2012-03-26

Evaluation of Swedish Hydropower Centre

Utvärdering av Svenskt VattenkraftCentrum

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Faugert & Co Utvärdering AB, March 2012

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Svensk sammanfattning

Svenskt VattenkraftCentrum (SVC) är ett kompetenscentrum för utbildning och forskning inom vattenkraft och gruvdammar. SVCs vision är att säkerställa Sveriges kunskaps- och kompetensförsörjning för effektiv och tillförlitlig vattenkraftproduktion som en viktig del av landets energiförsörjning, och nödvändig stabiliserande faktor i kraftsystemet samt för tryggad säkerhet vid driften av dammar.

Föreliggande utvärdering utgör en del av en större insats som omfattar en vetenskaplig bedömning genomförd av en internationell expertgrupp. Expertgruppen har kompletterats av Faugert & Co Utvärdering, som i egenskap av utvärderingsakkunnig på ett mer generellt plan har bedömt de industriella effekterna och värdet av satsningen för finansiärer och deltagare. Vårt uppdrag har även omfattat att bedöma programmets målsättningar, dels av de egna målen och dels som avser Energimyndighetens uppdrag inom området energiforskning och innovation.

Utvärderingen visar att SVC har lyckats väl med att uppnå flertalet av de målsättningar centret satt upp för sin verksamhet och Energimyndigheten har för området, och arbetar målmedvetet och systematiskt i riktning mot de mål som fortfarande ligger något längre bort att uppnå. Programformen och arbetet som valts för att arbeta med de uppsatta målen förefaller mycket ändamålsenlig, och beskrivs entydigt som framgångsrik av programdeltagare på olika nivåer. Så här långt har programmets direkta effekter på industrin, i form av implementerade forskningsresultat, varit små. Den främsta effekten därvid består i kompetensuppbyggnad; ett betydande antal doktorer utexamineras och hamnar i företag i branschen.

SVC kan således visa upp en mycket framgångsrik start och uppbyggnad. En fråga som nu inställer sig är om den nuvarande modellen och inriktningen är den optimala även för en kommande programperiod där hårdare krav på ett bredare industriengagemang och en tydligare orientering mot resultat och implementering kan bli aktuella.

1. Swedish Hydropower Centre (SVC)

Swedish Hydropower Centre (Svenskt VattenkraftCentrum, SVC) is a competence centre for education and research within hydro power and mining dams. SVC constitutes a foundation for the long-term knowledge and skill supply to the hydropower and mining industries. The funding of SVC is split in three parts, one third from the industry, one third national funding and the remaining part from the participating universities (in kind). The exchange between universities, industries and authorities is the main thread in SVC’s activities.

SVC was established in 2005 by the Swedish Energy Agency (SEA), Elforsk and Swedish national grid (Svenska Kraftnät) together with Luleå University of Technology (LTU), The Royal Institute of Technology (KTH), Chalmers University of Technology (CTH) and Uppsala University (UU). More than 30 hydro power companies fund and participate in the centre.

The vision of the centre is to secure Sweden’s knowledge and skill supply for an efficient and reliable hydropower production, as an important part of the nation’s energy provision, and necessary stabilizing factor in the power system, as well as, for ensured dam operation safety. The main objectives to reach the vision is to

- Build scientifically high-quality long-term sustainable competence at universities connected to SVC
2. The evaluation remit

2.1 Objective and scope
According to the SVC programme plan, an evaluation is to be carried out in 2012. This evaluation should cover scientific aspects as well as industrial relevance, results goal attainment and programme administration. The scientific evaluation is carried out by an international expert group, whereas issues concerning impacts on industry and the value of the initiative to its funders and participants are carried out by Faugert & Co Utvärdering and presented in the present report. This report also deals with objectives fulfillment, SVC’s own as well as those of the Swedish Energy Administration. Within the area of energy research and innovation those objectives are:

• To build knowledge to facilitate the conversion to a long-term sustainable energy system
• To develop technology and services that through commercialization in Swedish industry can contribute to the conversion and development of the energy system

The present report, thus, is part of an overall evaluation report, including the international experts’ report. Sections 3-5 present the views of interviewees and survey responses. Section 6 builds on the same data sources, but the assessment represents our understanding of these data after discussions with the international experts. Section 7, finally, summarizes the view of Faugert & Co Utvärdering on finalizing the task. In order to facilitate the process of completing the overall evaluation report against a tight deadline, the present report focuses directly on the evaluation questions as formulated in our proposal to Elforsk.

