Scaling Wind Turbines: Is It Really Worth it ?

Anker Mardal
Nordic Folkecenter for Renewable Energy

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EMPOWERING RURAL HABITATS

What should the wind turbine pull

- Light
- Machinery
- Waterpump

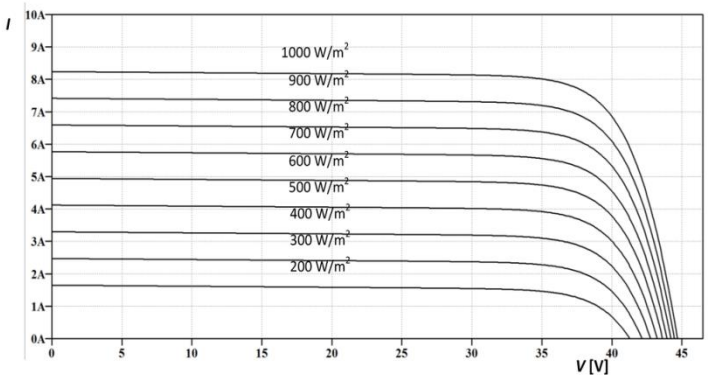
It's all a matter of energy in KwH

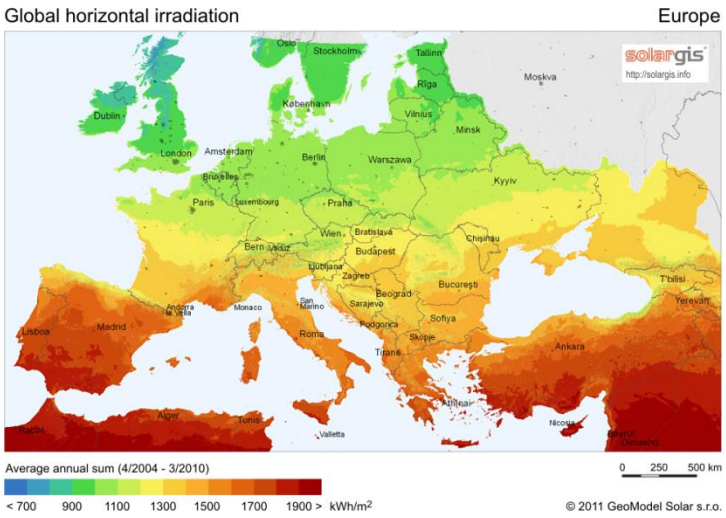
PV is directly scalable $/KwH

- A small system with a PV panel and battery + inverter costs approx. 500 $
- A larger system with 10 panel and battery + inverter costs approx. 5000 $
- An even larger system with 20 panel and battery + inverter costs approx. $ 10,000

Solar radiation and produced Kw are linear

- More sun, more watts
- No altitude and local conditions should be included



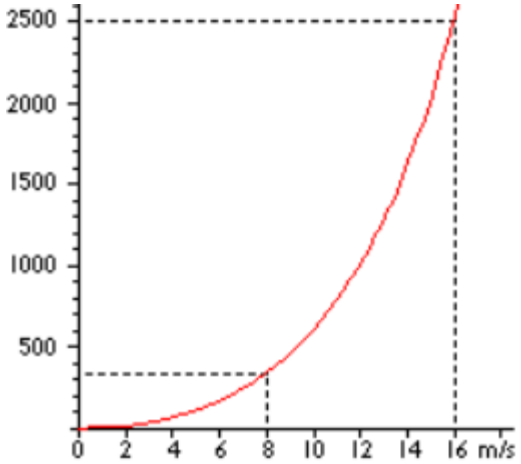


Wind, there are many conditions to be considered

- People don't normally settle where the wind blows.
- People don't like background noise.
- People settling in fields and houses that provides turbulent wind conditions
- The wind turbine must be capable of handling heavy storms
- The wind turbine should be able to produce at low wind speed.
- And much more

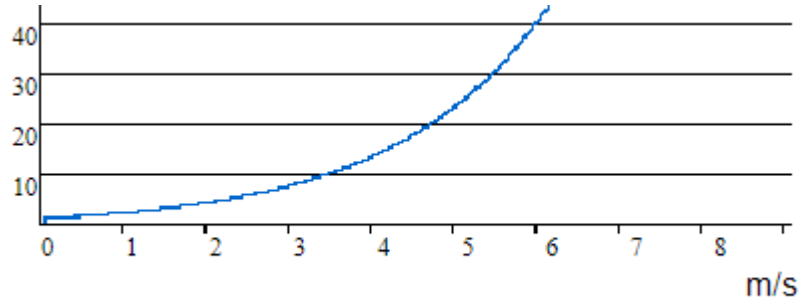
Wind speed is not linear with Kw

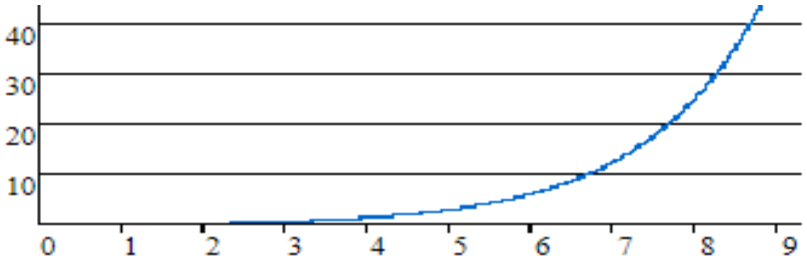
- Watt/m2=1/2 x 1,225 x m/s^3
- Wind speeds in 3rd potency * Betz
- 2m/s=5w x 0,4 = 2 w
- 4m/s = 39w x 0,4 = 15 w
- 6m/s=132w x 0,4 = 52 w
- 8m/s=313w x 0,4 = 125 w
- 10m/s=612w x0,4 = 244 w



