SVC – SWEDISH CENTRE FOR SUSTAINABLE HYDROPOWER

Annual reporting of activities within SVC during 2024

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SWEDISH CENTRE FOR SUSTAINABLE HYDROPOWER

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Annual reporting of activities within SVC during 2024

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CONTENT

SWEDISH CENTRE FOR SUSTAINABLE HYDROPOWER

SUMMARY

SVC - Swedish Centre for Sustainable Hydropower - is a competence centre led by Luleå University of Technology (LTU) with Energiforsk as programme manager. The centre conducts research and development for hydropower, in areas such as technology, systems and methods, with the aim of strengthening the role of hydropower in the transition to a sustainable energy system.

The organisation consists of three work packages: Environment and Society, Hydraulic Engineering and Turbines and Generators. Each work package has a steering group that discusses research direction and project proposals and monitors the progress of projects. A programme council handles project proposals and advises the LTU President on project funding.

In 2024, the SVC has initiated several new projects within its three work packages. In Environment and Society, seven new projects have been launched, including research on eel habitats and technical solutions for improved connectivity at hydropower dams. In Hydraulic Engineering, four new projects have been launched, including studies on quality assurance in CFD for air-water flows and effects on dams under cyclic loading. In Water Turbines and Generators, three new projects have been started, including studies on PFAS-free self-lubricating bearings and generator-grid oscillations. In total, 51 projects are ongoing, with a total of 31 PhD students and 11 post-docs.

2024 saw the presentation of a strategy for international work, which was developed by the programme council together with the director. The international work is of great importance for the centre. A joint workshop with HydroCen was held in Norway in April, and the international partners in the Scientific Council have reviewed and advised the Centre on the current project portfolio.The Centre has also carried out several activities during the year, including monthly lunchtime webinars to share research results and raise awareness of the Centre's work. The annual conference 'Hydropower R&D Days' was held in Umeå and gathered 112 participants. The SVC Graduate School held three courses during the year, with participants from both academia and industry.

SAMMANFATTNING

SVC – Svenskt centrum för hållbar vattenkraft – är ett kompetenscentrum som leds av Luleå tekniska universitet (LTU) med Energiforsk som programansvarig. Centret bedriver forskning och utveckling för vattenkraft, inom områden som teknik, system och metoder, med syfte att stärka vattenkraftens roll i omställningen mot ett hållbart energisystem.

Organisationen består av tre arbetspaket: Miljö och samhälle, Vattenbyggnad samt Turbiner och generatorer. Varje arbetspaket har en styrgrupp som diskuterar forskningsinriktning och projektförslag samt följer upp projektens framsteg. Ett programråd hanterar projektförslag och ger råd till LTU:s rektor om projektfinansiering.

Under 2024 har SVC initierat flera nya projekt inom sina tre arbetspaket. Inom Miljö och samhälle har sju nya projekt startats, inklusive forskning om ålars habitat och tekniska lösningar för förbättrad konnektivitet vid vattenkraftsdammar. Inom Vattenbyggnad har fyra nya projekt startats, inklusive studier om kvalitetssäkring i CFD för luft-vattenflöden och effekter på dammar vid cyklisk belastning. Inom Vattenturbiner och generatorer har tre nya projekt startats, inklusive studier om PFAS-fria självsmörjande lager och generator-nät-oscillationer. Totalt pågår 51 projekt, med totalt 31 doktorander och 11 post-docs.

Under 2024 så presenterades en strategi för internationellt arbete, som arbetats fram av programrådet tillsammans med föreståndaren. Det internationella arbetet är av stor vikt för centret. En gemensam workshop med HydroCen genomfördes i Norge i April, och det internationella parterna i det vetenskapliga rådet har granskat och rådgivit centret för den nuvarande projektportföljen.

Centret har också genomfört flera aktiviteter under året, inklusive månatliga lunchwebbinarier för att dela forskningsresultat och öka medvetenheten om centrets arbete. Den årliga konferensen "Vattenkraftens FoU-dagar" hölls i Umeå och samlade 112 deltagare. SVC:s forskarskola har hållit tre kurser under året, med deltagare från både akademi och industri.

1 Introduction

One of the challenges for the sustainable energy system is ensuring the balance of the power system. Here, hydropower plays a key role with its flexibility and cost-effective regulation capability. This competence center is a collaboration between the hydropower industry, academia, and government authorities to ensure that hydropower can continue to be an enabler for a well-balanced Swedish energy system in a transforming energy landscape and global environment.

Sustainable, secure, and optimized hydropower are some of the most important factors in Sweden's transition to a sustainable energy system. SVC – the Swedish Center for Sustainable Hydropower – is rooted in the latest technical and environmental research, with participation from seven different universities as well as stakeholders from industry and government authorities. Interdisciplinary research and innovative solutions strengthen Sweden's hydropower position and its ability to meet new conditions in the energy system. The center is one of eleven competence centers funded by the Swedish Energy Agency's joint initiative to build knowledge and expertise that accelerate the energy transition.

Luleå University of Technology is the host university for the center, and Energiforsk is responsible for coordinating the center's activities.

This report provides an overview of the activities carried out in 2024 by the SVC –

Swedish Centre for Sustainable Hydropower. It outlines the centre's vision, organizational structure, key initiatives, and progress toward its established goals. Additionally, the report presents an overview of ongoing research projects and includes a comprehensive list of deliverables published during the year.

1.1 SVC Vision

Sustainable, safe and optimized hydropower operates as the most important enabler in Sweden's transition to a sustainable energy system, while working to safeguard riverine biodiversity. Interdisciplinary research and innovative solutions, in close cooperation with the industry and public sector, strengthen our position among the international leaders in research in hydropower and river systems.

1.2 Goals

SVC strive towards the following goals:

- ensure that the industry has the knowledge and methods to maintain safe hydropower facilities with continued long-life spans,
- contribute to a solid scientific base for the implementation of measures for ecological rehabilitation of riverine ecosystems,
- optimize the usage of water in regulated rivers, balancing the needs of different stakeholders, including supply of renewable, fossil-free electricity to society.

2. Organization

SVC is a bottom-up organization, where the whole organization participates in leading the centre forward. The centre consists of three work packages (WPs), with a steering group each: Environment and Society (WP 1), Civil- and Hydraulic Engineering (WP 2) and Hydropower Technology (WP 3). The steering groups' role is to discuss research direction and project proposals and recommend them for implementation. The steering groups also follow the progress of the projects. Interdisciplinary collaborations between work packages are encouraged.

A Program Council handles project proposals recommended by the steering groups and advises the Vice-Chancellor (or delegated) of Luleå University of Technology, for decisions on project financing. Whilst the steering groups ensure deep expertise within the specific research field of the project, an important task for the program council is to work for synergies between the WP's. The Program council also deals with issues regarding the progress and strategy of the competence center.

Industry groups are representatives from stakeholders who are involved in the projects to follow the progress, contribute to the project and ensure their relevance for the stakeholders.

A Science Advisory Board (SAB), led by the centre director, provides international input to the centre activities.

Luleå University of Technology is the host university and has the overall responsibility for SVC. The centre management consists of the centre director, Staffan Lundström LTU, and the centre manager, Emma Hagner Energiforsk. The director is responsible for leading the centre according with its vision and ensuring that the interests of the stakeholders are recognized. The centre manager is responsible for the operation of the centre's activities. The program council chair, Hans Bjerhag Fortum, acts as support to the director and manager.

All participants in steering groups and the program council can be found in appendix 2.

2.1 PARTNERS IN SVC

Partners in SVC are Energiforsk (representing the Hydropower companies, Svenska kraftnät, mining industry and consultant companies), Luleå University of Technology (LTU), Royal Institute of Technology (KTH), Uppsala University (UU), Chalmers University of Technology (Chalmers), Karlstad University (KaU), Umeå University (UmU), Lund University (LU) and Swedish University of Agricultural Sciences (SLU).


AFRY

ANDRITZ
Hydro

AkerSolutions

BOLIDEN

CHALMERS

Energimyndigheten

fortum

Havs
och Vatten
myndigheten

HOLMEN

Jämtkraft

JÖNKÖPING
ENERGI

KTH


ENERGI

LKAB

LULEÅ
TEKNISKA
UNIVERSITET

LUNDS
UNIVERSITET

Mälarenergi

Norconsult

SLU

SVENSKA
KRAFTNÄT

SWECO

Skellefteå Kraft

Statkraft

Tekniska
verken

UMEÅ
UNIVERSITET

uni
per

UPPSALA
UNIVERSITET

VATTENFALL

Vattenkraftens
Miljöfond

VOITH

WSP

Zinkgruvan Mining

3 Selected highlights 2024

SVC´s R&D-days
In April the centre´s R&D days took place at Umeå University in Umeå. The conference focused on presenting and discussing current and future challenges for hydropower within an evolving power system.

Joint meeting with HydroCen
A joint workshop between HydroCen (now RenewHydro) and SVC was held in Trondheim in April, providing an opportunity to compare the two centres and discuss shared challenges. The ongoing exchange of knowledge and experience between Norway and Sweden remains crucial in advancing sustainable hydropower.

International strategy
In 2024, a strategy for international collaboration was approved. This strategy highlights existing international partnerships while setting new goals to further enhance the centre's global engagement.

SVC Webinars
Monthly lunch webinars have been organized to share research findings and raise awareness of the centre's work among a wider audience. These webinars have been highly appreciated by both academia and industry, attracting an average of 85 attendees per session.

Doctoral thesis
One new doctoral theses have been published during the year, which is one of the main goals of the centre.

4 Work packages

4.1 WP 1 - ENVIRONMENT AND SOCIETY

There is an urgent need for knowledge and innovative solutions to meet the environmental and societal challenges posed by a demand for more hydropower production, increased environmental awareness and changes to riverine ecosystems caused by ongoing and expected climate change. This work package focus on the following key areas:

- The environmental impact expected from future operational patterns of hydropower set to meet demands for short-term variation in electricity while balancing output with other renewables and how the environmental impact of hydropower can be mitigated in cost effective ways. This includes evaluating the effects of hydropower operation on riverine biodiversity during different seasons and the effectiveness of and impact on fish migration and other riverine organisms under new operational schemes.

- New environmental requirements and their effect on hydropower production. This includes developing environmental flow and fish passage solutions to meet new environmental and operational requirements, as well as methods for structural restoration of river channels and floodplains.

- Effects of climate change on riverine ecosystems and the interactive environmental effects of climate change and hydropower operation. This includes methods to mitigate as well as adapt ecosystems to climate change, e.g. by providing cold-water refuge and facilitating geographic range shifts of species. The consequences of allocating expected increases in average discharge to either hydropower production or environmental flows to provide benefits for ecosystems, as well as averting negative effects of droughts need to be assessed.

What happened during 2024?

WP1 initiated seven new projects during 2024. The projects range from hydraulic heavy topics such as "Hydraulic analysis of technical solutions for improved connectivity at hydropower dams" to the investigative approach of mapping historic eel habitat utilization in "Harnessing the power of otolith chemistry to assess habitat utilization of the European eel in Swedish waters". In total, these seven projects contributed to initiating one PhD, three post-docs and three senior research projects. As of this report, WP 1 has 15 active projects, with 7 being PhD-projects and 6 being post doctoral projects.

The steering group has had three meetings during 2024. As of the end of 2024, the steering group has allocated approximately 70.7 MSEK, with about 11.8 MSEK left. During 2024, the steering group sharpened their methodology for project prioritization and improved the ongoing hard work of selecting the best project ideas for execution.

4.2 WP2 - CIVIL & HYDRAULIC ENGINEERING

The focus is to provide the needed knowledge and methods to maintain a high functionality of the facility and dam safety, taking into consideration ageing structures, changed operational patterns and climate changes. Some of the challenges in this area are also shared by the mining industry who are therefore participating in this work package. Key areas are:

- Sustainable and cost-effective methods to maintain, repair and improve safety of existing constructions. Specifically, this means measures for maintenance, repairs and strengthening of existing concrete and embankment dams, development of innovative construction materials and materials for remedial grouting, how tunnels and other waterways in rock can be strengthened etc.

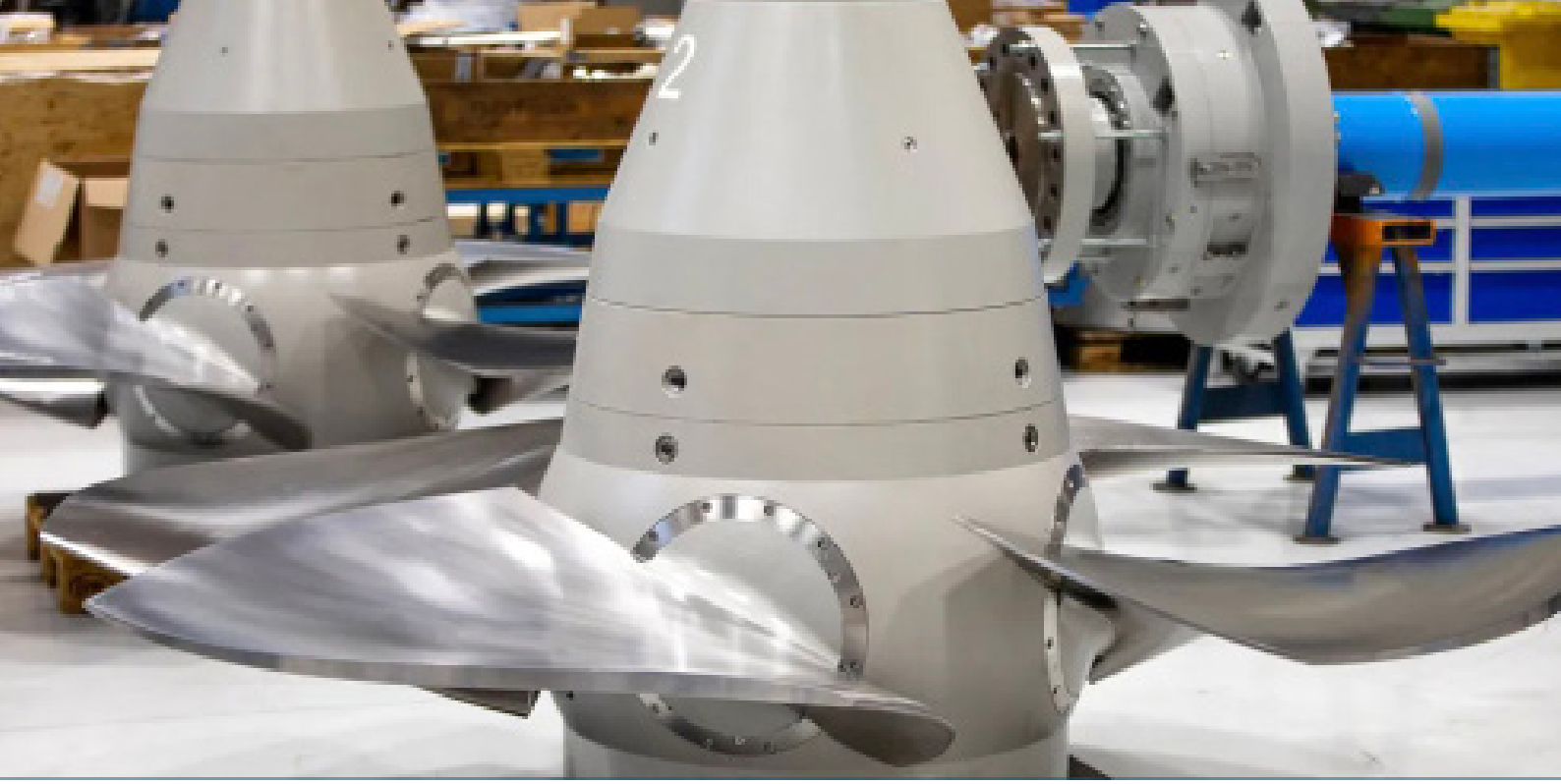
- Improved knowledge and methods to assess current state of hydraulic structures and their safety which is paramount to identify and prioritize repair and maintenance projects. The area includes investigations, surveillance and models, understanding static and dynamic loads and their effects on the construction. New operational patterns affect the waterways, and the hydraulic functions need to be optimized to reduce wear and erosion. Better understanding of the relation between hydraulic and structural engineering is of highest importance.

- Development and investigation of hydraulic and civil designs for new environmental measures to ensure positive environmental effects, minimize negative effects on operation and always maintaining a high dam safety.

What happened during 2024?

The work package Civil & Hydraulic Engineering initiated 4 new projects during 2024. The project portfolio now consists of 21 projects and contributes 11 PhD:s, 3 post-docs and a few senior researcher project. The projects range from studying quality and assurance in CFD for Air-Water flow predictions to studying the effects on embankment dams due to cyclic loading in a future scenario of hydropower usage.

The steering group has had three meetings during 2024 whereof one was held in Stockholm focusing on planning the demand analysis for SVC 2027-2032. Almost all the funding for the work package was allocated to projects during 2023, and the last projects were initiated early 2024. The focus for this year has been follow-up on the ongoing projects and preparing för a demand analysis that will be carried out during 2025.



4.3 WP3 – HYDROPOWER TECHNOLOGY

The ongoing transformation of hydropower's role in the energy system, which requires a more flexible production, affects the turbines and generators in ways not entirely known today. It is of great importance to gain knowledge in this area to ensure that hydropower can maintain and strengthen its role as the enabler of a sustainable and fossil free energy landscape as well as being a reliable supplier of energy and power.

- Sustainable and cost-effective methods to maintain and improve reliability of production units regardless of tougher working conditions.

- Improved knowledge and methods to assess current state of turbines and generators to minimize down time and support decision making concerning prediction of remaining lifetime and need of repairs and upgrades, i.e. predictive maintenance.

- Develop methods to assess loads, wear and fatigue on equipment and constructions from changing operational patterns and investigation of innovative ways to mitigate these negative effects while maintaining a safe and effective production, i.e. using battery storages in combination with HPP facilities or other new technologies.

- Environmental aspects of bearings with environmentally friendly lubricants.

- New and higher demands on working conditions (primary and secondary frequency response, such as FCR-N) based on new requirements should be investigated from a perspective of mechanical degradation as this could limit development of the network grid performance.

What happened in 2024?
The workpackage for Hydropower technology initiated 3 new projects during 2024. The projects range from studying the condition monitoring of behavioral changes of turbines, to evaluating PFAS-free self-lubricating bearings in hydropower components, and to studying generator-grid oscillations and grid codes. The project portfolio contributes 12 PhD:s, 4 post-docs and one senior researcher project which includes all the senior researchers in the work package in a synthesis of research to enable lifetime assessment of hydropower units.

The steering group has had three meetings during 2024. In principle, all the funding for the work package has been allocated to projects during 2023 and 2024, and the steering group has worked diligently in order to allocate the funding to the most relevant and appropriate projects. As there is only 700 000SEK of funding left for new projects, and reviewing process of projects is over, the steering group has started to steer towards a new role during this current stage of the centre period

5 Centre activities and goals

The center's quantitative goals, which are followed up on an annual basis, are listed in the table below.

Goal	Reult of 2024	Comment
15 senior researchers that are continuously active in the centre's projects.	17 senior researchers active in 2024.	Definition: project leader for at least 1 SVC project and member of a steering group.
30 active PhD-students or postdocs	42 PhD:s or post-docs.	31 PhD:s, 11 post-docs.
15 participants in each course in the centre´s research school (at least two from international partners).	Three courses were held 2024, with av average of 7 participants.	1 international student in the course Environmental impacts and rehabilitation measures in regulated rivers, from Norway.
30 scientifically reviewed articles published yearly.	15 scientifically reviewed articles published 2024.	31 in total since 2022. More articles are expected in 2025-2027.
20 conference contributions presented yearly.	16 conference contributions in 2024.	25 in total since 2022. More contributions are expected in 2025-2027.
That each research environment continuously participates in at least one (1) project that is carried out in collaboration with another research environment within the centre.	Of the 12 different research environments, 10 participates in at least another within the centre.	Definition: A joint project within two different research environments within a work package, or between work packages.

5.2 EQUALITY AND GENDER STATISTICS

SVC continuously works to foster gender equality within the hydropower sector. A number of goals have been set to achieve this, which are listed below:

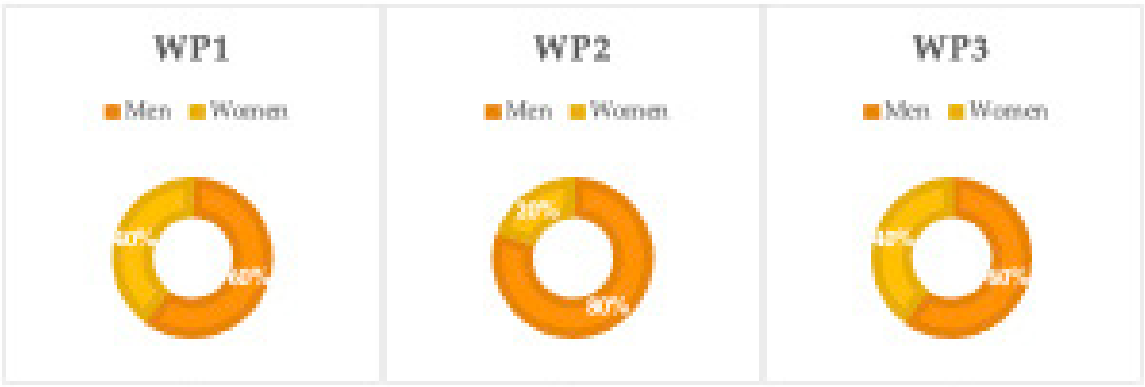
- Promoting Diversity and Equality: We believe that diversity enhances the quality of our work. By promoting gender equality and diversity, we aim to improve the outcomes of our activities and contribute to greater gender equality within the broader energy industry.
- Active Engagement: All organizations within our centre must have their own gender equality plans, actively pursued to address issues and foster a more inclusive environment.
- Balanced Representation: When forming project and reference groups, we strive for a balanced gender distribution to ensure diverse perspectives and experienc¬es. Our program council is required to have a maximum of 60 % of each gender.
- Transparency and Accountability: We believe in transparency. That's why we include gender distribution statistics for both applicants and appointed doctoral positions in our annual report, keeping ourselves accountable for progress.
- Continuous Evaluation and Improvement: We will conduct annual surveys to identify any risks of discrimination or obstacles to equality in the centre. Based on these findings, we will implement actions to address concerns and capitalize on positive aspects. As part of our overall evaluation process, we also assess our work on gender equality and diversity, ensuring that we're continuously striving for improvement.
- Highlighting Positive Role Models: We recognize the importance of positive role models. That's why we actively identify and showcase inspiring individuals, invit¬ing them to share their experiences at our events

Requirements in the gender equality plan are met:

- The program council may consist of a maximum of 60 % of each gender.
- All organizations in charge of projects in SVC must have their own gender equality plan that they actively work with.
- A balanced gender distribution should be aimed for when forming project and reference groups. The project leader must comment on this in the application.
- Statistics on the gender distribution of both applicants and appointed doctoral positions should be reported in SVCs annual report.

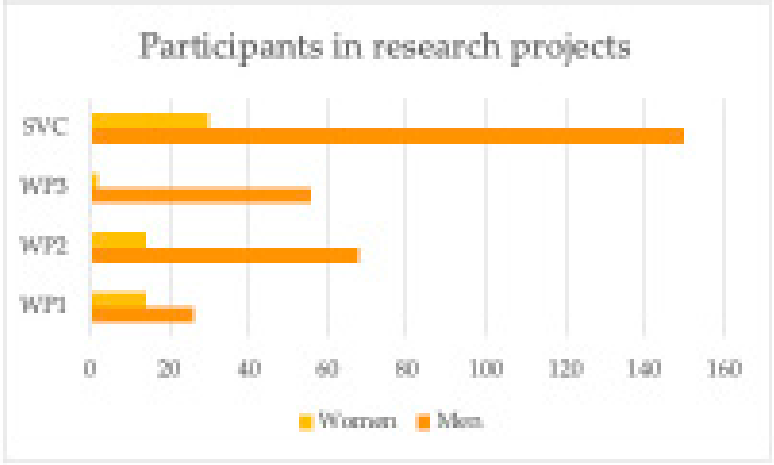
Goals:

- Steering groups for each work package within SVC should consist of a maximum of 60% of each gender. Goal is not met, see figures below. However, all steering group are more equal compared to 2023. Stakeholders are recommended to suggest two candidates to the steering group when someone is to be replaced as a way of reaching our goals.
- Gender-balanced representation should be pursued among presenters, panel participants, etcetera at the Hydropower R&D-days, workshops and other events organized by SVC. Representation on the R&D days 2024 was very close to equal, see figure below. The SVC lunch webbinars were male-dominated because of most PhD-students and project leaders meeting male.


WP1
Men
Women
WP2
Men
Women
WP3
Men
Women


R&D-DAYS SPEAKERS
Men
Woman
SVC LUNCH WEBINARS
Men
Woman


Recruitment statistics
600
500
400
300
200
100
0
571
94
16
10
Applicants
Hired
Men
Women


Participants in research projects
SVC
WP3
WP2
WP1
0
20
40
60
80
100
120
140
160
Woman
Men

5.3 SVC´S SCIENCE ADVISORY BOARD

The Science Advisory Board (SAB) of SVC consists of senior researchers from the centre, along with three highly recognized international experts. Each international expert represents one of the centre's work packages (WPs), alongside a senior researcher from each respective package within SVC. The board is chaired by the centre director, Prof. Staffan Lundström from Luleå University of Technology (LTU). The SAB board has the following representation:

WP1, Environment and Society
- Prof. Eva Bergman, KaU (SVC)
- Prof. Michael McClain, IHE Delft in the Netherlands

WP2, Civil and Hydraulic Engineering
- Prof. Fredrik Johansson, KTH (SVC)
- Prof. Anton Schleiss, Swiss Federal Institute of Technology in Lausanne.

WP3, Hydropower Technology
- Prof. Urban Lundin, UU (SVC)
- Prof. Giovanna Cavazzini, University of Padova in Italy

The primary role of the SAB is to provide an international perspective on the centre's activities while identifying opportunities for future collaborations within global research networks.

In April 2024, the SAB convened for a meeting in conjunction with the SVC R&D Days held in Umeå. During the meeting, the board reviewed the centre's progress and discussed strategic directions for each work package. The international representation from SAB also produced a report in 2024, primarily based on progress reports from funded projects. This report gave a positive review on the work within SVC.

The SAB plays a crucial role in evaluating and guiding the research conducted within the centre. This collaboration will continue in 2025, ensuring that SVC remains at the forefront of international hydropower research and innovation.

The annual joint workshop between HydroCen and SVC took place in Trondheim in 2024.

5.4 INTERNATIONAL WORK AND COLLABORATIONS

The annual joint workshop between HydroCen and SVC took place in Trondheim in 2024, continuing the strong collaboration between Swedish and Norwegian hydropower research. This partnership aims to advance hydropower research and contribute to a more sustainable future for the industry.

This year's workshop covered a range of key topics, including turbine research within EU-funded projects, dam safety, waterways, fish migration, and sediment management. Participants also had the opportunity to take a guided tour of the Vassdragslaboratoriet, choosing between visits to the geology lab and NINA-GEN lab or the hydropower lab and electrical power lab. The workshop also included discussions on research collaboration and PhD mobility.

Many of the representatives from SVC stayed in Trondheim for the HydroCen annual conference, which was held the following day.

Overall, the workshop fostered valuable discussions and raised important research questions that will help shape the future of hydropower innovation.

5.5 OUTREACH AND COMMUNICATION

The goal of SVC's communication and dissemination efforts is to share new knowledge with Sweden's hydropower and mining industries, as well as government agencies, while addressing the challenges that a sustainable energy system poses for hydropower. Additionally, SVC contributes to capacity building within the Swedish hydropower sector.

A significant portion of communication takes place within the centre, including steering group meetings, program council discussions, and industry group collaborations for each specific SVC project. The industry groups bring together representatives from the hydropower and mining industries, as well as government agencies, to ensure an active exchange of knowledge and perspectives.

Throughout 2024, monthly open webinars have continued to present ongoing research findings. A total of seven lunch webinars were held, attracting an average of 85 attendees per session. Both PhD students and senior researchers from all work packages took part in presenting their findings, while industry representatives contributed by discussing the practical implementation of the results.

We also hosted our annual Hydropower R&D Days in Umeå, providing a key platform for collaboration and knowledge exchange, with 112 attendees.
To ensure broad accessibility to information, the SVC website is regularly updated with details about ongoing projects, events, seminars, and webinars. Additionally, newsletters are sent out to inform the public and stakeholders about the centre's activities, with further updates shared on LinkedIn to expand outreach.

Throughout 2024, monthly open webinars have continued to present ongoing research findings. A total of seven lunch webinars were held, attracting an average of 85 attendees per session.

5.6 SVC RESEARCH SCHOOL

The centre provides a research school which target group PhD students and professionals from the industry, however it is available for everyone with an interest.
Three courses were held during 2024:

Environmental impacts and rehabilitation measures in regulated rivers, with senior researchers Birgitta Malm-Renöfäldt and Roland Jansson from UmU, and Dr Åsa Widen from SLU. This course had 14 participants.

Structural Engineering for Hydropower structures, which was given by senior researchers Andreas Sjölander and Erik Nordström at KTH and was held at both KTH in Stockholm and in Uppsala. This course had 5 participants.

Synchronous generators for Hydropower applications, which was given by senior researcher Urban Lundin at Uppsala University. This course had 6 participants.
For each course, 2 ECTS is credited if the participant passes the course. The Research School is also a great networking opportunity for the doctoral students and industry partners connected to SVC. Both PhD-students, industry representatives and even masters students have taken the course.

R&D-days in Umeå. Hans Bjerhag, Emma Hagner and XXXX on stage.

5.7 HYDROPOWER R&D-DAYS

During the centre's R&D-days, we enjoyed discussing several interesting research questions and presentations from ongoing projects. Two of the main areas presented by current PHD-students within the centre, was "Digital technologies that promoting sustainable hydropower". Frida Niemi and Lars-Johan Sandström, both PHD-students at LTU, presented how these digital technologies can be used for both hydraulic modelling within a river reach, and to map the maintenance need for turbines in new operating modes.

Marcus Martinsson, also from LTU, provided an interesting presentation on how socioeconomic analysis can be used for trade-offs in the work with environmental adaptation of Swedish hydropower. These socioeconomic analysis methods were used to balance energy production and concern for the environment, with examples from the rivers Ljungan and Mörrumsån. Another interesting topic was representatives from both the academy and industry, presenting strategies for increased flexibility and optimized reservoirs.

The R&D conference from 2024 was appreciated by many of its participants, and the lasting feeling is that the research being done within the centre is of high importance for the industry, and the future of sustainable hydropower. The width of the disciplines and the work packages could also work with and learn from each other.

6 Meet one of our PhDs

Jasmina Toromanovic has always been interested in technology, which led her to become an engineer. Today, Jasmina conducts research on dam constructions at LTU and also works as the program director for the new Master of Science in Civil Engineering program. She wants to inspire young people to pursue engineering careers!

Jasmina, why did you choose to become an engineer?
"I like math, physics, and chemistry. My stepfather was a carpenter, and sometimes I got to accompany him to work, where we talked about technology. He was the one who suggested that I should become an engineer. I always did quite well in school and was curious about different technical solutions, so the idea of becoming an engineer was appealing."

Now, in addition to her research, Jasmina works as the program director for the new Civil Engineering program, which replaces the current Civil Engineering program.
"We are keeping the foundation of the program but have added some new courses and a focus on a broader perspective of civil engineering. This is a way to modernize the program. We need to structure the education in a way that makes more 'youngsters' understand how exciting it is to work as an engineer in the civil engineering sector. There is a great demand for engineers in this field and so many exciting challenges to tackle!"

Jasmina researches dam constructions.
"Dams interest me! They must be safe structures. We need to have reliable methods

for evaluating their stability and security. There is still a lot to research in this area."

Jasmina completed her dissertation, "Monitoring and Modelling of Embankment Dams," this past spring. Since then, she has been working on a senior project related to dams in the green transition.
"What happens when new ways of operating generators and new reservoir levels are introduced? We have created a new load scenario that does not include the classical parameters for rapid drawdown and normal flow conditions. We will investigate what happens to the dam under these conditions."

In addition to this, Jasmina and her research group are collaborating with Vattenfall on the experimental dam in Älvkarleby.
"We discovered some unusual behaviors that we struggled to explain. This has been on my mind since I wrote my dissertation, and I would really like to find answers to these strange behaviors exhibited by the dam."
What is most important for hydropower in the future? What are the biggest challenges?
"This connects to my role at LTU—I want to help ensure that more engineers enter the field. We need expertise for the future! I believe the biggest issue is understanding the effects of climate change. Additionally, Sweden has many aging hydropower plants, which presents another challenge."

You recently visited South Africa with students in their final year of the Civil Engineering program. What were your impressions?
"South Africa has many natural resources. It is a beautiful country. Many students aspire to study at the highly ranked universities, but unfortunately, there aren't enough spots available. The cost of studying is extremely high, and while there are scholarships, they are not sufficient to meet the demand."

What did you do in South Africa?
"We visited a mine and a dam used for drinking water and irrigation. The research on tailings dams in South Africa is quite similar to our research on embankment dams. Modeling and instrumentation methods are quite comparable. This allows us to understand each other and exchange ideas.
The universities we visited had impressive laboratory facilities. Perhaps we can establish a research collaboration and exchange guest lecturers. It was fascinating to see that much of my knowledge and my students' knowledge is applicable worldwide! That alone should inspire young people to become engineers—the idea of having the whole world as your workplace!"

7 R&D-projects within SVC

7.1 GRANTED, ONGOING AND FINISHED PROJECTS

The tables below show all projects that are granted funding from SVC phase 2022 – 2027.

Project title	Project leader	Academic Partners	Industry partners	Project period	Status
Floods for riparian biodiversity – Flood pulses to maintain riparian biodiversity in regulated rivers	Roland Jansson, UmU	UmU		2022.09 -2025.06	Ongoing
Digital twins of regulated rivers stretches coupling hydraulic modelling with individual based models for fish population	Anders Andersson, LTU	LTU	Vattenfall	2022.07 – 2026.12	Ongoing
Ecological status of aquatic and riparian habitat in relation to hydropeaking in winter	Lutz Eckstein, KaU	KaU, UmU		2023.01 – 2027.06	Ongoing
Ecohydraulic flows in shallow waterways with large bed rougness, Anders Andersson LTU	Anders Andersson, LTU	LTU	Vattenfall	2023.01-202706	Ongoing
Using machine learning for improved eel downstream passage design	Olle Calles, KaU	KaU	Vattenfall	2024.01-2026.12	Ongoing
Verification of individual-based models for population-level analysis and development of demogenetics models in hydropower-regulated river	John Piccolo, KaU	KaU	Vattenfall, Fortum	2023.10-2025.12	Ongoing
Morphological measures to promote biodiversity in hydropeaking reservoirs	Birgitta Malm Renöfält, UmU	UmU	Vattenfall	2024.01-2027.06	Ongoing
Hydraulic analysis of technical solutions for improved connectivity at hydropower dams	Anders Andersson, LTU	LTU		2024.01 - 2025.06	Ongoing
Environmental design for rehabilitation of regulated lakes and reservoirs	Johan Östergren, SLU	SLU	Vattenfall	2024.04 - 2027.06	Ongoing

Predict salmonid migration pathways from flow simulations in rivers	Johan Leander (SLU)	SLU	Vattenfall	2024.05-2026.12	ongoing
Legal issues in connection with the revision of hydropower plant licenses – assessment of modern environmental requirements and unreasonable costs	Maria Pettersson (LTU)	LTU		2024.05-2027.06	Ongoing
Functionality of Depth Restricted Inclined Fish Screens (DRIFS) for downstream passage of brown trout - a case study at Väsa hydropower plant in Österdal river	Daniel Palm (SLU)	SLU	Fortum	2025.01-2027.06	Granted
FREEL (Freshwater Eel) - Harnessing the power of otolith chemistry to assess habitat utilization of the European eel in Swedish waters.	Philip Jacobson (SLU)	SLU		2025.06 - 2027.06	Granted

Table 1 Granted, ongoing and finished projects WP1, 15 in total.

Project title	Project leader	Academic Partners	Industry partners	Project period	Status
Adaptation of monitoring with DCIP tomography for management of embankment dams	Torleif Dahlin, LU	LU		2023.01 – 2024.12	Ongoing
Integrating electrical resistivity results interpretation with numerical flow for detection of internal defects in embankment dams	Torleif Dahlin, LU	LU		2023.01 – 2025.12	Ongoing
Spillway Discharge Safety – Quality and Assurance in CFD for Air-Water Flow Predictions	James Yang, KTH	KTH	Vattenfall	2023.01 – 2027.06	Ongoing
Analysis of stilling-basin damages for cost-effective refurbishment	James Yang, KTH	KTH	Vattenfall	2023.07-2027.06	Ongoing
Assessment of rock scour in spillway channels through experiments and numerical simulations	Gunnar Hellström, LTU	LTU, KTH		2023.07 – 2027.06	Ongoing
Degradation of grout injection in hydropower dams – coupled hydro-geological – geochemical modeling to predict dam condition and remaining lifetime	Liangchao Zou, KTH	KTH, LTU	Vattenfall, Fortum	2023.04-2027.06	Ongoing
Dynamic load and response interaction for hydropower civil structures	Erik Nordström, KTH	KTH	Vattenfall	2023.01 – 2027.05	Ongoing
Realistic failure modelling of concrete dams	Erik Nordström, KTH	KTH		2023.03 – 2025.08	Ongoing
Practical design under large uncertainties according to Eurocode 7	Fredrik Johansson, KTH	KTH	UNIPER	2023.03 – 2026.07	Ongoing
Description of pore pressure and alarm thresholds for probabilistic assessment of sliding stability for concrete dams	Fredrik Johansson, KTH	KTH, LTU		2023.10 – 2026.03	Ongoing
Safe dams – A holistic approach for improved safety of concrete dams	Gabriel Sas, LTU	KTH, LTU		2023.10 – 2026.03	Ongoing

Innovative design and experimental-numerical studies of Piano Key Spillway for significantly enhanced discharge and hydraulic performance	James Yang, KTH	KTH	Vattenfall	22023.04 - 2023.12	Finished
Cyclic loading - future use and storage	Jan Laue, LTU	LTU	Vattenfall	2023.01 – 2025.12	Ongoing
Towards migration of fines inside embankment dam cores	Jan Laue, LTU	LTU	Vattenfall	2023.07 - 2027.06	Ongoing
Photogrammetry for flow measurements at hydropower plants with no operational restrictions or limitations	Gunnar Hellström, LTU	LTU	Vattenfall	2023.01 - 2024.12	Ongoing
Trust in CFD for hydraulic design of open water ways and spillways	Gunnar Hellström, LTU	LTU	Vattenfall	2023.01 - 2024.12	Ongoing
Forecasting of ice-loads on concrete dams	Erik Nordström, KTH	KTH	Vattenfall, Uniper	2023.07 - 2027.06	Ongoing
Framework for optimisation of uplift pressure monitoring and maintenance of drainage holes	Fredrik Johansson, KTH	KTH, LTU	Vattenfall, Uniper	2026.04 - 2027.06	Granted
Defect detection and seepage characterisation for the Älvkarleby test embankment dam using resistivity-IP monitoring and 3D flow modelling	Torleif Dahlin, LU	LU		2024.10 - 2026.03	Ongoing
Engineering Measures for Energy Dissipation Improvements in Existing Spillway Chutes	James Yang, KTH	KTH	Vattenfall	2024.08 - 2025.08	Ongoing

Table 2 Granted, ongoing and finished projects WP2, 22 in total.

Project title	Project leader	Academic Partners	Industry partners	Project period	Status
Electrical dump-loads increasing spill capacity	Urban Lundin, UU	UU		2023.01 – 2026.12	Ongoing
Optimization of joint operation of fast and slow storage reservoirs reducing Hydropower wear and tear for Grid benefits	Urban Lundin, UU	UU	Vattenfall, Fortum	2023.01 – 2025.12	Ongoing
Environmentally acceptable lubricants for hydropower applications	Kim Berglund LTU	LTU	Vattenfall	2023.01 – 2027.06	Ongoing
Condition monitoring for the identification of behavioral changes – continuation stage	Kim Berglund, LTU	LTU	Skellefteå Kraft	2023.01 – 2023.12	Finished
Three-dimensional FE modelling of vertical rotors	Jan-Olov Aidanpää, LTU	LTU	Vattenfall	2023.01 – 2027.06	Ongoing
Synthesis of research to enable lifetime assessment of hydropower units	Jan-Olov Aidanpää, LTU	LTU, UU, Chalmers	Vattenfall	2023.01 – 2023.12	Ongoing
Development of components for increased damping in hydropower units	Jan-Olov Aidanpää, LTU	LTU	Vattenfall	2023.01 – 2023.12	Ongoing
Models for mechanical analysis generators with floating rotor rim	Jan-Olov Aidanpää, LTU	LTU	Vattenfall	2023.01 – 2024.06	Ongoing
Artificial intelligence for enhanced hydraulic turbine lifetime	Håkan Nilsson Chalmers	Chalmers	Vattenfall	2023.01 – 2027.06	Ongoing
Hydropower operation and lifetime analysis	Håkan Nilsson Chalmers	Chalmers	Vattenfall, Skellefteå Kraft	2023.01 – 2027.06	Ongoing
Determination of added parameters in hydraulic turbines	Michel Cervantes LTU	LTU	Vattenfall, Skellefteå Kraft	2023.01 – 2025.12	Ongoing
Instabilities at deep-part-load/ speed-noload in a Kaplan turbine	Michel Cervantes LTU	LTU	Vattenfall, Skellefteå Kraft	2023.01 – 2025.01	Ongoing

PIV measurements on a model turbine during detrimental operational conditions	Michel Cervantes LTU	LTU	Vattenfall, Skellefteå Kraft	2023.01 – 2025.06	Ongoing
Development of the pressure-time method for low-head machines	Michel Cervantes LTU	LTU	Vattenfall, Skellefteå Kraft	2023.01 – 2024.06	Finished
Development of a draft tube guide vane system to improve the flexibility and extend the fatigue life of axial hydro electric turbines	Michel Cervantes LTU	LTU	Vattenfall, Skellefteå Kraft	2023.06 - 2027.06	Ongoing
Condition monitoring for the identification of behavioral changes – PhD stage	Kim Berglund LTU	LTU	Vattenfall	2024.01 - 2027.06	Ongoing
Evaluation of PFAS-free self-lubricating bearings for hydropower applications	Kim Berglund LTU	LTU		2024.12-2026.06	Ongoing
Generator-grid oscillations and grid codes	Urban Lundin UU	UU		2026.04 - 2027.06	Granted

Table 3 Granted, ongoing and finished projects WP3, 19 in total.

7.2 PUBLICATIONS IN INTERNATIONAL JOURNALS AND CONFERENCES

Journals (Publication, Author, Date, Journal, DOI, Project)

2024

• *Fast and cost-efficient species identification of Atlantic salmon (Salmo salar L.), brown trout (Salmo trutta), and their hybrids using a single SNP marker*, Tutku Aykanat, Athina Balatsou, Kirsi Kähkönen, Jukka T. Syrjänen, Matti Janhunen, Tuomas Leinonen, Jenni M. Prokkola, Johnny R. Norrgård, John J. Piccolo, December 17, 2024, Journal of Fish Biology, DOI: 10.1111/jfb.16032, Verification of individual-based models for population-level analysis and development of demogenetics models in hydropower-regulated rivers

• *Numerical Analysis of Flow Characteristics and Energy Dissipation on Flat and Pooled Stepped Spillways*, Umar Farooq, Shicheng Li, James Yang, September 13, 2024, Water, Volume 16, Issue 18, Article 2600, DOI: 10.3390/w16182600, Spillway Discharge Safety – Quality and Assurance in CFD for Air-Water Flow Predictions
Parametric study on influence of location and inclination of large-scale asperities in the concrete-rock interface for small buttress dams, Dipen Bista, Adrian Ulfberg, Leif Lia, Jamie Gonzales, Gabriel Sas, Fredrik Johansson, October 2024, Journal of Rock Mechanics and Geotechnical Engineering, https://doi.org/10.1016/j.jrmge.2023.12.036, Safe dams - A holistic approach for improved safety of concrete dams

• *Monitoring of Älvkarleby test embankment dam using 3D electrical resistivity tomography for detection of internal defects*, Reyhaneh Norooz, Aristeidis Nivorlis, Per-Ivar Olsson, Thomas Günther, Christian Bernstone, Torleif Dahlin, March 27 ,2024, Journal of Civil Structural Health Monitoring, DOI: https://doi.org/10.1007/s13349-024-00785-x, Integrating electrical resistivity results interpretaion with numerical flow modelling for detection of internal defects in embankment dams

• *Natural surface floaters in image-based river surface velocimetry: Insights from a case study*, Hang Trieu, Per Bergström, Mikael Sjödahl, J. Gunnar I. Hellström, Patrik Andreasson, Henrik Lycksam, February 26, 2024, Flow Measurement and Instrumentation, DOI: 10.1016/j.flowmeasinst.2024.102557, Photogrammetry for flow measurements at hydropower plants with no operational restrictions or limitations

• Measurements and Simulations of the Flow Distribution in a Down-Scaled Multiple Outlet Spillway with Complex Channel, P.A. Mikael Hedberg, J. Gunnar I. Hellström, Anders G. Andersson, Patrik Andreasson, L. Robin Andersson, April 8, 2024, Water, Vol. 16, DOI: 10.3390/w16060871, Trust in CFD for hydraulic design of open water ways and spillways

• *Three-Dimensional Modeling for Mechanical Analysis of Hydropower Generators with Floating Rotor Rim*, Rondon D., Pääjärvi S., Aidanpää, J.O. & Gustavsson, R., April 17, 2024, Machines, E-ISSN 2075-1702, Vol. 12, DOI: 10.3390/machines12040268, Three-dimensional FE modelling of vertical rotors

• *Cost-Effective Design Modification of a Sleeve Bearing with Large Bearing Clearance*, Benti G., Aidanpää J.O. and Gustavsson R., April 8, 2024, Applied Sciences, E-ISSN 2076-3417, Vol. 14, DOI: 10.3390/app14031214, Development of components for increased damping in hydropower units

• *An efficient intrusive deep reinforcement learning framework for OpenFOAM*, Saeed Salehi, June 6, 2024, Meccanica, DOI: https://doi.org/10.1007/s11012-024-01830-1, Artificial intelligence for enhanced hydraulic turbine lifetime

• *Modal analysis of vortex rope using dynamic mode decomposition*, Saeed Salehi, Håkan Nilsson, February 23, 2024, Physics of Fluids 36, DOI: https://doi.org/10.1063/5.0186871, Artificial intelligence for enhanced hydraulic turbine lifetime

• *Formation and evolution of vortex breakdown consequent to post design flow increase in a Francis turbine*, Faiz Azhar Masoodi, Saeed Salehi, Rahul Goyal, February 8, 2024, Physics of Fluids 36, DOI: https://doi.org/10.1063/5.0187104, Artificial intelligence for enhanced hydraulic turbine lifetime

• *Reorganization of flow field due to load rejection driven self-mitigation of high load vortex breakdown in a Francis turbine*, Faiz Azhar Masoodi, Saeed Salehi, Rahul Goyal, September 6, 2024, Physics of Fluids Vol 36, DOI: https://doi.org/10.1063/5.0222739, Artificial intelligence for enhanced hydraulic turbine lifetime

• *Analysis of hydropower plant guide bearing vibrations by machine learning based identification of steady operations*, Xiao Lang, Håkan Nilsson, Wengang Mao, September 24, 2024, Reneweable Energy, Vol 236, DOI: https://doi.org/10.1016/j.renene.2024.121463, Hydropower operation and lifetime analysis

• *Extending the pressure-time method to bend using 3D-CFD*, Mehrdad Kalantar Neyestanaki, Georgiana Dunca, Pontus Jansson, Michel Cervantes, January 17, 2024, Flow Measurement and Instrumentation, Volume 96, DOI: https://doi.org/10.1016/j.flowmeasinst.2024.102535, Development of the pressure-time method for low-head machines

• *Effects of nonlinear magnetic forces on the dynamics of hydropower generators with floating rotor rim*, Rondon, D., Aidanpää, J.O. & Gustavsson, R., January 16, 2025, CHAOS 2023 International Conference 13-16 June 2023 Heraklion, Crete, Greece, DOI: https://doi.org/10.1007/978-3-031-60907-7_38, Models for mechanical analysis generators with floating rotor rim

2023

• *Modelling erosion of a single rock block using a coupled CFD-DEM approach*, Peng¬-hua Teng, Fredrik Johansson, J. Gunnar I. Hellström, August 14, 2023, Journal of Rock Mechanics and Geotechnical Engineering, https://urn.kb.se/resolve?urn=urn:nbn:se:l-tu:diva-99600, 45527, Assessment of rock scour in spillway channels through experi-ments and numeri¬cal simulations

• *Probabilistic finite element analysis of failures in concrete dams with large asperities in the rock–concrete interface*, Adrian Ulfberg, Jamie Gonzalez, Oisik Das, Dipen Bista, April 17, 2023, Archives of Civil and Mechanical Engineering, DOI: 10.1007/s43452-023-00652-4, Safe dams - A holistic approach for improved safety of concrete dams

• *Geometric Modification of Piano Key Weirs to Enhance Hydraulic Performance and Discharge Capacity*, James Yang, Shicheng Li, Anna Helgesson, Erik Skepparkrans, 2023, Water, Vol 15, DOI: https://doi.org/10.3390/w15234148, Innovative design and experimental-numerical studies of Piano Key Spillway for significantly enhanced discharge and hydraulic performance

• *Using hydropower turbine discharge as a complementary spillway*, Urban Lundin, Pontus Jonsson, Luca Facciolo, May 10, 2023, Journal of Applied Water Engineering and Research, Vol 11, DOI: https://doi.org/10.1080/23249676.2022.2087774, Electri-cal dump-loads increasing spill capacity

• *Simulation of Rapid Voltage Edge Related Voltage Surges in Highly Inductive Windings with Frequency Dependent Parameters*, Roberto Felicetti, JPIER, https://www.jpier.org/PIERB/pier.php?paper=22122705, Wanted and unwanted Forces in generators

• *A Synchronous Machine Transient Model Based upon an Algebraic Loop Account¬ing for Nonlinearity and Cross-Magnetization*, Roberto Felicetti, Hindawi, https://doi.org/10.1155/2023/4547086, Wanted and unwanted Forces in generators
Storage System Design for Improved Primary Frequency Control From Hydro-power Units, Danilo Laban, IEEE, April 24, 2023, https://ieeexplore.ieee.org/do-cument/10107425, Op-timization of joint operation

• *Simplified transformation matrices of journal bearings in vertical application*, Benti G., Aidanpää J.O. and Gustavsson R., August 28, 2023, Applications in Engineering Science, Volume 15, DOI: https://doi.org/10.1016/j.apples.2023.100147, Development of components for increased damping in hydropower units

• Determination of all hydrodynamic added properties resulting from fluid structure interactions using singular value decomposition, M. Raisee, M.J. Cervantes, May 22, 2023, Journal of Fluids and Structures, Vol 120, DOI: https://doi.org/10.1016/j.jfluid-structs.2023.103898, Determination of added parameters in hydraulic turbines

• *Hydrodynamic damping in laminar, transient and turbulent regimes: Analytical and computational study*, M. Bahrami, M.J. Cervantes, M. Raisee, A. Nourbakhsh, November 16, 2023, Ocean Engineering, Volume 289, DOI: https://doi.org/10.1016/j.oceaneng.2023.116277, Determination of added parameters in hydraulic turbines

• *Mitigation of the Pressure Pulsations in an Axial Turbine at Speed-No-Load With Independent Guide Vanes Opening*, J. Kranenbarg, P. P. Jonsson, B. G. Mulu, and M. J. Cervantes, July 26, 2023, Journal of Fluids Engineering, Vol 145, DOI: https://doi.org/10.1115/1.4062823, Instabilities at deep-part-load/speed-no-load in a Kaplan turbine

• *Uncertainty in the numerical prediction of the tangential velocity in axial turbines at part load operations: A parametric study*, J. Kranenbarg, P. P. Jonsson, B. G. Mulu, and M. J. Cervantes, September 18, 2023, Energy reports, Volume 10, DOI: https://doi.org/10.1016/j.egyr.2023.09.054, Instabilities at deep-part-load/speed-no-load in a Kaplan turbine

• *A Comparison of Different Methods for Modelling Water Hammer Valve Closure with CFD*, Mehrdad Kalantar Neyestanaki, Georgiana Dunca, Pontus Jansson, Michel Cervantes, April, 2023, Water, Vol 15, DOI: 10.3390/w15081510, Development of the pressure-time method for low-head machines

• *Numerical Investigation of the Pressure-Time Method, Head loss in Developed and Developing Flows*, Mehrdad Kalantar Neyestanaki, Georgiana Dunca, Pontus Jansson, Michel Cervantes, December 30, 2023, International Journal of Fluid Machinery and Systems, Vol 16, DOI: 10.5293/IJFMS.2023.16.3.332, Development of the pressure-time method for low-head machines

• *Extending the Pressure-Time Method to Pipe With Variable Cross-Section With Three-Dimensional Numerical Simulations*, Mehrdad Kalantar Neyestanaki, Georgiana Dunca, Pontus Jansson, Michel Cervantes, October 18, 2023, Journal of Fluids Engineering, Vol 146, DOI: 10.1115/1.4063491, Development of the pressure-time method for low-head machines

• *Experimental study of the pressure-time method with potential application for low-head hydropower*, Mehrdad Kalantar Neyestanaki, Georgiana Dunca, Pontus Jansson, Michel Cervantes, March 24, 2023, Journal of Fluids Engineering, Vol 125, DOI: https://doi.org/10.1115/1.4062090, Development of the pressure-time method for low-head machines

Conferences (Publication, Author, Date, Conference, DOI, Project)
2024

An Ecohydraulic Approach for 2D Hydraulic Modelling of a Regulated River Reach, Frida Niemi, Anders Andersson, Gunnar Hellström, 2024, In Proceedings of the 8th IAHR Europe Congress, Lisbon, Portugal, 2024, https://ltu.diva-portal.org/smash/record.jsf?pid=diva2%3A1934786&dswid=2052, Digital twins of regulated river stretches coupling hydraulic modelling with individual based models

Experimental investigation of open channel flow around a hemisphere at different relative depths using 3D-PTV, Dan Nilsson, Anders Andersson, Sofia Larsson, Robin Andersson, 2024, 21st International Symposium on Applications of Laser and Imaging Techniques to Fluid Mechanics, July 8-11, 2024, Lisbon, Portugal, DOI: https://doi.org/10.55037/lxlaser.21st.16, Ecohydraulic flows in shallow waterways with large bed roughness

Modelling of fractured rock erosion in open channels, Penghua Teng, J. Gunnar I. Hellström, Fredrik Johansson, Carl-Oskar Nilsson, 2024, 30th Meeting of the European Working Group on Internal Erosion (EWG-IE) and the 5th Meeting of the European Working Group on Overflow and Overtopping Erosion (EWG-OOE), Analysis of stilling-basin damages for cost-effective refurbishment

Modelling of turbulent flow over a submerged boulder in open channels, Penghua Teng, J. Gunnar I. Hellström, Dan Nilsson, 2024, 15th International Conference on Hydroinformatics, Analysis of stilling-basin damages for cost-effective refurbishment

Influence of uplift on the probability of sliding failure for concrete buttress dams, Johanna Dyberg, Fredrik Johansson, Marie Westberg Wilde, 2024, 92nd Annual Meeting & Int´l Symposium, 27th Sept.-3rd Oct. 2024, New Delhi, India, Description of pore pressure and alarm thresholds for probabilistic assessment of sliding stability for concrete dams

Photogrammetry for flow measurement at the air-water interface of flow past a semi-circular cylinder, Hang Trieu, Per Bergström, J. Gunnar I. Hellström, Mikael Sjödahl, June 2024, IAHR Europé Congress 2024, Photogrammetry for flow measurements at hydropower plants with no operational restrictions or limitations

Shallow channel spillway experiments, P. A. Mikael Hedberg, J. Gunnar I. Hellström, Anders G. Andersson, June, 2024, 9th International Junior Researcher and Engineer Workshop on Hydraulic Structures, Trust in CFD for hydraulic design of open water ways and spillways

• *Installation of Large-Scale Load Panels and Measurement of Ice Load on Swedish Dams*, Andreas Sjölander, Erik Nordström, Rikard Hellgren, Anders Ansell, June, 2024, 27th IAHR International Symposium on Ice, Gdansk, 2024, DOI: 10.5281/zenodo.14544116, Forecasting of ice-loads on concrete dams

• *Comparison of model performance and field data for hydro-battery hybrid systems providing frequency control*, Danilo Laban, May 14, 2024, 8th Hybrid power plants & systems workshop, Azores, Portugal, 14-15 May 2024, Op¬timization of joint operation

• *Dynamics of a Hydropower Rotor System supported by an Elastic Generator-Bearing Bracket*, Pääjärvi S., Aidanpää, J.O. & Gustavsson, R., Dec 1, 2024, CHAOS 2023 International Conference 13-16 June 2023 Heraklion, Crete, Greece, https://link.springer.com/book/9783031609060, Three-dimensional FE modelling of vertical rotors

• R*otor-stator contact in a hydropower machine with squeeze-film damper,* Benti G., Aidanpää J.O. and Gustavsson R., April 9, 2024, CHAOS 2023 International Conference 13-16 June 2023 Heraklion, Crete, Greece, https://link.springer.com/book/9783031609060, Development of components for increased damping in hydropower units

• *A machine learning based analysis of bearing vibrations for predictive maintenance in a hydropower plant*, Xiao Lang, Håkan Nilsson, Wengang Mao, September, 2024, 32nd IAHR Symposium on Hydraulic Machinery and Systems Roorke, India, DOI: https://dx.doi.org/10.1088/1755-1315/1411/1/012046, Hydropower operation and lifetime analysis

• *Effects of load reduction on forces and moments on the runner blades of a Kaplan turbine model,* Martina Nobilo, Saeed Salehi, Håkan Nilsson, September, 2024, 32nd IAHR Symposium on Hydraulic Machinery and Systems Roorke, India, DOI: https://dx.doi.org/10.1088/1755-1315/1411/1/012001, Hydropower operation and lifetime analysis

• *Towards practical applications of deep reinforcement learning in computational fluid dynamics*, Saeed Salehi, Håkan Nilsson, 2024, Workshop on Machine Learning for Fluid Dynamics, Paris, https://research.chalmers.se/publication/540654, Artificial intelligence for enhanced hydraulic turbine lifetime

• *Physics-Informed Neural Networks for Modeling Linear Waves*, Mohammad Sheikholeslami, Saeed Salehi, Wengang Mao, Arash Eslamdoost, Håkan Nilsson, August 9, 2024, ASME 2024 43rd International Conference on Ocean, Offshore and Arctic Engineering, DOI: https://doi.org/10.1115/OMAE2024-125048, Artificial intelligence for enhanced hydraulic turbine lifetime

• *Effects of nonlinear magnetic forces on the dynamics of hydropower generators with floating rotor rim*, Rondon, D., Aidanpää, J.O. & Gustavsson, R., January 16, 2025, CHAOS 2023 International Conference 13-16 June 2023 Heraklion, Crete, Greece, DOI: https://doi.org/10.1007/978-3-031-60907-7_38, Models for mechanical analysis generators with floating rotor rim

2023

• *Modelling of Erosion in Rock Spillway Channels*, Penghua Teng, J. Gunnar I. Hellström, Fredrik Johansson, Carl-Oscar Nilsson, October 22-25, 2023, Canadian Dam Association (CDA) 2023 Annual Conference, https://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1810776&dswid=2156, Assessment of rock scour in spillway channels through experiments and numeri¬cal simulations

• *On the applicability of scale model tests for concrete dams: A Review*, Adrian Ulfberg, Jamie Gonzales, Oisik Das, Gabriel Sas, June 2023, 91st Annual ICOLD Meeting, June 13-14, 2023, Gothenburg, Sweden, Safe dams - A holistic approach for improved safety of concrete dams

• *Geoelectrical monitoring of embankment dams for detection of internal erosion - work in progress in Sweden*, Reyhaneh Norooz, Torleif Dahlin, Per-Ivar Olsson, Aristeidis Nivorlis, Léa Lévy, Thomas Günther and Christian Bernstone, 91st Annual ICOLD Meeting – Gothenburg 13-14 June 2023, , 45466, Integrating electrical resistivity results interpretation with numerical flow modelling for detection of internal defects in embankment dams

• *Experimental and computational evaluation of fish passageway with porous media boundary*, Mikael Hedberg, J. Gunnar I. Hellström, Nils Solheim Smith, June 2023, 40th IAHR World Congress, Vienna , Austria, August 21-25, 2023, DOI: 10.3850/978-90-833476-1-5_iahr40wc-p0908-cd, Trust in CFD for hydraulic design of open water ways and spillways

• *Modified guide walls for incremental increase of spillway capacity*, Nils Solheim Smith, Mikael Hedberg, Hanne N. Lunde, Elena Pummer, Leif Lia, 2023, 40th IAHR World Congress, Vienna , Austria, August 21-25, 2023, DOI: https://doi.org/10.3850/978-90-833476-1-5_iahr40wc-p0375-cd, Trust in CFD for hydraulic design of open water ways and spillways

• *Analysis of dam structures by scale model tests: A review*, Adrian Ulfberg, 91st Annual ICOLD Meeting – Gothenburg 13-14 June 2023, https://icold-cigb2023.se/documen-tation/icold-2023-proceedings/ , Safe dams – A holistic approach for improved safety of concrete dams

Increasing spill capacity with an electrical dumpload, Adam Strömme-Mattson, 91st Annual ICOLD Meeting – Gothenburg 13-14 June 2023, Electrical dump-loads increasing spill capacity

2022

Sensitivity analysis of a swirling flow to the GEKO model, J. Kranenbarg, P. P. Jonsson, B. G. Mulu, and M. J. Cervantes, June, 2022, 31st IAHR Symposium on Hydraulic Machinery and Systems, DOI: 10.1088/1755-1315/1079/1/012030, Instabilities at deep-part-load/speed-no-load in a Kaplan turbine

Licentiate and doctoral thesis published (Publication, Author, Publisher, DOI, Project)

2024

Extension of the Pressure Time Method to 3-Dimensional Flows, Mehrdad Kalantar Neyestanaki, Luleå Tekniska Universitet, https://www.diva-portal.org/smash/get/diva2:1833782/FULLTEXT01.pdf, Development of the pressure-time method for low-head machines

2023

• *A concrete dam assessment approach using probabilistic non-linear finite element analysis and scale model testing*, Adrian Ulfberg, Luleå Tekniska Universitet, https://www.diva-portal.org/smash/get/diva2:1751257/FULLTEXT01.pdf,
45405, Safe dams - A holistic approach for improved safety of concrete dams

• *Performance of image-based velocimetry in river flow – Large Scale PIV and PTV*, Hang Trieu, Luleå Tekniska Universitet, https://urn.kb.se/resolve?urn=urn:nbn:se:ltu:-diva-94130, Photogrammetry for flow measurements at hydropower plants with no operational restrictions or limitations

• *Experimental and computational evaluations of parallel spillway outlets*, Mikael Hedberg, Luleå Tekniska Universitet, https://urn.kb.se/resolve?urn=urn:nbn:se:ltu:diva-98513, Trust in CFD for hydraulic design of open water ways and spillways

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8 Partners SVC 2022–2027

Swedish Energy Agency
Svenska kraftnät

Universities
Luleå University of Technology
Chalmers University of Technology
Royal Institute of Technology
Uppsala University
Lund University
Karlstad University
Umeå University
Swedish University of Agricultural Sciences

Hydropower industry:
Vattenfall Vattenkraft AB (inkl. VIAB)
Fortum AB
Sydkraft Hydropower AB
Statkraft Sverige AB
Skellefteå Kraft AB
Holmen Energi AB
Jämtkraft AB
Tekniska verken i Linköping AB
Mälarenergi AB
Karlstads Energi AB
Jönköping Energi AB

Other industry, WP1 – Environment and Society
AFRY
Sweco Sverige AB
Norconsult AB

Other industry, WP2 – Civil and hydraulic engineering
LKAB
Boliden Mineral AB
Zinkgruvan Mining AB
WSP Sverige AB
Sweco Sverige AB
AFRY AB
Norconsult AB

Other industry, WP3 – Hydropower Technology:
Andritz Hydro Sverige Filial
Aker Solutions AB (originally Rainpower)
Voith Hydro AB
Sweco Sverige AB
Norconsult AB

9 Participants steering groups and Program council

9.2 STEERING GROUPS

Participants in the steering group for WP1 – Environment & society:
Sydkraft hydropower: Johan Tielman (chair)
Fortum Sverige: Sonja Åberg
Tekniska verken i Linköping: Jakob Bergengren
Skellefteå Kraft: Sandra Åström
Statkraft Sverige: Daniel Axelsson
Jämtkraft: Susann Handler
KaU: Eva Bergman
UmU: Roland Jansson
LTU: Anders Andersson
SLU: Johan Östergren
Vattenkraftens miljöfond: Joakim Thanke Wiberg
AFRY: Mats Andersson
Sweco Sverige: Maria Sundesten
Norconsult: Axel Emanuelsson
Vattenfall Vattenkraft: Lo Persson

Co-opted:
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Havs- och Vattenmyndigheten: Johan Kling
Vattenfall R&D: Mats Billstein, Patrik Andreasson
KaU/Vattenfall: David Aldvén
UmU: Birgitta Malm-Renöfält
Vattenmyndigheten: Elin Spegel
LTU: Gunnar Hellström
LTU: Jesper Stage
KaU: Larry Greenberg
Energiforsk: Emma Hagner
Energiforsk: Andreas Larsson
Energiforsk: Bertil Wahlund

Bild: Vattenfall Vattenkraft

Participants in the steering group for WP2 – Civil and Hydraulic Engineering:

Fortum: Stina Åstrand (chair)
Svenska kraftnät: Karen Kemling
Vattenfall vattenkraft: Patrik Groth
Sweco Sverige: Petter Stenström
AFRY: Mårten Janz
WSP: Andreas Halvarsson
Boliden: Erik Ronne
Zinkgruvan: Staffan Fahlgren
LKAB: Faez Sayahi
Sydkraft Hydropower: Carl-Oscar Nilsson
Statkraft: Ann Mari-Darj
Norconsult: Petter Noren
LTU: Jan Laue
KTH: Fredrik Johansson
LTH: Torleif Dahlin
Co-opted:
Fortum: Magnus Svensson
LTU: Jasmina Toromanovic
Vattenfall R&D: Mats Billstein
LTU: Gunnar Hellström
KTH: Erik Nordström
KTH: James Yang
KTH: Andreas Sjölander
Energiforsk: Carolina Holmberg
Energiforsk: Emma Hagner

Participants in the steering group for WP3 – Hydropower technology:

Vattenfall Vattenkraft: Emma Nordin (chair)
Uniper: Lars Svensson
Fortum Sverige: Peter Altzar
Statkraft Sverige: Sverker Högbom
Norconsult: Johan Olofsson
Sweco Sverige: Anders Bard/Mikael Sendelius
Skellefteå kraft: Jenny Jungstedt
Svenska kraftnät: Linn Saarinen
Aker Solutions: Rebecka Nilsson
Voith Hydro: Bo Herrnäs/Björn Hellström
Andritz Hydro: Johan Olofsson/Thor-Martin Heen
Chalmers: Håkan Nilsson
Uppsala universitet: Urban Lundin
LTU: Jan-Olov Aidanpää
Co-opted:
Vattenfall R&D: Mats Billstein
Vattenfall R&D: Carl-Maikel Högström
LTU: Kim Berglund
LTU: Michel Cervantes
LTU/Vattenfall R&D: Rolf Gustavsson
Energiforsk: Emma Hagner

PROGRAM COUNCIL

Participants program council:
Fortum: Hans Bjerhag (chair)
Vattenfall vattenkraft: Magnus Lövgren
Statkraft: Emma Wikner
Sydkraft Hydropower: Maria Johansson
Svenska kraftnät: Maria Bartsch
Svenska kraftnät: Linn Saarinen
LTU: Anna Lena Ljung
KTH: Marie Westberg Wilde
LTH: Gerhard Barmen
Chalmers: Anders Hellman
UU: Cecilia Boström
KaU: Larry Greenberg
UmU: Birgitta Malm Renöfält
SLU: Anders Alanärä

SAB
Michael McClain, IHE Delft in the Netherlands
Anton Schleiss, Swiss Federal Institute of Technology in Lausanne.
Giovanna Cavazzini, University of Padova in Italy

Co-opted:
Energimyndigheten: Andreas Gustafsson
LTU: Staffan Lundström
Vattenfall vattenkraft: Anna-Karin Sundquist
Fortum: Stina Åstrand
Vattenfall vattenkraft: Emma Nordin
Sydkraft Hydropower: Johan Tielman
Energiforsk: Emma Hagner
Energiforsk: Carolina Holmberg
Energiforsk: Andreas Larsson

SVC - Swedish Centre for Sustainable Hydropower

SVC – Swedish Centre for Sustainable Hydropower, conducts research and development of technology, systems and methods to strengthen the role of hydropower in the transition to a sustainable energy system. SVC is operated by Energiforsk in collaboration with Luleå University of Technology. The centre is funded by the Swedish Energy Agency, Svenska kraftnät, the Swedish hydropower industry, and several of Sweden's leading academic institutions. SVC has a budget of approximately 280 million Swedish kronas during the program period 2022-2027.

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