



---

**Choose certainty.  
Add value.**

[www.tuv-sud.cz](http://www.tuv-sud.cz)

# Wind Potential in Poland

**Martin Shanel, TÜV SÜD Central Eastern Europe**  
**Thomas Arnold, TÜV SÜD Industry Service GmbH.**  
December 2010

# Poland – Country Specific Information



## Poland

## Germany

Area	312 685 km <sup>2</sup>	357 104 km <sup>2</sup>
Population	38,2 Mio.	82 Mio.
Population density	122 ppl./ km <sup>2</sup>	229 ppl. / km <sup>2</sup>
Gross electricity demand	159 TWh/year	639,1 TWh/year
Energy Share from RES	9,1 %	14,8%
Target Share from RES in 2020	15%	18%

Poland recently hinted a move towards nuclear power plants in the future

Hydropower with current 2GW of installed capacity will remain the most generating RES in 2020, approx twice the energy of wind planned in terms of GWh

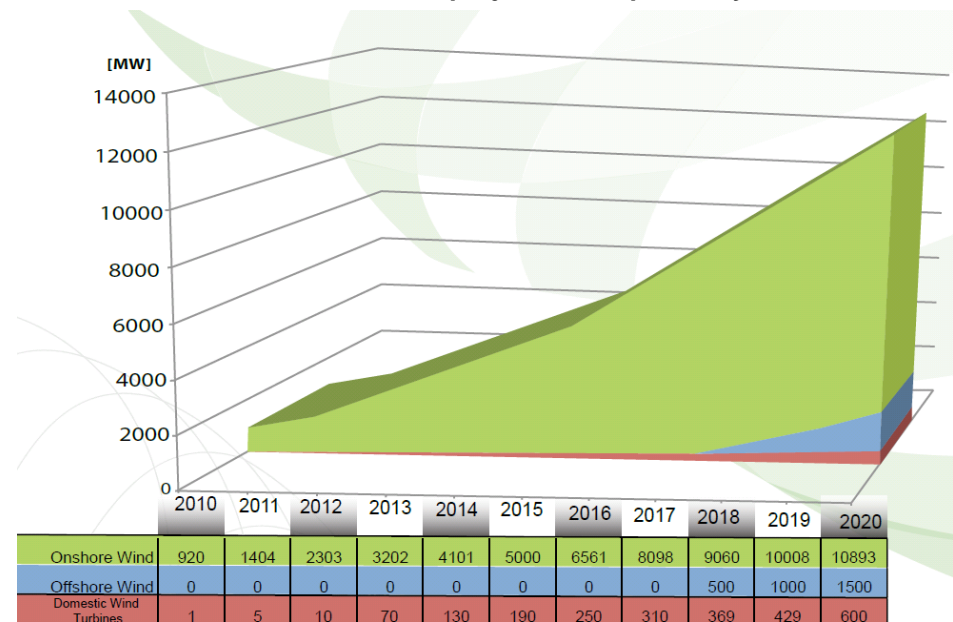
Biomass has a great potential to multiply approx. 10x by year 2020

Wind power > currently 910 MW  
average scenario considers 500MW additions annually

optimistic scenarios > could increase by 800MW annually

pessimistic scenarios > a rise to „only“ 3800MW in 2020

Outlook for Wind Power project development by PWEA

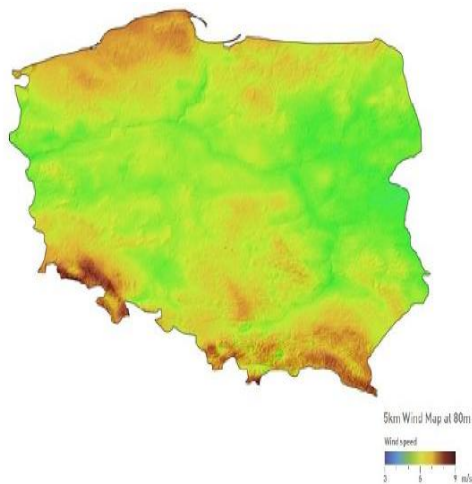


Source: The „Wind power development in Poland by 2020 – a vision“ report

# Installed Wind Turbines in Poland



Companies mainly intend to invest in Zachodnio Pomorskie region , Pomorskie region and Dolnoslaskie region



# Poland – Key Energy Sector Players and Regulatory Bodies



## Utility companies >



PGE SA  
Tauron S.A.  
PAK S.A.  
ENEA  
GDF  
SUEZ  
ENERGA



## Grid Operators >

Polskie Sieci Elektroenergetyczne  
Vattenfall S.A.  
ENEA  
ENERGA  
EnergiaPro  
Enion  
RWE  
Stoen Operator Sp. z o.o.

