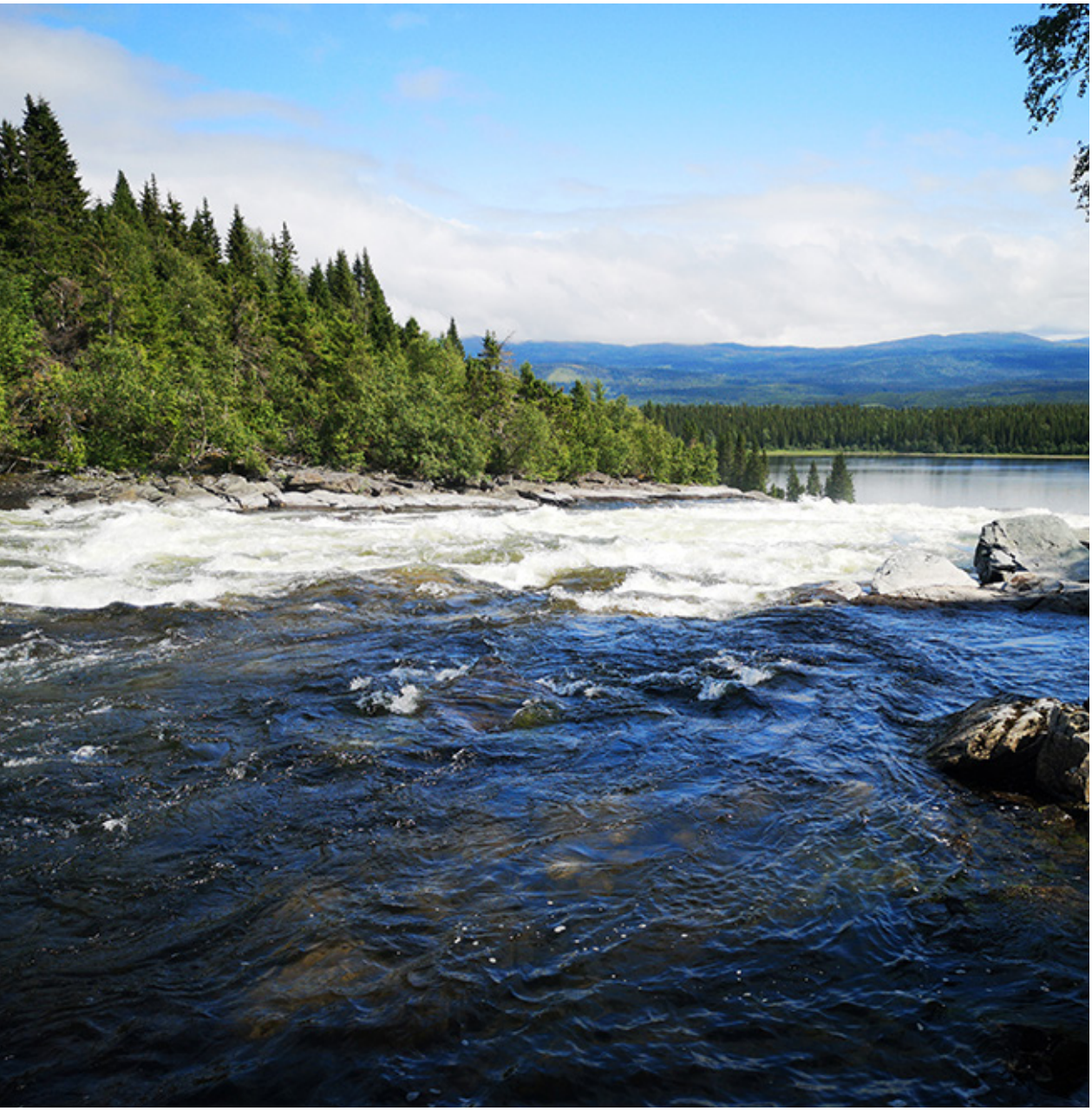
SVC – SWEDISH CENTRE FOR SUSTAINABLE HYDROPOWER

Annual reporting of activities within SVC during 2025

Report 2026-1184



Energiforsk

SWEDISH CENTRE FOR SUSTAINABLE HYDROPOWER

Summary

The Swedish Centre for Sustainable Hydropower (SVC) plays a key role in strengthening hydropower's contribution to Sweden's transition to a sustainable and fossil-free energy system. As variable renewable electricity production increases, hydropower's flexibility and regulation capacity are essential for maintaining balance and reliability in the power system. SVC brings together academia, industry, and public authorities to ensure that hydropower remains safe, environmentally sustainable, and optimized in a changing energy landscape. Hosted by Luleå University of Technology and coordinated by Energiforsk, the centre unites eight universities and a broad range of stakeholders. SVC is one of eleven competence centres funded by the Swedish Energy Agency to build knowledge and expertise that accelerate the energy transition.

SVC's research is organised into three interdisciplinary work packages: Environment and Society (WP1), Civil and Hydraulic Engineering (WP2), and Hydropower Technology (WP3). Together, they address environmental performance, dam safety and infrastructure resilience, and the technological challenges linked to increasingly flexible hydropower operation. Five new projects were initiated within WP1 during 2025. WP2 and WP3 focused on advancing and monitoring ongoing projects. Preparations for the next programme phase (2027–2031) have been a strategic priority throughout the year within all work packages.

