

# *Windpower*

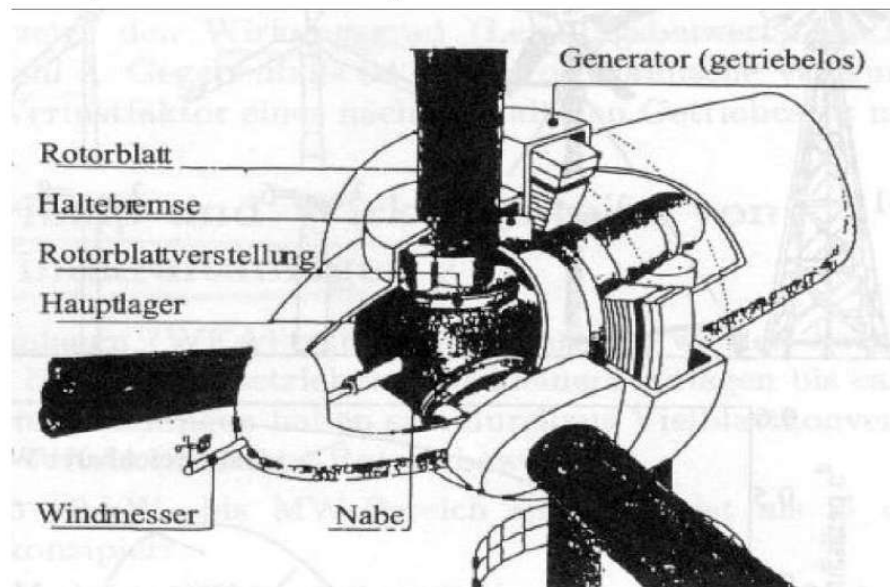
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# 1. Principle function of a wind generator

Picture 1:

Principal function of a wind generator



From: B.Diskmann, K.Heinloth „Energie“

Wind generators with two or three rotor blades have succeeded. They have an efficiency of about 40-50% of the offered wind power to rotor plane between 4 m/s (soft wind) and 20 m/s (storm). For comparison an old wood windmill has an efficiency of about 15%.

Typically you gain 100kW power output.

The rotor blades are formed in a way, that wind drives them to rotation. From this mechanical rotation a generator generates electricity. Furtheron it is transformed to get compatible to the power supply system. For optimal use the rotation plane should be perpendicular to the winds direction. Therefore you have a system that turns them into the wind.

Another point that is important for optimal use is the tower height, which depends on

1. price/m
2. roughness of your landscape (woods and towns slow the wind down)
3. later earned electricity price per kWh.

Normal heights are between 10m and 150m.

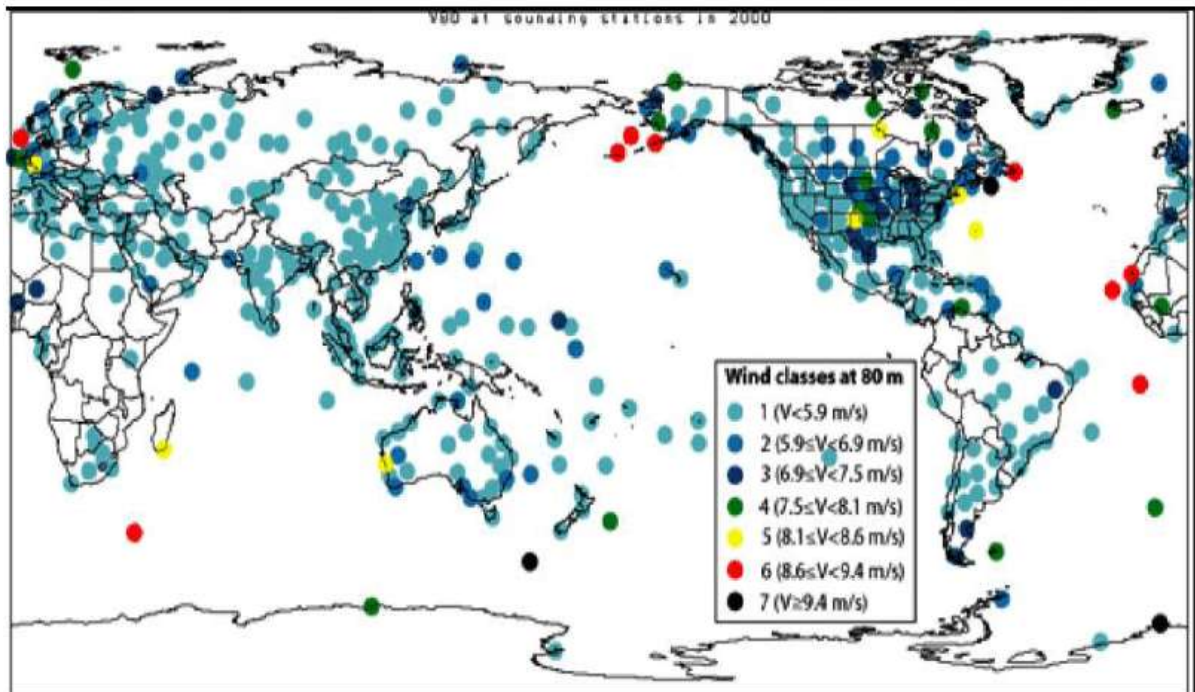
It is typical that height corresponds to rotor diameter.

