Some thoughts from the International Scientific Advisory Committee, Swiss-Austrian-Canadian Division

CEDREN
Centre for Environmental Design of Renewable Energy

CEDREN avslutningsseminar 25.—26. October 2016

Scandic Lerkendal, Trondheim

Klaus Jorde, KJ Consult, Klagenfurt, Austria
Daniel Boisclair, Université de Montréal, Montréal, Canada

KJCONSULT

What was the mandate of CEDREN Scientific Advisory Committee?

« The Scientific Committee will be responsible to ensure the quality of the work plan and PhD and post doc programs, and will give advice on the direction of the research. This includes an active recruitment strategy, invitation of international capacities for giving lectures, arrangements of scientific colloquia and seminars, and exposing scholars to industry and leading international research groups. »

Atle Harby, CEDREN Director

March 9th, 2010

Who was selected to be part of the Scientific Advisory Committee?

- Prof. Dr. –Ing. **Silke Wieprecht**, Director of the Institute for Modeling Hydraulic and Environmental Systems, University of Stuttgart, Germany**. Geomorphology, sediment transport, and hydrology.**
- Dr. –Ing. **Klaus Jorde**, Director of KJ Consult, Klagenfurt, Austria. **Hydraulic and river engineering, hydropower, and ecohydraulics.**
- Prof. Dr.–Geophys. **Nils Roar Salthun**, Professor Emeritus., Department of geophysics, University of Oslo. **Development and application of hydrological models.**
- Prof. Dr.–Biol. **Daniel Boisclair**, Chair of the Département de sciences biologiques and Director of NSERC HydroNet, Université de Montréal, Canada. **Fish bioenergetics and habitat modeling.**

… and why?

- Appropriate expertise

… and why?

- Appropriate expertise
- Great complementarity

… and why?

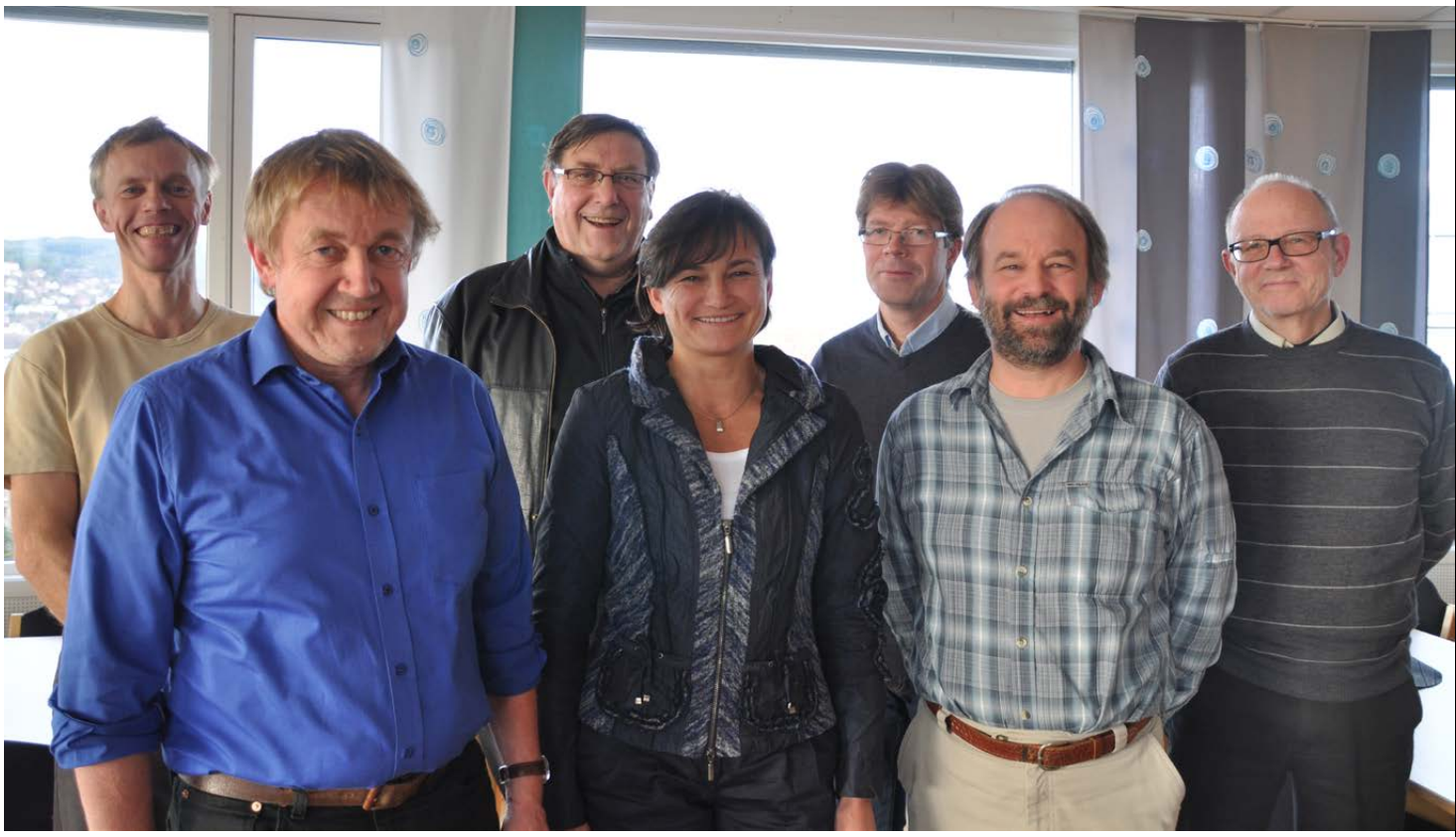
- Appropriate expertise
- Great complementarity
- Outspoken

