Centre for environmental design of renewable energy - CEDREN
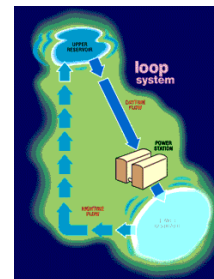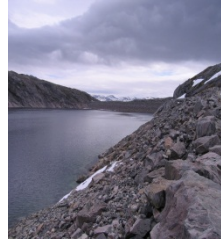
News – HydroPEAK meeting Oct 2014

Hydropower technology

Environmental impacts of hydropower
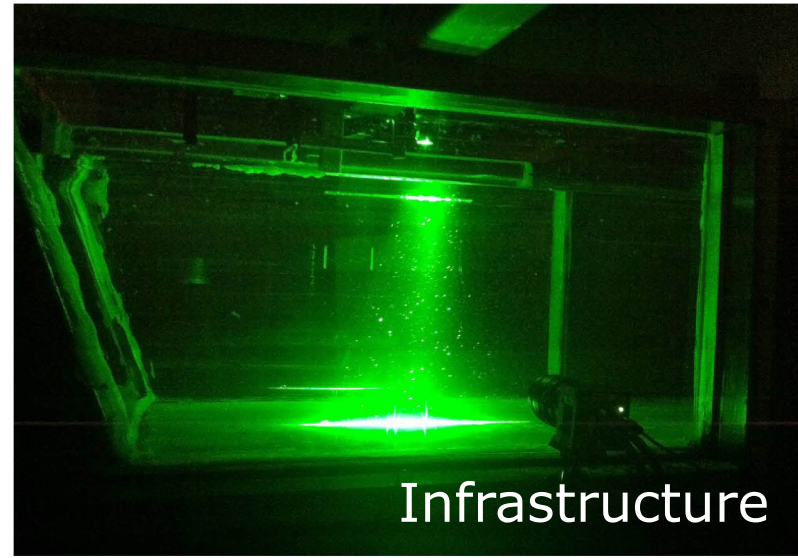
Environmental impacts of wind power and power transmisson

How to reconcile energy and environment policy?

Highlights since last meeting

Innovation and implementation
of results

Infrastructure

10th International Symposium on Ecohydraulics 2014
Norwegian University of Science and Technology
Trondheim, Norway, June 23rd - 27th

#ecohyd

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NINA Temahefte

Håndbok for miljødesign i regulerte laksevassdrag

Redaktører:

Torbjørn Forseth og A...

CEDREN
Centre for Environmental Design of Renewable Energy

Del I – Diagnose

Verktøy (D1-D7)

DATAINNSAMLING OG VERKTØY
- Kartlegging av elveklasser, substrat og skjul
- Kartlegging av forekomst og spredning av gytehabitat
- Sammenheng mellom vanndekt areal og vannføring
- Hydrologisk variasjonsanalyse
- Temperaturdata eller modellering
- Innsamling av bestandsdata
- Beskrivelse av kraftproduksjonssystemet og reguleringseffekter

SYSTEMATISERING OG KLASSIFISERING
- Laksebestanden
- Kraftproduksjon

DIAGNOSE

Habitatflaskehalser
- Skjul
- Gyteområder

Hydrologiske flaskehalser
- Vannføring:
  - sommer- og vintervannføring
  - gytevannstand
  - smoltvannføring
  - 0+ habitat
  - homogenisering av elveløp
  - habitatforringelse
- Vanntemperatur:
  - 0+ vekst
  - smoltalder

Del 2 – Designløsninger

Tiltaksmetodikk (T1-T5)

DESIGNLØSNINGER OG TILTAKSMETODIKK

Habitattiltak
- Skjul
  - rensing av grusbanker
  - etablering av skjul
  - terskelfjerning og annen restaurering
  - "elv i elv"
- Gytehabitat
  - rensing
  - utlegging av gytegrus

