



**Symposium on Climate Change and the European Water Dimension
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Climate Change & Hydropower Consequences and challenges

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Climate Change and the role of Hydropower in Europe Hydropower & Climate Change

Hydropower and Climate Change

two questions

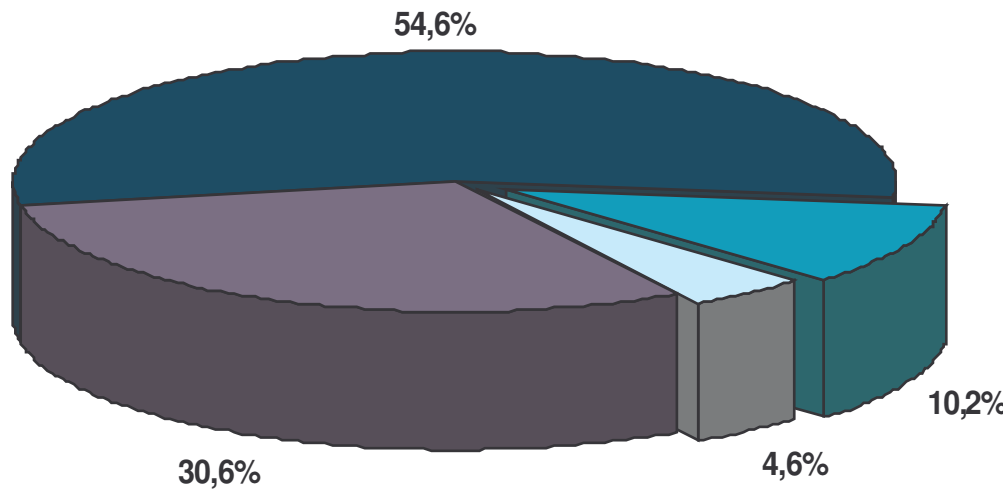
Hydropower
- Renewable Energy;
contribution of HP;
Avoidance of GGE

Consequences of
Climate Change Scenarios
on Hydropower



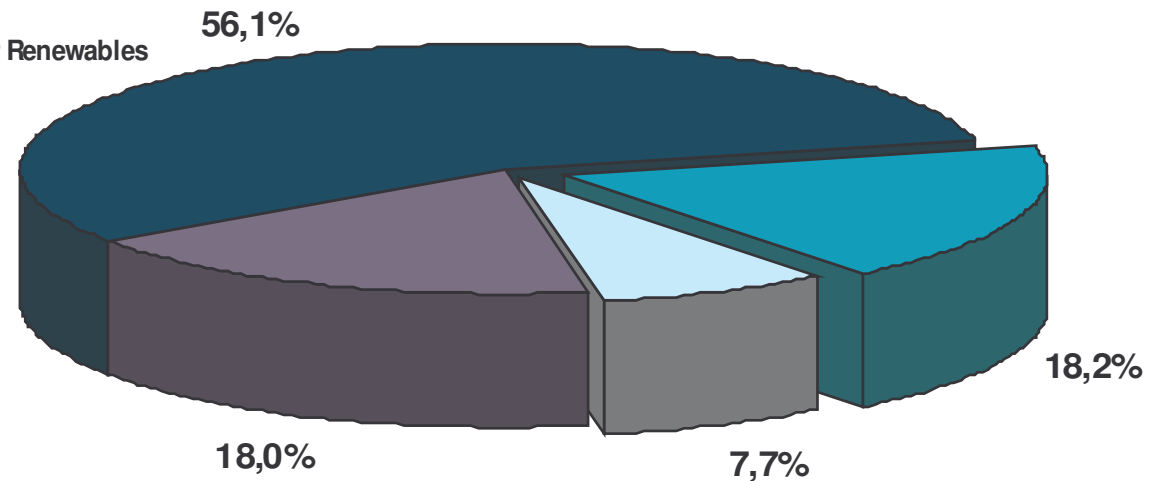
Climate Change and the role of Hydropower in Europe Generationmix in the European Union (EU-25) 2005