… and why?

- Appropriate expertise
- Great complementarity
- Outspoken
- Trustworthy

… and why?

- Appropriate expertise
- Great complementarity
- Outspoken
- Trustworthy
- Very pleasant



When was this Committee involved?

"The Centre for Environmental Design of Renewable Energy (CEDREN) was established by the Research Council of Norway (RCN) as one of eight thematic research centres for environmental-friendly energy in 2009."

- **First involvement:** Review of original proposal by Klaus Jorde
- **First meeting of the International Scientific Advisory Committee :** last week of October 2010
- Meeting every year since 2010 [except 2015] October [June 2014]

What did this Committee do?

- Read meeting documents
  - Activity reports
  - New projects
- Listen to presentations
  - Project leaders
  - Ph D students and Post-doctoral fellows
- Ask questions, contribute to discussions, and issue written comments
  - Project leaders, students, post-doctoral fellows
  - Norwegian Research Council

"The Scientific Committee has no doubt that CEDREN is internationally at the forefront of science and research in the area of environmental and societal aspects of renewable energy, and in particular, of hydropower." (2012)

What did this Committee do?

- Give seminars
  - Feedback about projects
  - Perspectives

2010: Fish and hydropower : how to make a successful marriage?

2011: New Swiss energy and hydropower scenarios and activities after Fukushima

NSERC HydroNet: A national research network to promote sustainable hydropower in Canada

2012: The situation of regulation in Canada

What did this Committee do?

- Promote international activities
- CEDREN-HydroNet Joint Workshop
  - Trondheim, October 2012
  - 31 participants research scientists: Master students, Ph D students, PDF; 16 from HydroNet, 15 from CEDREN
  - « Foster communication between two Networks that share common scientific and applied objectives; Evaluate the potential to develop collaborations and joint-projects. »

KJCONSULT

What did this Committee do?

- Promote international activities

- CEDREN-HydroNet Joint Workshop
  - Trondheim, October 2012
  - 31 participants research scientists: Master students, Ph D students, PDF; 16 from HydroNet, 15 from CEDREN
  - « Foster communication between two Networks that share common scientific and applied objectives; Evaluate the potential to develop collaborations and joint-projects. »

- CEDREN invited to HydroNet Annual Symposium
  - Montreal, March 2013
  - Special session ***"CHALLENGES AND SOLUTIONS TO SUSTAINABLE HYDROPOWER AROUND THE WORLD"***
  - *Sustainable Development of Hydropower – Case-studies and perspectives in Norway.* **A. Harby**, Director, Centre for Environmental Design of Renewable Energy (CEDREN), Norway.

What did this Committee do?