2.2 Work carried out
Background information has consisted in SEA decision documents, reports on programme and project level and the evaluation of the previous programme period. We have then carried out the following data collection:

• 18 interviews with people involved in the centre - members of the SVC Board and Steering Groups, participating companies and researchers, the programme manager at SEA and representatives from companies and organizations not actively involved in SVC. Furthermore, mail interviews were carried out with six members of different reference groups.
• Surveys to
  • Members of the Steering Groups: 26 answers of 35 (74 %)

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1 Dr. Christer Ovrén, ABB Corporate Research (co-ordinator of the group), Dr.-Ing. Albert Ruprecht, Institute of Fluid Mechanics and Hydraulic Machinery, Stuttgart University. Prof. Dr. Ignacio Escuder-Bueno, Department of Hydraulic and Environmental Engineering, Universidad Politecnica Valencia and Prof. Em Tord Torisson, Thermal Power Engineering, Lund University.

3. Effects

3.1 Evaluation question 1: What are the impacts of the programme for industry?

The main effect of SVC on industry is clearly competence building. Investments in the sector peaked in about 1960, and then turned downwards rapidly. For many years available competence was bigger than demand, leading to a decline in the interest for related university education. University students went elsewhere where better job and career opportunities were available. The Swedish hydro power sector was in need of renewed competence and new blood, and a relatively large number of PhDs and master thesis students are now entering a sector where industry in certain areas have lagged behind. This is described as an important achievement by representatives from industry and Academia alike.

The main company in the sector, Vattenfall Hydro Power, has absorbed several former SVC PhD students. Other utilities have not done so, but claim to benefit indirectly from the presence of a cadre of qualified people entering the sector. The Swedish hydropower sector is small, so an influx of this degree will have an impact. It is also worth noting that several former PhD students now work for consultancies that are important sub-contractors in the sector.

SVC brings industry in close contact with universities, to a degree hitherto uncommon. This facilitates basic education and PhD training more relevant to industrial needs, and improves “employability”. The presence of five adjunct professors (at LTU, UU and KTH) associated with SVC improves communication and creates opportunities for collaboration with industry. This, together with ten industrial PhD’s and at least 66 master’s theses, are of great value for the building of competence and sustainability in the hydro power research, and in the mid-term create more direct impact on industry.

Three patent applications (one granted) in tribology facilitated through SVC “slack money” and one in electro mechanics also serve a mention in this respect, as sources of potential future impacts of the programme.

3.2 Evaluation question 2: How (well) are the results from SVC implemented in the hydropower business?

Not surprisingly there are as yet few cases of implemented results. The Senior Researchers´ reports to Elforsk do not highlight industrially relevant results or implementation, but interviews and surveys have provided some examples of concrete implementation:

- Results from a thesis now used by Vattenfall Water Power in its requirements specification process. This former PhD student now works in the company

- The PhD project predicting surfacing internal erosion in moraine core dams carried out at the Division of River Engineering at The Royal Institute of Technology (KTH) will also shortly lead to results that will be implemented in industry

Three patent applications, one granted and two pending, in tribology have been facilitated through SVC “slack money”. A further patent application in electro mechanics has been filed. A patent or a patent application is obviously not to be regarded as an implemented result, but they are an indicator of industrial relevance.
External activities, such as the “SVC days”, provide players in the sector with an opportunity to keep up with developments in SVC. This opportunity is seized to an unequal extent; some smaller utilities co-fund the centre but do not see a need to follow it more closely. Perhaps significantly, some of these utilities were not interested in participating in the evaluation.

Summing up, dissemination of results outside Academia seems to need further improvement. The SVC magazine and newsletter are important channels in reaching out, and it seems that a more frequent newsletter could be a way to increase the interest in the results among the part of the sector that today is less involved. Obviously, this requires more resources and has to be traded off to other demands and needs.

4. Programme strategy

4.1 Evaluation question 3: How efficient is the SVC concept with regards to reaching the goals for SVC?

SVC is defined as a competence centre, and as such it contains some elements that are unusual:

- The funders identified certain (parts of) universities that were to be part of the operation. More commonly, competence centres start from an idea of the content, the “competence” that is to be focused on
- These parts, that provide the content of the research carried out, are geographically distributed. This is not unseen, but competence centres are more often concentrated to one place
- The creation of the figure of the “senior researcher” is somewhat of an innovation as far as competence centres are concerned, and has contributed very much to successfully building areas of competence

In fact, nobody we have been in contact with thinks that a different working mode for SVC would further the goals of the Centre better. “This is one of the best centres I have been involved in”, in the words of one experienced researcher.

4.2 Evaluation question 4: How can SVC contribute to bridge the gap between the industry and universities?

SVC is generally regarded as a very good way to build bridges between Academia and industry. There was no meeting place for the players in the sector. SVC fills a gap, and is considered to fulfill this role well. One comment that sums up several other ones well is that “the more contacts between universities and companies there are, the better you close the gap between them. And SVC provides that meeting point”. As mentioned before, there are a number of adjunct professors and industrial PhD’s attached to SVC, and these are very useful elements in bridging the gap.

Many interviewees point out that it is vital to concentrate forces and knowledge, not dilute them. This has been a clear strategy from the onset, and carried out in a successful way.