## Key banks investing into renewables >

BZ WBK  
Bank Ochrony Środowiska

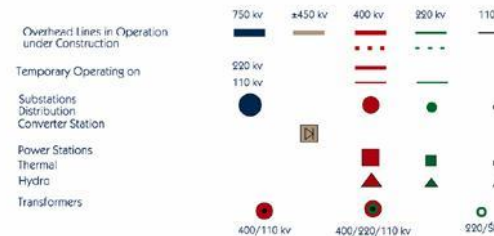
## Investors into Wind energy >

RWE

## Regulatory bodies >

Urząd Regulacji Energetyki

Polish Wind energy association claims that grid capacity for Wind installations is 13000 MW, as a counter-argument against position of state grid operator



the Polish power grid consists of about 200 km of 750 kV lines, about 4,700 km of 400 kV lines, and about 7,900 km of 220 kV lines, and is interconnected using more than 80 large substations.





## Feed-in tariff for Wind in Poland in 2010

0,255 zł/kWh = **0,0646 €/kWh**

## Project development

It usually takes four or five years from the moment a decision is made until the actual realisation of an investment in wind energy.

The process is typically first delayed by the painful fact of usually no zoning plan for the area where the investment is to be built — in Poland this has become the norm.

Delays are also caused by legal barriers, such as the lack of uniform regulations regarding the necessary modernization of power grid infrastructure.



Headquartered in Warsaw

A team of 60 experienced technical inspectors and auditors

Most frequent activities of TÜV SÜD Polska :

- **Industry Service Division** + Energy Team – consultancy on renewable energy, GHG, inspection of materials, certification of welders, supervision of steel constructions
- **Real Estate Division** – construction monitoring, on behalf of investors and banks, quality audits
- **Product Service Division** – pre/post-shipment inspections

