



Entretiens du Centre Jacques Cartier Grenoble

Le rôle de l'hydroélectricité dans l'Europe de l'énergie décarbonnée

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Area of conflict for Hydropower

Economic Framework Conditions

Competition
Liberalization
Deregulation
....

Public opinion
& acceptance

Energy and climate change targets

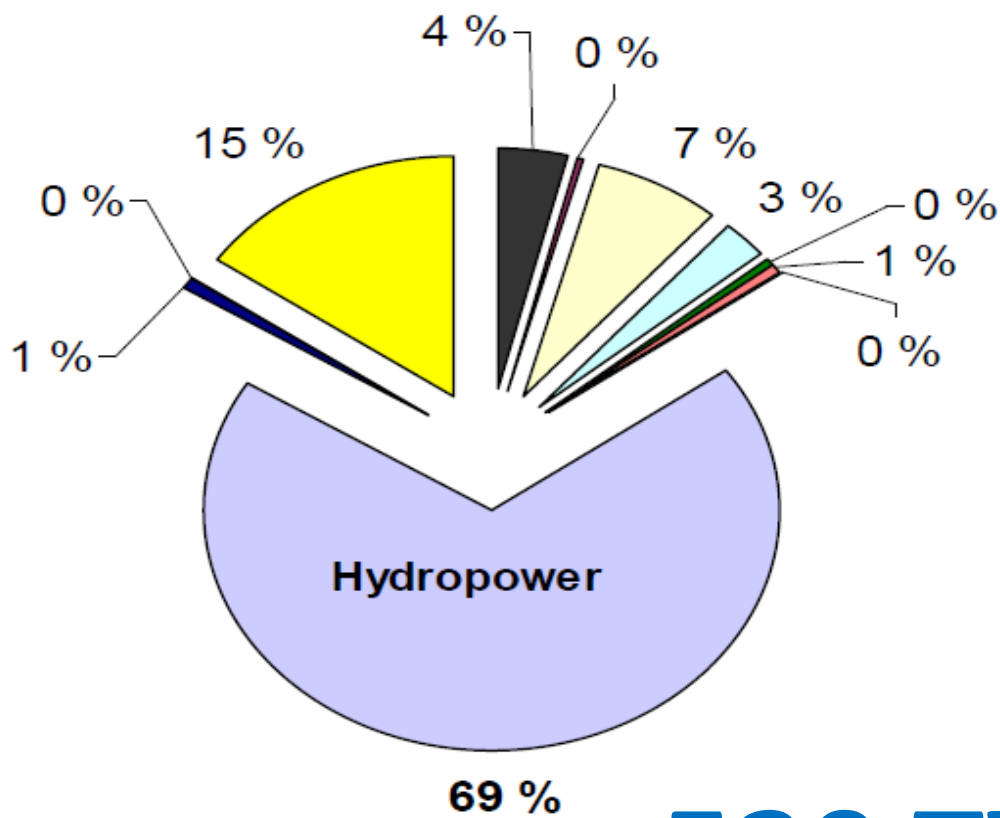
Renewable energy targets
Security of supply
National energy objectives
National targets
Multi-purpose function of the hydro

Nature and Water Protection

Objectives of the EU WFD
Natura 2000
FFH - Directive
others

Hydropower is Europe's most important RES

Renewable Electricity Generation in Europe by Source in GWh (IEA. 2008)

