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Sweden's Evolving Hydropower Sector: Renovation, Restoration and Concession Change

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CONTENTS

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The views and conclusions expressed in this report are solely those of the author.

ENGLISH-SWEDISH GLOSSARY

CAB	County Administrative Board (Länsstyrelse)
EIA	Environmental Impact Assessment (Miljökonsekvensbeskrivning)
EQN	Environmental Quality Norm (Miljökvalitetsnorm)
EQO	Environmental Quality Objectives (Miljökvalitetsmål)
LEC	Land and Environment Court (Mark och Miljödomstol)
LECA	Land and Environment Court of Appeal (Mark och Miljööverdomstol)
LFASA	Legal, Financial and Administrative Services Agency (Kammarkollegiet)
RBA	River Basin Authority (Vattenmyndighet)
SBF	Swedish Board of Fisheries (Fiskeriverket)
SEC	Swedish Environmental Code (Miljöbalken)
SEPA	Swedish Environmental Protection Agency (Naturvårdsverket)
SGI	Swedish Geotechnical Institute (Statens Geotekniska Institut)
SMHI	Swedish Meteorological and Hydrological Institute (Sveriges Meteorologiska och Hydrologiska Institut)
SwAM	The Swedish Agency for Marine and Water Management (Havs- och Vattenmyndigheten)

SUMMARY

In 2010 Sweden generated 67 000 GWh of electricity from hydropower, making it the biggest hydropower producer in the European Union and the tenth biggest worldwide. Hydropower production provides around 45% of Sweden's total electricity. It is also a valuable source of renewable electricity and provides capacity to balance the national electricity grid. At the same time, the scale of hydropower production in Sweden means that roughly three-quarters of the total river discharge in the country's largest river systems is either moderately or strongly affected by fragmentation from dams and water regulation. The negative ecological effects of hydropower production on the ecosystems of the affected river systems are well documented. This means that hydropower production can cause ecological damage that requires mitigating measures in order to comply with Swedish and EU environmental legislation.

This report reviews how the Swedish hydropower sector evolved between 1990 and 2012. It focuses specifically on the measures taken to restore rivers affected by hydropower production, as well as on the process for renovating and repowering existing large-scale hydropower stations. The report makes its core focus changes to existing hydropower installations. The type, extent and speed of these changes are central to understanding whether and how EU and national goals on the environment and energy are being implemented in Sweden, both at individual hydropower stations and in the sector more generally.

The report finds that the increase in hydropower energy produced as a result of the renovation of 39 hydropower stations in the past nine years is roughly 24 times larger than the reduction in production as a result of hydropower concession reviews in the period 1990–2010. In addition, the results presented in this report on the extensive renovation of six large-scale (>10 MW) hydropower stations support theoretical extrapolations that show the potential for an increase in production of 3000 GWh/year in the coming years from the renovation and refurbishment of existing large-scale hydropower stations in Sweden. The results presented demonstrate that, thanks to the extensive ongoing renovation of existing large-scale hydropower stations, there is scope for significant implementation of river restoration measures in Sweden without incurring an overall loss in production or the balancing capacity of Swedish hydropower production.

The report examines three processes of change in hydropower concessions: two concession modification hearings and one concession review hearing. One of the key issues in the examined concession modification hearings is the question of setting legal precedents on the appropriate scope of examination in a modification hearing. In the examined concession review hearing the key issue was how the costs of mitigation measures should be shared between the actors. The findings on the three concession change processes are discussed in the light of the government's stated goals on hydropower production and concession change. The report's general policy recommendation is the creation of a common compulsory fund for all hydropower producers. This fund would be used to finance the river restoration measures arising from individual concession review hearings. It is argued that such a change would lead to improved implementation and increased coherence of outcomes in the Swedish system for regulating hydropower concession changes, and increase the efficiency of the process itself.

1 INTRODUCTION

In 2010 Sweden generated 67 000 GWh of electricity from hydropower, making it the biggest hydropower producer in the European Union and the tenth biggest worldwide (IEA 2012). Sweden's hydropower industry is mature, with a high proportion of ageing dams and stations. Hydropower production in Sweden is in most cases regulated by concessions – which are equivalent to licences for hydropower operators to use water resources – that have been granted in a court of law. These concessions usually specify issues such as how much water can be diverted from the river in question into turbines to produce electricity and, in cases of the storage hydropower, the allowed maximum and minimum level of the impoundment or lake in question. Once a concession for hydropower production has been granted, it has legal force against all parties and no time limit. This means that no Swedish or EU legislation or policy that is enacted after a concession has been granted has any direct effect on the operating conditions stipulated in the original hydropower concession. Roughly 90% of all hydropower concessions in use in Sweden today were granted before 1983, in some cases many decades before, and according to the Water Law of 1918 or even older legislation.