Wind speed is not linear with altitude

- Now we know that the wind speed is important, but the altitude determines the wind speed
- Roughness class has a bearing on how high the wind turbine should be



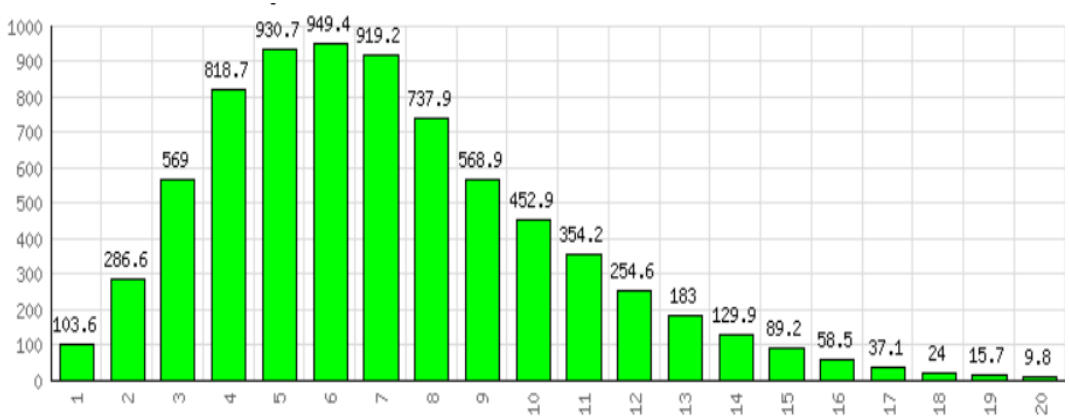


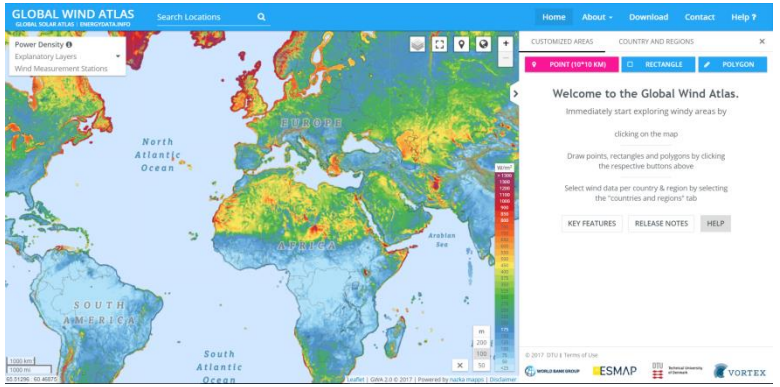
The price of wind turbines in €

	complete wind turbine	Year KwH	Cost pr KwH x 5 year
400w Chinese	6500	200	6,50
600w European	8000	250	6,40
3 Kw	40000	2000	4,00
6 Kw	46000	10000	0,92
10 Kw	56000	25000	0,45
15 Kw	66000	40000	0,33
25 Kw	80000	70000	0,22

Average winds tells nothing about annual production

- Many hours between 8-12 m/s gives many KwH
- Many hours below 5m/s and above 20m/s gives almost no KwH
- But the main wind can be the same





Height, size, price

- A smaller turbine is normally on a small tower = low wind speed
- Small wind turbine is expensive / KwH
- A large wind turbine is normally high and therefore more wind speed
- A large wind turbine is cheap / KwH
- If the needs are small, choose solar cells
- If there are few sunshine hours and the needs are small, choose a small windmill
- Electricity needs large, choose a large wind turbine that corresponds to the consumption

The right location

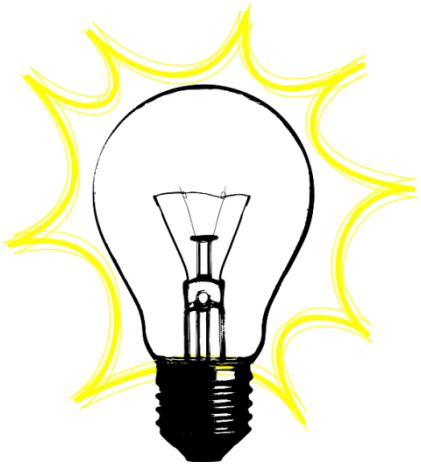
- A wind turbine should be visible
- Otherwise there is not enough wind and therefore PVs should be considered

Grid connected or island, it almost gives itself

- Is there the possibility of grid connection and the price relevant, grid connection
- If there is no grid, then island operation

Know the need in kwh

- Are there fair wind conditions
- Are you willing to pay the price per kwh
- Then we'll find solutions



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- Thank you for keeping awake

Thanks