More Power and Energy: Strategic Insights

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Hydropower R&D Days, Uppsala

NTNU SINTEF NHH NINA

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What’s in the pipeline concerning hydropower and energy system studies?

“A Norwegian perspective.”

From construction of Glomfjord power plant in Nordland. Foto: Statkraft SF

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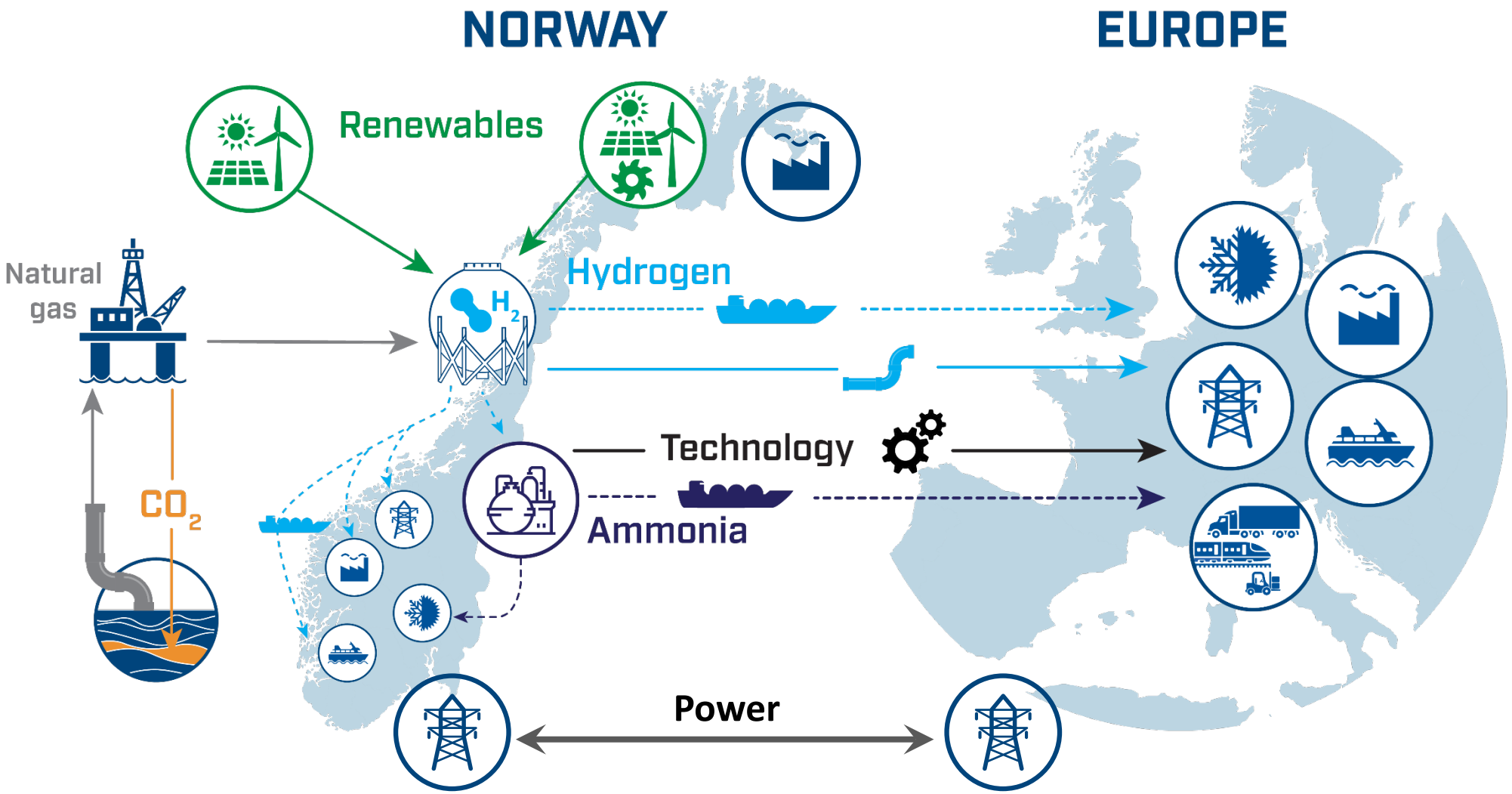
"Hydropower is the forgotten giant of clean electricity, and it needs to be put squarely back on the energy and climate agenda if countries are serious about meeting their net zero goals".