# Services of TÜV SÜD for Wind Business in Poland



**Manufacturers**

**CE Marking, Type certification**

**Investors**

**Site assesment**

**Wind Measurement, Wind Expert Report**

**Environmental Impact Assessment**

**Technical Due Diligence**

**Supervision during Construction, Witness of Commissioning**

**Wind farm certification**

**Operators**

**Assessment of documentation acc. to Polish and European requirements**

**Regular inspections of machinery and electrical equipment, elevators,  
personal protection equipment**

**EPC contractors,  
O&M providers**

**Certification of competence for developers and service organization**

**Training**

# Poland – Geography – Location in Europe



## Classification into geographic areas

Coast: Baltic Sea from Pomerania to Danzig Bay

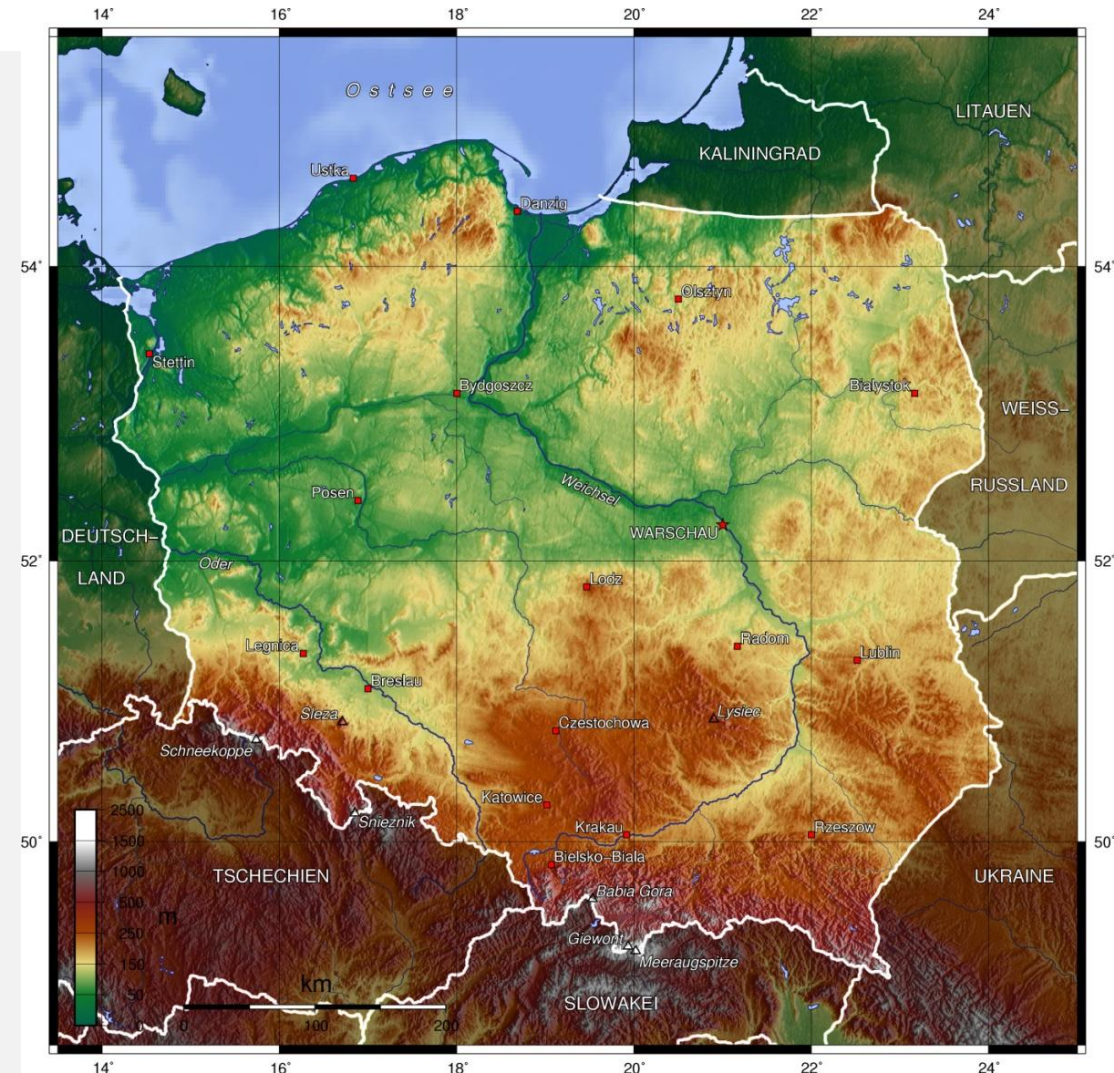
North: Baltic land ridge (20 – 331 m → Turmberg as highest point), including several lake districts

Centre: Central Lowlands (50 – 250 m)

Czech Border: Sudetes (500-1603m: Mt. Sněžka)

Slovakian-Ukrainian Border: Carpathian Mountains-Tatra (500-2499m: Rysy)

Belarus Border: Fl. Bug (100-200 m)



Source: [http://upload.wikimedia.org/wikipedia/commons/3/35/Polen\\_topo.jpg](http://upload.wikimedia.org/wikipedia/commons/3/35/Polen_topo.jpg)