- Students exchanges
- Students interships
- Communication
- Exposure


NSERC
CRSNG
Université de Montréal
McGill
Hydro Québec
Canadian Hydropower Association
Association canadienne de l'hydroélectricité
BC hydro
FOR GENERATIONS
UNIVERSITY OF WATERLOO
Ontario
Manitoba Hydro
Canadian Electricity Association
Association canadienne de l'électricité
Manitoba
Water Stewardship
Ressources naturelles et Faune
Québec
MEMORIAL UNIVERSITY
Canadian Rivers Institute
Carleton UNIVERSITY
University of Alberta
TransAlta
University of Lethbridge
Brookfield
Renewable Power
INRS
Université d'avant-garde
FIAT LUX
UBC
UNB
University of New Brunswick
Pêches et Océans Canada
Fisheries and Oceans Canada
NSERC
HydroNet
CRSNG

Did CEDREN International Scientific Advisory Committee fulfill its mandate?

« The Scientific Committee will be responsible to **ensure the quality of the work plan and PhD and post doc programs**, and will **give advice on the direction of the research**. This includes an **active recruitment strategy**, invitation of international capacities for **giving lectures, arrangements of scientific colloquia and seminars**, and **exposing scholars to industry and leading international research groups**. »

Atle Harby, CEDREN Director

March 9th, 2010

Did CEDREN Scientific Advisory Committee fulfill its mandate?

« The Scientific Committee will be responsible to **ensure the quality of the work plan and PhD and post doc programs**, and will **give advice on the direction of the research**. This includes an **active recruitment strategy**, invitation of international capacities for **giving lectures, arrangements of scientific colloquia and seminars**, and **exposing scholars to industry and leading international research groups**. »

Atle Harby, CEDREN Director

March 9th, 2010

1st reason: **CEDREN was fantastically well managed. Thanks to Atle and Arnt Oven!**

2nd reason: **Projects leaders, students, post-doctoral fellows delivered.**

What are our suggestions/messages for/to future/other Committees?

- Read and listen with an open mind.
- Be generous with your time.
- Be constructive with your comments.
- Enjoy.

Faglig oppsummering

CEDREN Projects

- Hydropower
  - EcoManage – management of energy and water resources
  - EnviDorr – increased power and salmon production
  - EnviPeak – hydropeaking effects and mitigation
  - HydroBalance – Norwegian storage for balancing European renewables
  - HydroPeak – integrate increased variable load from wind, technical requirements and constraints
  - SafePass – upstream and downstream fish migration

CEDREN Projects continued

- Wind power
  - BirdWind – birds and onshore wind parks
- Power transmission
  - OptiPol – design and routing of power lines
  - SusGrid – sustainable power grid development
- Policy and public engagement
  - GovRep – how to combine environmental and energy policy
  - SusWater – water management in regulated rivers
- Climate change – not a specific project