Vannbruk
- Vanntemperatur
  - fleksible tappeløsninger
  - vannmengder i nøkkelperioder
  - ulike vannveier
- Vannføring
  - økt minstevannføring
  - omfordeling
  - gytevannføring
  - situasjonsavhengige slipp
  - utvidelser

HJELPEVERKTØY
- Byggeklossmetoden
- Vannbank
- Varighetskurver for vannføring
- Prioriteringstabell
- Vannforhandlinger
- Effektestimater for vannbruk
- Effektestimater for habitattiltak

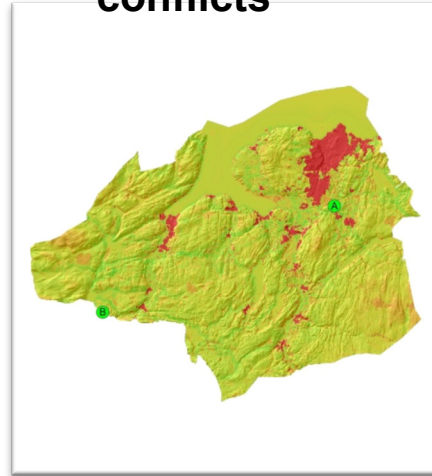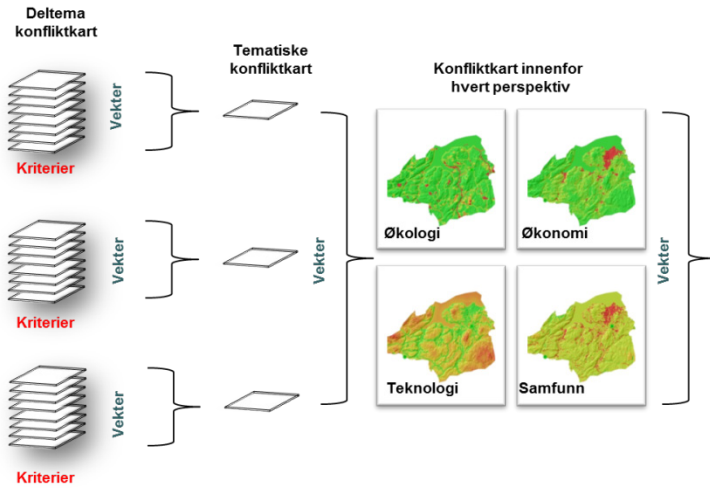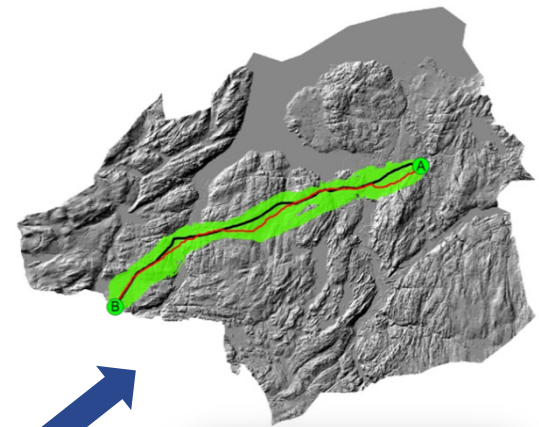|	Habitatflaskehals	Produktivitet (1-3)
...gel	Gyte	1
...gel	Gyte	1
...gel	Gyte	1
...gel	Gyte	2
...gel/parr	Begge	1
...gel/parr	Begge	1
...r	Skjul	2
...r	Skjul	2
...r	Skjul	2
...en	Ingen	3
...en	Ingen	3
...gel	Gyte	2
...gel	Gyte	1
...gel	Gyte	2