# Poland – Wind potential I



Source: Lecture: Wind potential in Poland, Chun, 11.10.2007

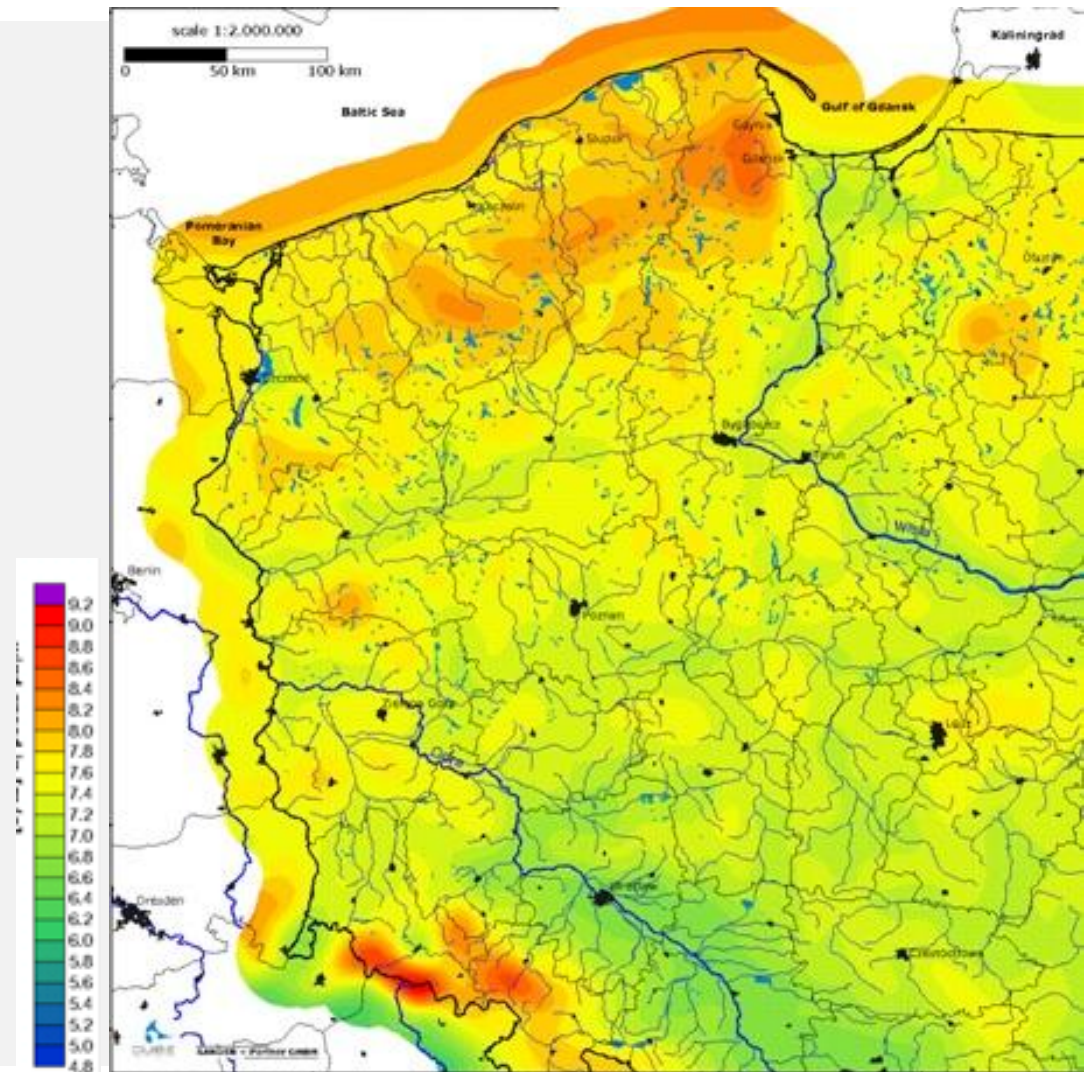
Potential map I

## Land area:

Maximum value	9.0 m/s
Minimum value	5.8 m/s and less
Potential difference	0.2 m/s
Range of values	3.2 m/s

## Offshore:

Maximum value	9.0 m/s
Minimum value	8.0 m/s
Potential difference	0.2m m/s
Range of values	1.0 m/s