Legal action is required to change any of the operating conditions of a hydropower station or dam that are regulated in a granted concession. If the change is meant to mitigate the negative ecological effects that a hydropower station can cause so that it complies with Swedish and EU environmental legislation, this usually takes the form of a concession review hearing. Swedish hydropower is also going through a period of widespread renovation and repowering because many existing hydropower stations are reaching the end of their lifecycle. Renovation or the replacement of turbines and generators can often be carried out without changes to the operating conditions in the granted concession, in what is referred to, in this report, as an extensive renovation. There are, however, sometimes opportunities for extended renovations which create additional efficiency gains and boost energy production. Extended renovations that require a change to the operating conditions regulated in the existing concession will also require legal action in the shape of a concession modification hearing.

This report reviews how the Swedish hydropower sector evolved between 1990 and 2012. It focuses specifically on the measures taken to restore rivers affected by hydropower production, as well as on the renovation and repowering of existing large-scale hydropower stations. It also analyses and compares the overall hydropower production losses and gains from these changes. This report makes changes to existing hydropower installations its core focus, because the type, extent and speed of these changes are central to understanding whether and how EU and national goals on the environment and energy can be implemented in Sweden, both in individual hydropower cases and for the sector in general. The implementation and coherence of environmental and energy goals in the hydropower sector are central to Sweden in general, since existing hydropower provides around 45% of the country's total consumed electricity. It is also a valuable source of renewable electricity and provides capacity to balance the electricity grid. At the same time, the scale of hydropower production in Sweden means that roughly three-quarters of the total river discharge in the country's largest river systems is either moderately or strongly affected by fragmentation from dams and water regulation (Dynesius and Nilsson 1994). The negative ecological effects of hydropower production on the ecosystems of the affected river systems are well documented (Vorosmarty et al. 2010). This means that hydropower production in many cases can cause ecological damage that would need mitigation measures in order to comply with Swedish and EU environmental legislation.

Because changes to hydropower stations and operations often require that concessions are modified, the type, extent and speed of change in the sector depends to a large extent on the current institutional framework that governs concession change, and how the institutional framework is used by the actors involved in the process. This report scrutinizes and evaluates relevant national and EU legislation and policy related to hydropower functioning and change which is referred to as the institutions governing hydropower production and concession change. The actors involved in the processes of concession change are also identified, as well as their main interests, as part of this framework. Three hydropower concession change processes – two concession modification hearings and one concession review hearing – are analysed in detail using the analytical framework created. The key findings from these three concession change processes are distilled and discussed

The outcome of the analysis of hydropower change processes is discussed in the light of the Swedish government's stated goals for hydropower as well as its stated objectives regarded the concession change process.

The main aims of this report are in summary to:

1. Provide an overview of the measures that have been carried out to restore rivers as well as increase hydropower production in existing hydropower stations in Sweden.

2. Analyse three processes of concession change in order to understand the main factors that shape these processes and their outcomes. The main focus is on the ways in which the interests of actors, and institutional rules and knowledge are articulated and considered prior to and during the legal process, as well as the outcomes of the processes.

3. Discuss the findings in the light of the Swedish government's stated goals for hydropower, as well as its stated objectives regarding the process of concession change.

Chapter 2 explains the methodology and case study selection. Chapter 3 reviews the government's stated hydropower goals. Chapter 4 provides an overview of the measures for river restoration and increasing hydropower production that have been implemented in Sweden in recent decades. Chapter 5 elaborates and explains a framework for analysing the process of concession change based on institutional theories. Chapter 6 examines three processes of hydropower concession change in line with the analytical framework. Chapter 7 analyses the three processes with a focus on the key factors that help explain the shape and outcomes of the processes. The findings are discussed in the light of the government's stated goals. Chapter 8 provides conclusions and discusses a policy suggestion. Appendix 1 provides a detailed overview of the hydropower stations in Sweden that receive renewable electricity certificates for an increase in production as a result of renovation. Appendix 2 provides an overview of cost-sharing between the state and operators for physical mitigation measures in concession review cases.

2 METHODOLOGY AND CASE STUDY SELECTION

Data on river restoration are taken from the report on hydropower concession reviews by the County Administrative Board (CAB) in Värmland (Hedeskog and Monsén 2012:13). The report analyses all known concession reviews between 1990 and 2010 and aggregates the review results in terms of the restoration of fish stocks, biodiversity and loss of energy production. Statistics from the Swedish Energy Agency were analysed in order to collect relevant data on measures to increase hydropower production in Sweden. The Swedish Energy Agency allocates renewable electricity certificates for measures to increase production at existing hydropower stations. From these allocation decisions it is possible to extract information on the production capacity and average production of hydropower stations, the measures implemented to increase efficiency and the resulting increase in production. In each case, it is the hydropower operator that calculates and verifies the increase in production. This information provides an empirical basis for both the absolute production increase and the increase in percentage terms that results from the measures implemented to increase efficiency. This allows the efficiency gains from actual renovations to be calculated and compared with theoretical calculations from 2003 (see below). Appendix 1 provides detailed information on the 39 hydropower stations. Six hydropower stations that have undergone extensive renovation or replacement of turbines and generators are highlighted and are shown in map 1.