5. Programme efficacy

5.1 Evaluation question 5: What do programme participants think of SVC’s administrative processes?

According to programme participants at different levels, SVC works very well. Project selection, initiation and monitoring are handled appropriately, whereas dissemination
and implementation in industry of results could still be improved. Elforsk also gets very high marks for its role as an administrator of the programme, from all categories of participants.

There is a certain overlap of people simultaneously sitting on two or more chairs in the programme. For several reasons this is certainly helpful, and gives a greater coherence to the initiative. That said, some interviewees have commented upon the size of some groups, in the sense that representation sometimes seems to prevail over efficiency.

5.2 Evaluation question 6: To what extent has the recommendations from evaluation carried out in 2008 been taken into account in the current phase of SVC?

The evaluation carried out in 2008 put forward a number of recommendations, and all of these have been addressed in a systematic way by the Board in the present programme period. As can be expected, some issues have been tackled with more success than others. It is for example not clear to what extent the international collaboration in the competence area of Hydraulic Engineering has been strengthened, and the dissemination of results to the industry still needs to be addressed. This is a necessary step in order to facilitate implementation of results.

5.3 Evaluation question 7: What changes to the programme would make it more attractive and efficient?

Survey results and some interviews indicate a wish for more involvement from the centre’s industrial partners. This would include bringing project ideas to the table. The surveys also suggest that basic education training could have a clearer element of hydropower-related issues. Finally, as was pointed out in the previous evaluation and confirmed by interviews to still be an area in need of attention, international contacts and outlook could be improved in some of the nodes.

6. Objectives fulfillment

6.1 Evaluation question 8: To what extent have the objectives of SVC been fulfilled?

- Build scientifically high-quality long-term sustainable competence at universities connected to SVC

This is clearly a long-term mission and the system is still a vulnerable one, but there is no doubt that SVC is on its way to achieving the objective.

- Constitute a national resource in education related to hydro power

More courses are being developed, there is an (slightly uneven) increased interest in relevant university educations. This objective has been achieved.

- Increase interest within the industry, publics and students for hydropower related issues

Interest has increased within the industry and among students, although more still needs to be done.

- Build excellent competence within hydro power technology

This objective is on its way to be fulfilled, but there are different opinions as to how far the centre has come at this point. Not all the nodes are equally developed.

- Develop the international co-operation with participation from industry as well as university
This is still an issue that needs attention. The focus in the programme is mainly a national one, although there are examples of guest researchers and international contacts.

6.2 Evaluation question 9: To what extent have the objectives of the Swedish Energy Administration concerning energy research and innovation been fulfilled?

- To build knowledge to facilitate the conversion to a long-term sustainable energy system

SVC is an important building block to achieve this objective. In order to be able to develop wind energy and solar cell energy, there needs to be sufficient back-up regulatory capacity. Hydro energy is crucial here.

- To develop technology and services that through commercialization in Swedish industry can contribute to the conversion and development of the energy system

Largely, this still lies in the future. Innovations can come through that, taken in conjunction, will be important in order to make hydro energy more efficient when the time for renewal comes.

7. Reflection

The creation of SVC was a much-needed initiative, and the centre has been built up in an impressive way to meet its objectives. Through SVC, a meeting point has been created for Academia, industry and public authorities to discuss topics of common interest for the sector, and to carry out relevant research.

SVC plays a role in making undergraduate courses and PhD training more industry relevant, and gives industry an opportunity to update its knowledge in several areas.

The build-up phase of SVC has been carried out in an exemplary way. Scientificaly high-quality long-term sustainable competence at universities connected to SVC is in place, a national resource in education related to hydro power is constituted, excellent competence within hydro power technology is being created (to an unequal extent?) and interest in industry and among students has increased. The organization and programme strategy has been instrumental and efficient in creating and consolidating this. However: is the build-up phase over, and is there a need to take a further step?
Appendix A Interviewees

Jan-Olov Aidanpää, LTU
Gunnar Axheim, Vattenfall
Peter Balogh, EON
Annika Bjelkevik, Tailings AB
Niklas Dahlbeck, Vattenfall
Tommy Edeskär, LTU
Fredrik Engström, Vattenfall
Sergi Glavatskih, KTH
Erik Höglund, LTU
Fredrik Johansson, KTH
Lennart Josefsson, CTH
Göran Karlsson, Linde Energi
Jan Lidström, Holmen Energi
Mats Lindberg, Mälarenergi
Henrik Lindsjö, Andritz
Urban Lundin, UU
Karl-Oskar Nilsson, EON
Åke Nilsson, WSP Samhällsbyggnad
Sara Sandberg, Elforsk
Håkan Stille, KTH
Peter Viklander, WSP Group
Erik Wängdahl, EON
Anders Wörman, KTH
Sten Åfeldt, Swedish Energy Administration