- IEA Executive Director Dr Fatih Birol, 2021

What does Norway & Europe look like in 2040-2050?



Slide from HydroConnect project, Atle Harby

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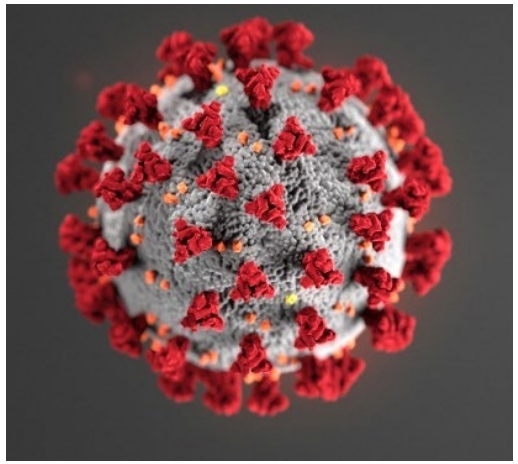
Unexpected events impacting the energy system

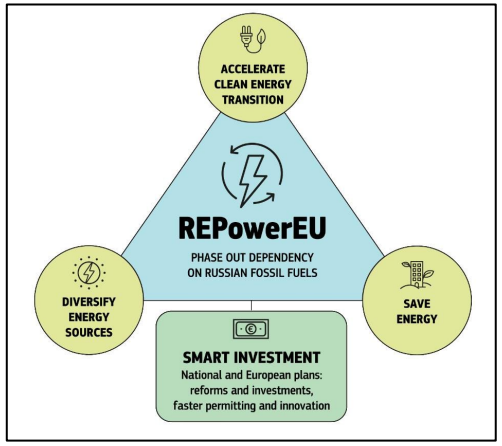


Pandemic