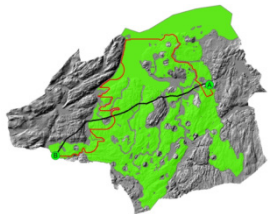# Least cost path for power lines

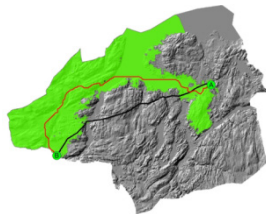**Thematic maps and weighing** → **Map of conflicts**

Deltema
konfliktkart

Kriterier

Tematiske
konfliktkart

Konfliktkart innenfor
hvert perspektiv

Økologi   Økonomi

Teknologi   Samfunn

Vekter   Vekter   Vekter

Kriterier
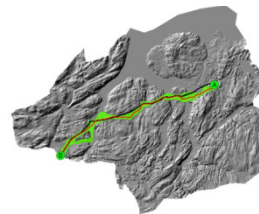
Optimal path and macro corridor
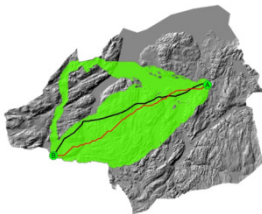
Ecology + **Economy** + **Society** + **Technology** →

LCP TOOLBOX 1.0
ECOLOGY
ECONOMY
SOCIETY
TECHNOLOGY

New design and more news www.cedren.no

LOGIN

CEDREN News

Seminar om energilagring - fra batterier til vannkraft

Bli med å diskutere behovet for energilagring i Europa og få siste nytt om en rekke energilagringsteknologier.

Luft i vann skaper trøbbel for fisk og kraftselskap

For mye luft i vannet i et kraftanlegg kan både drepe fisken og føre til eksplosjoner. Nå tester norsk forsker et nytt designverktøy for å unngå disse problemene.

Improved development and management of energy and water resources- EcoManage

The main objective of EcoManage is to test, evaluate and adapt new concepts and indicators for the improved development and management of energy and water resources.

What is the value of water? Photo © Edelpix

The selected set of concepts and indicators to be studied are Energy Payback Ratio (EPR), water consumption in the hydropower sector and the off-set options for ecosystem services.

The study sites will mainly be in river basins regulated for hydropower production. Secondary objectives are:

CEDREN Centre for Environmental Design of Renewable Energy
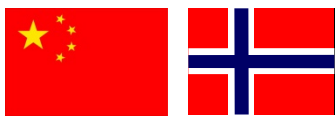
CEDREN in China
FutureHydro

Visit to Beijing and Fengman Hydropower

Presentations, Discussions

Changchun Jilin
Beijing

New dam to be constructed at Fengman

Group work

Beijing ➡ Fengman

Changchun
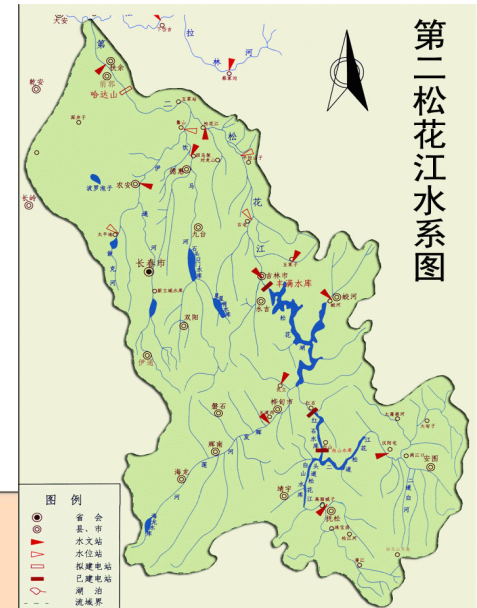Jilin

Beijing

Tsinghua University, Beijing

Jilin, on the bus

Fengman site visit

NE China,
Amur River
catchment

第二松花江水系图

Fengman dam & power plant

❑ Built by the Japanese in 1937-42 as part of hydro-power development for their puppet state Manchuko

❑ Dam damaged toward the end of World War II; almost all of the hydroelectric plant was removed to the Soviet Union

❑ After 1949 restoration works by the Chinese government; dam was extended and strengthened; power generation equipment was restored with Soviet aid

❑ Afterwards several upgrades and reinforcements, but still problems with dam safety - need for better solutions!