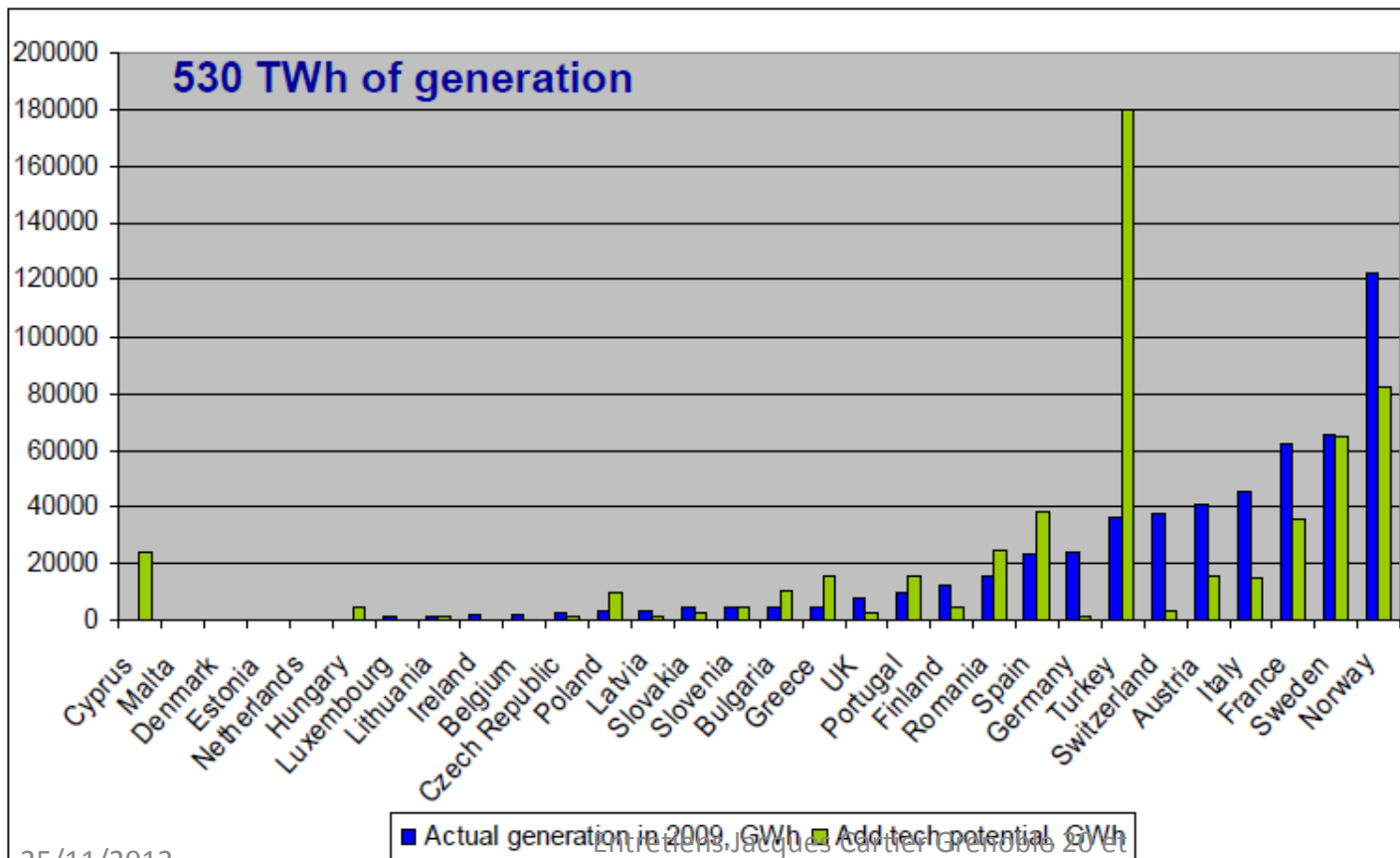


- Municipal Waste*
- Industrial Waste
- Primary Solid Biomass**
- Biogas
- Liquid Biofuels
- Geothermal
- Solar Thermal
- Hydro
- Solar Photovoltaics
- Tide, Wave, Ocean
- Wind