War

No gas from Russia → LNG from USA

Power and energy prices



Regulations and incentives

Slide from HydroConnect project, Atle Harby

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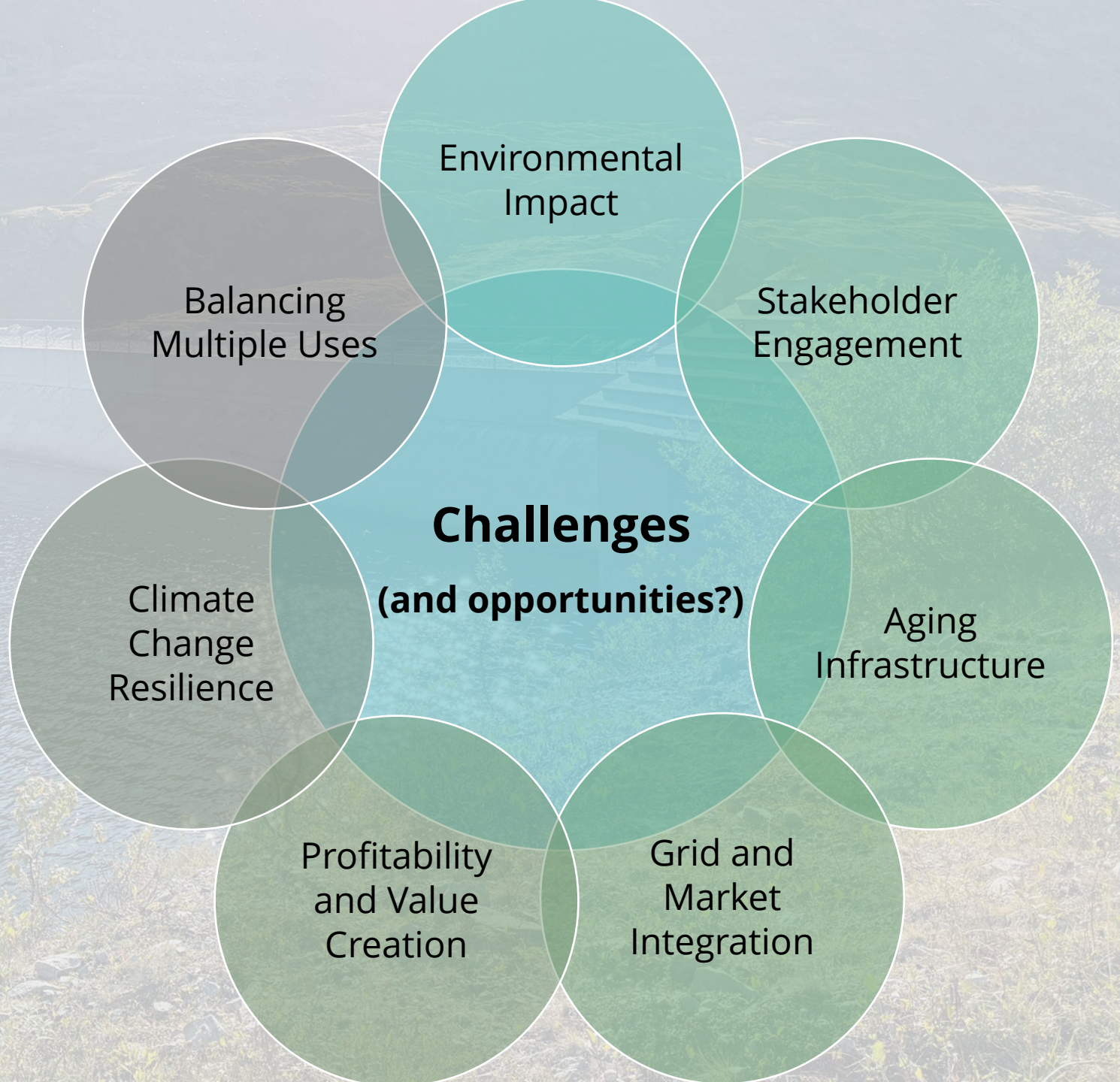
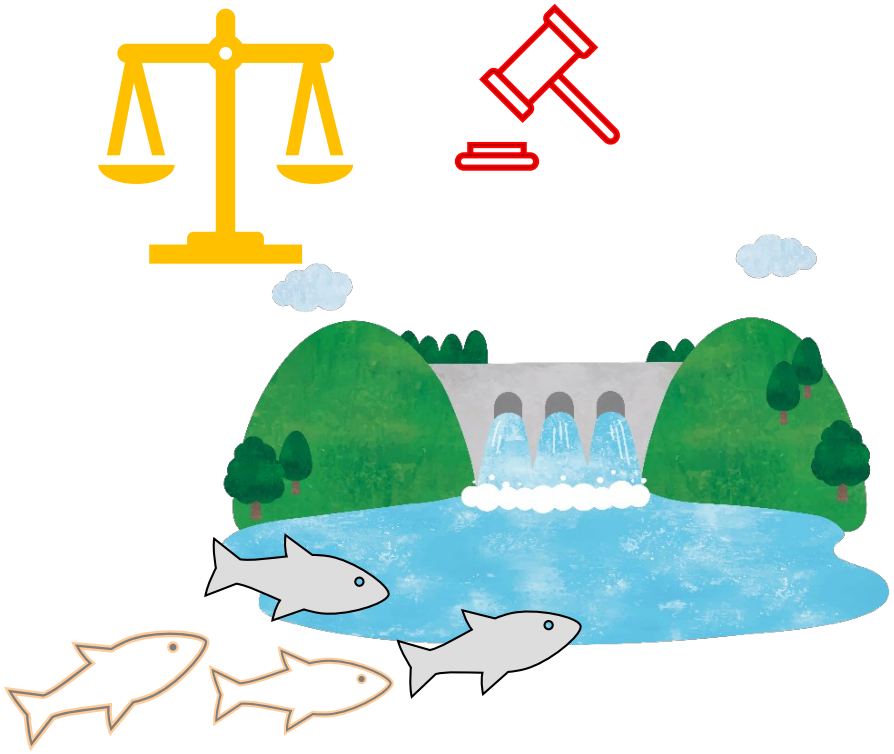
Research targeting an interdisciplinary spectre of challenges