Power Plants Around the World
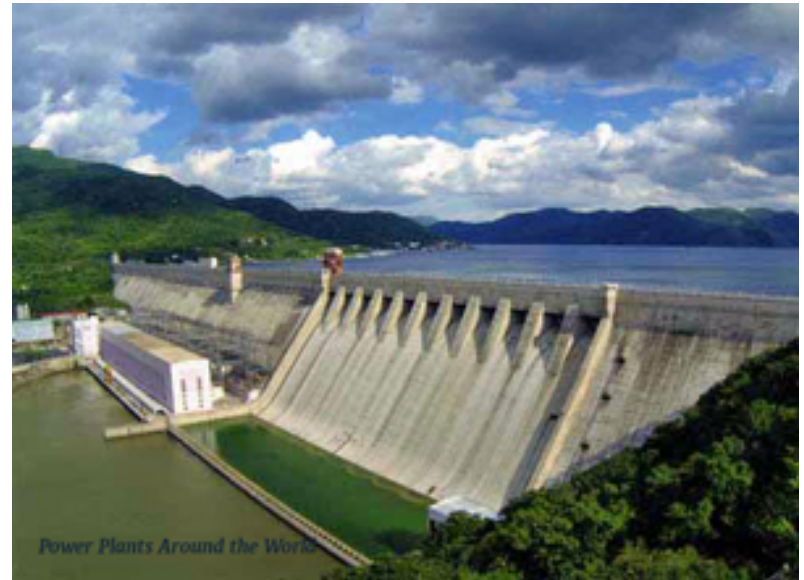
❑ Massive concrete dam, 91 m in height, 1080 m long
❑ Reservoir storage volume 88.5 x 10^8 m^3
❑ Multi-purpose (mean flow 430 m^3/s)

Fengman dam reconstruction project

- Built a new dam 120 m downstream of the original dam

- Recover the original station's functions without changing the reservoir's characteristic water level

- Build 6 new sets of 200 MW Francis turbine generator units and remain two older units, new total capacity 1480 MW

- Use 10-15 % of the budget for environmental measures, such as fish passages

STATE GRID

工程枢纽平面布置图
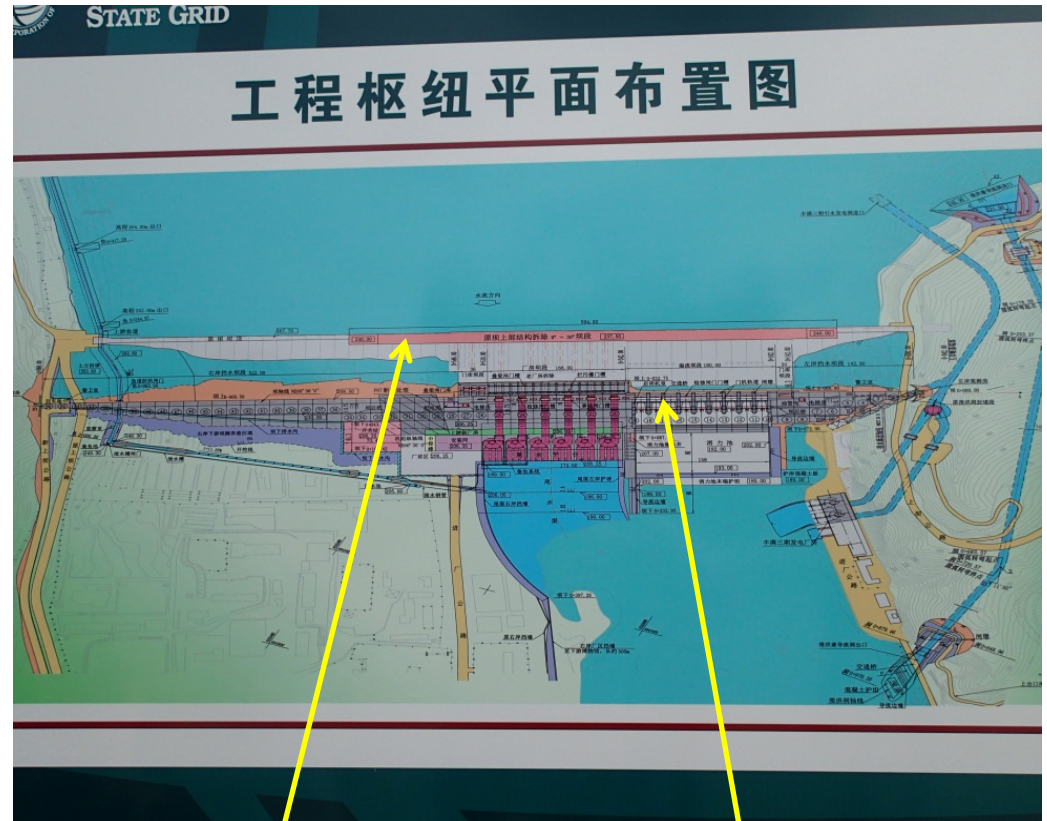
Existing dam   Planned new dam

Jilin at night

Re-regulation dam
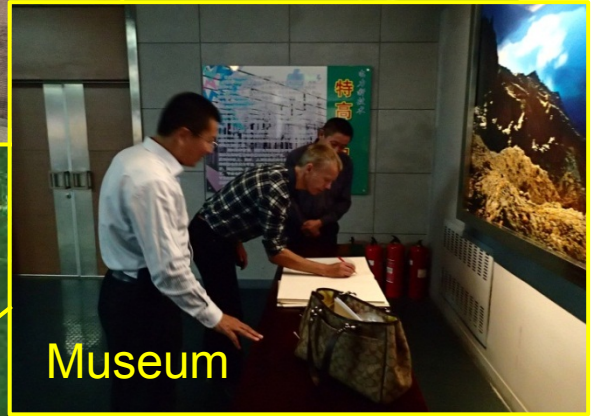
Fengman, Jilin,

Museum

Boat trip

Location of the new dam

Image © 2014 CNES / Astrium
Image Landsat
Image © 2014 DigitalGlobe

FME CENTRE FOR ENVIRONMENT-FRIENDLY ENERGY RESEARCH
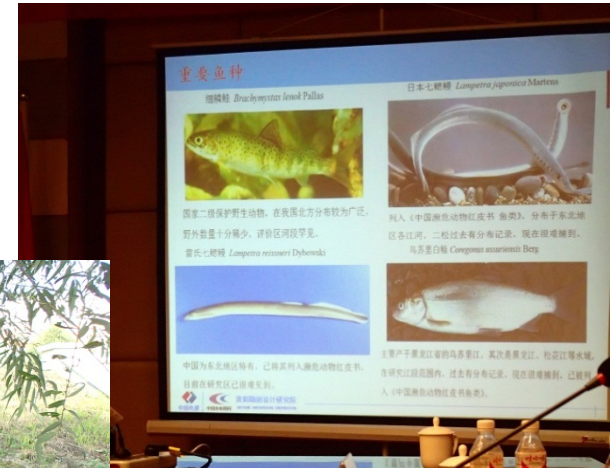
Re-regulation dam

Purpose: dampening of hydro-peaking

Discussing the planned position of the fish way at the re-regulation weir

Fengman power company

Day 4,
Meeting with Fengman power company

Among the special requirements which the power company has to fullfil:
Release of water for the "Ice Tree Festival" during night time over three months.

Info about the reconstruction project

❑ Seven different alternatives were investigated for the reconstruction of Fengman dam. Flood safety is quite essential; downstream of the dam are large flooding areas where 20 Mill. people are affected.

❑ The environmental part of the reconstruction has been an important consideration, including the following aspects:

  o Design of fish-passage (at the dam and the regulation weir)
  o Variable intake heights for water intake because of fish reproduction
  o Fish recruitment

❑ According to the requirements of the government, the reconstruction plan will be only approved if the environmental part is included (10-15 % of total investment for environmental issues).

❑ Fish-way need and design at the dam

Discussion topics

❑ Fish-way design re-regulation dam

❑ 3D temperature stratification between the old and the new dam

❑ Recover of vegetation around the new dam

CEDREN research applications 2014

Project name	R&D partners	User partners	Budget
SafePass Safe and efficient two-way migration for salmonids and European eel past hydropower structures	**NINA**, SINTEF, Uni Research, NTNU, Karlstad Universitet, DTU, BOKU, EDF, HydroNet	Eidsiva, GLB, Agder, Sira-Kvina, Miljødir., Energi Norge, Statkraft, TrønderEnergi, E-CO, SFE, BKK, Lyse, NVE	**24 532 000** (8 932 000) 2015-2018 ENERGIX Fornybar
SuperSat Hydropower induced supersaturation - effects on ecosystems, mitigation measures and guidelines for sustainable water management	**Uni Research**, NIVA, NINA, SINTEF, NTNU, Univ. Idaho, BOKU, Ferskvannsbiologen	Otra Kraft, Statkraft, Troms Kraftforsyning, E-CO, BKK, Miljødir., Fylkesmannen i Aust-Agder, NVE	**12 000 000** (3 200 000) 2015-2018 ENERGIX Fornybar
SusWater Sustainable governance of river basins with Hydropower production	**SINTEF**, NINA, Stockholm Environment Institute, NIVA	Energi Norge, BKK, SFE, Sira-Kvina, TrønderEnergi, Statkraft, Hydro, Lyse, Agder, Miljødir., NVE	**18 000 000** (5 000 000) 2015-2018 ENERGIX Samfogøk
InterHydro Improved methods for sustainability in international hydropower development	**SINTEF**, NTNU, NINA, Multiconsult	Statkraft, Hydro, Centre for Ecology and Hydrology, METLA, SEI, Multiconsult	**16 000 000** (3 200 000) 2015-2018 ENERGIX Fornybar
HydroClim Hydropower and future climate extremes	**SINTEF**, NINA, NTNU	-	**7 385 000** (410 000) 2015-2018 KLIMAFORSK

SafePass
Håndbok for toveis vandringsdesign for laks og innlandsfisk

Et brukerfinansiert prosjekt i CEDREN

CEDREN
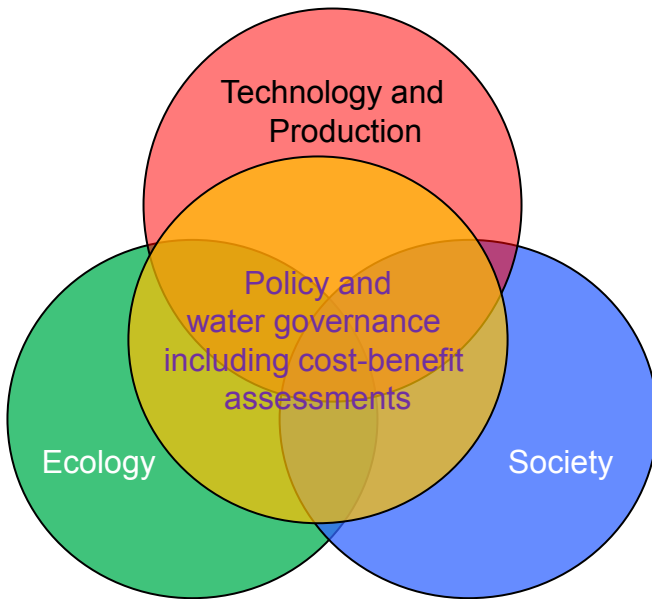Centre for Environmental Design of Renewable Energy

Sustainable governance of heavily regulated river basins - SusWater

Background:
- Implementation of Water Framework Directive
- Re-licensing of hydropower
- Refurbishing and upgrading hydropower

Proposed work packages:

- Comparative assessments of the challenges in current policies and institutional framework

- Improved methods and tools for environmental flow estimations

- Benefits for environmental, economic and societal interests

- New and more sustainable collaboration models for governance of hydropower production

SUPERSAT- Effects, solutions, guidelines

- **Hydropower induced super-saturation is still common**
- **Fish kills have been observed in several rivers in the last years**
- **Sub-lethal effects (e.g. reduced fish production)**
- **No guidelines – little is known about effects on freshwater ecosystems**
- **Zero super-saturation target is expensive to reach at existing plants with today's technology**

Pilot study (2013-2014)

- **Summary of state of the art knowledge**
- **Designing a research proposal focusing on:**

- *Biological effects (including fish, invertebrates, sub-lethal effects)*
- *Technical solutions*
- *Guidelines – how much super-saturation can be tolerated? What can be done?*

Otra, Brokke: Super-saturation on 12,5 km, 4 km fish free

Partners: Industry, Norwegian and international research institutes
Kontakt: Ulrich Pulg, LFI Uni Miljø, ulrich.pulg@uni.no
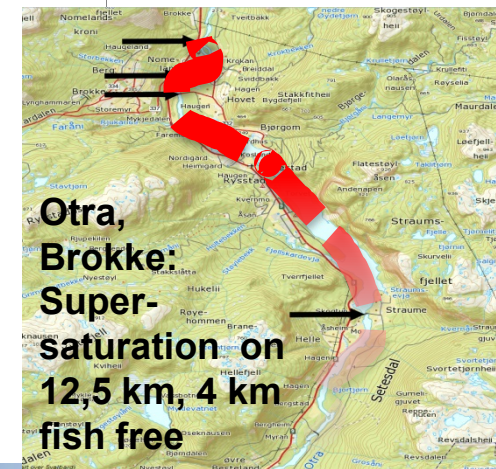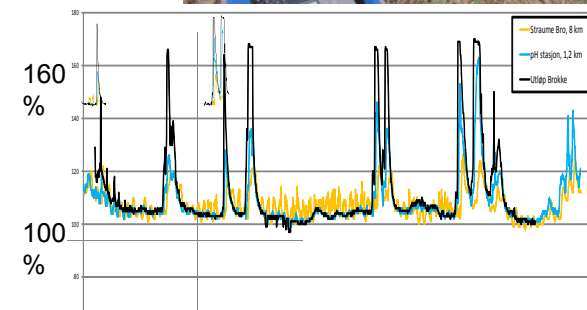
InterHydro: Improved methods for sustainability in international hydropower development
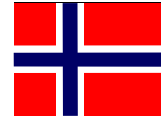
- Sound methods for setting environmental flows
- Predicting net greenhouse gas emissions from reservoirs (carbon footprint)
- Adequate calculation of water consumption in hydropower production (water footprint)
- Integration
- Dissemination

"Renewable energy respecting nature"

Indo-Norwegian seminar, Mumbai, 7-8 May 2013

- Opening session
- Renewables and their integration in the energy system
- Sustainable hydropower
- Roundtable discussions on research needs
- Future collaboration possible

NORSK VANNKRAFTSENTER

Norsk Vannkraftsenter (NVKS) er et nasjonalt samlende senter for å sikre og videreutvikle undervisning og forskning innen vannkraftteknologi. Senteret drives i samarbeid mellom universiteter, forskningsinstitusjoner, vannkraftbransjen og norske myndigheter, med hovedsete på NTNU.

NVKS
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