# Poland – Wind potential II



Source: Lecture: Wind potential in Poland, Chun, 11.10.2007

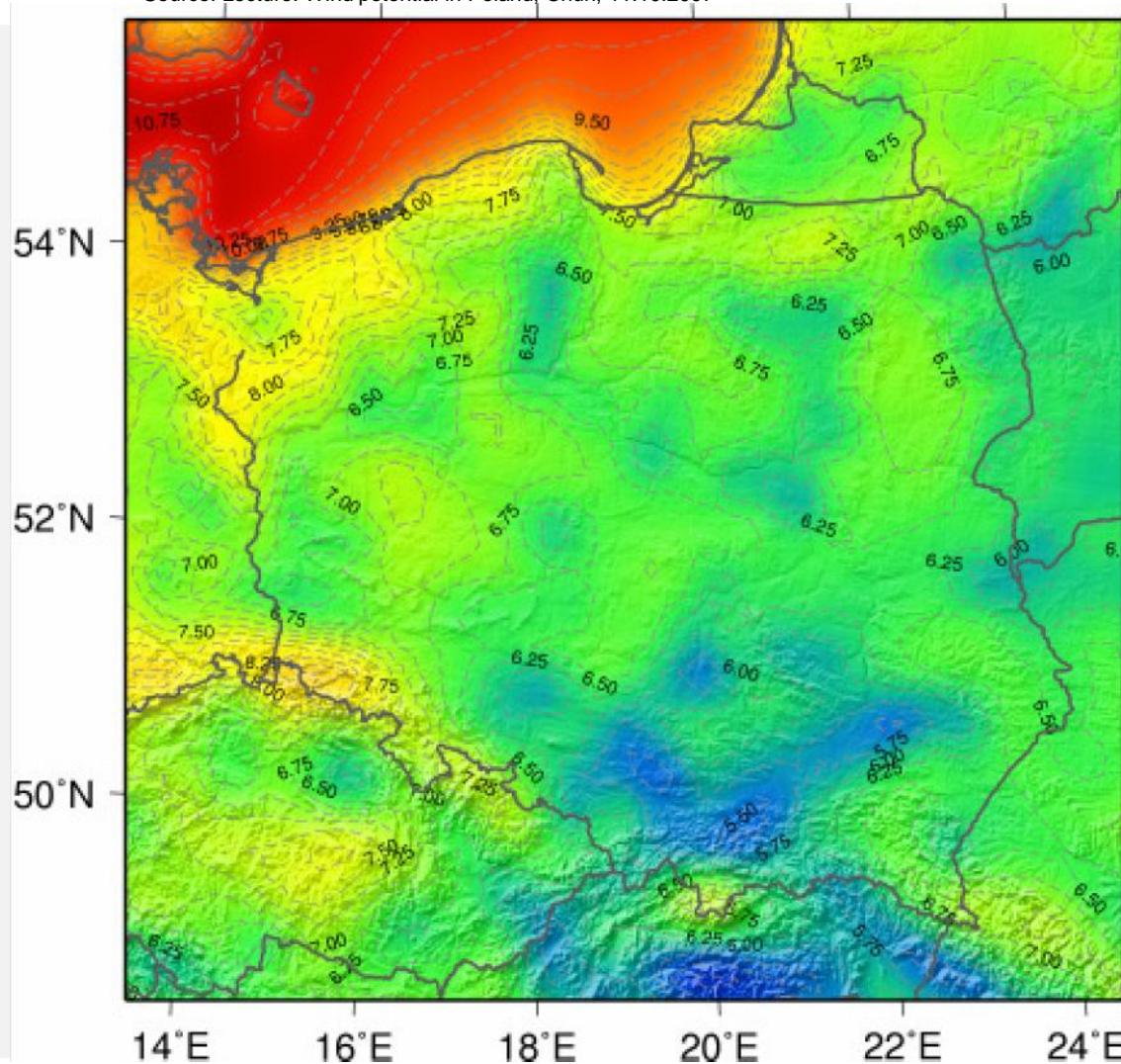
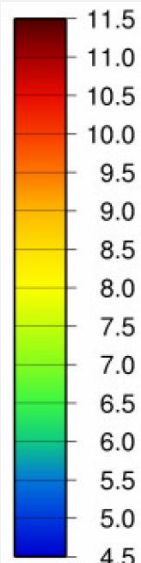
Potential map II

## Land area:

Maximum value	8.5 m/s
Minimum value	5.0 m/s and less
Potential difference	0.5 m/s
Range of values	3.5 m/s

## Offshore:

Maximum value	11.5 m/s
Minimum value	8.5 m/s
Potentialabstufung	0.5 m/s
Range of values	3.0 m/s