Environmental Impact

“Balancing clean energy generation with environmental measures to minimize habitat loss or disruption, altered hydrological regimes, and impacts on fish and biodiversity.”



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Stakeholder Engagement

"Effectively engaging local communities, indigenous people, environmental organizations, and government agencies in decision-making processes to address concerns and incorporate diverse perspectives. "

Activists, Alta hydropower plant


Activists, Fosen wind power park

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Aging Infrastructure

«Upgrading and refurbishing aging hydropower plants while considering technical feasibility, cost, and minimizing disruptions to power generation. “

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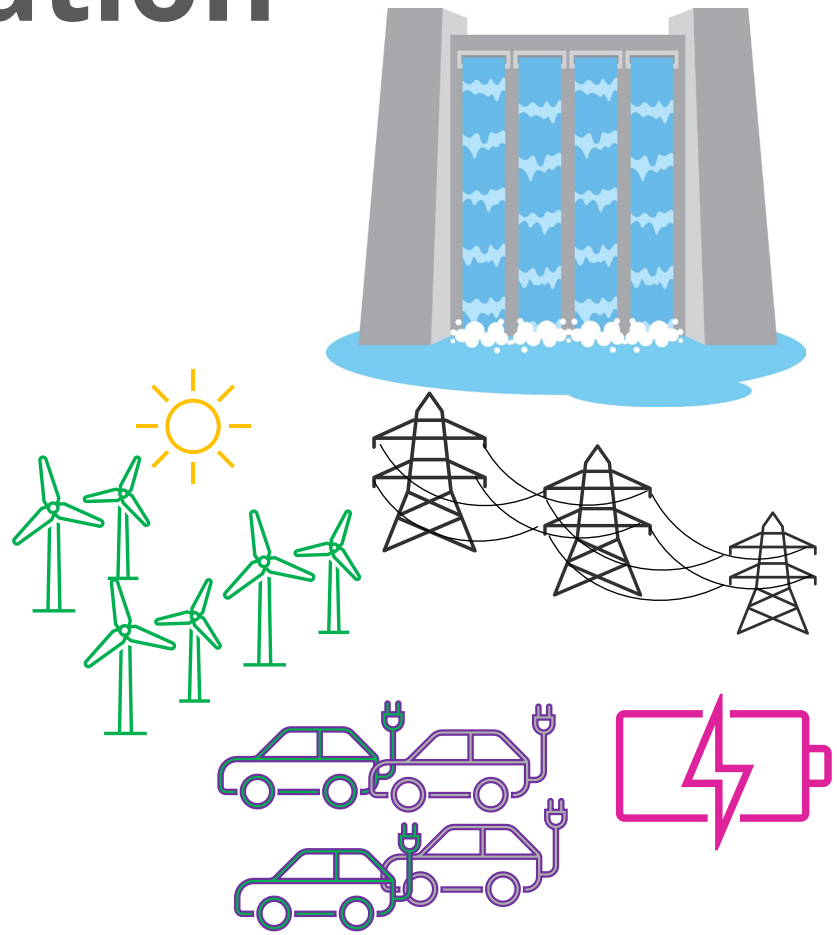
Grid and Market Integration

"Overcoming technical and regulatory challenges to integrate hydropower into existing grids and energy markets, addressing intermittency and facilitating fair market access. "



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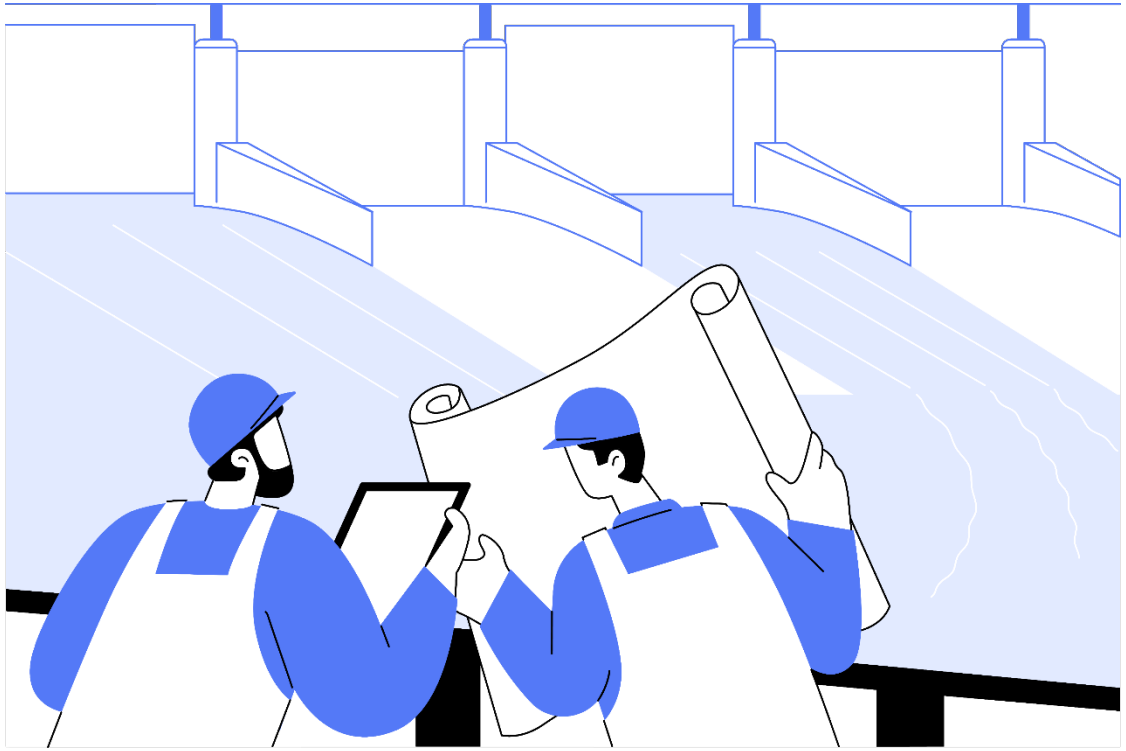
Profitability and Value Creation

“Making a cost-effective transition to a new role for hydropower, creating value for companies and society under changing technical, economic, and environmental conditions.”



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RenewHydro shall provide knowledge and solutions that enable flexible hydropower to support the energy transition and reach national energy, climate and nature targets.

RP2. More Power and Energy will:

Explore the potential and designs for sustainable large-scale expansion of Norwegian hydropower to provide vital flexibility services and security of supply.

Explore the potential and designs for sustainable large-scale expansion of Norwegian hydropower to provide vital flexibility services and security of supply

Sustainable flexibility services	Sustainable upgrading and expansion	Provision of energy security and adequacy	Resource allocation and markets
• Develop methods and metrics for quantifying flexibility services from hydropower	• Develop and investigate concepts for increasing capacity and storage from hydropower	• Establish a framework for assessing energy security and adequacy from hydropower	• Understand how hydropower resource allocation best can adapt to the future

Four – very different - interdisciplinary projects

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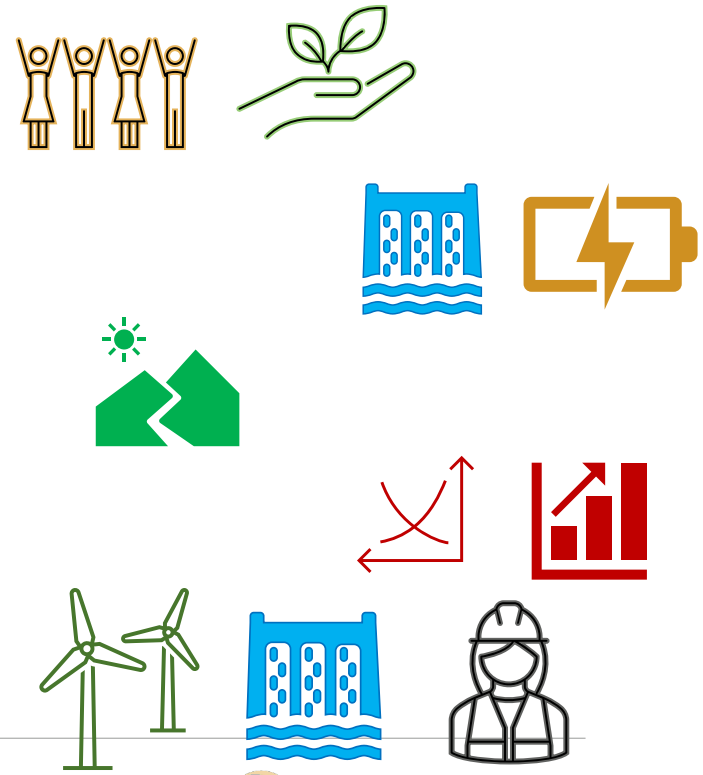
Sustainable flexibility services	**Sustainable upgrading and expansion**	Provision of energy security and adequacy	Resource allocation and markets
• quantifying flexibility services	• increasing capacity and storage	• energy security and adequacy	• resource allocation in future markets

1. Investigate the potential for environmentally (biodiversity and ecosystem) and societally acceptable (attitudes of local people) expansions in the Norwegian hydropower system.
2. Develop innovative concepts and solutions for pumped-storage hydropower suited for the Norwegian system.
3. Investigate land and carbon budgets of existing and planned expansions, including possibilities for ecological restoration and compensation.
4. Assess the market impact and power system integration of planned expansions considering different market designs and regulatory frameworks.
5. Investigate the effect of changing operational environments on generators, tunnels and embankment dams.



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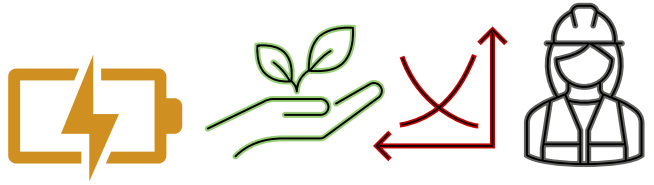
Sustainable flexibility services	Sustainable upgrading and expansion	Provision of energy security and adequacy	Resource allocation and markets
• quantifying flexibility services	• increasing capacity and storage	• energy security and adequacy	• resource allocation in future markets

1. Explore the concept of flexibility, considering market, technical, and environmental aspects.



2. Develop methods and metrics for assessing flexibility services from hydropower from both a techno-economic and environmental perspective.

3. Develop decision support tools for assessing profitability and risk of investments in projects enhancing sustainable flexibility services from hydropower.

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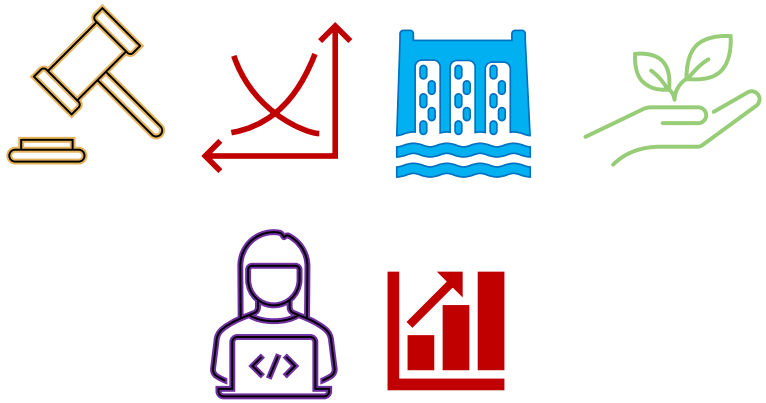
Sustainable flexibility services	Sustainable upgrading and expansion	Provision of energy security and adequacy	Resource allocation and markets
• quantifying flexibility services	• increasing capacity and storage	• energy security and adequacy	• resource allocation in future markets

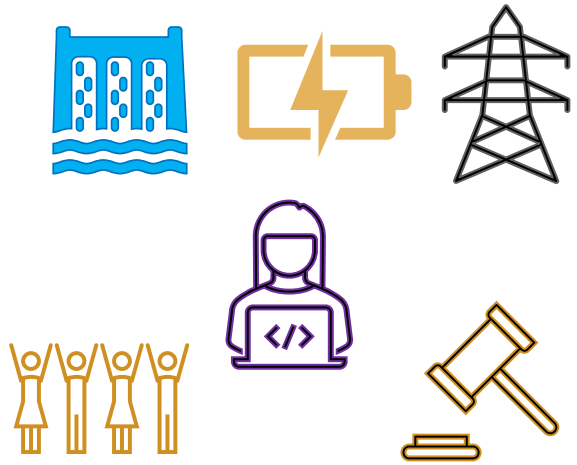
1. Explore the concept of block bidding, considering market, technical, and environmental aspects.

2. Develop methods and analyses for assessing novel bidding concepts for hydropower from both a techno-economic and environmental perspective.



Sustainable flexibility services	Sustainable upgrading and expansion	Provision of energy security and adequacy	Resource allocation and markets
• quantifying flexibility services	• increasing capacity and storage	• energy security and adequacy	• resource allocation in future markets

1. Establish a methodological framework to assess the contribution of hydropower to energy security and adequacy in the future electricity system.
2. Develop algorithms and tools for hydropower planning that facilitate robust and efficient operation of hydropower resources and thus promote energy security.
3. Assess whether existing markets and regulations align individual incentives with social welfare maximization, or whether new market designs or regulations are needed.



And so much more..

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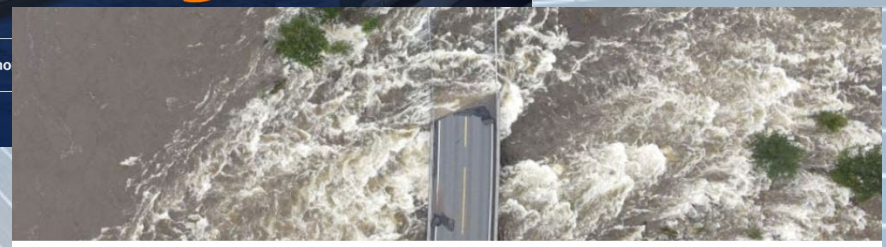
RES100: Modeling a 100% Renewavle Electricity System

Provide new insight into the power market modeling needs and knowledge about possible patterns for dispatch and price formation in the Nordic region in a 100% renewable European electricity system.



PROSJEKT

ReAdapt - Tilpasning av vannkraft til framtidens klimaekstremer

Takk for meg!

Ebba Andersson beating Therese Johaug, Cross-country worlds, Trondheim 2025.
Foto: Kai Pfaffenbach (Reuters)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