To meet the second aim, this report examines three hydropower concession processes in order to understand the main factors that shape concession processes and their outcomes. The cases were chosen to illustrate issues that are relevant to the broader Swedish hydropower administrative system. The concession change processes selected were:

1. A concession modification hearing to refurbish and increase the swallowing capacity of the turbines at Edensforsen hydropower station (Court case number M 6061-09).

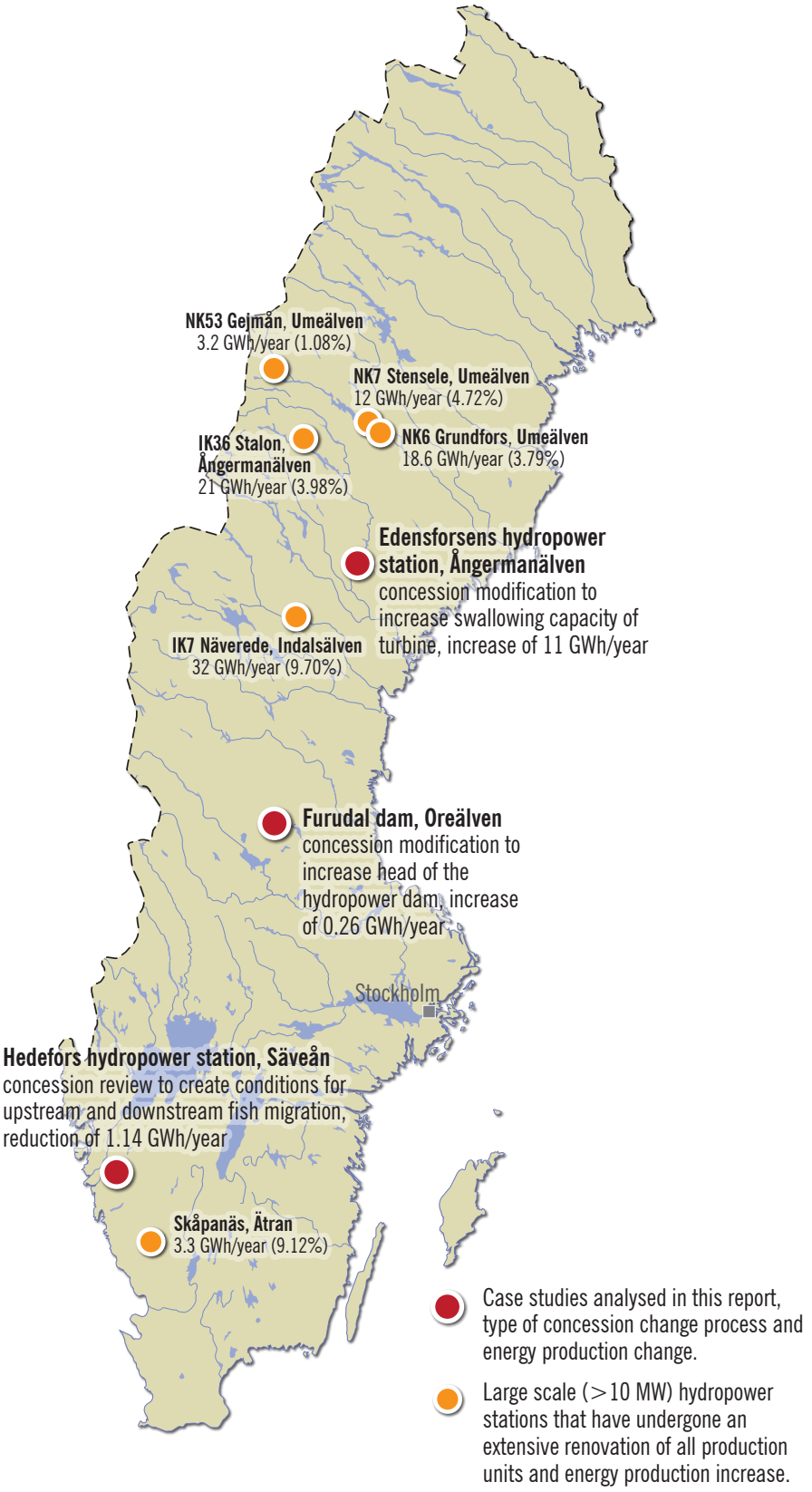
2. A concession modification hearing for Furudal dam, including safety measures and an increase in the regulated head (Court case number M 2187-08).