# Poland – Wind potential III



Source: Internet

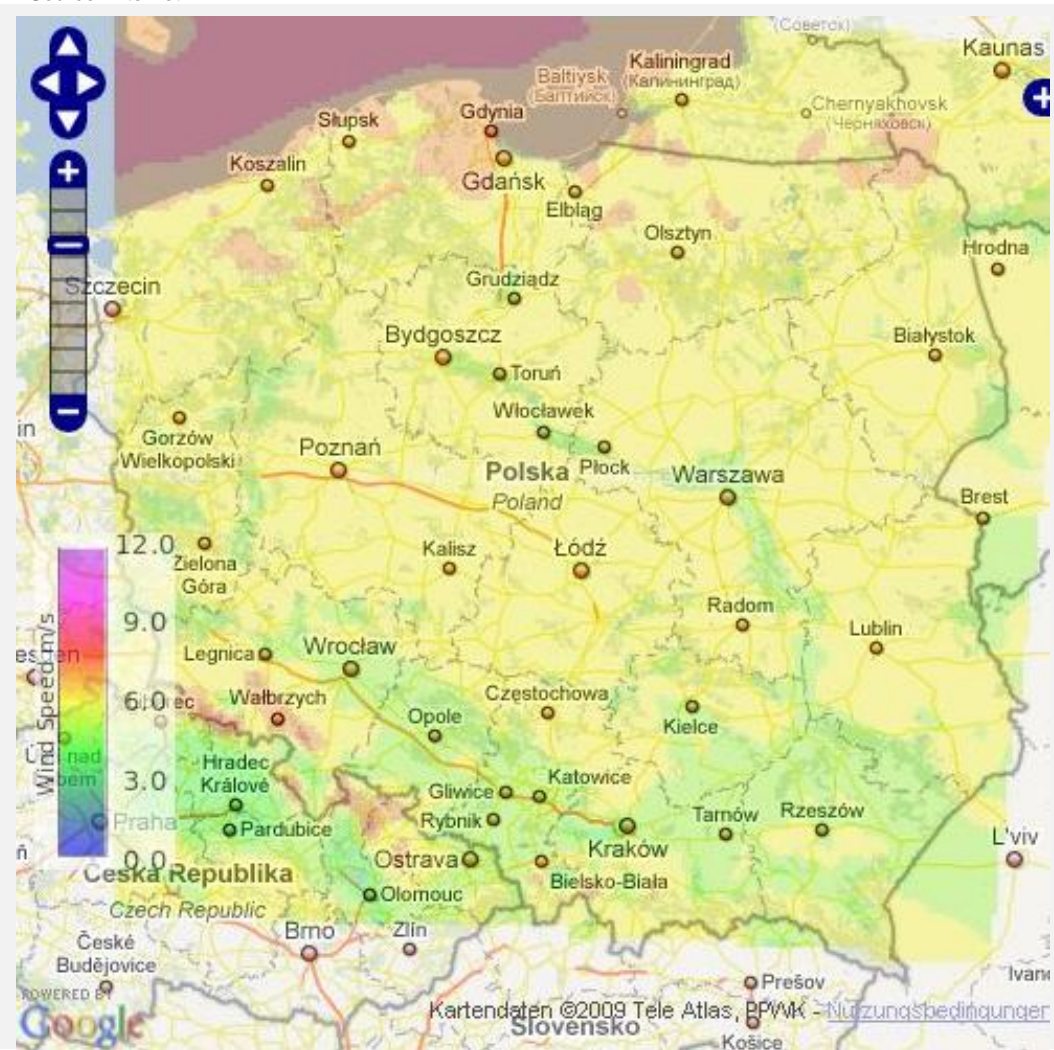
Potential map III

## Land area:

Maximum value	10.0 m/s
Minimum value	5.0 m/s and less
Potential difference	sliding
Range of values	5.0 m/s

## Offshore:

Maximum value	12.0 m/s
Minimum value	10.0 m/s
Potential difference	sliding
Range of values	2.0 m/s