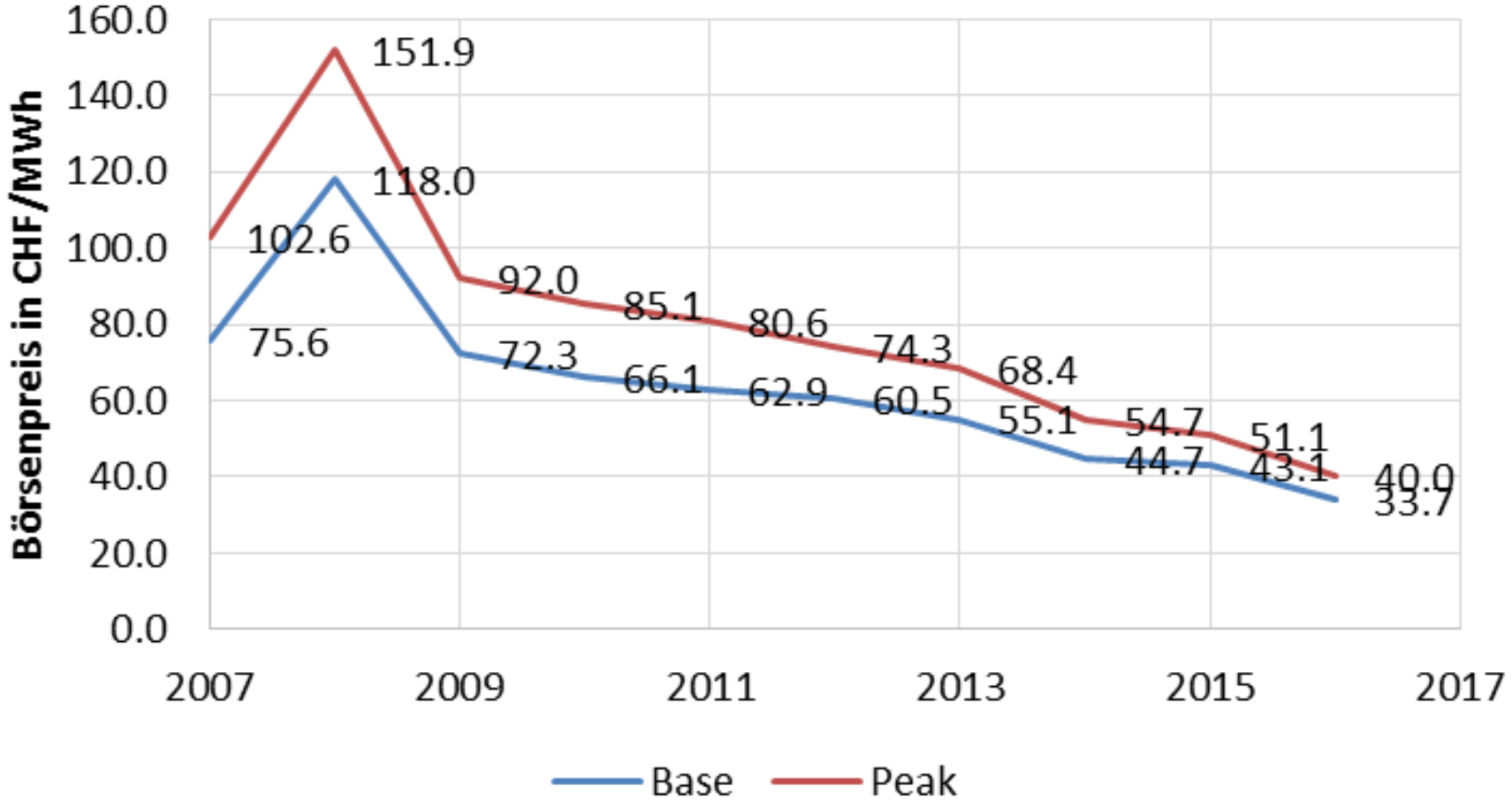
CEDREN evaluation

- CEDREN has performed well
- CEDREN is integrated in policy: climate change and energy strategy
- CEDTREN is integrated into energy research in Norway, Europe and elsewhere
- CEDREN results are implemented and research is continued
- Large research networks are very attractive to young scientists and attract attention of global research community
- Research capacities and lab facilities are shared and utilized more efficiently
- Financial contributions from industrial and other partners can be more easily attracted
- Can the results be summarized as a success story?