3. A concession review hearing on Hedefors hydropower station to create conditions for upstream and downstream fish migration at the hydropower station (Court case number M 7200-10).

The Edensforsen and Furudal cases were selected since they are two concession modification hearings to allow for measures to increase hydropower production. The Hedefors case was selected because it involved what Swedish and EU environmental legislation identify as “high natural values”, and since the court process was initiated without prior agreement between the parties involved – although this later changed when agreement was reached out of court. Agreement prior to the judicial process has been identified as one of the necessary elements of an effective concession review process (LFASA 2012, BothnianSea 2008:16). The procedure for reaching such agreements, and their terms, are therefore highly relevant to study. The location and an overview of the cases analysed can be found in Map 1.

The Swedish government’s stated objectives on energy and the environment, and the concession process in general, are contrasted with the results of the analysis of the measures carried out in existing hydropower stations and the functioning and outcomes of the analysed concession change processes. Government directives and other statements on public policy are used to identify the government’s objectives.

Relevant empirical material was gathered by reviewing the documentation submitted by the central actors in the legal processes and the rulings of the Land and Environment Court (LEC). In the Hedefors case, which was the most extended process, interviews with key actors in the review process were used to gain information on agreements made and discussions that were not part of the court hearing.



Map 1: Map of case studies analysed in this report and large scale hydropower stations that have undergone an extensive renovation of all production units

Hugo Ahlenius, Nordpil, 2013

3 THE SWEDISH GOVERNMENT'S STATED GOALS ON HYDROPOWER

It is a full-scale research task in itself to condense the government's myriad stated goals on environmental and energy policy in general, and hydropower in particular. However, since 2007 the government has written various terms of reference for committees of inquiry and special investigators that deal specifically with water operations, environmental considerations and hydropower. These terms of reference outline government objectives in the field.

In 2007 the terms of reference were published for the committee of inquiry known as the Environmental Process Investigation. One of the main aims of the investigation was to simplify and make more efficient the procedure for the examination of legal cases under the Swedish Environmental Code (Dir 2007:94). In an addition to the original terms of reference, the committee was requested to investigate the need to change legislation related to water operations. The stated overall purpose of the investigation was to make the legal examination of environmental questions more efficient, and to ensure that all the operations that require a concession are in line with the requirements of the Swedish Environmental Code (SEC) (Dir, 2007:184). Furthermore, the terms of reference stated that as far as possible the review should promote hydropower production capacity without undermining efforts to achieve the Environmental Quality Objectives (EQO), and take into consideration general and private fishing interests.

In 2012 the government issued terms of reference for a special investigator to examine legislation on water operations, including hydropower, and suggest changes to ensure that all water operations that require concessions have concessions that are in line with the environmental requirements of the SEC and EU legislation. The changes should also seek to ensure well-functioning ground drainage and maintain the production capacity of Swedish hydropower as well as its balancing capacity for the electricity grid (Dir 2012:29). The terms of reference also restate the aim of achieving these overarching goals in an efficient way.

Government goals in recent terms of reference on hydropower

Three overarching government aims can be distilled from the terms of reference reviewed for this study:

- for water operations to possess concessions that are in line with national and EU environmental legislation;
- to maintain production and balancing capacity for Swedish hydropower;
- to reach the stated goals in an efficient way.

4 OVERVIEW OF MEASURES TO RESTORE RIVERS AND INCREASE HYDROPOWER PRODUCTION IN SWEDEN

4.1 RIVER RESTORATION MEASURES

In Sweden, significant measures to restore rivers and improve fish stocks and biodiversity are decided on in a concession review hearing. There are currently more than 3700 concessions in force in Sweden regulating the operating conditions of hydropower stations and dams (SOU 2009:42). This number translates into roughly 2000 hydropower stations, since nearby or connected hydropower stations and dams can have several concessions (Energimyndigheten 2008).

Ninety of the 3700 concessions were reviewed between 1990 and 2010, resulting in 132 measures to improve biodiversity and the habitat for fish (Hedeskog and Monsén 2012:13). These measures included 29 fish passages and seven fish weirs/guiders. A minimum flow was established in 64 cases. In the majority of cases where a minimum flow was stipulated, the production loss resulting from the reduced flow through turbines was 5% or less of a given station's total production capacity.

Between 1990 and 2010 the total loss of hydropower production capacity resulting from reviewed concessions in which a minimum flow was stipulated for existing stations was roughly 14 GWh/year (Hedeskog and Monsén 2012:13). This figure represents 0.02% of total Swedish hydropower production in an average year (calculated based on an average production of 65,500 GWh/year).