## 2. Where are wind power plants useful?

About 2% of the incoming sunpower and rotation of earth produce winds. Wind force differs according to the district.

Picture 2:

Map of global wind speeds



From: Stanford university

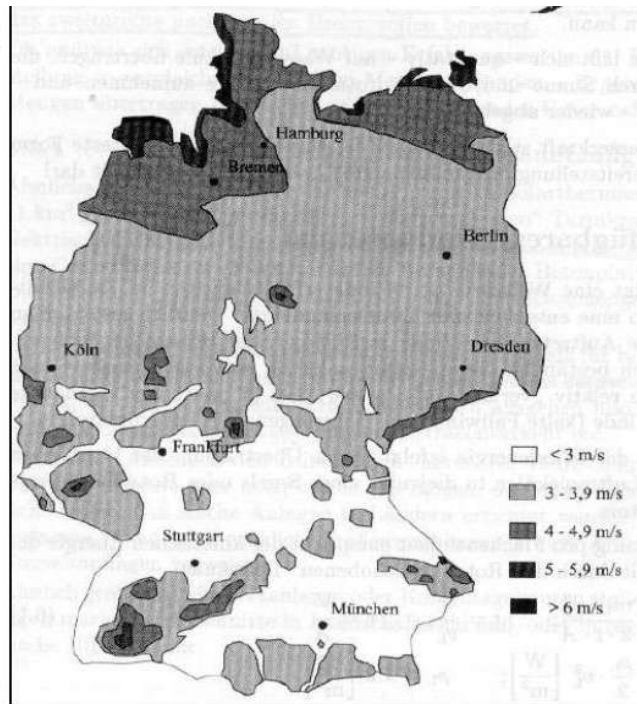
Picture 2 shows a global map of wind speeds according to a study from Stanford University. There it is said that wind has the potential to produce five times more energy than the world consumes.

This has to be seen carefully, because not yet we have the needed techniques to exploit these sources.

Picture 3:

Map of german wind speeds

Average of a year in 10m high from ground



From: B.Diekmann, K.Heinloth  
„Energie“

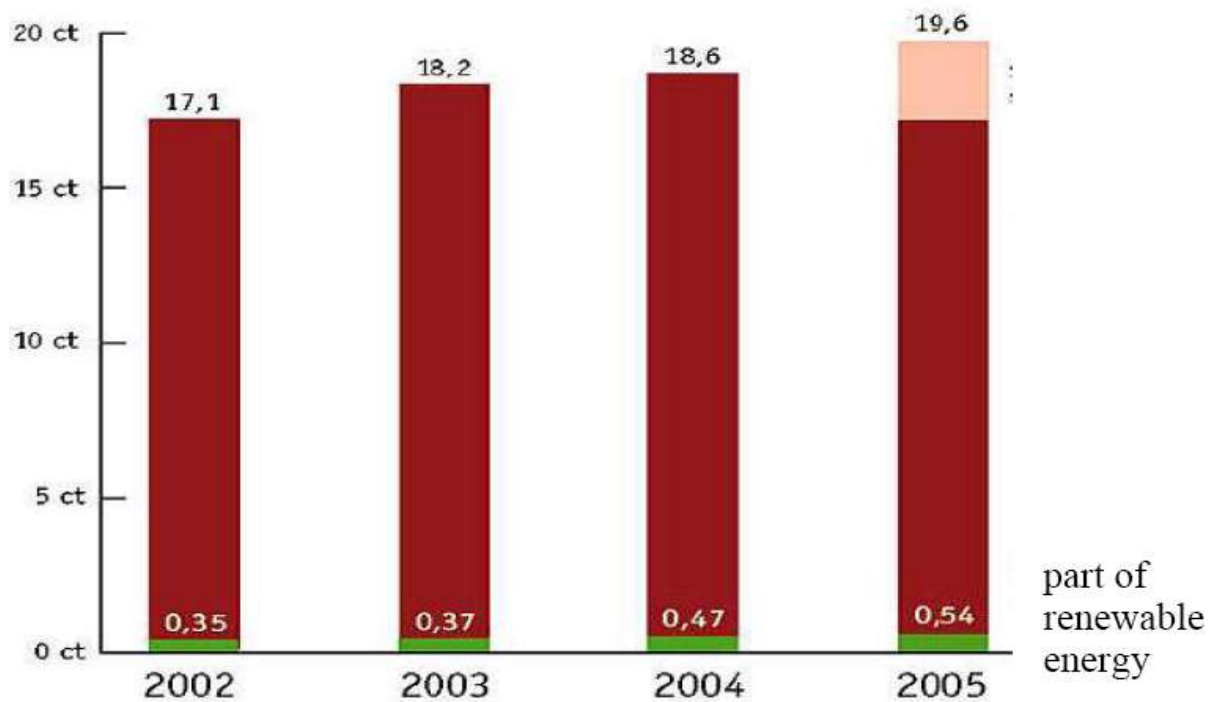
In picture 3 the average of a year in 10m height from ground is shown. It can be seen that wind can be used in germany for the most part near the coast and in the mountains.

At the end of 2002 there were 13759 wind power plants installed in germany. 0.9% of primary energy came from water and wind. 3% of the electricity was produced from wind.

### 3. Influence of windpower on electricity price development

Picture 4:

Average Price of 1kWh electricity for a german household



From: Bundesverband WindEnergie e.V. (BWE)

In reference to the „Bundesverband Wind Energie“ only 2.8% of the price for 1kWh falls on renewable energy, 65% of that means windenergy. Their result is that the Renewable Energy Law (EEG) is not responsible for ascending electricity prices. The EEG is one of the most important laws for renewable energy. One of its aims is that until 2010 at least 12.5% of electricity shall come from renewable energy.

### 4. Subsidy

To make this possible for every kWh electricity, which goes into the power supply system from a wind power plant which is built in 2005, the wind park carrier gets 8.53 cent from the net carrier. The next year he gets 5.39 cent. After this the price falls every year about 3.5% .

According to that the forecast of the BWE is that in about 10-15 years electricity from wind will be as cheap as electricity from fossil fuels.

The „Verband der Elektrizitätswirtschaft (VDEW)“ says that net carriers have to

pay 9.5 cent per kWh, which is three times the market value.

Picture 5:

Comparison of electricity production from wind in  $10^9$  kWh to installed power in  $10^6$  W and support price in  $10^9$  euro



From: Verband der Elektrizitätswirtschaft (VDEW)

Picture 5 shows that installed power in 2003 was five times the one of 1998. Production and the set payment went in each case to four times of 1998.

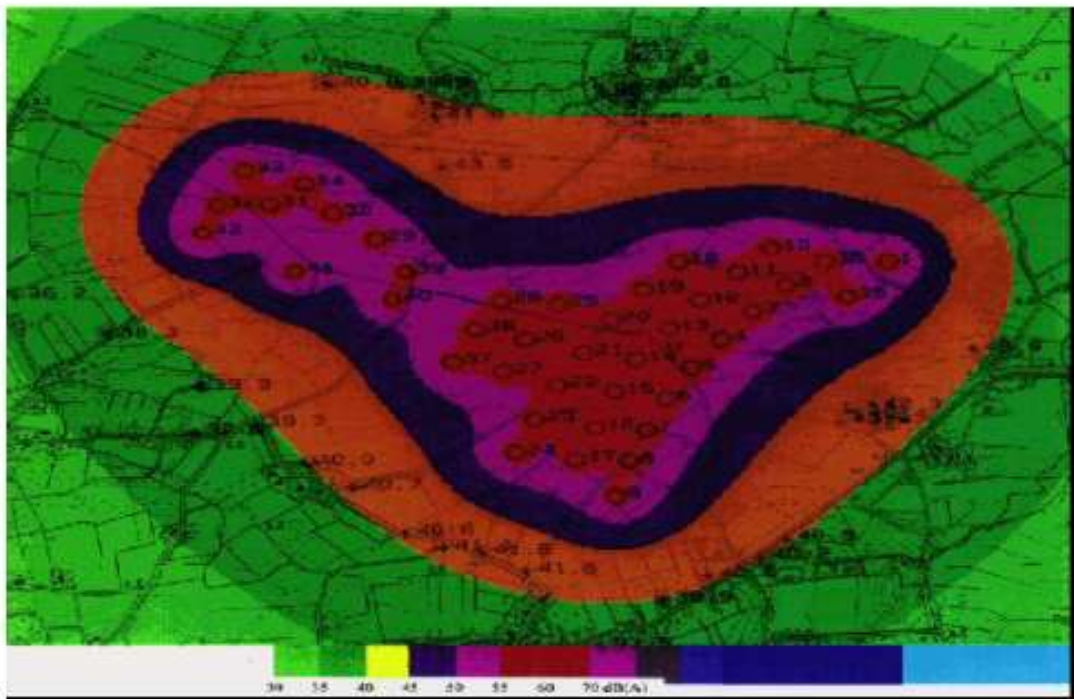


## 5. Ecologically friendly?

1. In 2004 over 20 mio t carbon dioxide could be saved, which was 2.3% of germany`s total ejection in that year (854.29 mio t).
2. There are several laws which are supposed to prevent wind power plants and wires in nature reserves, but it is possible to get exception licenses.
3. To get an impression of the influence on people picture 6 shows the dB-levels near a windpark with 42 wind power plants.

Picture 6:

Db-levels around a windpark of 42 wind energy plants



From: Deutsches Windenergie-Institut (DEWI)

A new edict in NRW provides that there have to be at least 1500m to the next residential area.

In picture 7 the dB-levels of a wind power station under maximum wind in several distances are compared to other noises.

Picture 7:

## Noisy or not : sources of noise in comparison

Wind power station under maximum wind:

in 200m distance: 45dB

in 1500m distance : 27.5 dB (like soft wispers in 5m distance)

Traffic : 90 dB (noisy)

Source: Tipler „Physik“

## 6. Sources

Deutsches Windinstitut: [www.dewi.de](http://www.dewi.de)

BWE (Bundesverband Windenergie): [www.wind-energie.de](http://www.wind-energie.de)

VDEW (Verband der Elektrizitätswirtschaft): [www.strom.de](http://www.strom.de)

Statisches Bundesamt Deutschland: [www.destatis.de](http://www.destatis.de)

Ruhdorfer Architekten Ingenieure Sachverständige: [www.ruhdorfer.de](http://www.ruhdorfer.de)

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit: [www.bmu.de](http://www.bmu.de)

B.Diekmann, K.Heinloth „Energie“