



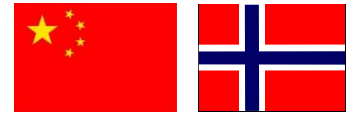
Summary of workshop Day 1

Beijing, September-2013



FutureHydro

Sustainable hydropower development in China and Norway to meet future demands



The overall objective is to promote **bilateral exchange** of knowledge, technology and experience between Norway and China and enlarge the **scientific knowledge** regarding the use of hydropower and pump-storage as a battery to **balance intermittent energy sources**.



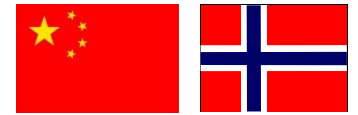
Primary and secondary objectives of the project

The overall objective is to *promote bilateral exchange of knowledge, technology and experience* between Norway and China and *enlarge the scientific knowledge* regarding the use of hydropower and pump-storage as a battery to balance intermittent energy sources.

Sub-goals are:

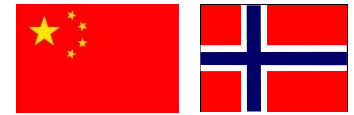
- Evaluate current and future needs and capacity of Chinese hydropower to balance intermittent energy sources in a system in need of expansion.
- Investigate physical and biological consequences of balancing power operation in both reservoirs and downstream water courses and assess mitigation measures for potential negative impacts on aquatic ecosystems

Summary I



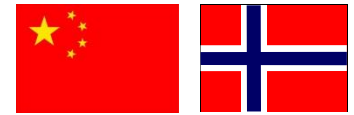
- Hydropower important in China and Norway
 - Norway: "Old", reservoir type, tunnels
 - China: River and cascade type, strong growth
- Environmental Impact Assessments
 - Norway: Established process, backed by law/regulation
 - China: In the starting phase, backed by law/regulation
 - Both: Lack of review, weak post-scheme monitoring
- Tools and methods:
 - Holistic, use expert knowledge, models, data, BBM
- Three Gorges impacts on fish
 - Important for carp, pelagic eggs, special requirements for spawning (habitat variations important!)

Summary II



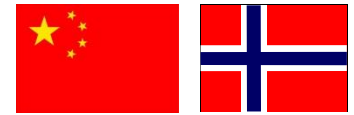
- Morphological processes
 - Altered in many ways by hydropower
 - Methods and models to assess and mitigate
- Biological impacts
 - Water is their habitat → hydropower always has effects
 - Productive zones affected? New species?
 - Effectiveness of fishways? Away from turbines?
- Reservoirs and renewable energy
 - Solar (Qinghai), Wind (Gansu, Inner Mongolia)
 - Yellow River hydropower: 55 reservoirs planned
 - Flood, irrigation, ice prevention, ecological flow (Montana)
 - Ecological flow = base flow

Summary III



- Rapid water level fluctuations in rivers and reservoirs
 - Tools available
- FutureHydro to support wind and PV
 - How to increase the capacity of hydropower for balancing intermittent energy in the future?
 - Cascade reservoir operation control in same river
 - Reservoirs in different catchments dispatching together
 - Rise the FBL (starting level for flood control)?
- Chinese hydropower and grid
 - Five levels of operation control
 - Uneven distribution of wind energy

Summary IV



- Hydropower education at NTNU
 - Civil, electrical and mechanical engineering
 - Which topics to focus on in future training and education?
 - Which topics to focus on in FutureHydro?
- North China University of Water Resources and Electric Power
 - Comprehensive education focusing on engineering
 - Water resources – many defined research directions
 - We should perhaps focus on "Environment + Technology"

Topics for discussions

- Demand and potential for pumped hydro
- Environmental Impact Assessments
 - Legislation
 - Methods and models
- Hydrological modelling
- Hydraulic and habitat modelling
 - Rivers
 - Reservoirs
 - Sediments
- Impacts on fish and ecology from hydropower