4.2 MEASURES TO INCREASE HYDROPOWER PRODUCTION

A 2003 report to the Swedish Energy Agency studied the potential for increasing the production of the more than 200 large-scale hydropower stations in Sweden (i.e. those with a capacity of >10 MW) (Bernhoff et al. 2003). The report focused on large-scale stations because these produce roughly 95% of the total hydroelectric power in Sweden. The results showed that efficiency gains from renovating turbines and generators, and improving water-flow pathways, would increase hydropower production by approximately 5%, or 3000 GWh/year. However, the results only give an approximate picture of potential efficiency gains, due to limitations in the available data and the fact that they were extrapolated from eight large-scale hydropower stations to the entire stock of large-scale stations.

Even though the results are not precise, they are interesting since Swedish hydropower is currently undergoing a thorough overhaul. The majority of Swedish hydropower production capacity was built between 1950 and 1980, and several production units in hydropower stations are approaching the end of their life. It is estimated that investment of MSEK 2500 per year will be needed in the coming decade to renovate existing large-scale hydropower installations (Elforsk 2010).

The introduction of renewable electricity certificates in 2003 provided an additional incentive to renovate existing hydropower stations. Hydropower operators receive these certificates for increases in production (SFS 2011:1480). These are then sold on a certificate market to provide additional revenue for the operator. The types of measures specified in the certificate scheme include increasing the average use of the water flow through the installation, reducing losses in the waterways and reducing losses in the energy conversion system. Specific measures include renovating or replacing turbines, generators and transformers, improving the sealing of the wicket gate and improving the control system of the production unit.

Between 2003 and 2012, 39 hydropower stations were granted renewable electricity certificates for increasing production (SEA 2012), 36 of which can be classified as large stations with a production potential greater than 10 MW, and 22 of which have a production capacity of more than 100 MW. The 39 hydropower stations in receipt of renewable electricity certificates produced an average of 25 550 GWh/year prior to implementing any measures. The efficiency measures implemented have led to an increase in production of 337 GWh/year. However, in a number of cases the measures were limited in scope and did not constitute an extensive renovation of turbines and generators. Limited measures include improving the sealing of the wicket gate or improving the control system of the production unit.

There has been an extensive renovation of one or more production units, or the replacement of turbines and generators, in 17 large-scale hydropower stations. In

these stations, the average level of production prior to renovation was 12 853 GWh/year and the measures resulted in a production increase of 262 GWh/year. In several of the stations, however, only one production unit of several was extensively renovated. This means that the increased production from the renovation of one production unit is split between all the production units in that station. In addition, it is likely that the order of priority for running the different turbines changed as a result of the renovation, which means that some of the production increase comes from the increased running time of the renovated turbine. In six large-scale hydropower stations, all the production units have undergone extensive renovation of all turbines and generators. These stations on average produce 1943 GWh/year and the renovations have led to production increases of 4.66%, or 90.7 GWh/year. These stations are shown in map 1 and the information for each station can be found in table 1.

In sum, measures to increase hydropower production in 39 hydropower stations between 2003 and 2012 led to an average increase in hydropower production of 337 GWh/year, which represents an increase in total hydropower production in Sweden of roughly 0.5% in an average year (calculated based on an average production of 65,500 GWh/year). The hydropower stations in which all the production units have undergone extensive renovation of turbines and generators show an average percentage production increase of 4.66%. This result is in line with the theoretical calculations carried out in 2003, which indicated that a production increase of roughly 5%, or 3000 GWh/year, could be expected from renovating the turbines and generators of all the existing large-scale hydropower stations in Sweden.

4.3 COMPARING HYDROPOWER PRODUCTION LOSSES AND INCREASES

Roughly 24 times more hydropower energy is produced each year as a result of the renovation of 39 hydropower stations in the past nine years than the reduction in production as a result of all the hydropower concession reviews in the period 1990–2010. A large share of the reduction in hydropower production has occurred in small run of the river stations with limited balancing capacity for the electricity grid. The 39 hydropower stations where there have been production increases are mostly large dam hydropower stations, which have important balancing capacity. This means that the overall effect when comparing production losses and increases is even more positive for the overall balancing capacity of hydropower for the electricity grid in Sweden.

