



Maaseudun energiapäivä

30.11.2017

Pentti Itkonen

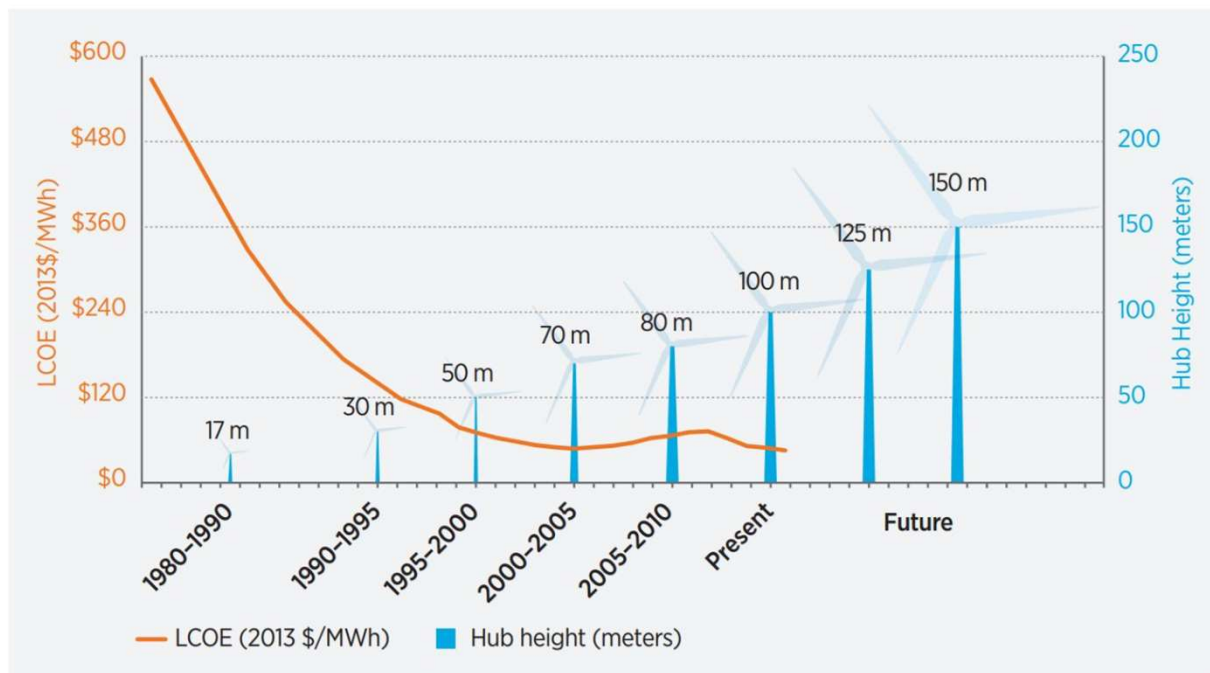
Sales Manager Finland

- **Gearless** direct drive wind energy converters
- **Founded** in 1984 by Aloys Wobben and now owned by Aloys-Wobben foundation.
- One of the TOP-5 Wind Turbine Manufacturers in the world
- **Headquarter** Aurich, Germany
- **Production:** Rotor blades, Generator, Hub, main carrier, etc.,
Tower (steel / concrete), Electronic components,
Final assembly
- **Employees** > 15,000
- **Sales offices** 8 in Germany; 24 international
- **Service stations** more than 300 worldwide



Tuulivoima: Kustannuskehitys ja hämmennys Suomessa

Scale-up of wind technology has supported cost reductions.



Note: LCOE is estimated in good to excellent wind resource sites (typically those with average wind speeds of 7.5 m/s or higher), excluding the federal production tax credit. Hub heights reflect typical turbine model size for the time period.

