%] | 100.4 | 100.4 | 100.4 | 0.2 | 0.0 | 0.2 |




Scale 1:25,000

New WTG

## Calculated Annual Energy for Wind Farm

| WTG combination | Result PARK | Result-10.0% | GROSS (no loss) Free WTGs | Wake loss | Specific results¤) Capacity factor | Mean WTG result | Full load hours | Wind speed free | wake reduced |
|---|---|---|---|---|---|---|---|---|---|
| | [MWh/y] | [MWh/y] | [MWh/y] | [%] | [%] | [MWh/y] | [Hours/year] | [m/s] | [m/s] |
| Wind farm | 92,757.7 | 83,481.9 | 97,246.7 | 4.6 | 31.7 | 13,913.7 | 2,783 | 7.0 | 6.9 |

¤) Based on Result-10.0%

## Calculated Annual Energy for each of 6 new WTGs with total 30.0 MW rated power

| | WTG type Valid | Manufact. | Type-generator | Power, rated [kW] | Rotor diameter [m] | Hub height [m] | Power curve Creator | Name | Annual Energy Result [MWh/y] | Result-10.0% [MWh/y] | Wake loss [%] | Wind speed free [m/s] | reduced [m/s] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | No | ENERCON | E-147 EP5 E2-5,000 | 5,000 | 147.0 | 126.0 | USER | Mode 00 - OM 0 s - 5000 kW | 15,755.5 | 14,180 | 3.1 | 7.03 | 6.93 |
| 2 | No | ENERCON | E-147 EP5 E2-5,000 | 5,000 | 147.0 | 126.0 | USER | Mode 00 - OM 0 s - 5000 kW | 15,887.8 | 14,299 | 2.3 | 7.03 | 6.95 |
| 3 | No | ENERCON | E-147 EP5 E2-5,000 | 5,000 | 147.0 | 126.0 | USER | Mode 00 - OM 0 s - 5000 kW | 15,388.1 | 13,849 | 4.7 | 7.00 | 6.84 |
| 4 | No | ENERCON | E-147 EP5 E2-5,000 | 5,000 | 147.0 | 126.0 | USER | Mode 00 - OM 0 s - 5000 kW | 15,304.4 | 13,774 | 5.0 | 7.00 | 6.82 |
| 5 | No | ENERCON | E-147 EP5 E2-5,000 | 5,000 | 147.0 | 126.0 | USER | Mode 00 - OM 0 s - 5000 kW | 15,226.7 | 13,704 | 5.6 | 7.00 | 6.81 |
| 6 | No | ENERCON | E-147 EP5 E2-5,000 | 5,000 | 147.0 | 126.0 | USER | Mode 00 - OM 0 s - 5000 kW | 15,195.2 | 13,676 | 7.1 | 7.05 | 6.80 |

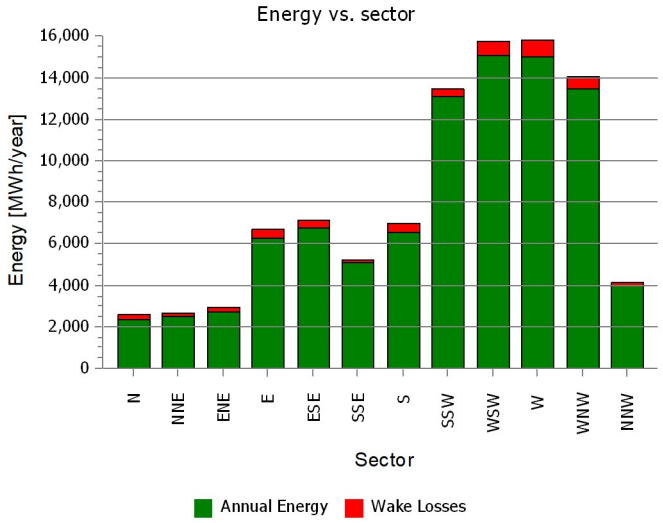
## WTG siting

| | UTM (north)-ETRS89 Zone: 32 Easting | Northing | Z [m] | Row data/Description | Calculation period Start | End |
|---|---|---|---|---|---|---|
| 1 | New | 547,702 | 6,061,711 | 60.0 01_ENERCON E-147 EP5 E2 5000 147.0 !O! hub: 126.0 m (TOT: 199.5 m) (12) | 1/1/1994 | 1/1/2025 |
| 2 | New | 547,819 | 6,060,747 | 60.0 02_ENERCON E-147 EP5 E2 5000 147.0 !O! hub: 126.0 m (TOT: 199.5 m) (13) | 1/1/1994 | 1/1/2025 |
| 3 | New | 548,537 | 6,060,868 | 60.0 03_ENERCON E-147 EP5 E2 5000 147.0 !O! hub: 126.0 m (TOT: 199.5 m) (14) | 1/1/1994 | 1/1/2025 |
| 4 | New | 549,253 | 6,061,072 | 60.0 E04_NERCON E-147 EP5 E2 5000 147.0 !O! hub: 126.0 m (TOT: 199.5 m) (15) | 1/1/1994 | 1/1/2025 |
| 5 | New | 548,497 | 6,061,973 | 60.0 05_ENERCON E-147 EP5 E2 5000 147.0 !O! hub: 126.0 m (TOT: 199.5 m) (16) | 1/1/1994 | 1/1/2025 |
| 6 | New | 549,164 | 6,061,683 | 60.0 06_ENERCON E-147 EP5 E2 5000 147.0 !O! hub: 126.0 m (TOT: 199.5 m) (17) | 1/1/1994 | 1/1/2025 |

# PARK - Production Analysis

## Calculation: AEP_Enercon_Normal WTG: All new WTGs, Air density 1.229 kg/m³
## Directional Analysis

| Sector | | 0 N | 1 NNE | 2 ENE | 3 E | 4 ESE | 5 SSE | 6 S | 7 SSW | 8 WSW | 9 W | 10 WNW | 11 NNW | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model based energy | [MWh] | 2,564.3 | 2,612.0 | 2,964.6 | 6,653.4 | 7,140.4 | 5,246.6 | 6,948.5 | 13,415.0 | 15,712.9 | 15,802.3 | 14,034.3 | 4,152.3 | 97,246.7 |
| -Decrease due to wake losses | [MWh] | 195.3 | 95.8 | 221.7 | 434.2 | 374.2 | 189.1 | 407.4 | 339.1 | 660.7 | 830.3 | 592.7 | 148.4 | 4,489.0 |
| Resulting energy | [MWh] | 2,369.0 | 2,516.2 | 2,743.0 | 6,219.2 | 6,766.2 | 5,057.5 | 6,541.1 | 13,075.8 | 15,052.2 | 14,972.1 | 13,441.5 | 4,004.0 | 92,757.7 |
| Specific energy | [kWh/m²] | | | | | | | | | | | | | 911 |
| Specific energy | [kWh/kW] | | | | | | | | | | | | | 3,092 |
| Decrease due to wake losses | [%] | 7.6 | 3.7 | 7.5 | 6.5 | 5.2 | 3.6 | 5.9 | 2.5 | 4.2 | 5.3 | 4.2 | 3.6 | 4.62 |
| Full Load Equivalent | [Hours/year] | 79 | 84 | 91 | 207 | 226 | 169 | 218 | 436 | 502 | 499 | 448 | 133 | 3,092 |



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# PARK - Power Curve Analysis

## Calculation: AEP_Enercon_Normal WTG: 1 - ENERCON E-147 EP5 E2 5000 147.0 !O!, Hub height: 126.0 m

Name: Mode 00 - OM 0 s - 5000 kW
Source: ENERCON GmbH

| Source/Date | Created by | Created | Edited | Stop wind speed [m/s] | Power control | CT curve type | Generator type | Specific power kW/m² |
|---|---|---|---|---|---|---|---|---|
| 8/1/2019 | USER | 2/10/2020 | 2/25/2020 | 25.0 | Pitch | User defined | Variable | 0.29 |

D0802432-3_#_de_#_Datenblatt_Betriebsmodus_E-147_EP5_E2___5000_kW_mit_TES.pdf
Enercon reserves the right to change the above specifications without prior notice.

## HP curve comparison - Note: For standard air density

| Vmean | [m/s] | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|
| HP value Pitch, variable speed (2013) | [MWh] | 8,581 | 13,010 | 17,262 | 21,030 | 24,193 | 26,713 |
| ENERCON E-147 EP5 E2 5000 147.0 !O! Mode 00 - OM 0 s - 5000 kW | [MWh] | 8,091 | 12,179 | 16,183 | 19,811 | 22,914 | 25,414 |
| Check value | [%] | 6 | 7 | 7 | 6 | 6 | 5 |

The table shows comparison between annual energy production calculated on basis of simplified "HP-curves" which assume that all WTGs performs quite similar - only specific power loading (kW/m^2) and single/dual speed or stall/pitch decides the calculated values. Productions are without wake losses.
For further details, ask at the Danish Energy Agency for project report J.nr. 51171/00-0016 or see the windPRO manual.
The method is refined in EMD report "20 Detailed Case Studies comparing Project Design Calculations and actual Energy Productions for Wind Energy Projects worldwide", jan 2003.
Use the table to evaluate if the given power curve is reasonable - if the check value are lower than -5%, the power curve probably is too optimistic due to uncertainty in power curve measurement.

## Power curve

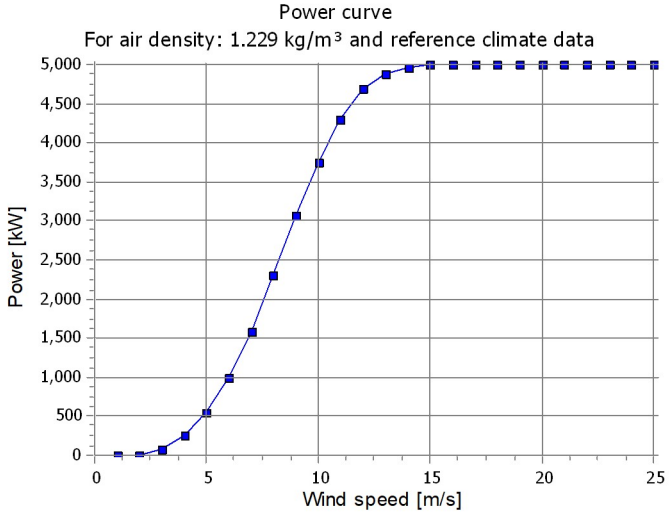
Original data, Air density: 1.225 kg/m³

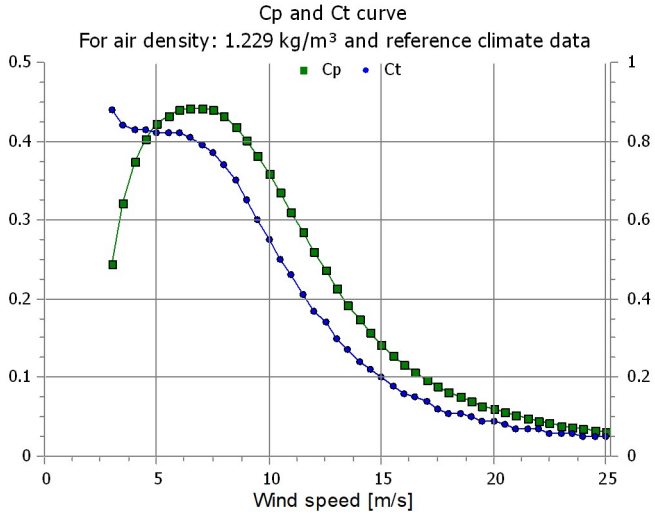
| Wind speed [m/s] | Power [kW] | Cp | Wind speed [m/s] | Ct curve |
|---|---|---|---|---|
| 3.0 | 68.0 | 0.24 | 3.0 | 0.88 |
| 3.5 | 143.0 | 0.32 | 3.5 | 0.84 |
| 4.0 | 248.0 | 0.37 | 4.0 | 0.83 |
| 4.5 | 382.0 | 0.40 | 4.5 | 0.83 |
| 5.0 | 548.0 | 0.42 | 5.0 | 0.82 |
| 5.5 | 748.0 | 0.43 | 5.5 | 0.82 |
| 6.0 | 986.0 | 0.44 | 6.0 | 0.82 |
| 6.5 | 1,263.0 | 0.44 | 6.5 | 0.81 |
| 7.0 | 1,578.0 | 0.44 | 7.0 | 0.79 |
| 7.5 | 1,926.0 | 0.44 | 7.5 | 0.77 |
| 8.0 | 2,297.0 | 0.43 | 8.0 | 0.74 |
| 8.5 | 2,676.0 | 0.42 | 8.5 | 0.70 |
| 9.0 | 3,050.0 | 0.40 | 9.0 | 0.65 |
| 9.5 | 3,406.0 | 0.38 | 9.5 | 0.60 |
| 10.0 | 3,736.0 | 0.36 | 10.0 | 0.55 |
| 10.5 | 4,036.0 | 0.34 | 10.5 | 0.50 |
| 11.0 | 4,297.0 | 0.31 | 11.0 | 0.46 |
| 11.5 | 4,514.0 | 0.29 | 11.5 | 0.41 |
| 12.0 | 4,682.0 | 0.26 | 12.0 | 0.37 |
| 12.5 | 4,804.0 | 0.24 | 12.5 | 0.34 |
| 13.0 | 4,886.0 | 0.21 | 13.0 | 0.30 |
| 13.5 | 4,937.0 | 0.19 | 13.5 | 0.27 |
| 14.0 | 4,967.0 | 0.17 | 14.0 | 0.24 |
| 14.5 | 4,984.0 | 0.16 | 14.5 | 0.22 |
| 15.0 | 4,993.0 | 0.14 | 15.0 | 0.20 |
| 15.5 | 4,997.0 | 0.13 | 15.5 | 0.18 |
| 16.0 | 4,999.0 | 0.12 | 16.0 | 0.16 |
| 16.5 | 5,000.0 | 0.11 | 16.5 | 0.15 |
| 17.0 | 5,000.0 | 0.10 | 17.0 | 0.14 |
| 17.5 | 5,000.0 | 0.09 | 17.5 | 0.12 |
| 18.0 | 5,000.0 | 0.08 | 18.0 | 0.11 |
| 18.5 | 5,000.0 | 0.08 | 18.5 | 0.11 |
| 19.0 | 5,000.0 | 0.07 | 19.0 | 0.10 |
| 19.5 | 5,000.0 | 0.06 | 19.5 | 0.09 |
| 20.0 | 5,000.0 | 0.06 | 20.0 | 0.09 |
| 20.5 | 5,000.0 | 0.06 | 20.5 | 0.08 |
| 21.0 | 5,000.0 | 0.05 | 21.0 | 0.07 |
| 21.5 | 5,000.0 | 0.05 | 21.5 | 0.07 |
| 22.0 | 5,000.0 | 0.05 | 22.0 | 0.07 |
| 22.5 | 5,000.0 | 0.04 | 22.5 | 0.06 |
| 23.0 | 5,000.0 | 0.04 | 23.0 | 0.06 |
| 23.5 | 5,000.0 | 0.04 | 23.5 | 0.06 |
| 24.0 | 5,000.0 | 0.03 | 24.0 | 0.05 |
| 24.5 | 5,000.0 | 0.03 | 24.5 | 0.05 |
| 25.0 | 5,000.0 | 0.03 | 25.0 | 0.05 |

## Power and efficiency vs. wind speed

Data used in calculation, Mean air density: 1.229 kg/m³

| Wind speed [m/s] | Power [kW] | Cp |
|---|---|---|
| 1.0 | 0.0 | 0.00 |
| 2.0 | 0.0 | 0.00 |
| 3.0 | 68.5 | 0.24 |
| 4.0 | 249.2 | 0.37 |
| 5.0 | 550.3 | 0.42 |
| 6.0 | 989.8 | 0.44 |
| 7.0 | 1,583.5 | 0.44 |
| 8.0 | 2,303.9 | 0.43 |
| 9.0 | 3,057.7 | 0.40 |
| 10.0 | 3,744.1 | 0.36 |
| 11.0 | 4,304.2 | 0.31 |
| 12.0 | 4,686.8 | 0.26 |
| 13.0 | 4,888.1 | 0.21 |
| 14.0 | 4,967.7 | 0.17 |
| 15.0 | 4,993.2 | 0.14 |
| 16.0 | 4,999.0 | 0.12 |
| 17.0 | 5,000.0 | 0.10 |
| 18.0 | 5,000.0 | 0.08 |
| 19.0 | 5,000.0 | 0.07 |
| 20.0 | 5,000.0 | 0.06 |
| 21.0 | 5,000.0 | 0.05 |
| 22.0 | 5,000.0 | 0.05 |
| 23.0 | 5,000.0 | 0.04 |
| 24.0 | 5,000.0 | 0.03 |
| 25.0 | 5,000.0 | 0.03 |



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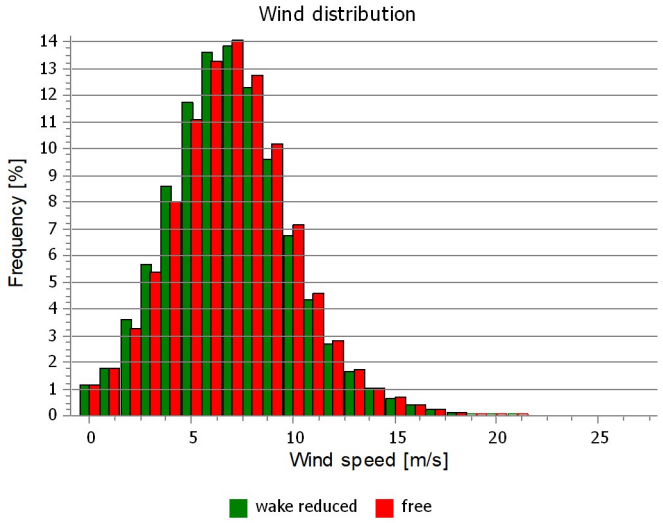
# PARK - Wind Data Analysis

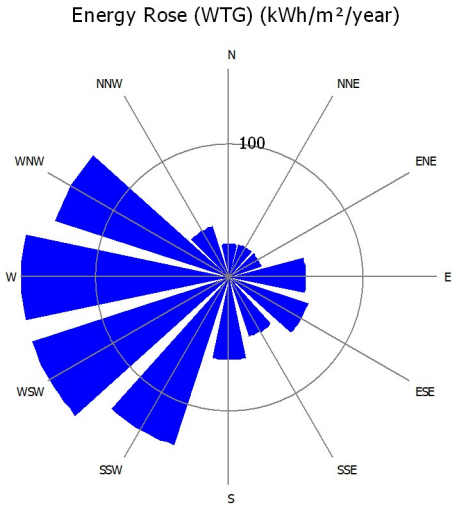
Calculation: AEP_Enercon_Normal  Wind data: 1 - 01_ENERCON E-147 EP5 E2 5000 147.0 !O! hub: 126.0 m (TOT: 199.5 m) (12); Hub height: 126.0

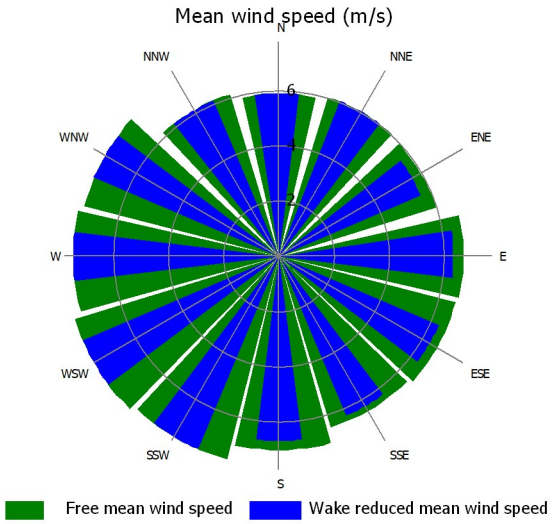
Site coordinates
UTM (north)-ETRS89 Zone: 32
East: 547,702  North: 6,061,711
01_ENERCON E-147 EP5 E2 5000 147.0 !O! hub: 126.0 m (TOT: 199.5 m) (12)
Masts used
Take nearest

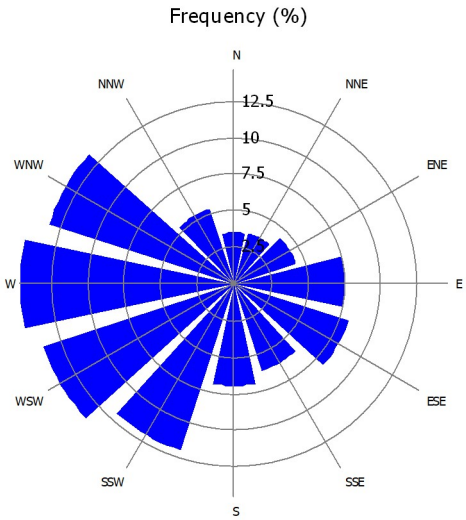
## Winddata for site

| Sector | Free mean wind speed [m/s] | Wake reduced mean wind speed [m/s] | Frequency [%] |
|---|---|---|---|
| 0 N | 5.9 | 5.9 | 3.6 |
| 1 NNE | 6.0 | 6.0 | 3.6 |
| 2 ENE | 6.0 | 5.6 | 4.5 |
| 3 E | 6.7 | 6.3 | 7.6 |
| 4 ESE | 6.6 | 6.3 | 8.3 |
| 5 SSE | 6.5 | 6.3 | 6.2 |
| 6 S | 7.0 | 6.7 | 7.0 |
| 7 SSW | 7.6 | 7.6 | 12.0 |
| 8 WSW | 7.7 | 7.7 | 13.7 |
| 9 W | 7.5 | 7.5 | 14.7 |
| 10 WNW | 7.3 | 7.3 | 13.4 |
| 11 NNW | 6.1 | 6.1 | 5.4 |
| All | 7.0 | 6.9 | 100.0 |



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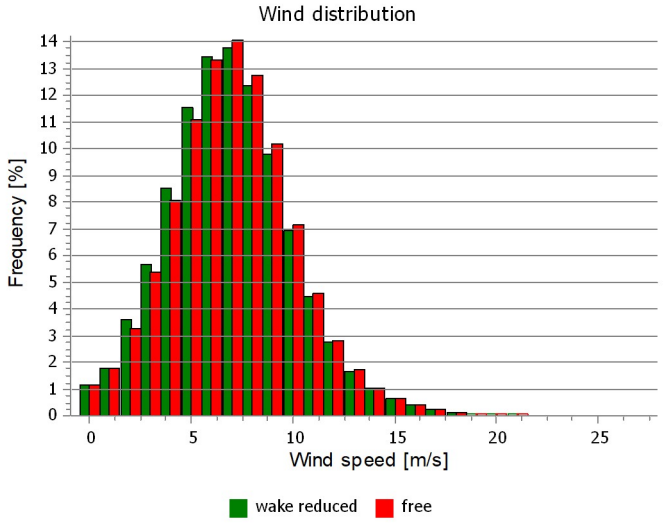
# PARK - Wind Data Analysis

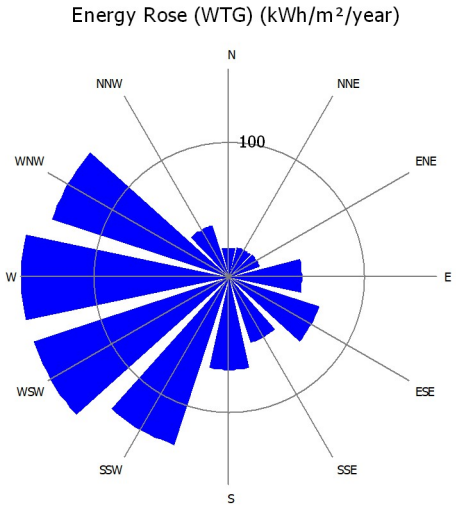
Calculation: AEP_Enercon_Normal  Wind data: 2 - 02_ENERCON E-147 EP5 E2 5000 147.0 !O! hub: 126.0 m (TOT: 199.5 m) (13); Hub height: 126.0

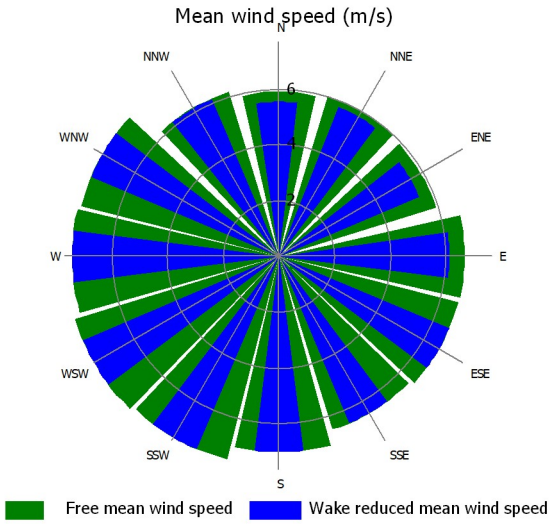
Site coordinates
UTM (north)-ETRS89 Zone: 32
East: 547,819  North: 6,060,747
02_ENERCON E-147 EP5 E2 5000 147.0 !O! hub: 126.0 m (TOT: 199.5 m) (13)
Masts used
Take nearest

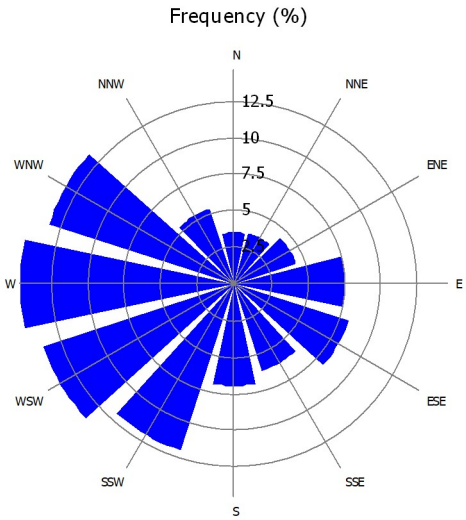
## Winddata for site

| Sector | Free mean wind speed [m/s] | Wake reduced mean wind speed [m/s] | Frequency [%] |
|---|---|---|---|
| 0 N | 5.9 | 5.6 | 3.6 |
| 1 NNE | 6.0 | 5.8 | 3.6 |
| 2 ENE | 5.9 | 5.5 | 4.5 |
| 3 E | 6.7 | 6.1 | 7.6 |
| 4 ESE | 6.7 | 6.7 | 8.3 |
| 5 SSE | 6.5 | 6.5 | 6.2 |
| 6 S | 7.0 | 7.0 | 7.0 |
| 7 SSW | 7.5 | 7.5 | 12.0 |
| 8 WSW | 7.7 | 7.7 | 13.7 |
| 9 W | 7.5 | 7.5 | 14.7 |
| 10 WNW | 7.4 | 7.4 | 13.4 |
| 11 NNW | 6.2 | 6.2 | 5.4 |
| All | 7.0 | 6.9 | 100.0 |



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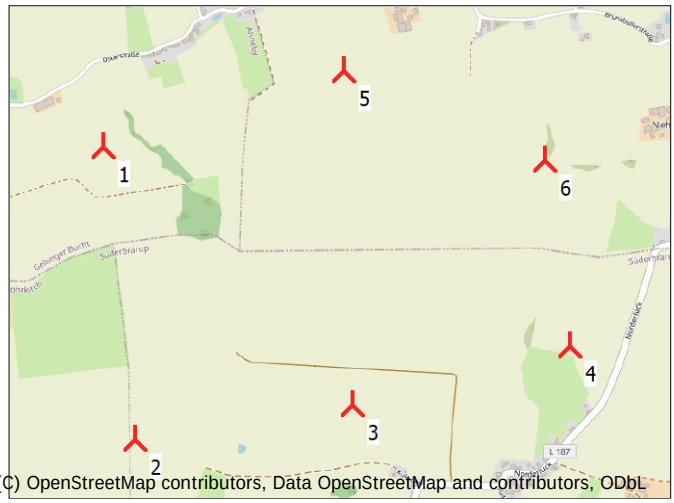
# PARK - WTG distances

## Calculation: AEP_Enercon_Normal

### WTG distances

| | Z [m] | Nearest WTG | Z [m] | Horizontal distance [m] | Distance in rotor diameters |
|---|---|---|---|---|---|
| 1 | 60.0 | 5 | 60.0 | 838 | 5.7 |
| 2 | 60.0 | 3 | 60.0 | 728 | 4.9 |
| 3 | 60.0 | 2 | 60.0 | 728 | 4.9 |
| 4 | 60.0 | 6 | 60.0 | 617 | 4.2 |
| 5 | 60.0 | 6 | 60.0 | 727 | 4.9 |
| 6 | 60.0 | 4 | 60.0 | 617 | 4.2 |
| Min | 60.0 | | 60.0 | 617 | 4.2 |
| Max | 60.0 | | 60.0 | 838 | 5.7 |






Scale 1:25,000

New WTG

# PARK - Time varying AEP

## Calculation: AEP_Enercon_Normal

Windfarm: 30.0 MW based on 6 turbines of type ENERCON E-147 EP5 E2 5000 147.0 !O!.
Selection: All new WTGs
Calculated mean yield per month and hour [MWh]. The result includes wake losses and any curtailment losses.
Values are scaled to a full year, see correction factors at main result page.

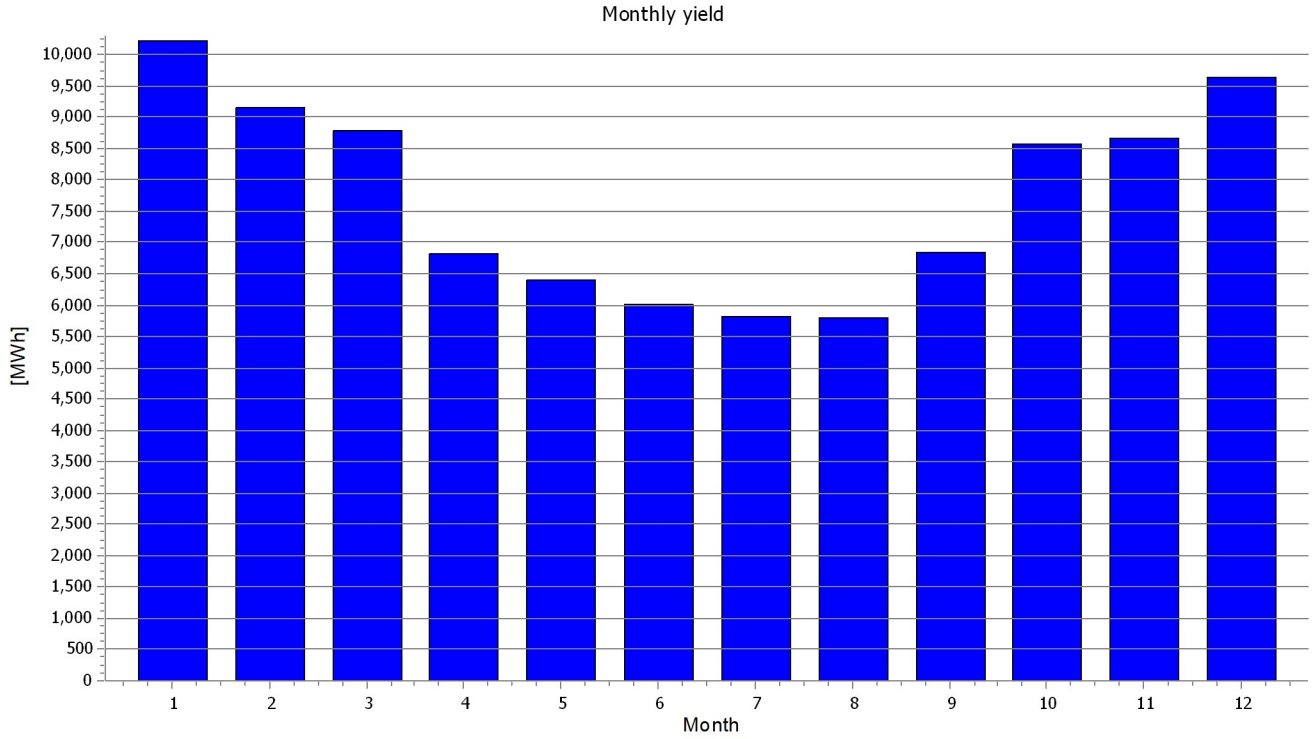
| Hour/Month [MWh] | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 452 | 404 | 389 | 314 | 303 | 277 | 266 | 266 | 310 | 389 | 390 | 427 | 4,187 |
| 1 | 445 | 402 | 389 | 310 | 292 | 267 | 254 | 270 | 299 | 368 | 393 | 421 | 4,110 |
| 2 | 443 | 396 | 385 | 311 | 286 | 264 | 258 | 264 | 299 | 365 | 388 | 433 | 4,094 |
| 3 | 439 | 396 | 372 | 300 | 291 | 254 | 260 | 260 | 294 | 371 | 390 | 417 | 4,045 |
| 4 | 449 | 396 | 378 | 306 | 286 | 258 | 257 | 259 | 300 | 368 | 383 | 423 | 4,061 |
| 5 | 441 | 401 | 375 | 295 | 286 | 257 | 252 | 251 | 297 | 364 | 371 | 426 | 4,015 |
| 6 | 440 | 391 | 369 | 286 | 270 | 240 | 235 | 249 | 290 | 373 | 366 | 418 | 3,928 |
| 7 | 430 | 387 | 367 | 273 | 241 | 233 | 222 | 220 | 271 | 359 | 363 | 410 | 3,777 |
| 8 | 427 | 381 | 341 | 235 | 234 | 222 | 216 | 206 | 259 | 347 | 349 | 398 | 3,616 |
| 9 | 413 | 368 | 330 | 236 | 216 | 222 | 221 | 202 | 239 | 324 | 334 | 391 | 3,495 |
| 10 | 413 | 353 | 331 | 240 | 220 | 226 | 222 | 214 | 264 | 323 | 337 | 383 | 3,525 |
| 11 | 402 | 347 | 331 | 242 | 223 | 222 | 217 | 210 | 252 | 317 | 312 | 373 | 3,447 |
| 12 | 395 | 360 | 339 | 257 | 246 | 246 | 238 | 230 | 273 | 332 | 338 | 379 | 3,633 |
| 13 | 408 | 373 | 361 | 278 | 260 | 262 | 249 | 244 | 294 | 351 | 338 | 382 | 3,799 |
| 14 | 409 | 372 | 372 | 289 | 274 | 277 | 265 | 260 | 285 | 352 | 350 | 382 | 3,886 |
| 15 | 411 | 381 | 375 | 290 | 278 | 277 | 262 | 251 | 294 | 355 | 337 | 383 | 3,893 |
| 16 | 407 | 367 | 362 | 288 | 270 | 265 | 249 | 249 | 283 | 344 | 345 | 382 | 3,810 |
| 17 | 410 | 358 | 351 | 277 | 265 | 258 | 242 | 240 | 278 | 334 | 348 | 391 | 3,752 |
| 18 | 409 | 364 | 357 | 272 | 252 | 241 | 233 | 226 | 271 | 339 | 351 | 394 | 3,709 |
| 19 | 430 | 376 | 364 | 280 | 262 | 238 | 230 | 229 | 274 | 363 | 362 | 391 | 3,799 |
| 20 | 432 | 386 | 381 | 295 | 281 | 232 | 234 | 232 | 283 | 367 | 368 | 404 | 3,894 |
| 21 | 439 | 399 | 395 | 302 | 279 | 255 | 240 | 244 | 301 | 381 | 381 | 405 | 4,021 |
| 22 | 440 | 403 | 398 | 315 | 296 | 259 | 248 | 256 | 300 | 396 | 389 | 418 | 4,117 |
| 23 | 439 | 398 | 387 | 316 | 294 | 264 | 257 | 269 | 322 | 396 | 382 | 418 | 4,143 |
| Grand Total | 10,224 | 9,155 | 8,797 | 6,807 | 6,405 | 6,015 | 5,829 | 5,802 | 6,833 | 8,577 | 8,665 | 9,648 | 92,758 |

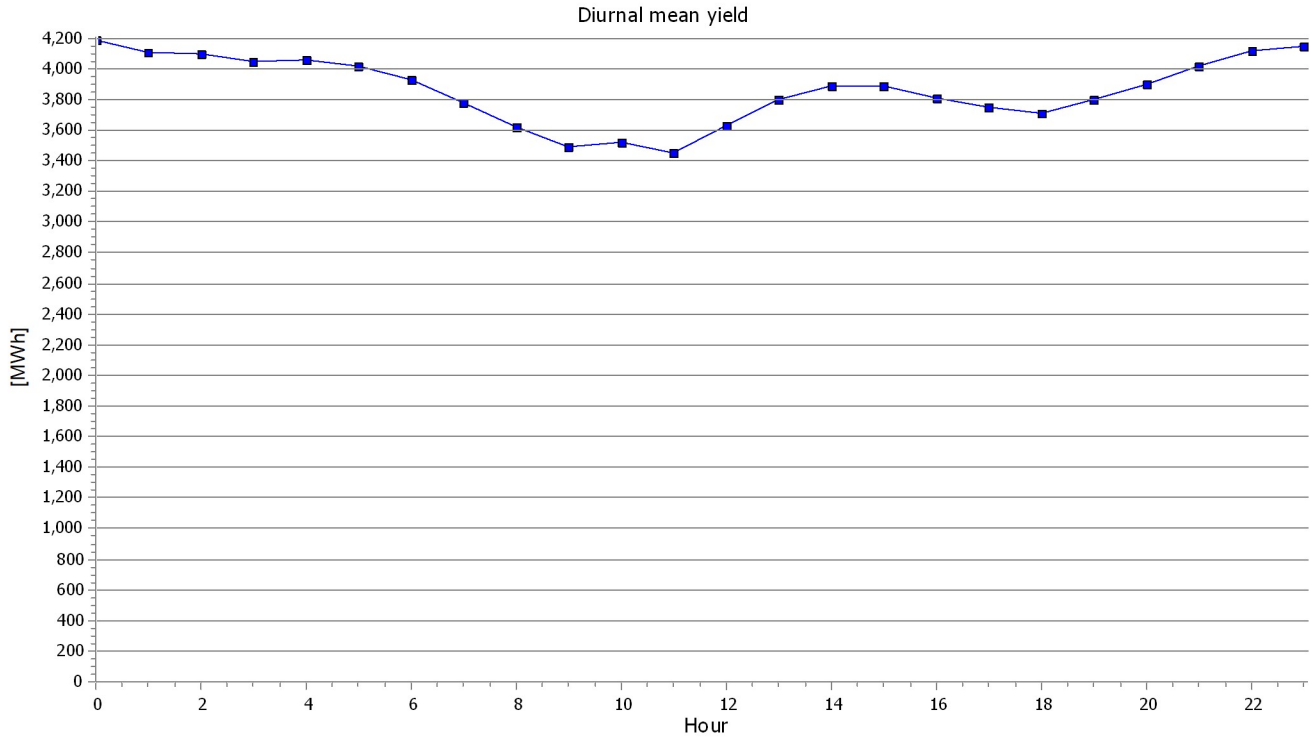
| Hour/Month [MW] | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 14.6 | 14.4 | 12.5 | 10.5 | 9.8 | 9.2 | 8.6 | 8.6 | 10.3 | 12.6 | 13.0 | 13.8 | 11.5 |
| 1 | 14.4 | 14.3 | 12.5 | 10.3 | 9.4 | 8.9 | 8.2 | 8.7 | 10.0 | 11.9 | 13.1 | 13.6 | 11.3 |
| 2 | 14.3 | 14.1 | 12.4 | 10.4 | 9.2 | 8.8 | 8.3 | 8.5 | 10.0 | 11.8 | 12.9 | 14.0 | 11.2 |
| 3 | 14.2 | 14.1 | 12.0 | 10.0 | 9.4 | 8.5 | 8.4 | 8.4 | 9.8 | 12.0 | 13.0 | 13.5 | 11.1 |
| 4 | 14.5 | 14.1 | 12.2 | 10.2 | 9.2 | 8.6 | 8.3 | 8.3 | 10.0 | 11.9 | 12.8 | 13.6 | 11.1 |
| 5 | 14.2 | 14.3 | 12.1 | 9.8 | 9.2 | 8.6 | 8.1 | 8.1 | 9.9 | 11.7 | 12.4 | 13.7 | 11.0 |
| 6 | 14.2 | 14.0 | 11.9 | 9.5 | 8.7 | 8.0 | 7.6 | 8.0 | 9.7 | 12.0 | 12.2 | 13.5 | 10.8 |
| 7 | 13.9 | 13.8 | 11.8 | 9.1 | 7.8 | 7.8 | 7.2 | 7.1 | 9.0 | 11.6 | 12.1 | 13.2 | 10.3 |
| 8 | 13.8 | 13.6 | 11.0 | 7.8 | 7.6 | 7.4 | 7.0 | 6.6 | 8.6 | 11.2 | 11.6 | 12.9 | 9.9 |
| 9 | 13.3 | 13.1 | 10.6 | 7.9 | 7.0 | 7.4 | 7.1 | 6.5 | 8.0 | 10.5 | 11.1 | 12.6 | 9.6 |
| 10 | 13.3 | 12.6 | 10.7 | 8.0 | 7.1 | 7.5 | 7.2 | 6.9 | 8.8 | 10.4 | 11.2 | 12.3 | 9.7 |
| 11 | 13.0 | 12.4 | 10.7 | 8.1 | 7.2 | 7.4 | 7.0 | 6.8 | 8.4 | 10.2 | 10.4 | 12.0 | 9.4 |
| 12 | 12.7 | 12.9 | 10.9 | 8.6 | 7.9 | 8.2 | 7.7 | 7.4 | 9.1 | 10.7 | 11.3 | 12.2 | 10.0 |
| 13 | 13.2 | 13.3 | 11.6 | 9.3 | 8.4 | 8.7 | 8.0 | 7.9 | 9.8 | 11.3 | 11.3 | 12.3 | 10.4 |
| 14 | 13.2 | 13.3 | 12.0 | 9.6 | 8.8 | 9.2 | 8.5 | 8.4 | 9.5 | 11.4 | 11.7 | 12.3 | 10.6 |
| 15 | 13.2 | 13.6 | 12.1 | 9.7 | 9.0 | 9.2 | 8.5 | 8.1 | 9.8 | 11.4 | 11.2 | 12.3 | 10.7 |
| 16 | 13.1 | 13.1 | 11.7 | 9.6 | 8.7 | 8.8 | 8.0 | 8.0 | 9.4 | 11.1 | 11.5 | 12.3 | 10.4 |
| 17 | 13.2 | 12.8 | 11.3 | 9.2 | 8.5 | 8.6 | 7.8 | 7.8 | 9.3 | 10.8 | 11.6 | 12.6 | 10.3 |
| 18 | 13.2 | 13.0 | 11.5 | 9.1 | 8.1 | 8.0 | 7.5 | 7.3 | 9.0 | 10.9 | 11.7 | 12.7 | 10.2 |
| 19 | 13.9 | 13.4 | 11.7 | 9.3 | 8.5 | 7.9 | 7.4 | 7.4 | 9.1 | 11.7 | 12.1 | 12.6 | 10.4 |
| 20 | 13.9 | 13.8 | 12.3 | 9.8 | 9.1 | 7.7 | 7.6 | 7.5 | 9.4 | 11.9 | 12.3 | 13.0 | 10.7 |
| 21 | 14.2 | 14.2 | 12.8 | 10.1 | 9.0 | 8.5 | 7.7 | 7.9 | 10.0 | 12.3 | 12.7 | 13.1 | 11.0 |
| 22 | 14.2 | 14.4 | 12.8 | 10.5 | 9.5 | 8.6 | 8.0 | 8.3 | 10.0 | 12.8 | 13.0 | 13.5 | 11.3 |
| 23 | 14.2 | 14.2 | 12.5 | 10.5 | 9.5 | 8.8 | 8.3 | 8.7 | 10.7 | 12.8 | 12.7 | 13.5 | 11.4 |
| Grand Total | 13.7 | 13.6 | 11.8 | 9.5 | 8.6 | 8.4 | 7.8 | 7.8 | 9.5 | 11.5 | 12.0 | 13.0 | 10.6 |

# PARK - Time varying AEP

## Calculation: AEP_Enercon_Normal

Windfarm: 30.0 MW based on 6 turbines of type ENERCON E-147 EP5 E2 5000 147.0 !O!.
Selection: All new WTGs
Calculated mean yield per month and hour [MWh]. The result includes wake losses and any curtailment losses.
Values are scaled to a full year, see correction factors at main result page.



Project:
Exam_16.01

Licensed user:
Hochschule Flensburg, University of Applied Sciences
Darf nur für Zwecke der Lehre verwendet werden
- -

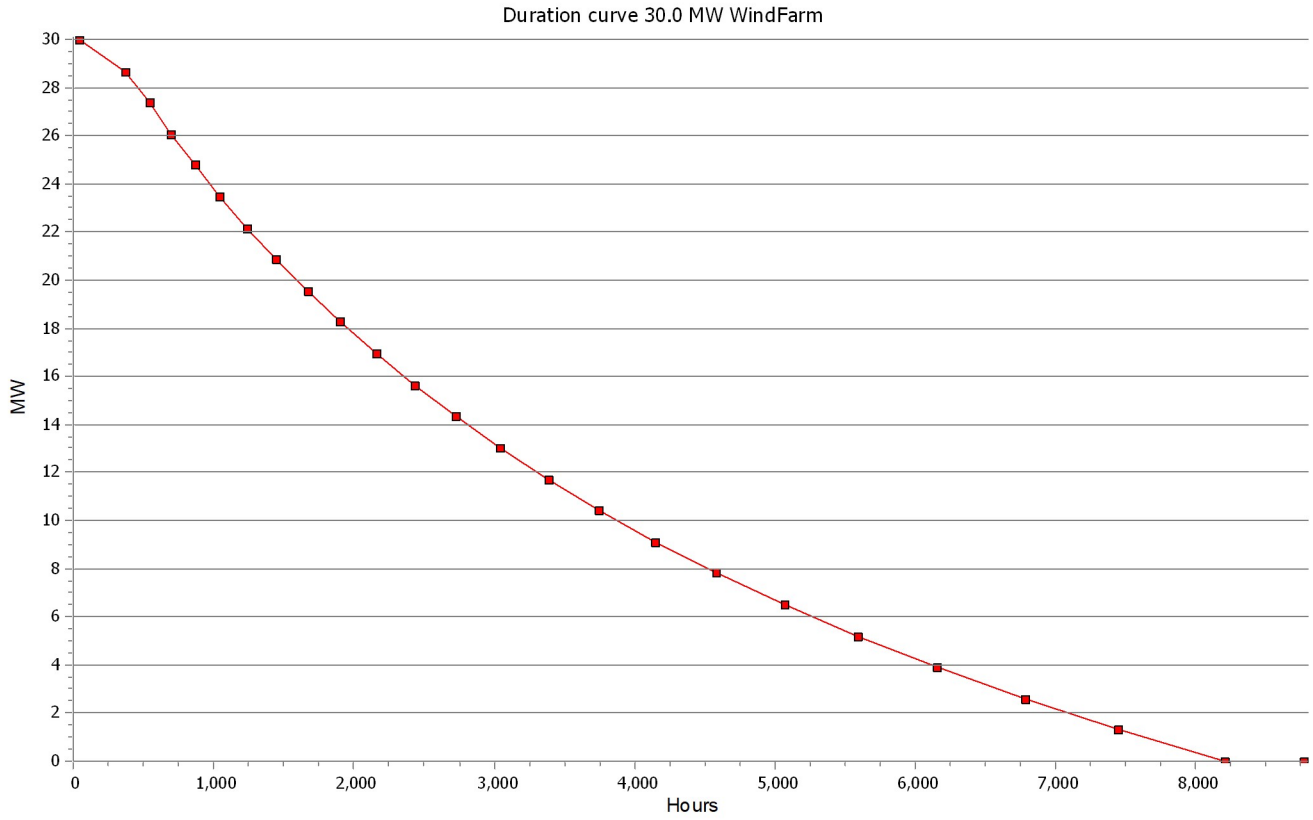
student / weti-lab-vt10@hs-flensburg.de
Calculated:
1/16/2025 3:27 PM/4.0.547

# PARK - Time varying AEP

## Calculation: AEP_Enercon_Normal

Windfarm: 30.0 MW based on 6 turbines of type ENERCON E-147 EP5 E2 5000 147.0 !O!.
Selection: All new WTGs
Calculated mean yield per month and hour [MWh]. The result includes wake losses and any curtailment losses.