Table 1: Large scale (>10 MW) hydropower stations with renewable electricity for the share of increase in production resulting from an extensive renovation, or the replacement of turbines and generators, in all the production units at the station

Name of hydropower station	Installed effect (MW)	Average production prior to renovation (GWh/year)	Production increase (GWh/year)	% Production increase
IK36 Stalon	130.2	527	21	3.98
IK7 Näverede	75.6	330	32	9.7
NK53 Gejmån	56.6	296.6	3.2	1.08
NK6 Grundfors	105	490.7	18.6	3.79
NK7 Stensele	57.6	254.2	12	4.72
Skåpanäs	11	36.2	3.3	9.12
Total		**1934.7**	**90.1**	**4.66 (average)**

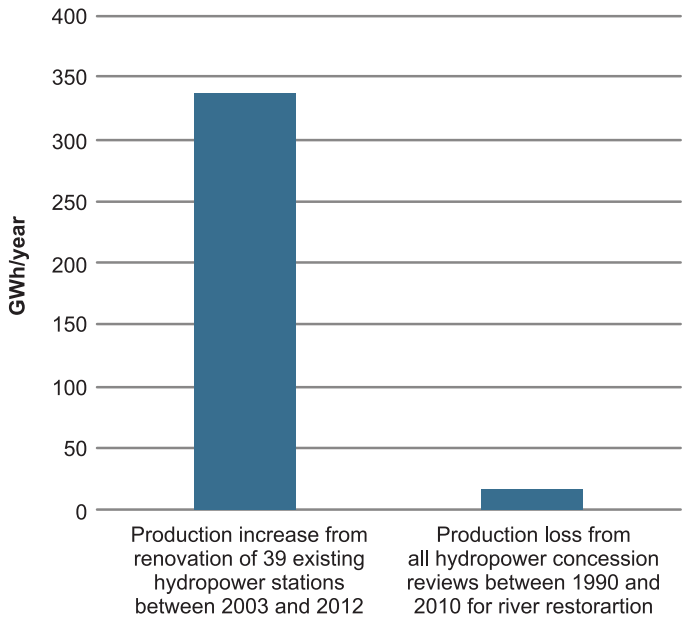


Figure 1: Comparison of hydropower production losses, 1990–2010, with hydropower production increases, 2003–2012

5 A FRAMEWORK FOR ANALYSING THE CONCESSION CHANGE PROCESS

This chapter elaborates a framework for analysing the concession change process based on institutional theory. Both the key organizational interests and the relevant institutions governing hydropower production and concession change are identified and explained.

Institutions can be seen as systems of rules and incentives that influence human interaction by directing the opportunities and incentives for individual and group behaviour and actions (Rhodes et al. 2008). Institutions in a society range from informal rules, such as cultural and social norms, to formal rules in the shape of legislation. This view of institutions is in line with the school of thought known as rational choice institutionalism, where a distinction is made between institutions and organizations (Hinich and Munger 1997, Laver 1997). The institutions in society are perceived as clearly separate from and existing independently of organizations. Organizations are entities made up of a group of people intentionally organized to pursue one or several interests. The pursuit of an organization's interests takes place within, and is conditioned by, the existing institutions in society. Third parties will to a varying degree enforce existing rules to ensure compliance by individuals and organizations. Despite being limited by existing institutions, there is still a wide variety of strategies open to the organization to further its interests. If existing institutions are deemed too restrictive, an alternative strategy could be pursued by the organization of investing time and energy in modifying the institutions or rules so that they are more in line with the interests of the organization (North 1990). In reality, these two efforts are often pursued in parallel by an organization.

Various ongoing processes could change the institutional framework for regulating hydropower operations and concession change processes. The most notable is the special investigator, who is to conduct an overview of the legislation pertaining to water operations in the SEC (Dir 2012:29). Various organizations with interests connected to hydropower production are active in this process, in order to ensure that any proposed changes to the institutions or rules are in line with their interests and objectives. Researching and understanding an organization's influence and strategy in the institutional change process, such as changes to the SEC, is analytically distinct from analysing an organization's actions and strategies in pursuit of its own interests within existing institutional constraints. The present analysis focuses on the actions and activities of the organizations concerned within the boundaries set by the current institutional landscape. The institutional framework regulating hydropower concession change and the legal processes and procedures surrounding concession change are the main parameters, as well as the arenas in which different organizations pursue their interests in relation to hydropower production and change.

Institutions and organizations

North (1990) makes reference to a football team to show the difference between institutions and organizations. The football team is an organization with an interest in winning as many matches as possible and ultimately winning the league it is playing in. The institutions/rules of the game tell the coach and the team which strategies are allowed, such as using different tactics and team formations. The rules also exclude some strategies, such as foul play or fighting, which could be successful strategies for winning matches.

In a football game there is a third party, the referee, who has enforcement and sanctioning powers and ensures, to the best of his/her ability, that the rules of the game are followed. If the football team is of the opinion that a specific rule reduces its chances of winning matches it could put energy into changing the rules, or institutions, of the game by petitioning the national football association to make changes to the rules. The football team therefore potentially has two options in order to improve its chances of winning matches: to spend energy and time on improving its strategy and tactics within the existing set of rules or to invest time and energy in pressing for a change in the rules of football.