530 TWh

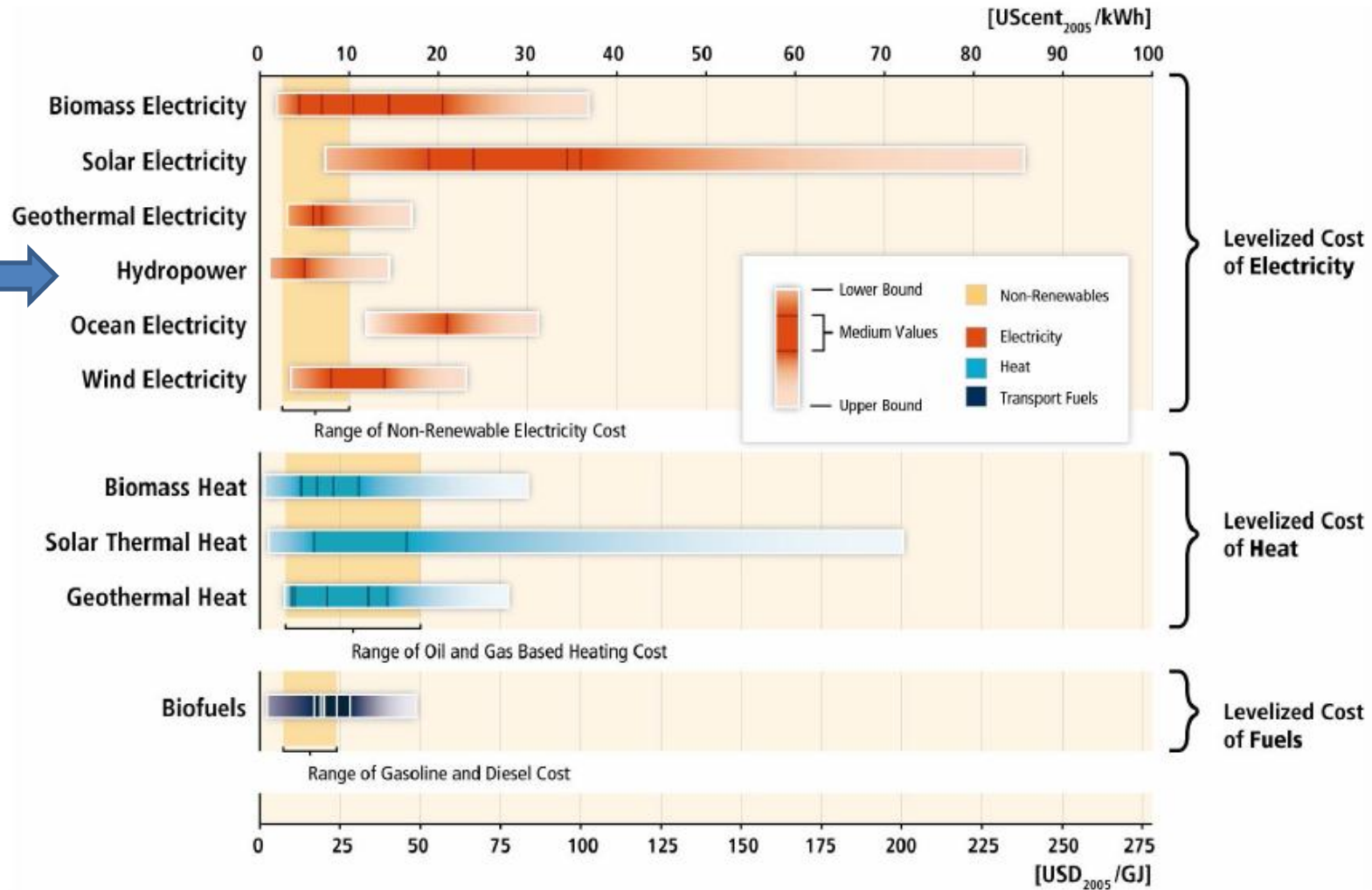
Hydropower potential in Europe

EURELECTRIC European Members



370 TWh
TURKEY not included
additional technically feasible potential
More than 50% can still be deployed

Hydropower is the most affordable renewable energy source



Hydropower provides flexibility to stabilise electricity systems and support increased integration of variable renewables

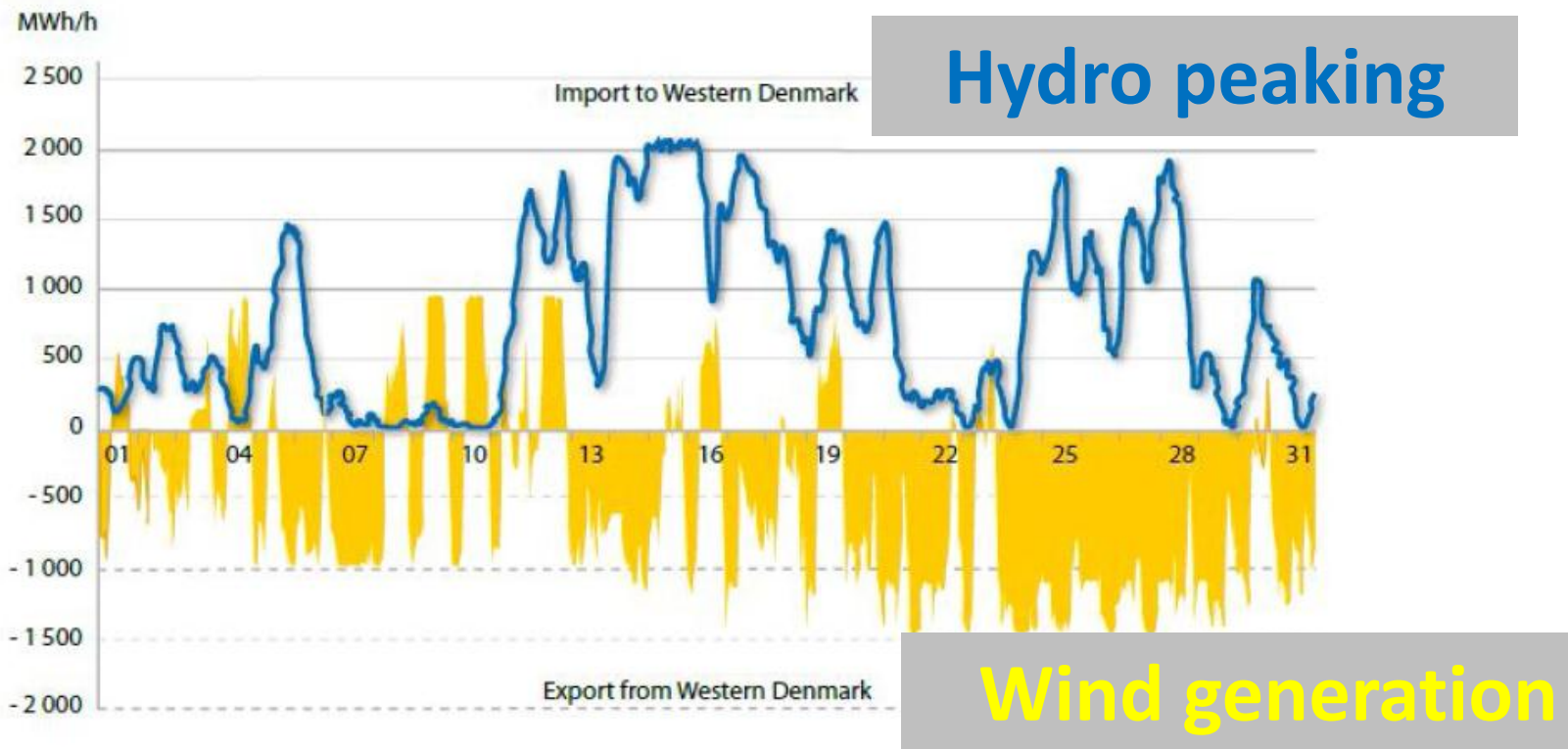
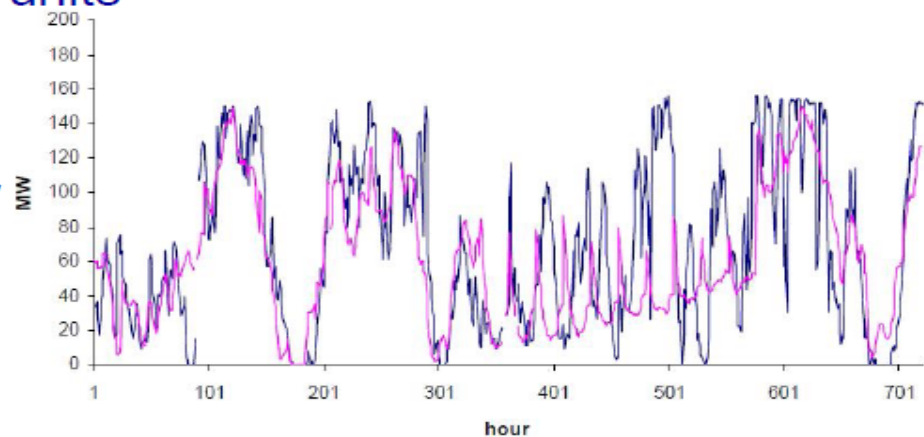


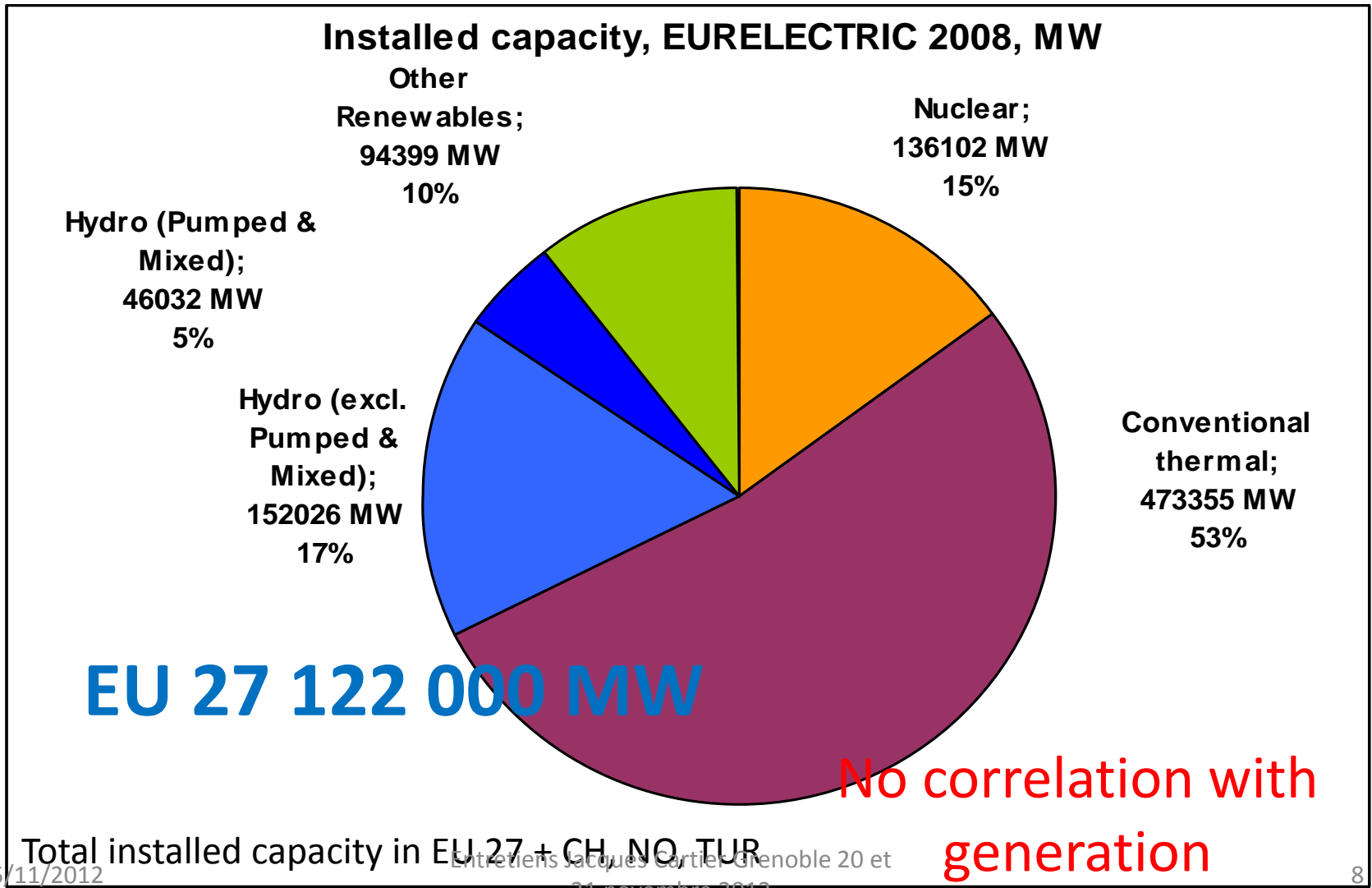
Figure 3: Western Denmark's electricity trading with Norway and Sweden: wind power for hydropower (Source: International Energy Agency, *Projected Costs of Generating Electricity*, 2010 Edition)

ancillary services to stabilise the demand and supply fluctuations in an electricity system and to sustain hence energy security

- > frequency regulation
- > voltage support
- > spinning reserve
- > synchronous reactive power modulation
- > improved efficiency of thermal units
- > improved system operation reliability
- > improved black-start capability



eurelectric Hydro capacity



Pumped hydro storages are the most efficient storage technology

Pumped hydro storage



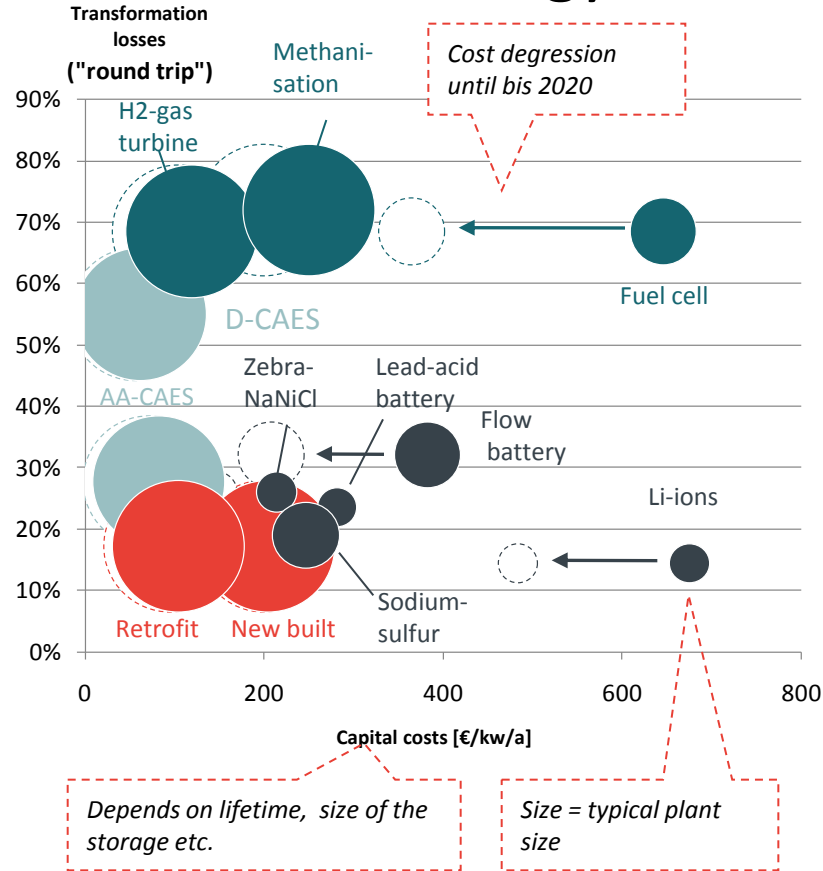
- Retrofit in Alpine storages
- Limited potential for new construction

Competitors in the electricity market

Compressed air storage (CAES)



- Requires salt caverns – potential in northern Europe
- Attractive where network congestion arises



Hydrogen



- Might make sense on the long-term
- Mobile, i.e. appropriate for „power-to-transport“

Competitors also in the transport market

Batteries



- Potential depends on learning effects
- May be viable decentrally
- Mobile

Source: Frontier Economics

Conclusion

- **Pumped hydro storages best combine investment costs, lifetime and efficiency**
- However, **the technical potential for PHS within the EU is limited** - this makes it even more important to use the existing potential

STEP en projet

Pumpspeicherkraftwerke in Mitteleuropa

Geplante PSW-Projekte in D, A, CH und LUX

PSW Kühltal II

Status: in Planung (230 MW)
Inbetriebnahme: 2016

PSW Vianden

Erweiterung um 200 MW
Inbetriebnahme: 2013

PSW Atdorf

Status: in Planung
ca. 1.400 MW
Inbetriebnahme: 2018

PSW Linthal

Status: im Bau
ca. 1.000 MW
Inbetriebnahme: 2015

PSW Nant de Drance

Status: im Bau
ca. 900 MW
Inbetriebnahme: 2016

PSW Puschlav

Baubeginn: 2013
ca. 1.000 MW
Inbetriebnahme: 2018

PSW Waldeck II

Erweiterung um 300 MW auf
780 MW
Status: in Planung
Inbetriebnahme: 2016

PSW Jochenstein-Riedl

Status: in Planung
300 MW
Inbetriebnahme: ca. 2018

PSW Feldsee

Baubeginn: 2008
zusätzliche 140 MW
Inbetriebnahme: 2011

PSW Reißbeck II

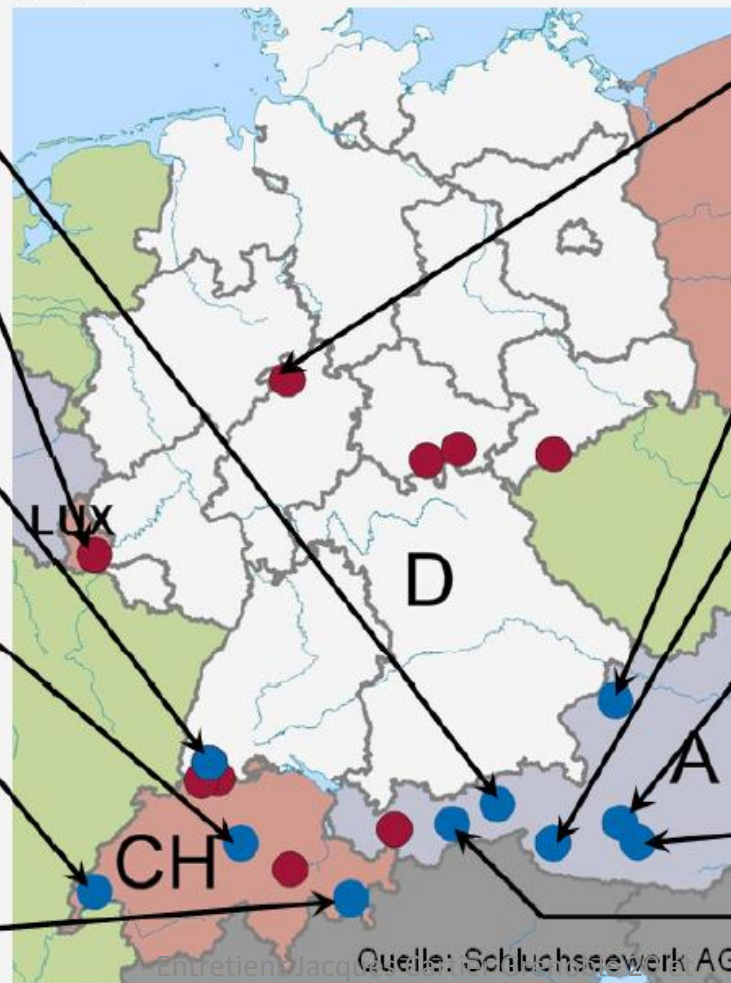
Status: im Bau
ca. 430 MW
Inbetriebnahme: 2014

PSW Limberg II / III

Status: im Bau / in Planung
jeweils ca. 480 MW
Inbetriebnahmen: 2011 / 2016

PSW Gepatsch

Status: in Planung
ca. 390 MW



Eurelectric WFD impact on Hydro

- Costs / benefits difficult to estimate
- WFD implementation losses
 - Increasing residual flow, sediment transportation, fish passes
 - More than 5% energy losses 26 TWh
 - Large impact on hydro storage and peaking capacity
- Pre planning mechanism
 - No-go areas : most of hydro potential concerned
 - List of criteria (AT)
- Labels: IHA, CHOICE, Nature Made...



European hydro equipment industry and expertise



- HEA founded in 2001, based in Brussels
- Represents electro-mechanical equipment manufacturers for hydropower globally
- 12 members:
 - 4 full members, world leaders in market share and technology with global presence
 - Alstom Hydro, Andritz HYDRO, Voith Hydro and Impsa Hydro
 - 8 associated members (HEA-E) representing the interests of the small turbines manufacturers in Europe
 - Global Hydro Energy, Litostrojj, Mavel, Mecamidi, MJ2 Technologies, Stellba, Turab and Turboinstitut

European hydro equipment industry and expertise



- HEA is involved in the stakeholders dialogue on energy supply strategies, by emphasizing all sustainable development aspects of hydropower.
- In cooperation with leading global partners, HEA supports the development of guidelines related to sustainable hydro and good practice in hydro projects, with the use of the "Hydropower Sustainability Assessment Protocol", developed by IHA, the International Hydropower Association.

European leadership is driving the technology development since 150 years

Thank you for your kind attention

Ghislain WEISROCK

25/11/2012

Entretiens Jacques Cartier Grenoble 20 et
21 novembre 2012

14