A comparison with Switzerland: the Situation

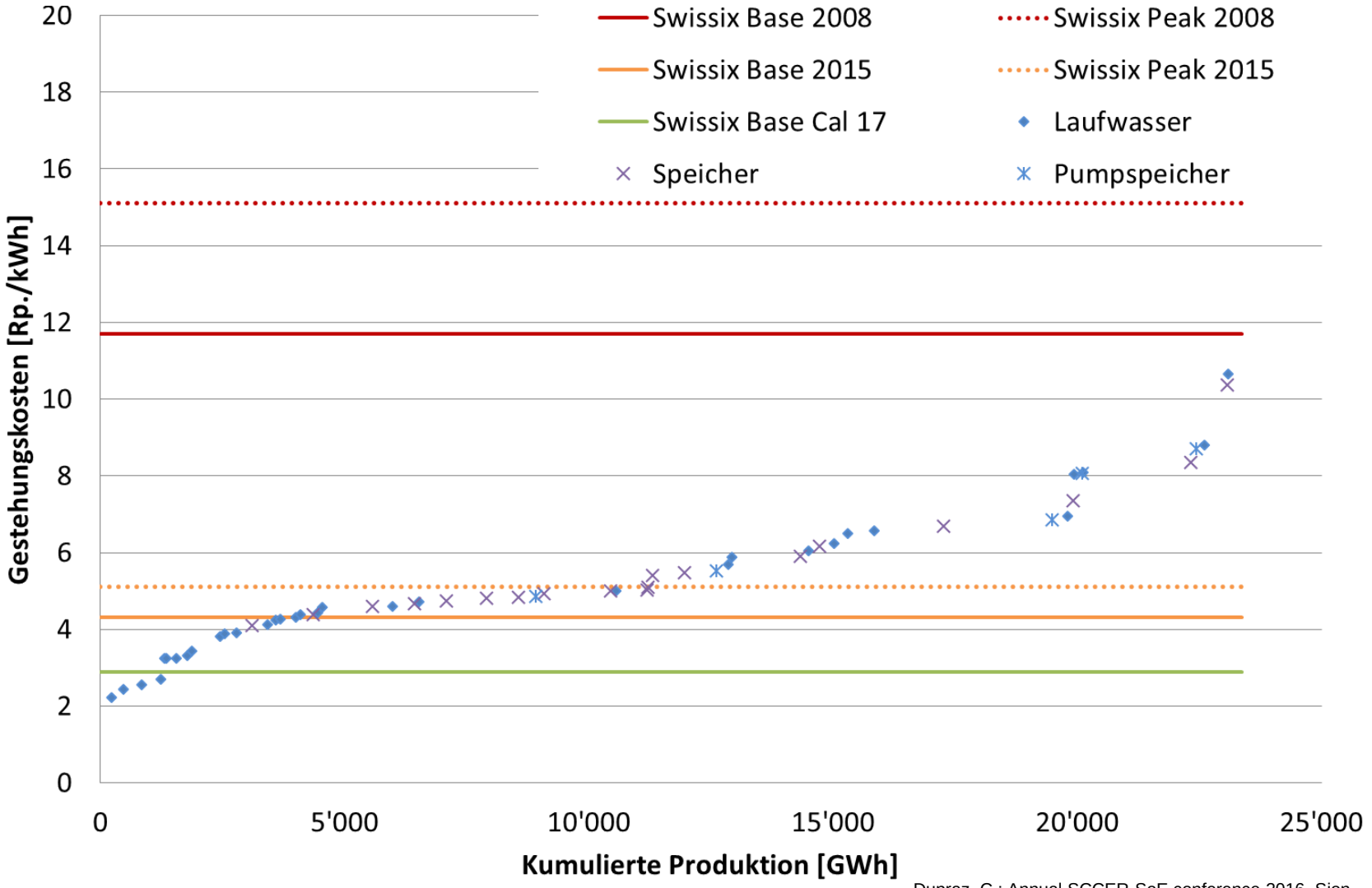
- Energy strategy 2015 expects a 5-8% increase of production
- Main drivers
  - Climate change impact:
    - Hydrology and glacier retreat
    - sediment supply
    - permafrost thawing
    - new potential reservoirs
  - Uncertain market situation
    - electricity prices
    - other countries policy
    - transmission capacity
  - Higher demand for intra-day and intra-annual storage for flexible operation
- Major relicensing process coming up over next decades

Mean annual price for electricity on the market:

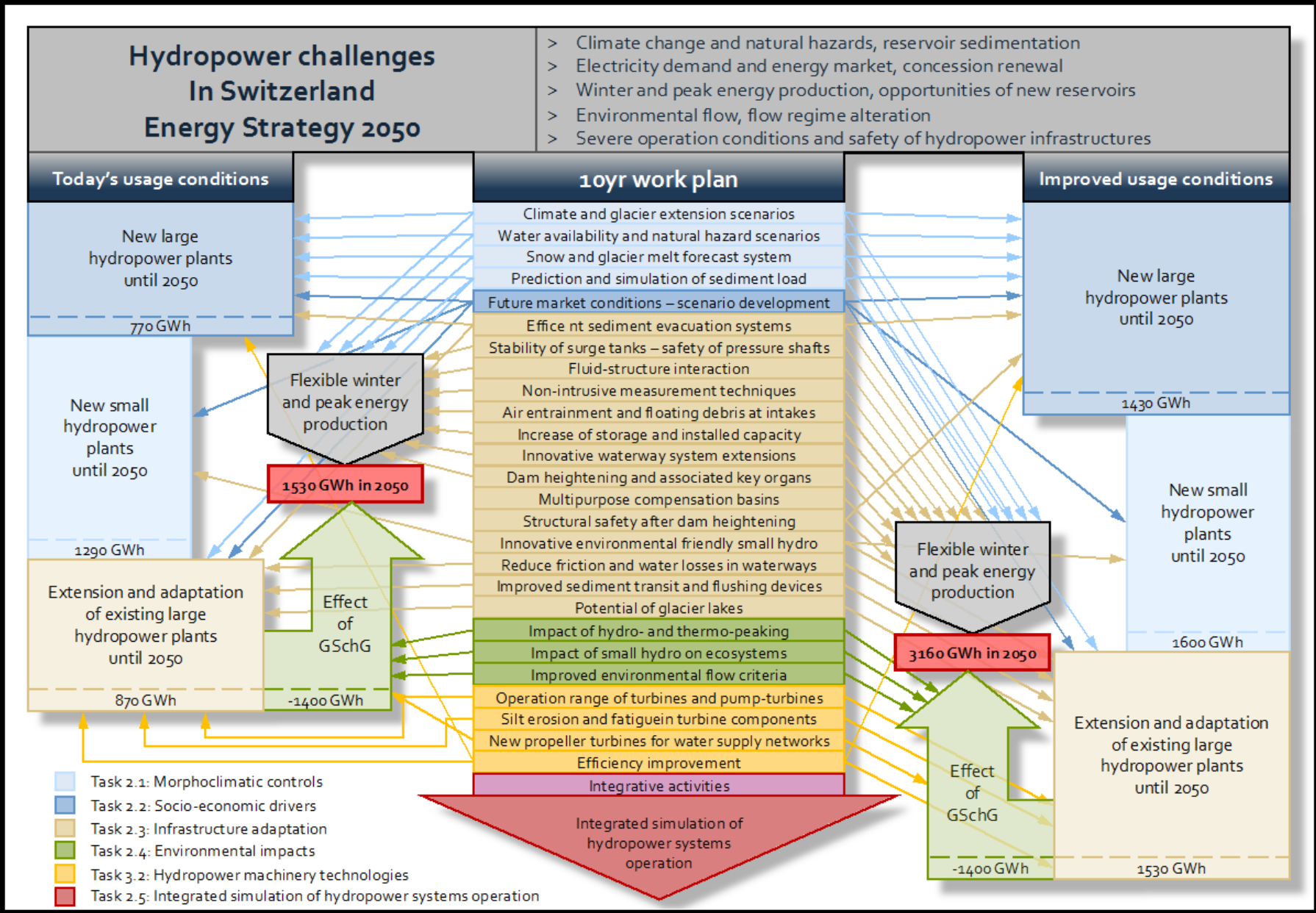


Dupraz, C.: Annual SCCER-SoE conference 2016, Sion

Mean generation costs in Swiss hydropower plants:



Dupraz, C.: Annual SCCER-SoE conference 2016, Sion


Hydropower challenges
In Switzerland
Energy Strategy 2050
> Climate change and natural hazards, reservoir sedimentation
> Electricity demand and energy market, concession renewal
> Winter and peak energy production, opportunities of new reservoirs
> Environmental flow, flow regime alteration
> Severe operation conditions and safety of hydropower infrastructures
Today's usage conditions
10yr work plan
Improved usage conditions
New large hydropower plants until 2050
770 GWh
New small hydropower plants until 2050
1290 GWh
Extension and adaptation of existing large hydropower plants until 2050
870 GWh
Flexible winter and peak energy production
1530 GWh in 2050
Effect of GSchG
-1400 GWh
Climate and glacier extension scenarios
Water availability and natural hazard scenarios
Snow and glacier melt forecast system
Prediction and simulation of sediment load
Future market conditions – scenario development
Effice nt sediment evacuation systems
Stability of surge tanks – safety of pressure shafts
Fluid-structure interaction
Non-intrusive measurement techniques
Air entrainment and floating debris at intakes
Increase of storage and installed capacity
Innovative waterway system extensions
Dam heightening and associated key organs
Multipurpose compensation basins
Structural safety after dam heightening
Innovative environmental friendly small hydro
Reduce friction and water losses in waterways
Improved sediment transit and flushing devices
Potential of glacier lakes
Impact of hydro- and thermo-peaking
Impact of small hydro on ecosystems
Improved environmental flow criteria
Operation range of turbines and pump-turbines
Silt erosion and fatiguein turbine components
New propeller turbines for water supply networks
Efficiency improvement
Integrative activities
Integrated simulation of hydropower systems operation
New large hydropower plants until 2050
1430 GWh
New small hydropower plants until 2050
1600 GWh
Flexible winter and peak energy production
3160 GWh in 2050
Effect of GSchG
-1400 GWh
Extension and adaptation of existing large hydropower plants until 2050
1530 GWh
Task 2.1: Morphoclimatic controls
Task 2.2: Socio-economic drivers
Task 2.3: Infrastructure adaptation
Task 2.4: Environmental impacts
Task 3.2: Hydropower machinery technologies
Task 2.5: Integrated simulation of hydropower systems operation

Manso, P.: Annual SCCER-SoE conference 2016, Sion