5.1 UNITS OF ANALYSIS IN THE FRAMEWORK

Three basic units of analysis can be identified when analysing the hydropower concession change process within an institutional framework:

1) The key interests of the organizations involved in the concession change process;

2) The institutions/rules governing hydropower production and concession change, which are of a general character;

3) The concession change process (in and out of court) in which: (A+B) the organizations act, argue and provide evidence in line with their interests; and (C) the court (the third party) comes to a decision through the application and interpretation of existing institutions to the specific case.

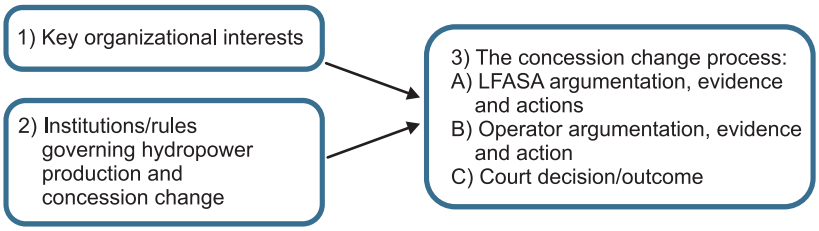


Figure 2: Analytical framework for the hydropower concession change process

Specification of the analytical framework for the hydropower concession change process

1. The key organizational interests of the operators of hydropower stations and theLegal, Financial and Administrative Services Agency (LFASA), which are the main organizations involved in the concession change process.

2. The institutions governing hydropower production and concession change include:
   - The Swedish Environmental Code
   - Legal precedent
   - The Swedish Environmental Quality Objectives
   - The Renewable Energy Directive
   - The Water Framework Directive
   - The Habitats Directive
   - The Eel regulation

3. In the concession change processes identify and analyse:

A+B) the LFASA and operator legal arguments, evidence and action:

i. Are agreements made out of court? In what way and to what effect?
ii. To what extent and in what ways are references made to the institutions governing hydropower production and concession change?
iii. What knowledge (technical and environmental) is provided, requested and disputed by the parties?

C) The decisions of the LEC and the LECA:

i. What is the ruling and how, why and to what extent does it consider the legal arguments of the actors?
ii. How are costs shared between the actors?

5.2 KEY INTERESTS OF THE ORGANIZATIONS INVOLVED IN THE CONCESSION CHANGE PROCESS

In order to use this framework, the organizations active in the concession change process need to be recognized and their interests identified. Two main types of organization initiate and are active in a concession change process in the LEC: the hydropower operators and the public authorities responsible for safeguarding environmental and other public interests.

Hydropower operators can be defined as economic organizations engaged in the production and sale of energy. In Sweden, hydropower operators can be divided into various types ranging from private individuals to corporations and municipally owned entities. The overwhelming majority of hydropower production in Sweden is carried out by organizations set up as joint stock companies. In the three cases selected, the hydropower operator is a joint stock company. As a joint stock company engaged in the production of energy for sale, one of the core assumptions in neoclassical economics should apply – that the basic goal of an economic organization is profit maximization (Boland 1981). There are several different avenues for achieving this goal, and several internal limitations restrict the organization's opportunities, such as on information, and computational and technology constraints. There are a number of criticisms of this basic assumption, which does not explain the behaviour of firms in all settings (Nelson and Winter 1974, Nelson 1991), but it can be argued that in the Swedish context, where the energy sector was deregulated in 1996 and energy is traded in a market place, organizations in the sector should, and do, operate according to market logic where profit maximization and shareholder value are key interests.

Interviews with representatives of leading energy companies as part of research carried out on the Swedish energy sector also support this idea: "Every company's goal is to earn as much money as possible" and "It is our obligation to our shareholders to create the maximum value possible in our production facilities" (Rönnborg 2009: 118). The assumption that hydropower operators in a deregulated energy market are principally acting to further their key interest in profit maximization and shareholder value therefore seems to be robust.

For non-economic organizations, such as public authorities, the goal of profit maximization does not apply and a closer look at the mandates of the individual organization is required to identify its goals and interests. The main public authority active in concession change processes on a national scale is the Legal, Financial and Administrative Services Agency (LFASA). The LFASA carries out a range of services for the state, but part of the organization works on hydropower concession change processes. The mission of the relevant section of the LFASA is to "appear for the public in the Land and Environment Court to safeguard environmental interests and other public interests in line with what is stated in the Environmental Code" (LFASA 2012, Department 2007). This mission can be defined as a basic interest in ensuring that the hydropower concessions regulating water operations are in line with the requirements of the SEC with regard to environmental and other public interests.

Public authorities, however, do not have limitless resources to pursue their mission and interests. In 2009 the LFASA had a budget of roughly MSEK 2.5/ year for hearings, examinations and procedural costs in the environmental domain. This set strict limits on the resources available for pursuing the organization's interests (SEPA 2009). All Swedish public authorities are under an obligation to economize and reduce their reliance on resources granted by the state (SFS 2007:515). In the light of this inherent resource limitation, the basic interest of the LFASA can be said to be ensuring that the hydropower concessions regulating water operations are in line with the requirements on the SEC at a minimum cost to the LFASA and the state.