Source: Internet

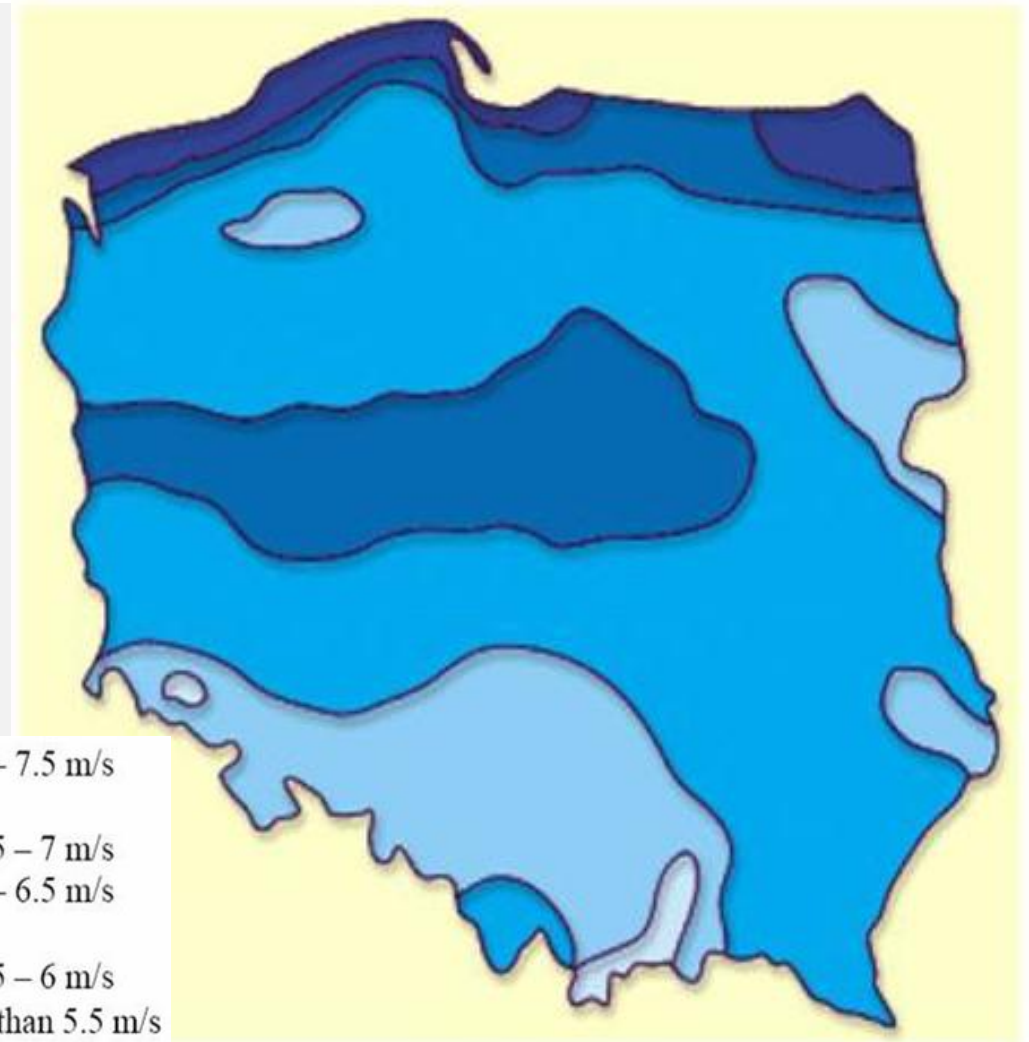
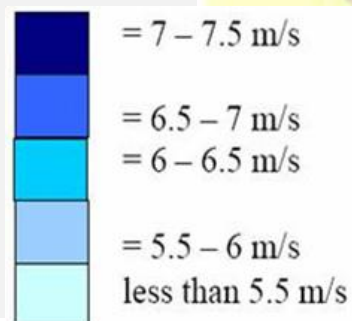
## Potential map IV

### Land area:

Maximum value	7.5 m/s
Minimum value	5.5 m/s and less
Potential difference	0.5 m/s
Range of values	2 m/s

### Offshore:

Maximum value	k.A.
Minimum value	k.A.
Potential difference	k.A.
Range of values	k.A.



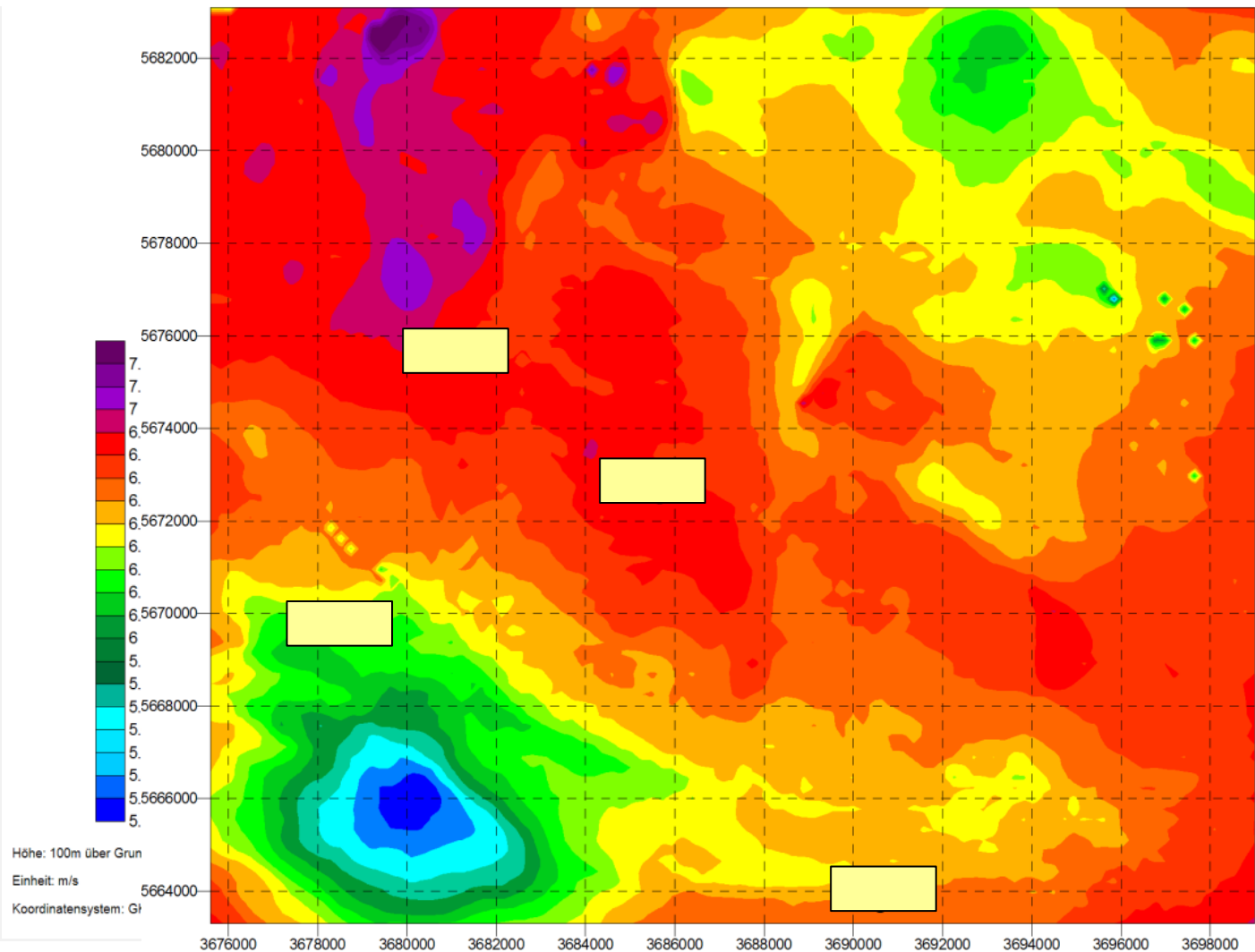
## Potential map V

### Land area:

Maximum value	7.2 m/s
Minimum value	5.2 m/s
Potential difference	0.1 m/s
Range of values	2 m/s

### Offshore:

Maximum value	k.A.
Minimum value	k.A.
Potential difference	k.A.
Range of values	k.A.



## Results of Validation

### Using existing wind turbines

Validations using existing wind turbines	Distance between Modell & Val.-Farm	Period	Real Energy Yield	Energy Yield based on Potential analysis	Quotient $E_{val} / E_{pot}$
Wind farm in the North (Puck)	n/a	> 12 Months	4'722 MWh/a per WTG	5'281 – 8'251 MWh/a	112% bis 174%

### Using existing wind measurements

Validations using existing wind measurements	Distance to Reference point	Wind speed validated model calculation ( $v_{val}$ )	Wind speed potential analysis ( $v_{pot}$ )	Quotient $v_{val} / v_{pot}$	Quotient $E_{val} / E_{pot}$
Atlas: North PL 100 m	n/a	6.8 m/s	7.0 m/s - 9.0 m/s	103% - 132%	106% - 156%
Atlas: Centre PL 100 m	n/a	6.4 m/s	5.0 m/s - 7.4 m/s	78% - 116%	57% - 132%
Atlas: South PL 100 m	n/a	6.4 m/s	5.4 m/s - 7.8 m/s	84% - 122%	67% - 145%

## Core Message

- Potential maps have only questionable information
- Only low number of wind farms available
- Energy yield data difficult to organise for validation purposes
- Significance in the north is higher than in the centre & south
- Northern Part has significant wind speed differences (elevation level)
- Wind measurements absolutely necessary (all areas)
- Northern and Southern part with stronger wind potentials (based on available wind measurements)
- Central wind potential widely unknown
- Mental change regarding investment for wind measurements