Figure ES.2-5. Wind technology scale-up trends and the levelized cost of electricity

- Sähköistyminen (lämpö, liikenne)
- Hajautuminen
- Digitalisaatio
- Kuluttajan rooli

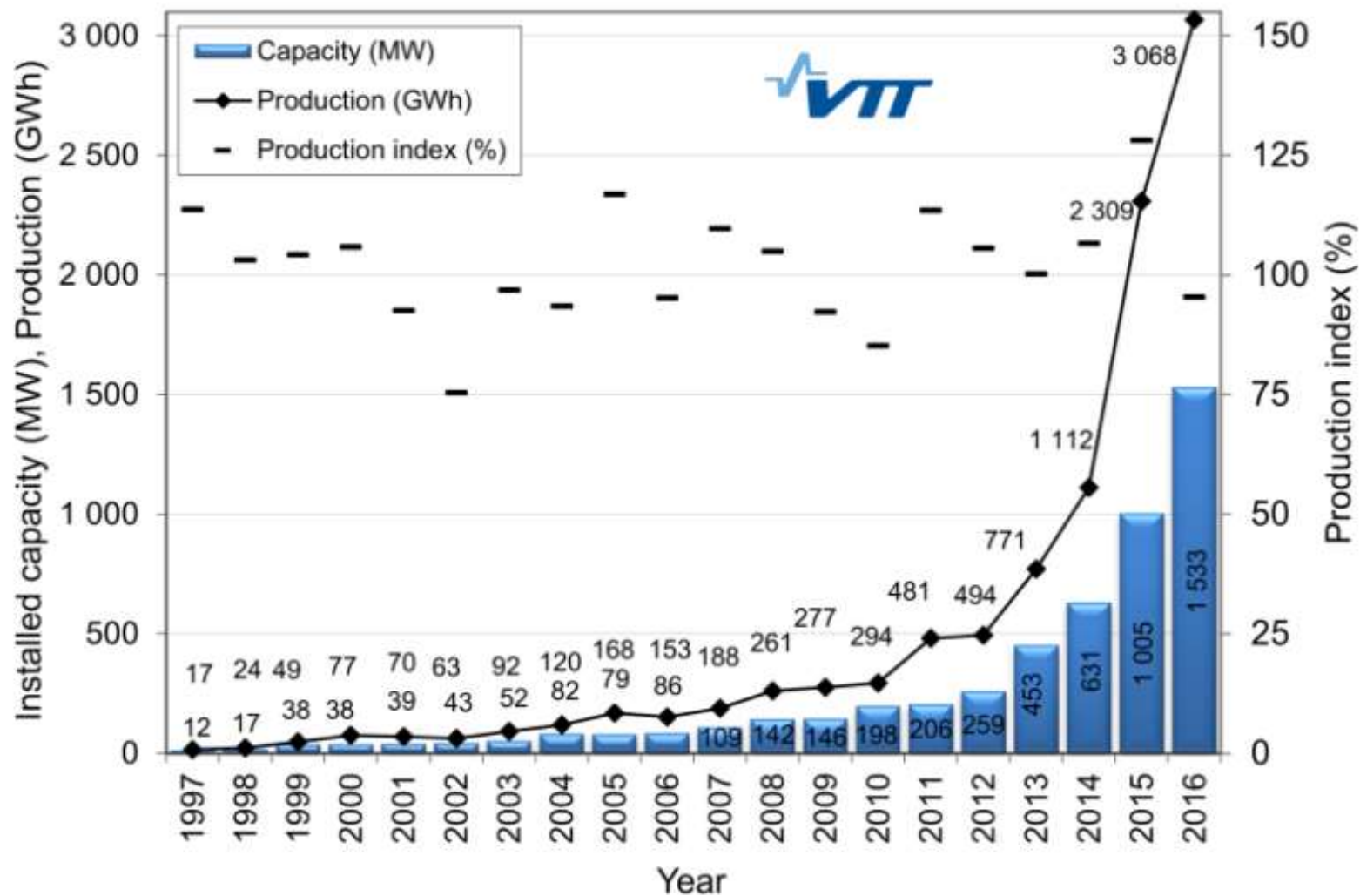
YLE 1.9.2017:

Kustannusvertailu: Maalla sijaitseva tuulivoima edullisin tapa tuottaa sähköä

LUT (2017):

Tuotantolaitos	Huipunkäyttöäika (h/a)	Tuotantokustannus (€/MWh)
Maatuulivoimala	2860	41,4
Ydinvoimala, olemassa oleva tontti	8000	42,4
Ydinvoimala, uusi	8000	55,4
Kaasusähkö		68,9
Merituulivoimala	3875	68,9
Puulauhde		76,2
Turvelauhde		75,7
Hiilisähkö (sis. CO2 talteenoton)		75,9
Aurinkovoimala	928	99,6

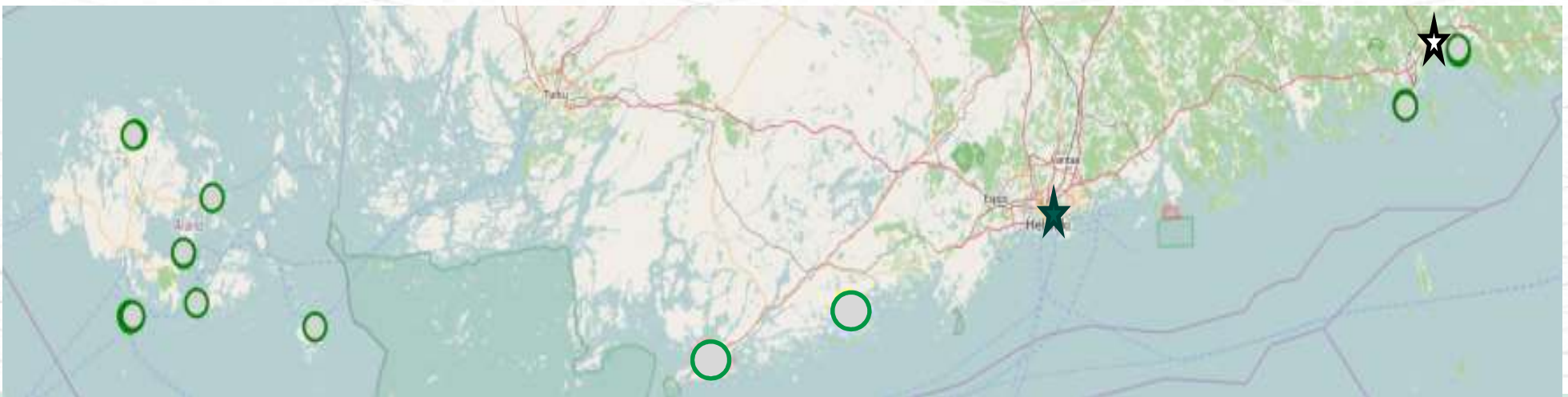
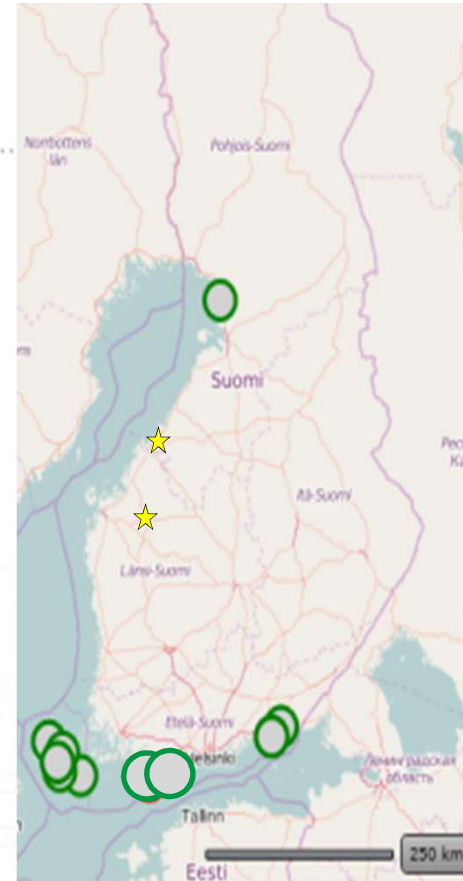
Tuulivoimakapasiteetti Suomessa



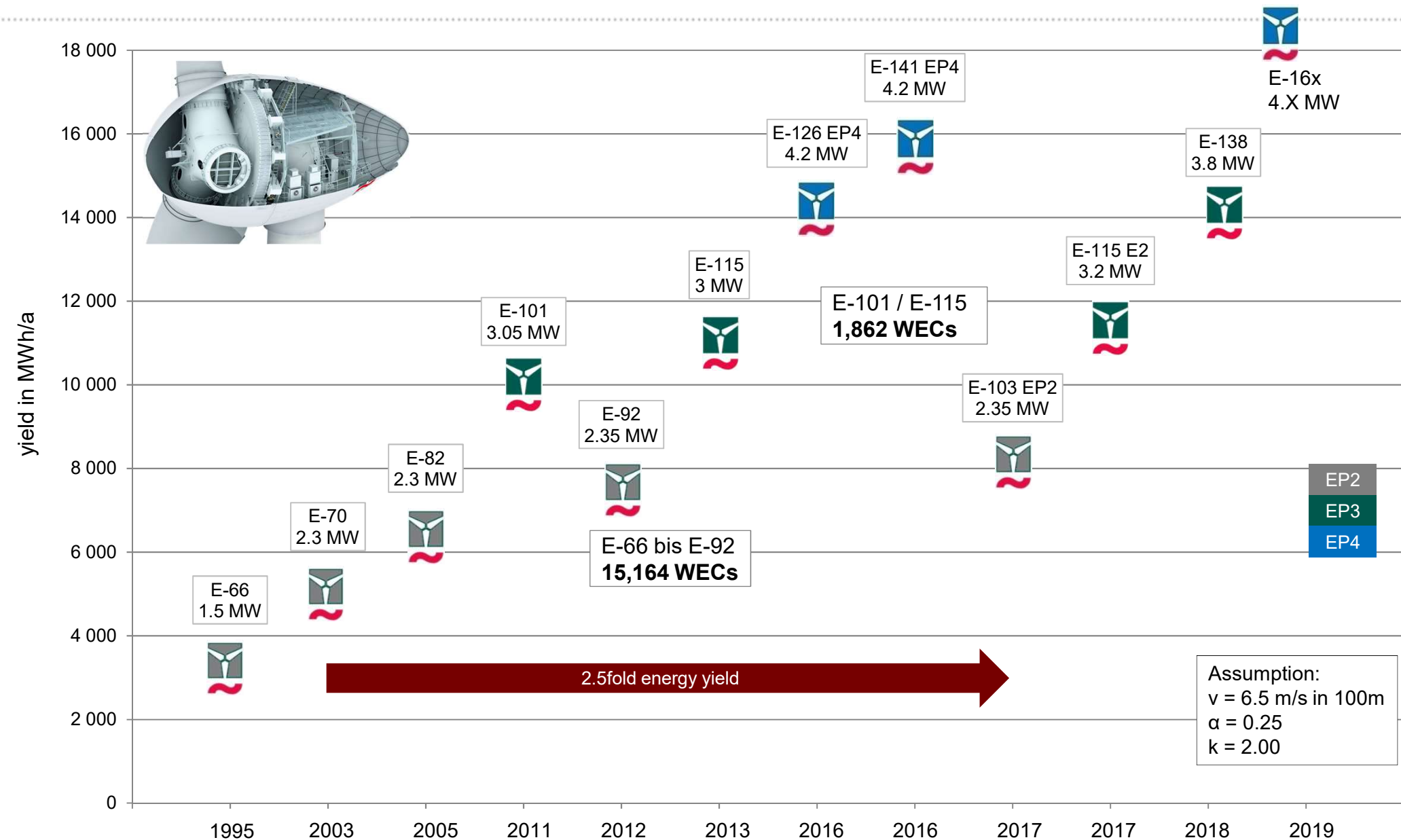
ENERCON in Finland, since 1990s

- 8 x E-40 Hanko+Åland
 - 1 x E-53 (Ii)
 - 7 x E-66 (Åland)
 - 6 x E-70 (Åland)
 - 3 x E-92 (Kotka)
 - 2 x E-101 (Hamina)
 - 1 x E-103 (Kokkola)
 - 1 x E-141 (Lapua)
- Sales Office in Helsinki
 - Service Station in Hamina

Total 29 WECs



CONTINUOUS TECHNOLOGICAL DEVELOPMENT

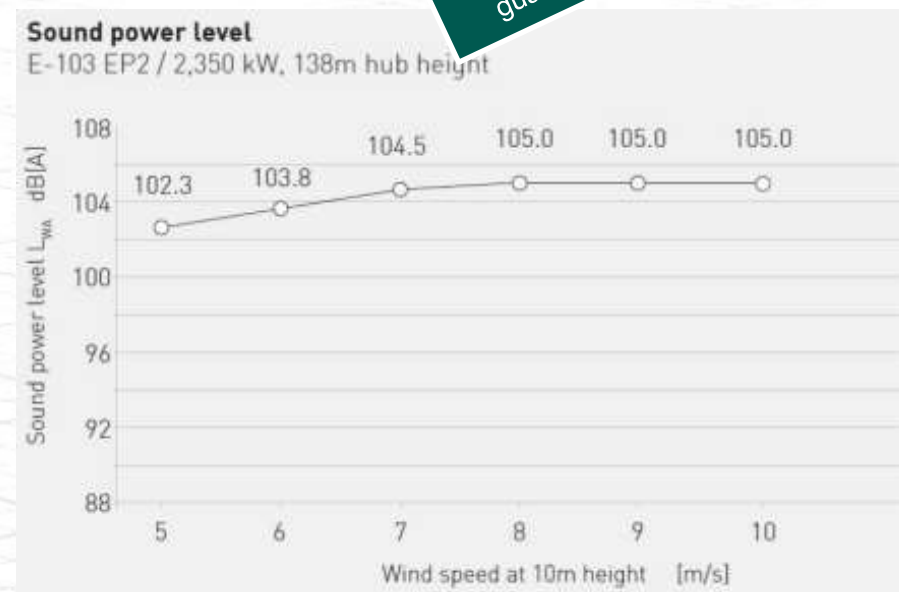
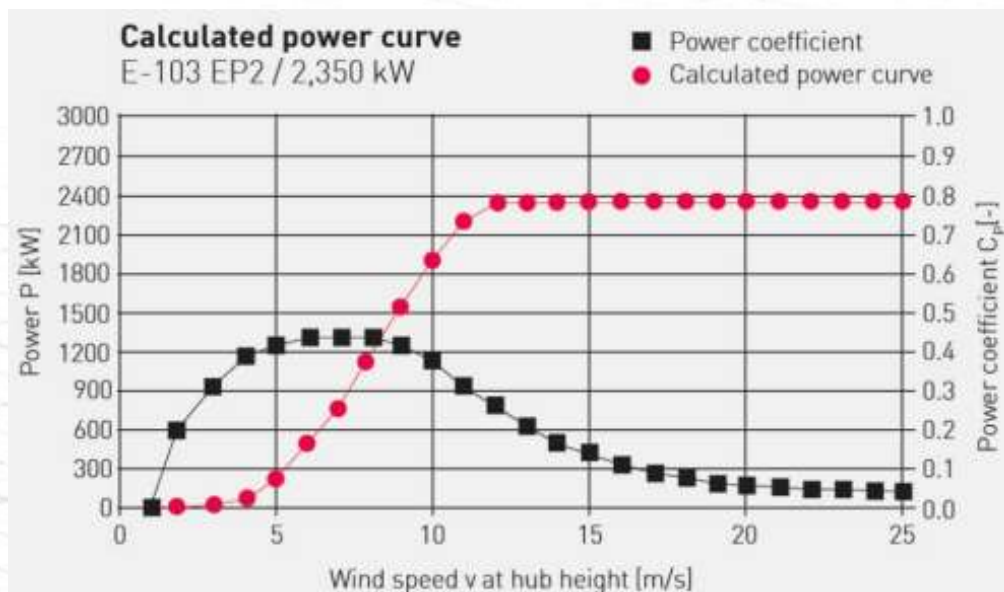


as of: 04/2017

	WIND CLASS I	WIND CLASS II	WIND CLASS III
EP4	E-126	E-141	E-16x EP4
EP3	E-101	E-115 E-101 E-126 EP3	E-138 EP3
EP2	E-70 E-82	E-70 E-82 E-92	E-103
EP1	E-44	E-48	E-53

New Products: E-103 EP2

Type:	E-103 EP2
Rated power:	2,350 kW
Rotor diameter:	103m
Hub-heights:	85, 138m
Wind class:	IEC/EN IIIA
Area:	Germany/ Export
Prototype:	End of 2016
Serial production:	2017



Plant technology – Cross sectional drawing



**E-141
EP4**

1 Rotor blade

3 Blade adapter

5 Main carrier

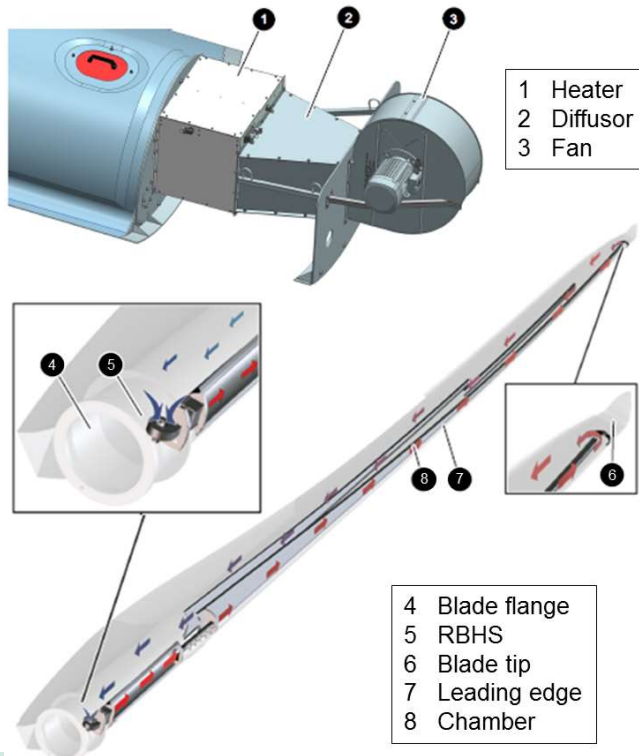
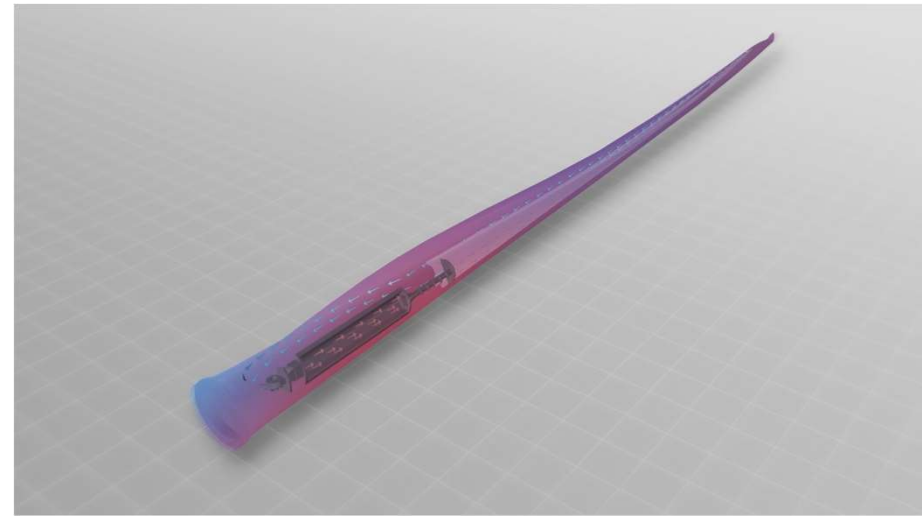
2 Rotor hub

4 Annular generator

6 Yaw drive

ROTOR BLADE HEATING SYSTEM

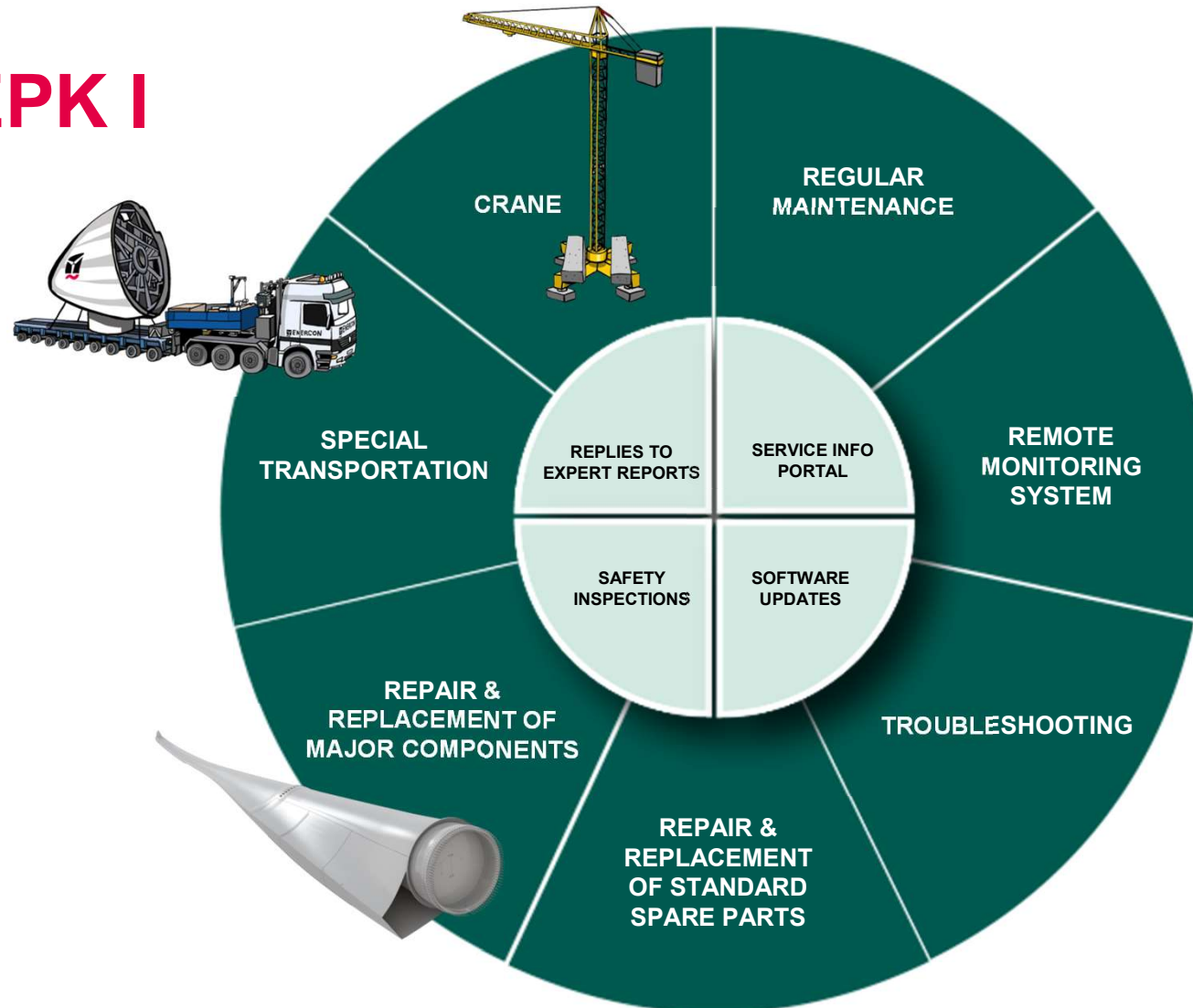
The Rotor Blade Heating System (RBHS) consists of two main parts, a heater and a fan which are both located at the blade flange. The heating elements heat up the air to a maximum of 72°C inside the leading edge chamber and the fan distributes it down to the blade tip.



RISKS DUE TO ICING OF ROTOR BLADES:

- Oscillations due to an unbalance of rotor blades
→ higher loads and probably shut down
- Ice pieces can fall down in a reasonable radius around the WEC
- Degradation of aerodynamic efficiency
→ decreased yield
- Total stop of yield production due to ice detection

EPK I



GUARANTEERING OF AVAILABILITY



- Tuulimittaukset
 - Tuotantoanalyysit
 - Melu- ja välkemallinnukset
 - Luvitusjärjestelyt (yhteistyökumppanin kautta)
 - Riskinarvionti rakennetulla alueella, sis. jäänheitto
 - Rahoituspalvelut
-
- Voimalan täysi huolto ja ylläpito, tuotantohäviöt kompensoitu

Sales-office and Service-station

Sales office in central Helsinki

Fredrikinkatu 61 A ●
00100 Helsinki
sales.finland@enercon.de

Sales managers:

- Marko Salmela
- Pentti Itkonen

Service station in Hamina

Ansaskuja 9B
49420 Hamina ●

1 service coordinator, 2 service technicians



KIITOS, THANK YOU!



Thank you for your attention!



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