Various public authorities can participate in concession change processes, such as the CAB and the local municipality concerned as well as the Swedish Agency for Marine and Water Management (SwAM).[1] Since the LFASA is the most active public authority in concession change processes, has a national mandate and the highest legal competence, the analysis below is focused on the LFASA. Any significant differences in the arguments made by another public authority are included in the analysis.

1 SwAM was created in 2011. Before that date, SEPA and the Swedish Board of Fisheries (SBF) shared the responsibilities related to the water environment.

5.3 INSTITUTIONS GOVERNING HYDROPOWER PRODUCTION AND CONCESSION CHANGE

This discussion of the institutions governing hydropower production and concession change is a partial overview of the laws and regulations relevant to the analysis in this report. For a full and authoritative insight the reader is directed to the references to further reading and to the specific legal analyses of the relevant law and regulations. The overview is focused on the law relevant to concession change processes for water operations and is to a large extent based on the analysis provided by the committee of inquiry on water operations (SOU 2009:42) and in the manual of the Swedish Environment Protection Agency (SEPA) on the application of article 11 of the SEC (SEPA 2008).

5.4 THE SWEDISH ENVIRONMENTAL CODE

The 1999 Swedish Environmental Code (SFS 1998:808) is the law with the most impact on the regulation of hydropower. The SEC replaced 15 earlier environmental acts, and aims to provide better coordinated, broader and sharper environmental legislation for sustainable development. The SEC is a framework law, which means that its rules do not generally specify limit values for various operations, and that it does not go into detail when it comes to striking a balance between various interests (Regeringskansliet, Ds 2000.61).

The analysis below is divided into the substantive and the procedural law of the SEC. Put simply, substantive environmental law can be characterized as the laws that describe the obligations and rules that apply to people and enterprises with regard to the environment. The procedural laws elaborate the steps and procedures that must be taken to enforce the substantive law. Although this delimitation is not perfect and the extent to which different laws are purely substantive, purely procedural or a mix of both is open to interpretation (Main 2009), it is a useful way of analysing the SEC for the purposes of this report.

Relevant substantive law in the Swedish Environmental Code related to hydropower in Sweden

The rules of the SEC apply to all those activities which are potentially detrimental to human health and the environment. Chapter 2 of the SEC establishes the general rules of consideration that must be complied with and apply to all operations covered by its provisions (Environment 2001). These include the burden of proof principle, which states that operators must demonstrate that their operations are undertaken in an environmentally acceptable manner in line with the requirements of the SEC, the polluter pays principle and the principle of the application of the best possible technology.[2] The polluter pays principle establishes that it is the entity which causes an environmental impact that must pay for the preventive or remedial measures that must be taken to comply with the general rules of consideration. This includes applying the best possible technology in the operation of an enterprise.[3] The rules of consideration are applicable to the extent that compliance is not deemed unreasonable when taking into account the costs and benefits of the proposed remedial measures.[4]

Chapter 11 of the SEC deals specifically with water operations, which include the construction or alteration of hydropower facilities and production conditions.[5] Chapter 11 stipulates that water operations have to be permissible in that they may only be undertaken if the benefits from the point of view of public and private interests are greater than the costs and damage associated with them.[6] The chapter further stipulates that operators that intend to carry out water operations which may be detrimental to fishing, aquatic molluscs and crustaceans must, at their own expense, make and maintain any arrangements that are necessary and supply water for the safe passage of these organisms. The operator may be discharged from this obligation if the benefits of such arrangements cannot reasonably be considered to justify the expense incurred for compliance.[7] Chapter 24 specifies that concession reviews have to be allowable which means that they cannot lead to the imposition of conditions that are so intrusive that hydropower production can no longer be pursued or is significantly hampered.[8]

The Law of Provisional Regulations of the SEC (SFS 1998:811) was passed together with the SEC and stipulates that a hydropower operator in possession of a concession granted according to the 1918 Water Law, or any older regulation, is only obliged to tolerate a loss equal to a five percent loss of production value from a concession review without compensation.

2 Chap 2:1 of the SEC

3 Chap 2:3 of the SEC

4 Chap 2:7 of the SEC

5 Chap 11:2 of the SEC

6 Chap 11:6 of the SEC

7 Chap 11:8 of the SEC

8 Chap 24:5 of the SEC

Relevant procedural law in the SEC regulating hydropower concession change in Sweden

Since 1918, hydropower concessions have been granted in five courts of law that are part of the general court system in Sweden. These courts were originally known as Water Courts and are currently called Land and Environment Courts. