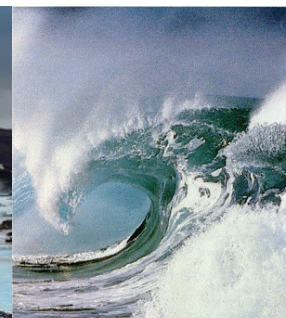




# Centre for environmental design of renewable energy – CEDREN



Hydro storage –  
a renewable battery





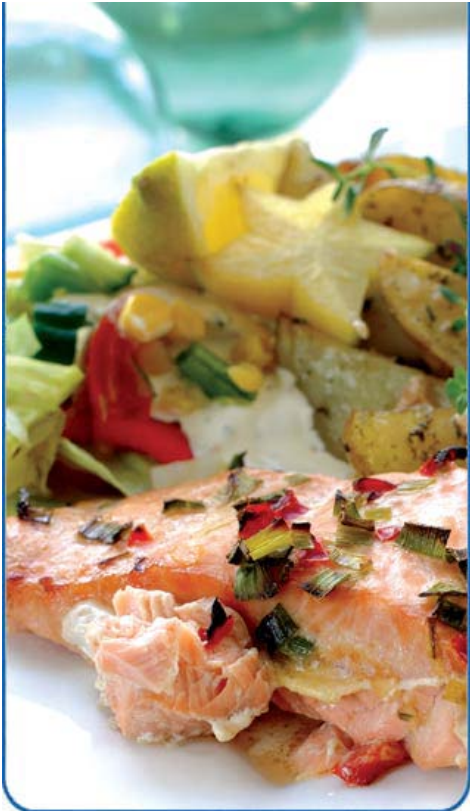
The main objective of CEDREN is to develop and communicate design solutions for renewable energy production that address environmental and societal challenges at local, regional, national and global levels.





Technology development for the future hydro system

## Hydropower development

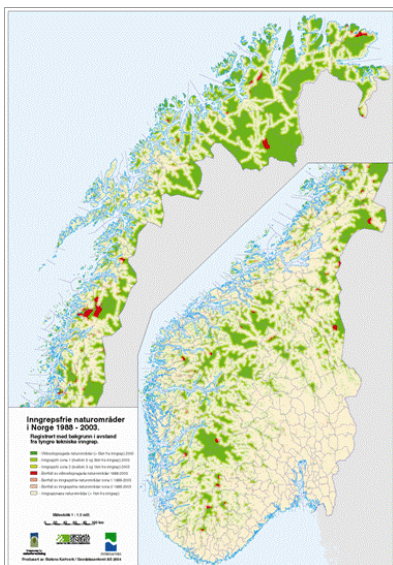


Increased power *and* salmon production



Environmental impacts of flow fluctuations – methods and tools

# Environmental design



Power transmission: Impacts on wildlife



Birds and wind turbines

Policy and society: How to reconcile energy and the environment?



- ▶ Scenarios for load/demand in Europe
- ▶ Improved hydrology/better operation
- ▶ Improved models for the power system
- ▶ Pumped storage/Load governing
- ▶ Effects of increased flow variability
- ▶ Effects on ice and rivers – Climate change



# Environmental impacts of rapid and frequent flow changes

Knowledge about how, when and where rapid variations in power production may be done with acceptable impacts on the ecosystem.



Physical processes



Biological processes



Mitigation



# EnviDORR

## Increased power and salmon production with Environmentally Designed Operation of Regulated Rivers



# BirdWind – research at Smøla



# OPTIPOL

## – power line rights of way; wildlife; biotopes



- ▶ Develop planning tools for optimal choice of power line rights of way
- ▶ Find solutions to reduce conflicts between transmission lines and wildlife

# GOVREP

GOVernance for Renewable Electricity PRoduction



*How to reconcile environmental- and energy policy concerns?*

Enabling a more effective realization of both energy- and environmental objectives as agreed upon by the Parliament

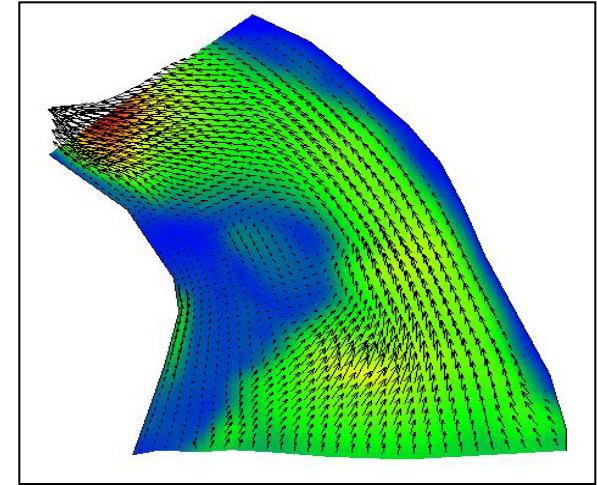
## In *situ* study



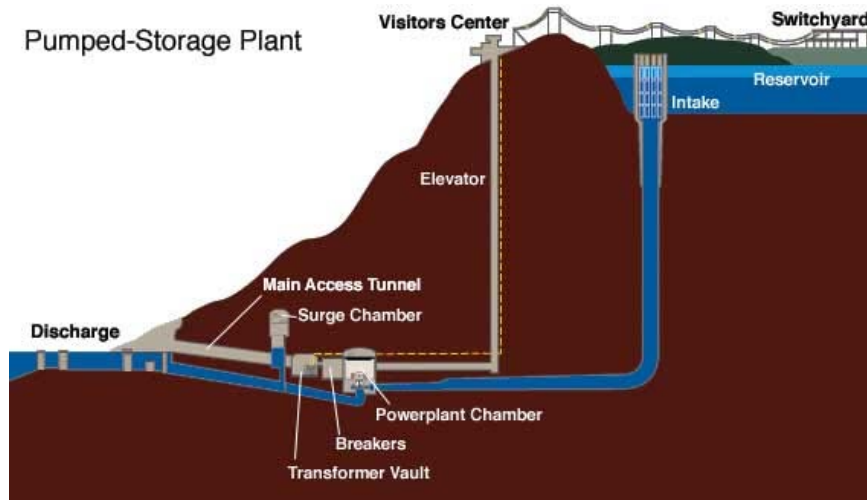
## Laboratory



## Model simulation



## Demonstration



# Users





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