The Use of Wind Energy – State of the Art and Outlook

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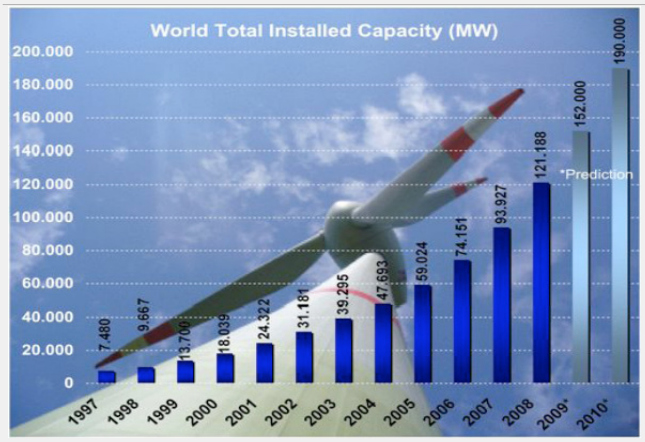
Key Figures World 2008

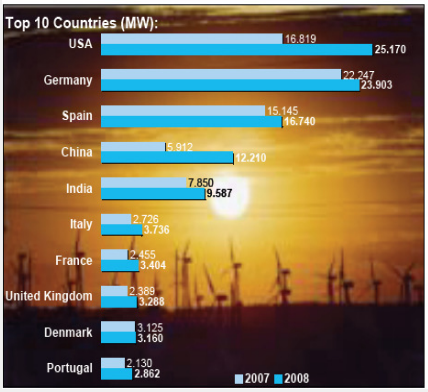


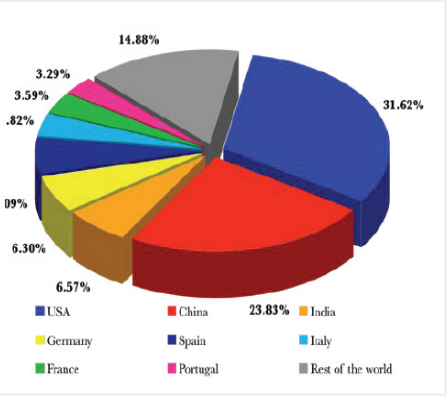
- Growth rate 2008: 29%
- 260 TWh generated in 2008 ,
- Contribution to world electricity consumption: 1,5%

Source:: WWEA – World Wind Energy Report 2008

GTZ-TERNA Expert Workshop 2009: Grid and System Integration of Wind Energy, 10.11.2009-12.11.2009, Berlin/Germany

Key Figures World 2008

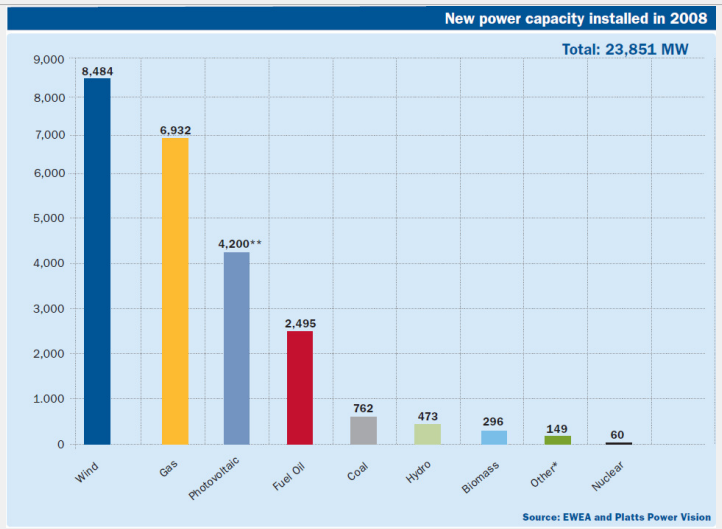




- USA with largest installed wind generation capacity
- Biggest markets in 2008: USA, China, India, Germany

Source:: WWEA – World Wind Energy Report 2008

Net Power Capacity Installed in EU27 in 2008



Source: EWEA 2009

The EU 2020-Targets

Target for 2020:

- 20% renewable contribution to total energy production

This requires:

- 35% electricity from RES
- 25% heating from RES
- 10% biofuels from RE

Electricity from RES in 2005:

- 15%, including 10% large hydro and 3% wind.