SVC continues to demonstrate strong competence development and stakeholder engagement. More than 30 PhD students and postdoctoral researchers are active within the centre, and during 2025 three licentiate seminars and three doctoral theses were completed. Seven open lunch webinars were organised, attracting around 100 participants per session, and the annual Hydropower R&D Days in Uppsala gathered 115 participants from academia, industry, and international partners. The SVC Research School delivered three doctoral courses, contributing to capacity building in both academia and industry. The international Science Advisory Board concluded in its 2025 review that SVC maintains high scientific quality and strong relevance to Sweden's energy transition, while recommending continued focus on synthesis, visibility, and international collaboration. A comprehensive list of the year's scientific journal publications and conference contributions is presented at the end of this report.

Overall, 2025 confirms SVC's position as a nationally and internationally relevant competence centre, combining scientific excellence, interdisciplinary collaboration, and active stakeholder engagement to support the long-term sustainability and competitiveness of Swedish hydropower

Sammanfattning

Svenskt centrum för hållbar vattenkraft (SVC) spelar en nyckelroll för att stärka vattenkraftens bidrag till ett hållbart och fossilfritt energisystem. Med en ökande andel variabel elproduktion från förnybara källor blir vattenkraftens flexibilitet och reglerförmåga avgörande för att upprätthålla balans och driftsäkerhet i kraftsystemet. SVC samlar akademi, industri och myndigheter för att säkerställa att vattenkraften förblir säker, miljömässigt hållbar och optimerad i ett föränderligt energilandskap. Centret har sitt huvudsäte vid Luleå tekniska universitet och koordineras av Energiforsk, och förenar åtta universitet samt en bred grupp intressenter. SVC är ett av elva kompetenscentrum som finansieras av Energimyndigheten för att bygga kunskap och expertis som påskyndar energiomställningen.

SVC:s forskning är organiserad i tre arbetspaket: Miljö och samhälle (WP1), Vatten- och byggteknik (WP2) och Vattenkraftteknik (WP3). Tillsammans behandlar de frågor om miljöpåverkan, dammsäkerhet och infrastrukturresiliens samt de tekniska utmaningar som är kopplade till en alltmer flexibel vattenkraftproduktion. Under 2025 initierades fem nya projekt inom WP1. WP2 och WP3 fokuserade på att driva och följa upp pågående projekt. Förberedelser för nästa programperiod (2027–2031) har varit en strategisk prioritet under året inom samtliga arbetsområden.

SVC fortsätter att visa stark kompetensutveckling och aktivt engagemang från intressenter. Mer än 30 doktorander och postdoktorer är aktiva inom centret, och under 2025 genomfördes tre licentiatuppsatser och tre doktorsavhandlingar. Sju öppna lunchwebbinarier organiserades med i genomsnitt cirka 100 deltagare per session, och de årliga Vattenkraft R&D-dagarna i Uppsala samlade 115 deltagare från akademi, industri och internationella partners. SVC:s forskarskola genomförde tre doktorandkurser, vilket bidrog till kapacitetsbyggande både inom akademin och industrin. Den internationella vetenskapliga rådet (SAB) konstaterade i sin granskning att SVC upprätthåller hög vetenskaplig kvalitet och stark relevans för Sveriges energiomställning, samtidigt som SAB rekommenderar fortsatt fokus på syntes av resultat, synlighet och internationellt samarbete. En fullständig förteckning över årets publikationer i vetenskapliga tidskrifter och konferensbidrag presenteras i slutet av denna rapport.

Sammanfattningsvis bekräftar 2025 SVC:s ställning som ett nationellt och internationellt relevant kompetenscentrum, som kombinerar vetenskaplig excellens, tvärvetenskapligt samarbete och aktivt intressentengagemang för att stödja långsiktig hållbarhet och konkurrenskraft inom svensk vattenkraft.

List of content

1 Introduction

Ensuring a stable and reliable balance in the power system is one of the most critical challenges in the transition to a sustainable energy future. In this context, hydropower plays a pivotal role. With its unique flexibility and cost-effective regulation capabilities, it provides the responsiveness required to integrate increasing shares of variable renewable generation and maintain system stability.

The Swedish Centre for Sustainable Hydropower (SVC) brings together the hydropower industry, academia, and public authorities in a long-term collaboration to secure hydropower's continued role as a cornerstone of a well-balanced Swedish energy system. In a rapidly transforming energy landscape and evolving global environment, the centre strengthens the knowledge, tools, and innovation needed to ensure that hydropower remains sustainable, secure, and optimized.

This annual report presents an overview of SVC's activities in 2025. It describes the centre's vision, governance, and strategic priorities, and highlights key initiatives and progress toward established goals. The report also provides an overview of ongoing research projects and a comprehensive list of publications and other deliverables produced 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 SVC 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 Organisation

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, Carolina Holmberg 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

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).

3 Work packages

3.1 ENVIRONMENT AND SOCIETY (WP1)

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.

Activities 2025

During 2025, we had a tough position budget wise since the portfolio had filled up, and we started to reach the ceiling for our project funding capacity. With only 11.8 MSEK left, many great projects were discussed and evaluated. In the end, we managed to initiate no less than five new projects. One of the projects focusses on benthic macroinvertebrates and how the mapping of their populations can be used as a biodiversity indicator. Another one of the projects examines potential connectivity and population restoration efforts of the Asp (Leuciscus aspius). We even managed to initiate a synthesis study, that will investigate the different models available for evaluating sustainable hydropower in the new energy system.

