CARL VON OSSIETZKY universität OLDENBURG

DoWES

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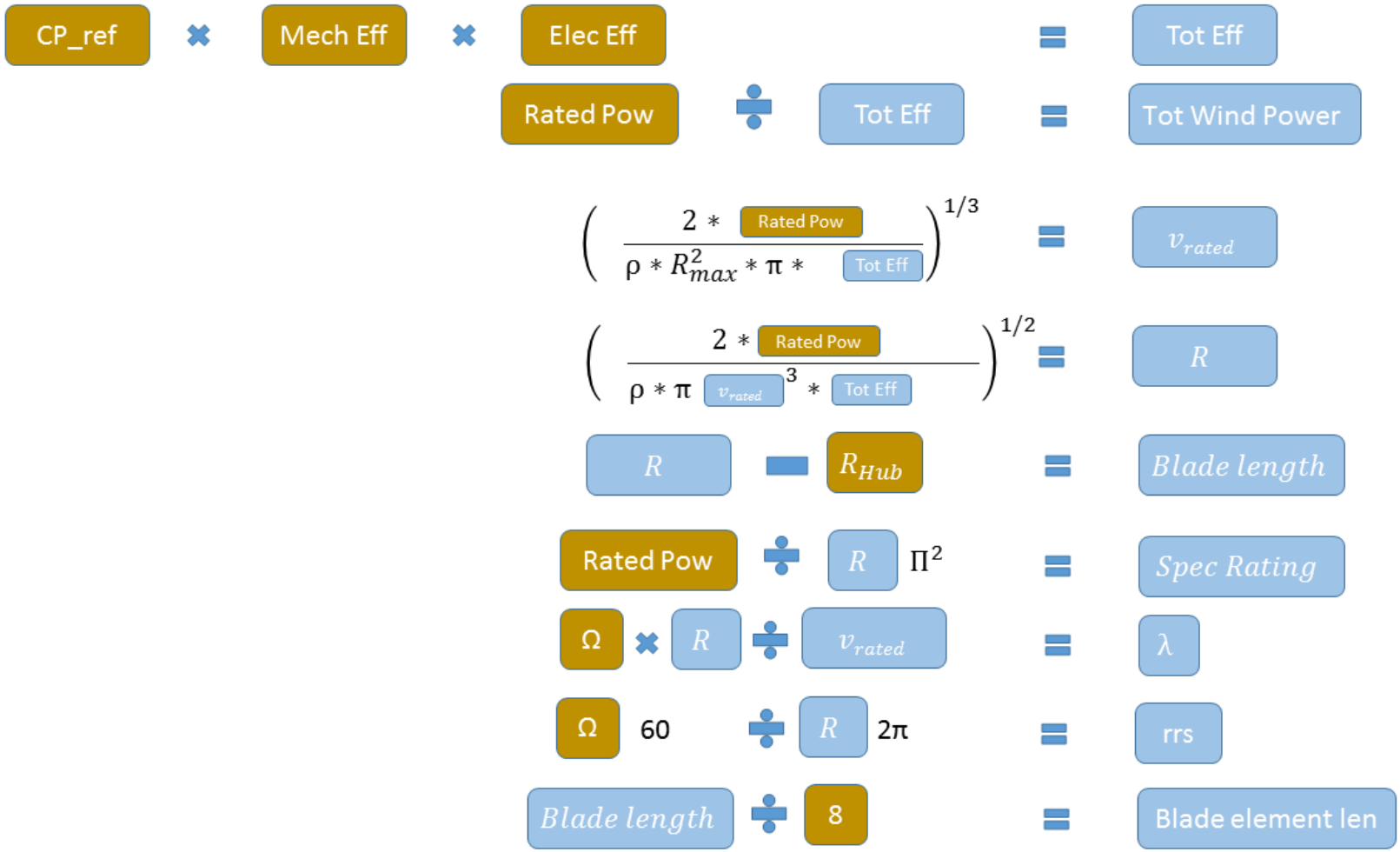
Table of Contents

Table of Contents

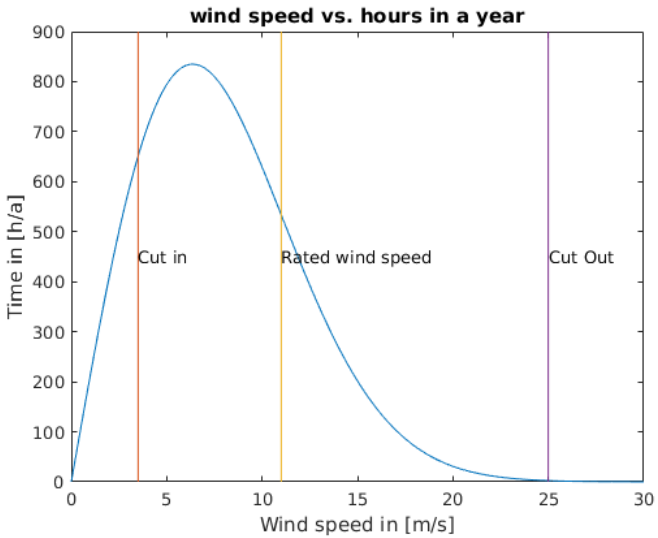
Formulas

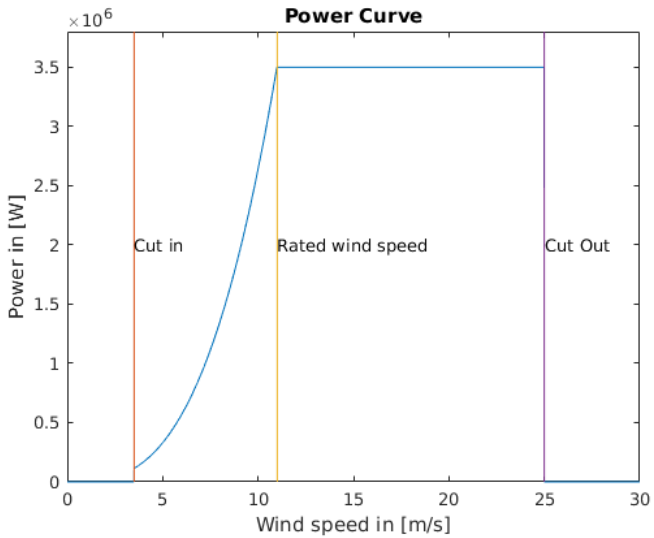

CP_ref
Mech Eff
Elec Eff
Tot Eff
Rated Pow
Tot Eff
Tot Wind Power
$\left(\frac{2 * \text{Rated Pow}}{\rho * R_{max}^2 * \pi * \text{Tot Eff}} \right)^{1/3}$
v_{rated}
$\left(\frac{2 * \text{Rated Pow}}{\rho * \pi \ v_{rated}^3 * \text{Tot Eff}} \right)^{1/2}$
R
R
R_{Hub}
Blade length
Rated Pow
R
Π^2
Spec Rating
Ω
R
v_{rated}
λ
Ω
60
R
2π
rrs
Blade length
8
Blade element len

Results

Main parameters	**Unit**	**Value**
Calculate total conversion efficiency	m	0.4704
Total wind power that needs to be extracted	kW	7439.258
Rated wind speed (rounded up)	m/s	11
Rotor radius (rounded up)	m	54
Blade length (without hub)	m	52.75
Rotor area (rounded radius)	m^2	9160.884
Specific rating (design)	W/m^2	382.051
λD Design tip speed ratio	-	7.454
Rotor rated speed	rpm	14.5
Blade element length (8 elements, same length)	m	6.593

Estimation of AEP

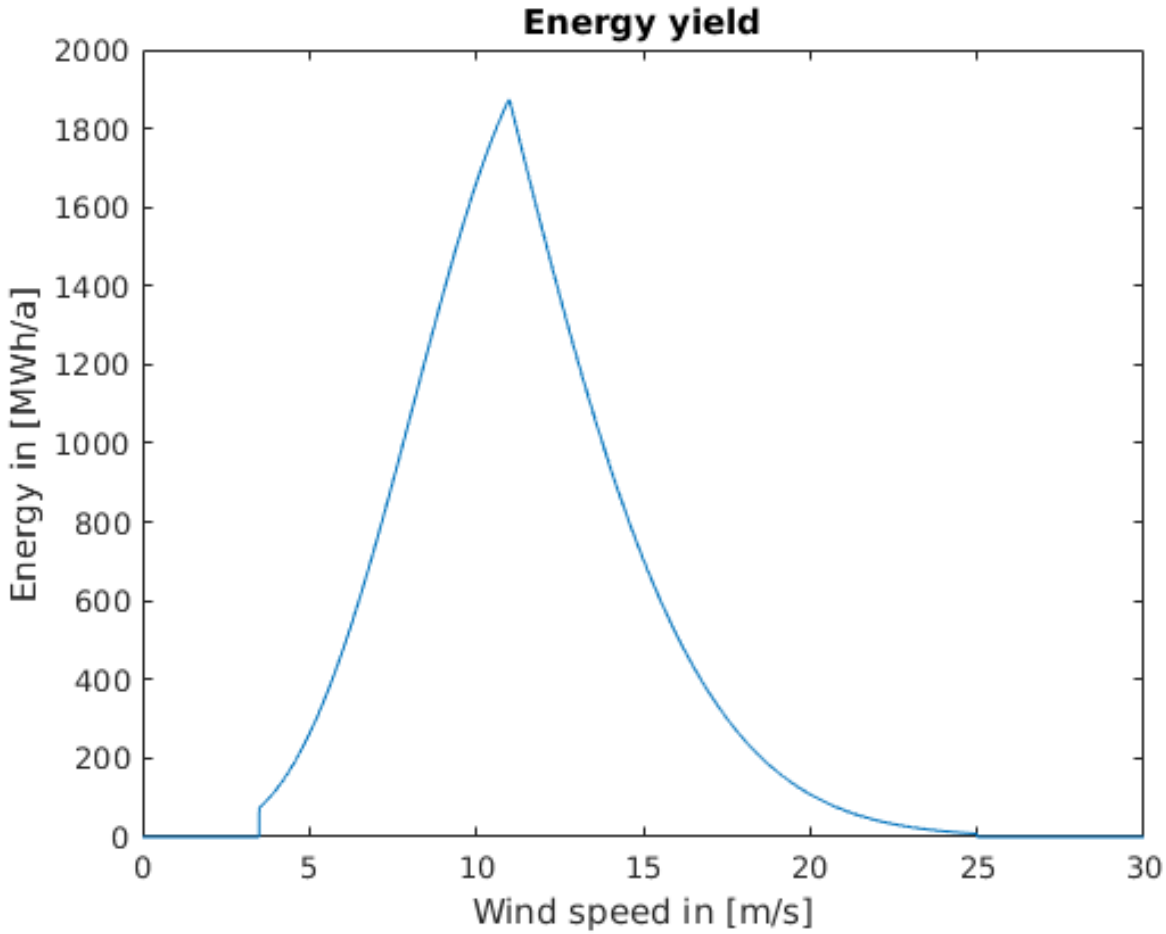




$$\text{AEP} = \sum_{v} n_v \cdot p_v$$

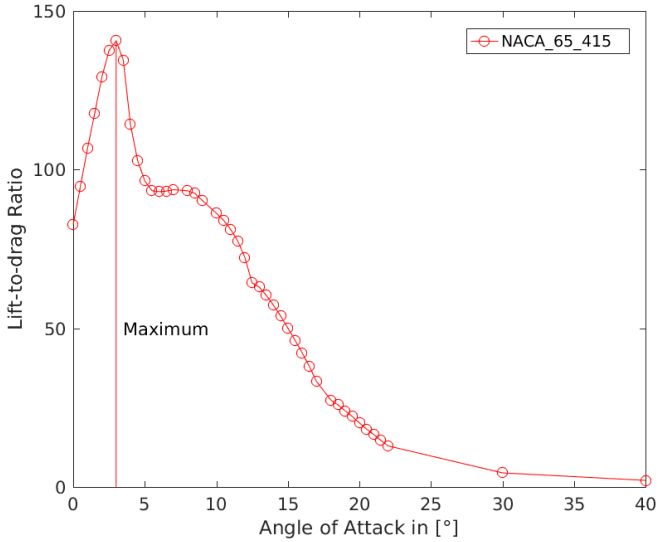
with:
n = number of hours
p = power curve
v = wind speed

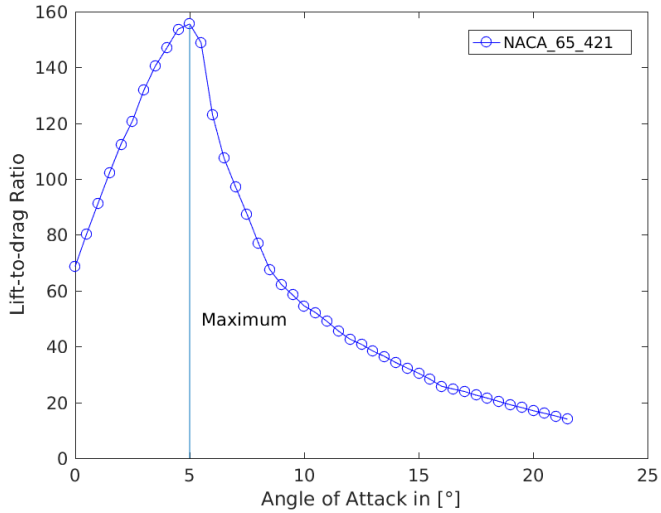
Resulting Energy yield



$$\text{AEP} = 13,49 GWh$$

Lift-to-drag ratio



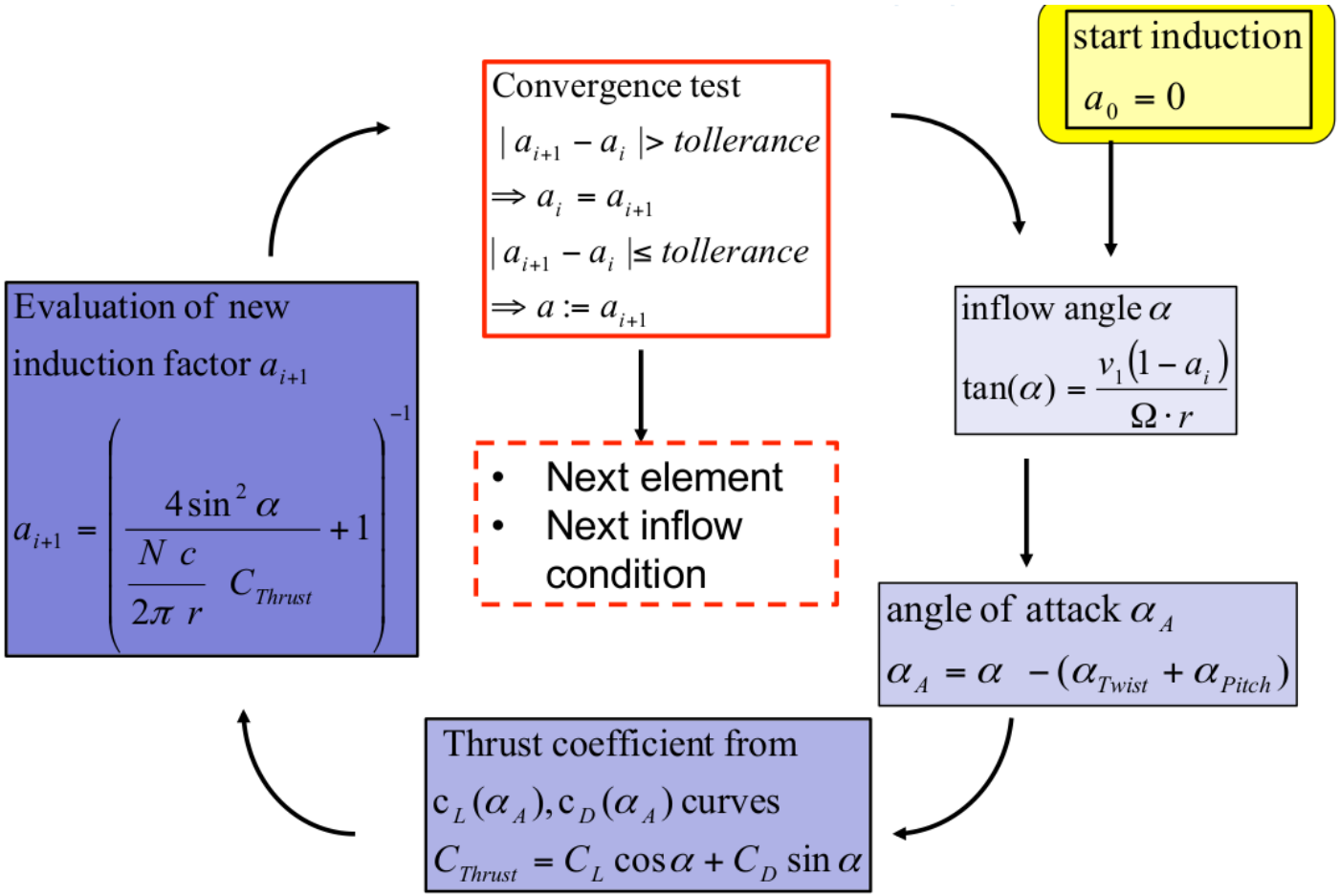


NACA 65-415	α	c_l	c_d	c_m
80% method	10	1.345	0.016	0.071
lift-to-drag method	3.0	0.710	0.005	0.088
NACA 65-421	α	c_l	c_d	c_m
80% method	11	1.255	0.026	0.055
lift-to-drag method	5.0	0.952	0.006	0.092

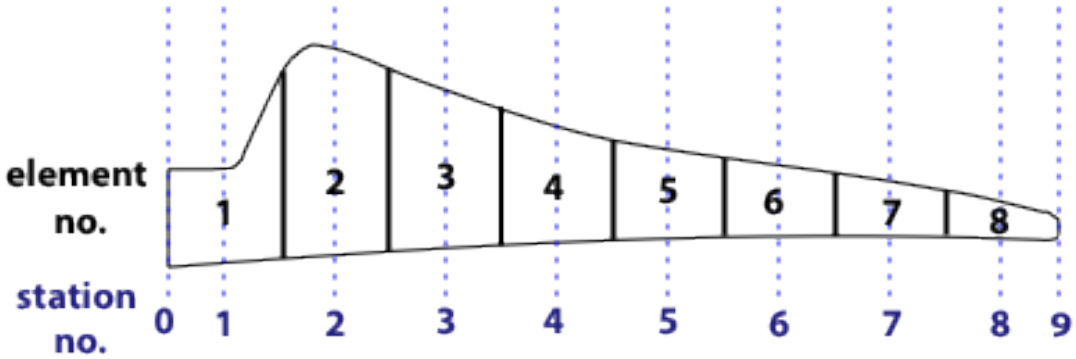
Table : Main aerodynamic parameters

Table of Contents

BEM algorithm



Blade design



Station	1 Cylinder	2 65-421	3 65-421	4 65-421	5 65-421	6 65-415	7 65-415	8 65-415	9 65-415
Blade	3.297	9.891	16.484	23.078	29.672	36.266	42.859	49.453	52.750
Chord	6,628	5,426	3,935	3,014	2,425	1,887	1,617	1,413	1,329
Twist	27,590	11,022	3,813	0,055	-2,211	-2,715	-3,783	-4,580	-4,907

Table of Contents

Table of Contents

Table of Contents

Table of Contents

Table of Contents

Thanks!