Total Net Electricity Production 2005



■ Nuclear ■ Conventional Thermal ■ Hydro ■ Total other Renewables

Total Net Generating Capacity 2005



Climate Change and the role of Hydropower in Europe

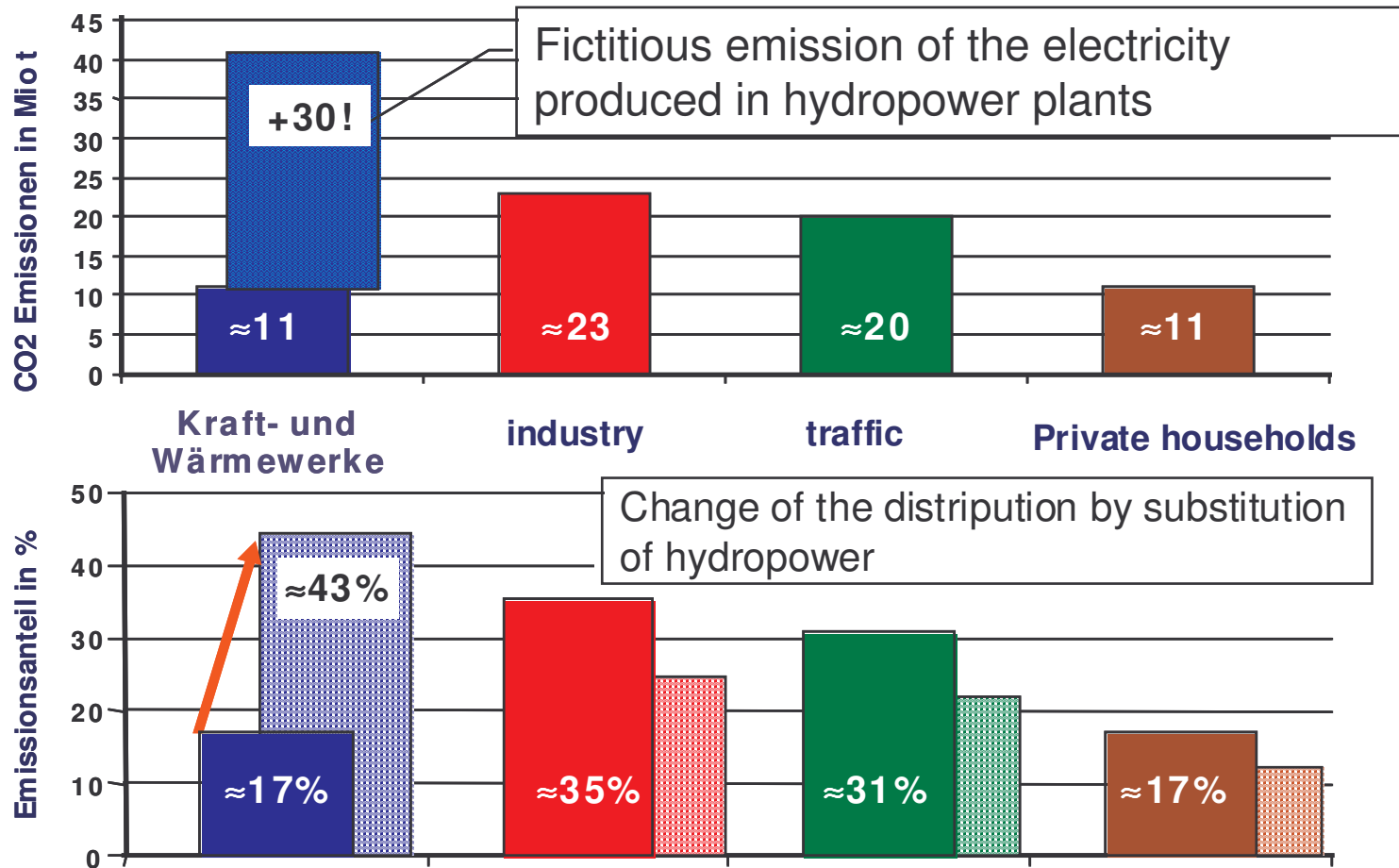
CO₂ avoidance by Hydropower

- ✓ **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)**

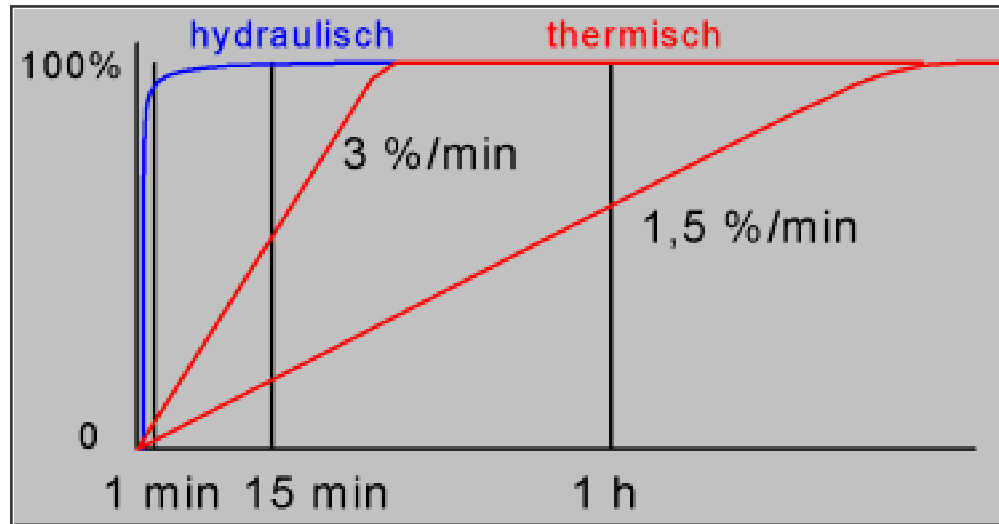




Climate Change and the role of Hydropower in Europe CO₂ avoidance by Hydropower (example – Austria)



Climate Change and the role of Hydropower in Europe Quality of Hydro power



- Increasing peakload-demand in Europe
- Extreme quick response of hydropower compared to other technologies
- Ideal for pump-storage-powerplants
- **Ideal partner for other renewables**



Climate Change and the role of Hydropower in Europe

Impacts of climate - change scenarios on the hydropower generation

- In general – the effects of the climate change scenarios on the water regime are:
 - very uncertain
 - locally differently
 - **at that time it is difficult to have clear strategies**
- In alpine areas (most scenarios show)
 - decrease of runoff during summer
 - increase of runoff during winter
 - **improvement for the hydropower production**
 - decrease of the glaciers
 - **importance of the storage capacity will rise**
 - increase of extreme events (floods and droughts)
 - **importance of the storage capacity will rise**
 - **Flood protection by storage HPP on a local scale**
 - **Positive influence on the run-off during drought periods**
 - **New rules in connection with dam safety (new hydrological methods)**
 - **Sediment problems will increase (permafrost level in alpine areas)**



Climate Change and the role of Hydropower in Europe

Impacts of climate - change scenarios on the hydropower generation

- **In South Europe areas**
 - decrease of runoff because of climate change?
 - **Reduction of Hydropower production**
 - Increase of (catastrophic) drought periods?
 - **Critical situation for run of river HPP production**
 - **Importance of the storage capacity will rise (multipurpose use!)**
 - **Restrictions for the operation of thermal power plants because of a lack of cooling water or the water temperature is to high**
 - **High electricity demand because of air conditioning**



Climate Change and the role of Hydropower in Europe

Conclusion

- **Climate Change is a serious issue for the whole electricity industry**
- **The new Package for Energy by the commission is an important step for future developments in Europe.**
- **The role of renewable energy sources will further increase**
- **Hydropower is still the most important renewable energy source worldwide and in Europe**
- **Hydropower operators must have a strong focus on climate change**
- **Climate Change is a big challenge for the future!**



Thank you for your attention