With the budget for this stage of SVC fully allocated we turned our attention to the next stage of SVC, which is set to start in 2027. We dived into our portfolio analysis and started the work with carving out a course for the new stage. This work has continued in 2026 and will do so until the years end.

3.2 CIVIL- AND HYDRAULIC ENGINEERING (WP2)

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.

Avtivities 2025

The steering group held three meetings during 2025, one of which took place in Stockholm and focused on project ideas for SVC 2027–2031. Almost all the funding for the work package was allocated to projects during 2023, and the last projects were initiated in early 2024. The focus for this year has been on following up ongoing projects as well as preparing for upcoming calls, conditional upon the centre being granted an extension. A significant portion of the work within this work package has been carried out through the reference groups associated with the various research areas, where needs analyses have been conducted. Senior researchers have contributed several valuable project ideas for the next phase, which have subsequently been reviewed and prioritized by the steering committee.

3.3 HYDROPOWER TECHNOLOGY (WP3)

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. Key areas are:

- 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.

Activities 2025

The workpackage for Hydropower technology initiated four new projects during 2025. The projects range from continuation of PhD projecrts with focus wear and trear modelling for joiuint operation in hybide parks to senior research projects dealing with cavitation damage prediction, validation of tilting pad bearing models and experimental investigation of a newly developed pressure-time method in low-head prototypes. 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 held three meetings during 2025. In principle, all funding for the work package had been allocated to projects; however, due to project changes, approximately 6.2 MSEK was released. New projects were approved during the year, resulting in 3.3 MSEK remaining unallocated at the end of the year.

The process of developing projects for the extension period started with an inventory of research needs, followed by the development of project ideas to address those needs.

4 Licentiate seminars and Disputations

During the year, several licentiate seminars and doctoral disputations were successfully completed. These milestones reflect the program's strong progress in advancing scientific knowledge and fostering the development of early-career researchers. The work presented spans a broad range of topics within sustainable hydropower. The completed theses are listed below:

Licentiate seminars

Licentiate candidate: Frida Niemi

- Modelling Dynamic Flow Conditions for Fish Habitats in Regulated Rivers, April 1, 2025

Licentiate candidate: Dan Nilsson

- Experimental Investigations of Ecohydraulic Flows in Shallow Waterways with Large Bed Roughness, April 22, 2025

Licentiate candidate: Martina Nobilo

- Flow-induced loads in a Kaplan turbine – towards fatigue damage lifetime analysis, August 26, 2025

Licentiate candidate: Mohammad Sheikholeslami

- Physics-informed neural networks with hard and soft boundary conditions for problems in fluid dynamics, June 11, 2025

Disputations

Doctorial candidate: Mikael Hedberg

- Experiments and CFD simulations of spillway discharge distribution, December 3, 2025

Doctorial candidate: Reyhaneh Norooz

- Monitoring Techniques for Embankment Dams: A Study on ERT and IP Measurements, and Seepage Modelling of the Älvekarleby Test Dam. A Multi-Method Approach to Investigating Internal Anomalies in an Embankment Dam, November 6, 2025

Doctorial candidate: Jelle Kranenbarg

- Mitigation of the Pressure Pulsations in a Hydraulic Axial Turbine with Asynchronous Guide Vanes, September 25, 2025

5 Mesurable goals and statistics

5.1 QUANTITATIVE GOALS

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

Goal	**Result as of 2024**	**Comment**
15 senior researchers that are continuously active in the centre's projects,	17 senior researchers active in 2025.	Definition: project leader for at least 1 SVC project and member of a steering group.
30 active PhD-students or postdoctoral researchers	42 PhD-students or post-doctorial reseracher. (33 PhD:s and 9 postdocs).	42 PhD-students or postdoctoral researchers includes individuals who completed their studies after obtaining a Licentiate degree.
15 participants in each course in the centre´s research school (at least two from international partners)	Three courses were held 2025, with av average of 9 participants. No international participants.	Discussions are ongoing on measures to increase the number of participants.
30 scientifically reviewed articles published yearly	16 scientifically reviewed articles published 2025.	31 peer-reviewed articles produced 2025, including articles not yet published. 64 in total since 2022.
20 conference contributions presented yearly	12 conference contributions in 2025.	41 in total since 2022.
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 FOLLOW-UP ON GENDER EQUALITY PLAN

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 experiences. 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, inviting 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 has their own gender equality plan that they actively work with.
- ✓ A balanced gender distribution is 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.

Gender statistics:

- Steering groups for each work package within SVC should consist of a maximum of 60 % of each gender.

- Goal is met for 1of 3 work packages. The gender balance in steering groups are: 60 % male and 40 % female in WP1 Enoronment and Sociey, 80 % male and 20 % female in WP2 Hydraulic engineering as well as in WP3 Hydropower Technology. To help achieve our goals, stakeholders are suggested to nominate two candidates, one of each gender, when proposing a replacement to the steering group.

- 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 Hydropower R&D-days 2025 was equal among the presenters and panel participants: 9 male and 8 female.
  - The lunch webinars were male-dominated as a result of most PhD- and postdocstudents as well as senor researchers being male. One of seven webinars was presented by a female.

- Recruitment statistics
  - The table presents the total number of applicants across all projects, disaggregated by gender, as well as the number of employed doctoral students and postdoctoral researchers.

	Applicants			**Employed**	
	Female	Male	Non-binary	Female	Male
WP1	51	138	2	7	6
WP2	40	241	0	4	9
WP3	27	214	0	3	14
Total	118	593	2	14	29

6 Interdsciplinary syntesis projects

SVC launched a targeted initiative focusing on interdisciplinary synthesis projects during 2025. The aim of this initiative has been to compile, analyse and synthesise existing research within key areas relevant to sustainable hydropower, thereby strengthening the knowledge base and identifying clear directions for future research and development.

Unlike traditional research projects, the synthesis projects have focused on bringing together knowledge from multiple disciplines and research fields. By combining perspectives from different research areas, these projects contribute to a more holistic understanding of complex challenges.

The call comprised three synthesis projects and was open to researchers at the partner universities for ideas with clear relevance to SVC's long-term objectives. Two projects were commissioned during 2025: Synthesis of research activities connected to the Älvkarleby test dam – a holistic view and A Cross-Disciplinary Synthesis of Models for Evaluating the Role of Sustainable Hydropower in a Future Energy System. A third project is to be commissioned in 2026.

Through this initiative, SVC has created conditions for increased collaboration across research domains, strengthened the link between academia and industry, and established a solid foundation for future research initiatives. The synthesis projects are expected to deliver well-founded knowledge bases that can be used in continued R&D activities, strategic decision-making and future applications within Swedish hydropower.

7 Outreach and communications

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 2025, monthly open webinars have continued to present ongoing research findings. A total of seven lunch webinars were held, attracting an average of 100 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. All webinars are available for on-demand viewing via the SVC website. The titles of the webinars were:

- Environmentally Adapted Lubricants for Sustainable Hydropower,
- Improving Dam Safety: Understanding Grout Degradation in Hydropower Dams,
- Environmental Design for the Rehabilitation of Regulated Lakes and Reservoirs,
- Socio-economic Perspectives on Environmental Improvements in Hydropower,
- Creating a better tool to predict rock erosion in spillway channels,
- Lifetime Assessment of Hydropower Plants: Research and Future Development,
- Advancing River Management for Biodiversity: Exploring the inSALMO Model for Salmonids.

We also hosted our annual Hydropower R&D Days in Uppsala, providing a key platform for collaboration and knowledge exchange, with 115 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 stakeholders about the centre's activities, with further updates shared on LinkedIn to expand outreach.

8 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 2025:

- **Ecohydraulics**, which was given by senior researcher Anders Andersson. This course had 17 participants.
- **Dams and dam Safety**, which was given by senior researchers Hans Mattsson, Jasmina Toromanovic and Jan Laue at LTU. This course had 3 participants.
- **Rotor dynamics**, which was given by senior researcher Jan-Olov Aidanpää at LTU. 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 courses.

9 Hydropower R&D-days

The 2025 Hydropower R&D Days were held on 18–19 March in Uppsala, bringing together just over one hundred participants from across the centre's network. The annual event continues to serve as a central meeting place for postdoctoral researchers, PhD students, senior researchers, industry representatives, authorities, and international partners affiliated with SVC.

Over two intensive days, participants shared new research findings, presented ongoing projects and discussed key challenges facing the hydropower sector. The program combined seminars, panel discussions and interactive workshops, fostering dialogue across disciplinary and organizational boundaries. By convening academia, industry, and policy stakeholders, the R&D Days contribute to knowledge exchange, strengthen professional networks, and create opportunities for new collaborations within the centre.

Feedback from participants confirms the event's continued relevance and value. The broad mix of researchers, engineers, decision-makers, and students enables knowledge and experience to be shared at multiple levels.

A dedicated workshop addressed hydropower's evolving role in the energy system. The session included presentations on recent developments in hydropower modelling, including new modelling approaches. Discussions spanned topics from detailed flow simulations and permitting processes to goal conflicts and long-term asset management, illustrating the breadth of expertise represented within the centre.

Doctoral education and competence development remain central to SVC's mission. During the conference, three PhD students — Jelle Kranenbarg and Noomi Westling Öhman from Luleå University of Technology, and Johanna Dyberg from KTH Royal Institute of Technology — were interviewed on stage about their research projects and their relevance to Sweden's ongoing energy transition. The session highlighted how young researchers contribute to advancing knowledge while preparing for future roles within the hydropower sector.

An invited presentation was delivered by Hanna Ek Fälth, PhD student at Chalmers University of Technology, who presented analyses of hydropower's ability to sustain high production levels over extended periods — a topic of growing importance in an increasingly variable power system.

International collaboration was also evident during the event, with participants from RenewHydro, Pen Hydropower, ETIP Hydropower, and EERA JP Hydropower contributing perspectives from across Europe. Their participation reinforces SVC's role within the broader international hydropower research community.

10 Assessment from Science Advisory Board

In 2025, the International Science Advisory Board (SAB) of the SVC continued to provide independent scientific review and strategic advice to the Centre. The SAB consists of senior international researchers who contribute an external perspective on research quality, relevance, and international positioning. The SAB met in March 2025 in Uppsala, in conjunction with Swedish Hydropower Days, and based its assessment primarily on the annual progress reports submitted by funded projects, complemented by professional expertise and international experience.

The international members of the SAB are Prof. Michael McClain from IHE Delft in the Netherlands representing Work Package 1 on Environment and Society; Prof. Anton Schleiss from the Swiss Federal Institute of Technology in Lausanne representing Work Package 2 on Civil and Hydraulic Engineering; and Associate Prof. Giovanna Cavazzini from the University of Padova in Italy representing Work Package 3 on Hydropower Technology.

The SAB's review confirms that SVC maintains a strong and growing research portfolio addressing key challenges for sustainable hydropower. Across the Centre, the projects are characterised by high scientific quality and relevance to Sweden's energy transition, covering environmental sustainability, dam safety, infrastructure resilience, and flexible hydropower operation. Many projects show solid progress, with increasing numbers of peer-reviewed publications, conference contributions, and the development of advanced experimental and modelling approaches.

A central conclusion of the SAB is that SVC-funded research holds significant potential for impact beyond individual projects. While academic outputs are strong, the SAB identifies opportunities to increase overall impact through stronger synthesis of results across projects, clearer communication of practical relevance, and broader dissemination to industry, authorities, and other stakeholders. Strategic use of synthesis papers, thematic workshops, and coordinated dissemination activities is recommended.

The SAB also reviewed the Centre's International Strategy and noted that SVC researchers and industrial partners are well connected internationally. However, these activities are not always clearly reflected in project reporting. The SAB therefore recommends strengthening the visibility of international engagement by documenting collaborations, joint publications, conference participation, and international funding efforts, as well as ensuring clearer affiliation with SVC in external activities.

Overall, the SAB concludes that SVC is well positioned as a nationally and internationally relevant centre for sustainable hydropower research. The Centre's activities in 2025 demonstrate scientific excellence, strong relevance to societal needs, and considerable potential for long-term impact. Continued strategic focus on visibility, synthesis of results, and international engagement will further strengthen SVC's role as a leading knowledge hub.

11 List of R&D-projects

The tables below show all projets that are grented funding from SVC phase 2022-2027.

Granted, ongoing and finished projects WP1, 20 in total.

Project title	Project leader	Academic- and 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	Finished
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 – 2027.06	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 - 2026.12	Ongoing
Experimental methods to predict riparian vegetation responses to environmental flows in regulated rivers	Roland Jansson, UmU	UmU	2024.01 - 2027.06	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 - 2026.06	Ongoing
Environmental design for rehabilitation of regulated lakes and reservoirs	Johan Östergren, SLU	SLU, Vattenfall	2024.04 - 2027.06	Ongoing
Economic valuation of benefits from environmental improvements: investigating threshold and interaction effects	Jesper Stage, LTU	LTU	2024.03 - 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	Ongoing
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	Ongoing
Benthic Macroinvertebrates as Biodiversity Indicators: A Spatially Explicit Assessment Tool for River Management and Restoration	Viktor Nilsson	KaU	2025.07 - 2027.06	Ongoing
Riverscape genomics - how natural and man-made structures influence genetic connectivity in different fish species	Anti Vasemägi	SLU	2025.07 - 2027.06	Ongoing

Environmental and hydropower impacts on brown trout life-history strategies	Gunnar Öhlund	SLU	2025.06 - 2027.06	Ongoing
Restoring connectivity and population viability of a threatened fish, the Asp (Leuciscus aspius)	Alfred Sandström (Joacim Näslund)	SLU	2025.06 - 2027.06	Ongoing
A Cross-Disciplinary Synthesis of Models for Evaluating the Role of Sustainable Hydropower in a Future Energy System	Anna Krook-Riekkola	LTU	2025.11 - 2027.03	Ongoing

Granted, ongoing and finished projects WP2, 21 in total.

Project title	**Project leader**	**Academic- and Industry partners**	**Project time**	**Status**
Adaptation of monitoring with DCIP tomography for management of embankment dams	Torleif Dahlin, LU	LU	2023.01 – 2024.12	Finished
Integrating electrical resistivity results interpretation with numerical flow for detection of internal defects in embankment dams	Torleif Dahlin, LU	LU	2023.01 – 2025.12	Finished
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	2023.01 – 2024.12	Ongoing (Delayed)
Degradation of grout injection in hydropower dams – coupled hydrogeological –	Liangchao Zou, KTH	KTH, LTU, Vattenfall, Fortum	2023.04 – 2027.06	Ongoing

geochemical modeling to predict dam condition and remaining lifetime				
Dynamic load and response interaction for hydropower civil structures	Erik Nordström, KTH	KTH, Vattenfall	2023.01 – 2027.06	Ongoing
Realistic failure modelling of concrete dams	Erik Nordström, KTH	KTH	2023.03 – 2026.08	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	LTU, KTH	2023.01 – 2025.12	Finished
Innovative design and experimental-numerical studies of Piano Key Spillway for significantly enhanced discharge and hydraulic performance	James Yang, KTH	KTH, Vattenfall	2023.04 - 2023.12	Finished
Cyclic loading - future use and storage	Jan Laue, LTU	LTU, Vattenfall	2023.06 - 2027.06	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 (Delayed)
Trust in CFD for hydraulic design of open water ways and spillways	Gunnar Hellström, LTU	LTU, Vattenfall	2023.01 - 2024.12	Finished
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
Synthesis of research activities connected to the Älvkarleby test dam – a holistic view	Jasmina Toromanovic, LTU	LTU, Vattenfall	2025.09 – 2027.06	Ongoing

Granted, ongoing and finished projects WP3, 23 in total.

Project title	**Project leader**	**Academic- and Industry partners**	**Project time**	**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	Finished
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, Vattnfall	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 – 2024.12	Finished
Development of components for increased damping in hydropower units	Jan-Olov Aidanpää LTU	LTU, Vattenfall	2023.01 – 2024.06	Finished

Models for mechanical analysis generators with floating rotor rim	Jan-Olov Aidanpää LTU	LTU, Vattenfall	2023.01 – 2024.06	Finished
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	Finished
Instabilities at deep-part-load/speed-noload in a Kaplan turbine	Michel Cervantes LTU	LTU, Vattenfall, Skellefteå kraft	2023.01 – 2025.01	Finished
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	2024.10-2027.06	Ongoing
Development of a test rig to characterise the roughness found in hydraulic turbines	Michel Cervantes, LTU	LTU	2025.01-2026.12	Ongoing

Experimental investigation of a newly developed pressure-time method in low-head prototypes	Michel Cervantes, LTU	LTU, Statkraft	2025.08-2027.06	Ongoing
Optimization of joint operation of fast and slow storage reservoirs reducing hydropower wear and tear for grid benefits, cont	Urban Lundin, UU	UU, Fortum	2026.01-2027.06	Ongoing
Validation of tilting pad bearing models	Jan-Olov Aidanpää, LTU	LTU, Vattenfall	2026.01-2027.06	Ongoing
Review and evaluation of methods for cavitation damage prediction in hydro turbines	Håkan Nilsson, CTH	CTH, Vattenfall	2025.10-2027.06	Ongoing

12 Publications

12.1 LICENTIATE AND DOCTORAL THESES

2025

Reliability-based assessment of concrete dams considering combined sliding and overturning, Ulfberg, A. (2025)., https://ltu.diva-portal.org/smash/get/diva2:2016227/FULLTEXT01.pdf

Physics-informed neural networks with hard and soft boundary conditions for problems in fluid dynamics, Mohammad Sheikholeslami, 2025, https://research.chalmers.se/en/publication/546577

Experimental Investigations of Ecohydraulic Flows in Shallow Waterways with Large Bed Roughness, Dan Nilsson, Luleå tekniska universitet, https://ltu.diva-portal.org/smash/get/diva2:1938939/FULLTEXT01.pdf

Modelling Dynamic Flow Conditions for Fish Habitats in Regulated Rivers, Frida Niemi, https://ltu.diva-portal.org/smash/get/diva2:1935321/FULLTEXT01.pdf

Flow-induced loads in a Kaplan turbine – towards fatigue damage lifetime analysis, Martina Nobilo, https://research.chalmers.se/publication/547698/file/547698_Fulltext.pdf

Experiments and CFD simulations of spillway discharge distribution, Mikael Hedberg, https://ltu.diva-portal.org/smash/record.jsf?pid=diva2%3A2009435&dswid=7593

Monitoring Techniques for Embankment Dams: A Study on ERT and IP Measurements, and Seepage Modelling of the Älvekarleby Test Dam. A Multi-Method Approach to Investigating Internal Anomalies in an Embankment Dam, Reyhaneh Norooz, Avhandling_Reyhaneh_Norooz_LUCRIS.pdfhttps://lucris.lub.lu.se/ws/portalfiles/portal/228730561/Avhandling_Reyhaneh_Norooz_LUCRIS.pdf

Mitigation of the Pressure Pulsations in a Hydraulic Axial Turbine with Asynchronous Guide Vanes, Jelle Kranenbarg, https://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1962720&dswid=8924

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

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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

Numerical investigation of the flow and instabilities at part-load and speed-no-load in an axial turbine, J. Kranenbarg, Luleå Tekniska Universitet, https://www.diva-portal.org/smash/get/diva2:1731926/FULLTEXT02.pdf, Instabilities at deep-part-load/speed-no-load in a Kaplan turbine

Toward Realistic Failure Evaluations for Concrete Buttress Dams, Enzell J, (2023), Licentiate thesis KTH Royal Institute of Technology. https://www.researchgate.net/publication/374755671_Toward_Realistic_Failure_Evaluations_for_Concrete_Buttress_Dams

12.2 PEER-REVIEWD ARTICLES

12.2.1 Environment and sociey (WP1)

2025

Individual-based modeling of Atlantic salmon and brown trout outmigrants in a hydropeaking-regulated river: effects of minimum baseflow and gravel augmentation on smolt production. *In preparation*. Addo, L., Watz, J., Piccolo, J, J., Norrgård, J., Syränen, J., Railsback, S. F., Hajiesmaeili, M. (2025).

Hydraulic Modelling of Bedload Transport to Support Restoration of Spawning Habitats in a Regulated River. Submitted to River Research and Applications. Niemi, F. M., Andersson, A. G., & Hellström, J. G. I., (2025).

Environmental conditions for operation of hydropower – a study of new legislation and initial legal processes in Sweden. Journal article under revision, Öhman, Gardelli, Pettersson (2026).

Scaling up individual-based models for salmonid populations in hydropower-regulated rivers: key advances and challenges, *River Research and Applications*, 1-32., Hajiesmaeili, M., https://doi.org/10.1002/rra.70023

Scale Experiments of a Shallow Channels Impact on Spillway Flow Distribution and Discharge Capacity, P. A. Mikael Hedberg, J. Gunnar I. Hellström, Anders G.

Andersson and Patrik Andreasson, January 9, 2026, Water, Volume 18, Issue 2, DOI: 10.3390/w18020177

Investigating Steady-State Interpolation and Transient Hydraulic Modelling to Evaluate European Grayling Habitat in a Hydropeaking River, Frida M. Niemi, Anders G. Andersson, J. Gunnar I. Hellström, Mahboobeh Hajiesmaeili and David Aldvén, April 4, 2025, Water, Volume 17, Issue 7. DOI: 10.3390/w17071083

Effect of Hydropeaking on Decomposition in Riparian Zones, Emil Nordström, Lovisa Lind, Rolf Lutz Eckstein, Birgitta Malm-Renöfält, Eva Bergman, Roland Jansson, Larry Greenberg, Johan Watz, August 21, 2025, River Research and Application, Volume 41, Issue 9, DOI: https://doi.org/10.1002/rra.70031

Three-Dimensional Particle Tracking Velocimetry Investigation of Flow Dynamics Around Simplified Stones at Low Submergence: Implications for Instream Habitat, Dan A. Nilsson, Anders G. Andersson, I. A. Sofia Larsson, Robin Andersson and Mats Billstein, January 15, 2025, Water, Volume 17, Issue 2, DOI: 10.3390/w17020217

Drift Foraging by Allopatric and Sympatric Atlantic Salmon and Brown Trout Parr Under Rapid Flow Fluctuations, Louis Addo, Lise Meneboo, Mahboobeh Hajiesmaeili, John J. Piccolo, Johan Watz, May 30, 2025, River Research and Applications, Volume 41, Issue 7, DOI: https://doi.org/10.1002/rra.4464

Discharge distribution in a multi-outlet spillway with varying adverse conditions, Nils Solheim, Mikael P A Hedberg, Gunnar I J Hellström, Leif Lia, Anders G Andersson, Patrik Andreasson, Elena Pummer, Februaru 21, 2025, Scientific Reports, 15:6329, DOI: 10.1038/s41598-025-89741-3

2024

Sustaining high-value salmonid populations in regulated rivers: insights from individual-based modelling of brown trout and Atlantic salmon. Global Ecology and Conservation. 51(June 2024), Hajiesmaeili, M, Addo, A., Watz, J., Norrgård, J., Railsback, S. F., Syrjänen, J., Blixt, M., & Piccolo, J. J. (2024). DOI: e02887

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

12.2.2 Civil- and hydraulic engineering (WP2)

2025

Reliability-based partial safety factor methods for design of rock tunneling (in preparation) Pham, T. A., Spross, J., Larsson, S., & Johansson, F. (2025)

Unified Rotation-Aware Random Field Framework for Anisotropic Characterization of Rock Mass Variability (in preparation), Pham, T. A., Spross, J., Larsson, S., & Johansson, F. (2026)

Sensitivity and reliability analysis of concrete dams. (Submitted to journal and under review), Ulfberg, A., Gonzalez-Libreros, J., Westberg Wilde, M., Johansson, F., Sas, G. (2025)

Behavior and failure mechanism of scale model buttress dams with large-scale asperities in the rock-concrete interface (Submitted to journal and under revision), Ulfberg, A., Gonzalez-Libreros, J., Westberg Wilde, M., Johansson, F., Sas, G. (2025)

Statistical evaluation of uplift pressures in rock foundations under concrete buttress dams (Submitted to journal), Dyberg Thonée, J., Westberg Wilde, M. Ulfberg, A., Sas, G., Johansson, F (2025).

Internal erosion in tills: mechanisms and a novel approach using transparent soils – A review (Draft to be re-submitted in Journal), Shane Aulestia, Jasmina Toromanovic, Peter Viklander, Jan Laue

3D DCIP for detection of internal defects in Älvkarleby test embankment dam (submitted), International Journal of Geo-Engineering, Norooz R., Dahlin T. & Johansson S.

Numerical Investigation of High-Velocity Two-Phase Flow Characteristics over Chute Spillway with an Aerator. (Submitted to a scientific journal), Farooq U.,Yang J., Li S., Ansell A., 2025

Process- and data-based modeling of flow-driven uplift pressures (Under 1st round of revision in a scientific journal), Li, S. Yang, J. (2026).

Impact of structural cracks on the stability and failure behaviour of concrete buttress dams (submitted to scientific journal), Enzell J, Nordström E, Sjölander A, Malm R, Ansell A, (2025)

Probabilistic evaluation of uplift pressure in rock foundation beneath concrete buttress dams (Submitted), ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering, J. Dyberg Thonée, F. Johansson, M. Westberg Wilde, A. Ulfberg, G. Sas, (2025)

Effective energy dissipation in chute spillway with labyrinth roughness appurtenances (to be submitted), Water. Yang J., Li S., Helgesson A., Ansell A.,

Integration of seepage modelling and electrical resistivity monitoring data for the Älvkarleby test embankment dam, Sweden, Reyhaneh Norooz, Torleif Dahlin, Jasmina Toromanovic, September 2, 2025, Engineering Geology, Volume 357, DOI: 10.1016/j.enggeo.2025.108311

Partial factor methods for rock tunnel design : Fundamental principles and assumptions. Pham, T. A., Spross, J., Larsson, S. & Johansson, F. (2025). I Fredrik Johansson, Anders Ansell, Daniel Johansson, Johan Funehag, Jenny Norrman

(Red.), Tunnelling into a Sustainable Future – Methods and Technologies (s. 1729-1736). Informa UK Limited.

Analytical Assessment of Combined Sliding and Overturning Failure in Concrete Dams, Adrian Ulfberg, Jaime Gonzalez-Libreros, Marie Westberg Wilde, Fredrik Johansson & Gabriel Sas, October 2, 2025, Structural engineering international, DOI: 10.1080/10168664.2025.2555918

Energy Dissipation in Chute Spillway with Labyrinth Roughness Appurtenances, James Yang, Shicheng Li, Umar Farooq and Anna Helgesson, December 1, 2025, Water, Volume 17, Issule 23, DOI: 10.3390/w17233417

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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

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Physical Model Tests of Concrete Buttress Dams with Failure Imposed by Hydrostatic Water Pressure, Enzell J, Nordström E, Sjölander A, Ansell A, Malm R, (2023), Water, DOI:10.3390/w15203627

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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

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12.2.3 Hydropower technology (WP3)

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Physics-informed neural networks with hard and soft boundary conditions for linear free surface waves, Physics of Fluids 37, 087158 (2025), Mohammad Sheikholeslami, Saeed Salehi, Wengang Mao, Arash Eslamdoost, Håkan Nilsson, 2025, DOI: https://doi.org/10.1063/5.0277421

Storage system optimization for enhancing frequency control from hydropower, Journal of Energy Storage, Laban, Norrlund, Lundin (2025)

Friction Monitoring in Kaplan Turbines, Lars-Johan Sandström, Kim Berglund, Pär Marklund and Gregory F. Simmons, April 11, 2025, Machines, Volume 13, Issue 4, DOI: 10.3390/machines13040313

Validation of a numerical model for an axial hydraulic turbine operating at upper and lower part-load conditions, Jelle Kranenbarg, Pontus P Jonsson, Berhanu G Mulu, Joel Sundström, Michel J Cervantes, September 2025, Next Research, Volume 2, Issue 3, DOI: https://doi.org/10.1016/j.nexres.2025.100516

On Using the Distributor as a Multi Degree-of-Freedom System to Mitigate the Pressure Pulsation in an Axial Turbine at Speed-No-Load, Jelle Kranenbarg, Pontus P. Jonsson, Berhanu G. Mulu, Joel Sundström, Michel J. Cervantes, February 2025, Journal of Fluids Engineering, 147(2), DOI: https://doi.org/10.1115/1.4066482

Lifetime analysis of hydro turbines with focus on fatigue damage in a renewable energy system – A review, Martina Nobilo, Saeed Salehi, Håkan Nilsson, 2025, Journal. https://doi.org/10.1016/j.rser.2025.116578

2024

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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

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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

2023

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, Electrical dump-loads increasing spill capacity

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12.3 CONFERENCE CONTRIBUTIONS

12.3.1 Environment and sociey (WP1)

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2024

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2023

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2025

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2024

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2023

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Appendix 1

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

Appendix 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: Jonas Elghagen
Jämtkraft: Susann Handler
KaU: Eva Bergman
UmU: Roland Jansson
LTU: Anders Andersson
SLU: Johan Östergren
Vattenkraftens miljöfond: Sara Grettve
AFRY: Mats Andersson
Sweco Sverige: Joakim Thanke Wiberg
Norconsult: Per Granström
Vattenfall Vattenkraft: Lo Persson
Co-opted:
Vattenregleringsföretagen: Anna Hedström Ringvall
Havs- och Vattenmyndigheten: Johan Kling
Vattenfall R&D: Mats Billstein, Patrik Andreasson
KaU/Vattenfall: David Aldvén
UmU: Birgitta Malm-Renöfält
Vattenmyndigheten: Alexander Hellquist
LTU: Gunnar Hellström
LTU: Jesper Stage
KaU: Folmer Bokma
SLU: Johan Brodin
Energiforsk: Andreas Larsson

Participants in the steering group for WP2 – Civil and Hydraulic Engineering:
Fortum: Stina Åstrand (chair)
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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:
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LTU: Jasmina Toromanovic
Vattenfall R&D: Mats Billstein
LTU: Gunnar Hellström
KTH: Erik Nordström
KTH: James Yang
KTH: Andreas Sjölander
Energiforsk: Carolina Holmberg

Participants in the steering group for WP3 – Hydropower technology:
Vattenfall Vattenkraft: Daniel Winsa/Mattias Wallin (chair)
Uniper: Lars Svensson
Fortum Sverige: Peter Altzar
Statkraft Sverige: Sverker Högbom
Norconsult: Johan Olofsson
Sweco Sverige: Mikael Sendelius
Skellefteå kraft: Jenny Jungstedt
AFRY: Mats Wahlén
Svenska kraftnät: Linn Saarinen
Aker Solutions: Rebecka Nilsson
Voith Hydro: Bo Herrnäs/Björn Hellström
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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: Bertil Wahlund (acting chair)

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Svenska kraftnät: Linn Saarinen
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LTH: Gerhard Barmen
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UU: Cecilia Boström
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UmU: Birgitta Malm Renöfält
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Swedish centre for sustainable hydropower (SVC) 2025

The Swedish Centre for Sustainable Hydropower (SVC) unites academia, industry, and public authorities to advance knowledge, innovation, and sustainable practices in hydropower. By combining cutting-edge research with practical applications, SVC strengthens the role of hydropower in Sweden's transition to a fossil-free, reliable, and environmentally responsible energy system. This report highlights the centre's activities in 2025, showcasing research projects and other efforts to ensure that Sweden remains a global leader in sustainable hydropower

SVC – Swedish Centre for Sustainable Hydropower – contributes to increased knowledge about how Swedish hydropower should be developed and maintained, to continue facilitating the transition towards a fossil-free energy system, while adapting to meet modern environmental standards. The knowledge from the centre guides the business sector, authorities and decision-makers in their work for the future of hydropower.

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