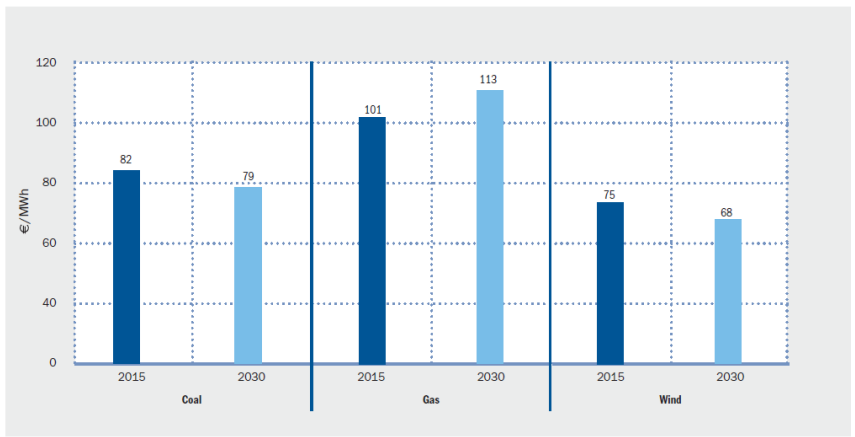
Required wind generation in 2020:

- 11-14% el. energy -> 180GW installed capacity (2007: 56GW)
- Required average newly installed capacity per year: 9,5GW
- 2007 market: 8,5GW

Costs/Support Schemes

Wind Generation - Costs

- Electricity generating costs in EU 2015 and 2020
  (for newly installed power plants)



Source: IEA – World Energy Outlook 2008/Euro-Dollar exchange rate 0,73

Support Schemes in Europe

- Feed-in Tarifs (e.g. Ge, Fr, Sp, Dk,)
- Quota-Systems – Green Certificates (e.g. UK, It, PL)
- Others (Less Important):
  - Tenders
  - Fiscal Incentives

Support Schemes – Feed-In Tariffs

Concept:

- Fixed price per kWh produced.
- Prioritized dispatch (every kWh produced must be taken)
- Prioritized grid access.

Advantages:

- Highly predictable return of investments for private investors

Disadvantages:

- Tariffs must be carefully defined for avoiding overpayment.
- No integration of RES into existing electricity markets.
- No competition between different RES-technologies.

Support Schemes – Quota/Green Certificates

Concept:

- RES participate in regular electricity markets.
- RES participate in Green-Certificate market.
- Suppliers must buy a defined number of Green-Certificates (Quota) for not being penalized.

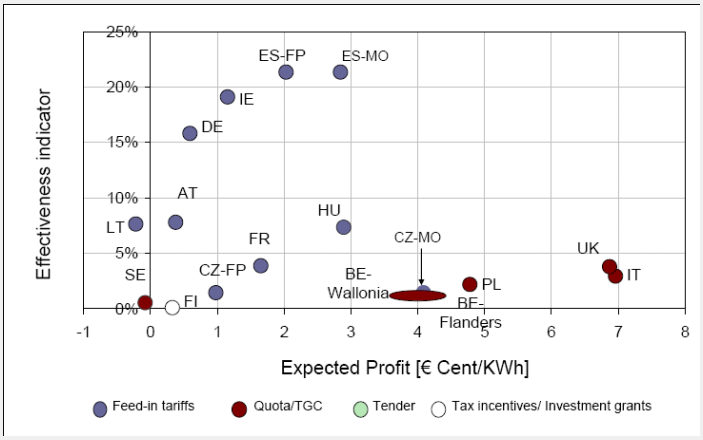
Advantages:

- Proper integration of RES in existing regulatory frameworks.
- Market mechanisms in place for controlling cost of electricity from RES.
- Amount of RES can be controlled via Quota.

Disadvantages:

- High level of insecurity for private investors.
- “Flip-Flop” effects in case of RES under- and oversupply.

Effectiveness of Support Schemes in the EU



Source: OPTRES, 2007, European Commission (COM(2008)19 final)

Support Schemes in EU - Summary

- Feed-In Tariffs show best effectiveness in terms of RES electricity generation in relation to the mid-term potential.
- At the same time, Feed-In-Tariff schemes are more cost effective than Quota/Green Certificate Schemes.
- But:
  - Mechanisms of Green Certificate Markets not yet well understood.
  - Level of RES too low for properly functioning Green Certificate markets.

Challenges

Wind Energy - Challenges

- Energy can only be used if it is available at the right **time** in the right **form** at the right **place**:
  - Right Time: Wind is variable energy source. Cannot be planned but only be predicted (with limited accuracy)
  - Right Form: Wind energy can be transformed into electrical energy very efficiently.
  - Right Place: Wind energy is typically available in remote areas. Requires transportation.
- Acceptance: Sight and noise

-> However, wind energy only disturbs but doesn‘t distroy.

Summary

- Wind Energy is one of the most economic renewable energy sources today.
- Wind energy still requires support for being competitive with other, conventional energy sources.
- Wind energy is:
  - a variable source, with limited predicibility
  - transport only possible via electrical lines (alternatively: compressed air, hydrogen -> not efficient nowadays)

➢ Grid and System Integration of wind energy is a very important challenge for using this form of energy efficiently.

Thank You

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