Water Framework Directive
and Heavily Modified Water Bodies

Statement Hydropower

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Hydropower in Europe
Generationmix in the European Union (EU-27) 2006

EU-27 Electricity Production 2006 (3 183 TWh)

- Total net Electricity Production (EU 27): 3.183 TWh
- Hydropower Generation 2006: 337 TWh
- Max Net. Generating Capacity (EU 27): 774.185 MW
- Bottleneck Capacity Hydropower: 140.321 MW

CO2-free

Conventional Thermal: 54%
Nuclear: 30%
Hydro: 11%
Total Other Renewables: 5%

CO2-emitting

EU-27 Generation Capacity 2006 (774 GW)

- Total net Electricity Production (EU 27): 3.183 TWh
- Hydropower Generation 2006: 337 TWh
- Max Net. Generating Capacity (EU 27): 774.185 MW
- Bottleneck Capacity Hydropower: 140.321 MW

CO2-free

Nuclear: 17%
Hydro: 10%
Total Other Renewables: 8%
Conventional Fossil: 57%

CO2-emitting
Quality Hydropower

- 5,000 year old technology
- Hydro-electric Power plants - more than 100 years of experience
- Efficiency more than 90%
- Multipurpose facilities
- Environmental friendly, CO₂-avoiding
- Highest availability compared to other technologies
- Quick response and reserve capacity
Challenges in the near future

- Increasing of electricity demand
- Decommissioning of generation units
- Increase of share of renewables
  - Energy and Climate Package
- Integration of non-dispatchable wind energy
- Increasing reserve capacity
- Security of supply

Primärregelung

- Prinzip: Kraftwerksregler

f < f_{soll} → Kraftwerksleistung ↑
f > f_{soll} → Kraftwerksleistung ↓

- Kennzeichen:
  - automatisch
  - nach wenigen Sek. wirksam
  - solidarisch
Beispiel für die Auswirkungen eines Kraftwerksausfalls von 1330 MW auf die Frequenz $f$;

$\uparrow$ ca. 50 mHz

$\downarrow$ 10 Sekunden

$\uparrow$ 10 Minuten
Primärregelung
- Prinzip: Kraftwerksregler

\[ f < f_{\text{Soll}} \rightarrow \text{Kraftwerksleistung} \uparrow \]
\[ f > f_{\text{Soll}} \rightarrow \text{Kraftwerksleistung} \downarrow \]

- Kennzeichen:
  - automatisch
  - nach wenigen Sek. wirksam
  - solidarisch

⇒ Übergabeleitungen notwendig!
Frequency Control

- **Primary frequency control**
- **Secondary frequency control**
- **Tertiary frequency control**

Load & Frequency Control
Balance Energy

- $t_0$
- $t_{0+30s}$
- $t_{0+15min}$
• Increasing peakload-demand in Europe
• Extreme quick response of hydropower compared to other technologies
• Ideal for pump-storage-powerplants
• Ideal partner for other renewables
Leistung aus Windkraftanlagen in MW

Tatsächliche Windkrafteinspeisung (IST)
Prognostizierte Windkrafteinspeisung (SOLL)

Windkraftbedingte Ausgleichsenergie in MW

Energie-überschuß
Energie-defizit

04.01.2004  05.01.2004  06.01.2004  07.01.2004  08.01.2004  09.01.2004  10.01.2004
1 GWh from Hydropower corresponds to approximately 220 t oil
1 GWh from Hydropower corresponds to approximately 330 t hard coal
In Europe 2005 (EU 25) 311.2 TWh HP production
Avoidance of 250 Mio. t CO₂ (based on oil fired power plants)
Avoidance of 290 Mio. t CO₂ (based on coal fired power plants)
Hydropower is the most important renewable in Europe.

Storage and Pumpstorage HPP play an important role in the European Electricity Supply (Security of supply).

Hydropower is the perfect partner for the development of all other renewable energy source (especially for wind power).

Common understanding between Hydropower and environmental goals is important.

We have grown systems; different systems need individual solutions.

Optimisation of the Hydropower System (including new plants) under the existing framework is a challenge for the near future.
The implementation of the WFD a challenge for the Hydropower industry
The designation of HMWB plays an important role
The definition of GEP crucial
The alternative approach seem to be a chance, because the importance of the hydropower - use must be taken into account
Production losses must be minimized
It is important that the quality of hydropower generation must be maintained
Thank you for your attention