| Hours | Hours [%] | Hours accumulated | Power [MW] | Power (MW/WTG) |
|---|---|---|---|---|
| 42 | 0.5 | 42 | 30.0 | 5.0 |
| 330 | 3.8 | 372 | 28.7 - 30.0 | 4.8 - 5.0 |
| 169 | 1.9 | 541 | 27.4 - 28.7 | 4.6 - 4.8 |
| 157 | 1.8 | 697 | 26.1 - 27.4 | 4.3 - 4.6 |
| 169 | 1.9 | 867 | 24.8 - 26.1 | 4.1 - 4.3 |
| 179 | 2.0 | 1045 | 23.5 - 24.8 | 3.9 - 4.1 |
| 192 | 2.2 | 1237 | 22.2 - 23.5 | 3.7 - 3.9 |
| 203 | 2.3 | 1441 | 20.9 - 22.2 | 3.5 - 3.7 |
| 226 | 2.6 | 1667 | 19.6 - 20.9 | 3.3 - 3.5 |
| 235 | 2.7 | 1901 | 18.3 - 19.6 | 3.0 - 3.3 |
| 255 | 2.9 | 2156 | 17.0 - 18.3 | 2.8 - 3.0 |
| 272 | 3.1 | 2429 | 15.7 - 17.0 | 2.6 - 2.8 |
| 297 | 3.4 | 2726 | 14.3 - 15.7 | 2.4 - 2.6 |
| 316 | 3.6 | 3042 | 13.0 - 14.3 | 2.2 - 2.4 |
| 341 | 3.9 | 3384 | 11.7 - 13.0 | 2.0 - 2.2 |
| 363 | 4.1 | 3746 | 10.4 - 11.7 | 1.7 - 2.0 |
| 400 | 4.6 | 4146 | 9.1 - 10.4 | 1.5 - 1.7 |
| 436 | 5.0 | 4582 | 7.8 - 9.1 | 1.3 - 1.5 |
| 483 | 5.5 | 5065 | 6.5 - 7.8 | 1.1 - 1.3 |
| 517 | 5.9 | 5582 | 5.2 - 6.5 | 0.9 - 1.1 |
| 570 | 6.5 | 6152 | 3.9 - 5.2 | 0.7 - 0.9 |
| 626 | 7.1 | 6777 | 2.6 - 3.9 | 0.4 - 0.7 |
| 663 | 7.6 | 7440 | 1.3 - 2.6 | 0.2 - 0.4 |
| 767 | 8.8 | 8207 | 0.0 - 1.3 | 0.0 - 0.2 |
| 559 | 6.4 | 8766 | 0.0 | 0.0 |



# PARK - Scaling info

## Calculation: AEP_Enercon_Normal

### Scaler settings

| | |
|---|---|
| Name | EMD Default Measurement Mast Scaler |
| Terrain scaling | Measured Data Scaling (WAsP Stability / A-Parameter) |
| RIX correction | No RIX correction |
| Displacement height | from objects |
| Micro terrain flow model | Site data: RESGEN (5) |

Site Data: Site data: RESGEN (5)

Obstacles:

All obstacles used

Roughness:

Terrain data files used in calculation:
C:\Users\student\Desktop\Exam_16_01_2025\Windpro_exam_16.01\ROUGHNESSLINE_ONLINEDATA_0.wpo
Min X: 518,359, Max X: 578,403, Min Y: 6,030,681, Max Y: 6,091,978, Width: 60,044 m, Height: 61,297 m

Orography:

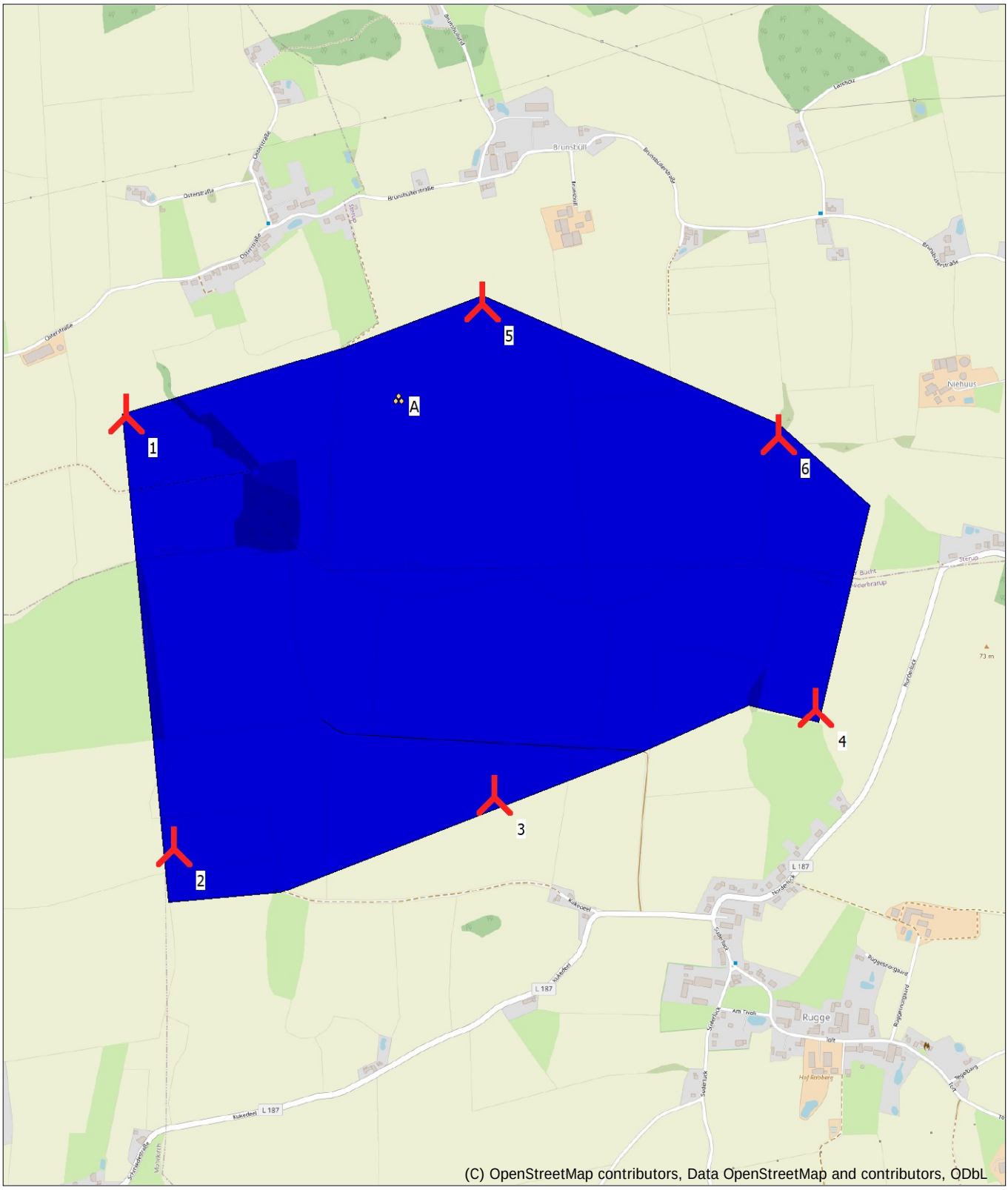
Terrain data files used in calculation:
C:\Users\student\Desktop\Exam_16_01_2025\Windpro_exam_16.01\CONTOURLINE_ONLINEDATA_0.wpo
Min X: 538,612, Max X: 558,177, Min Y: 6,051,218, Max Y: 6,071,644, Width: 19,565 m, Height: 20,426 m

### Post calibration

| | |
|---|---|
| Overall factor | 1.0000 |
| Overall offset | 0.0000 |
| By sector | No |
| By month | No |
| By hour | No |
| By wind speed | No |

# PARK - Map

## Calculation: AEP_Enercon_Normal




0 250 500 750 1000m

Map: EMD OpenStreetMap , Print scale 1:12,500, Map center UTM (north)-ETRS89 Zone: 32 East: 548,534 North: 6,061,313

New WTG WTG area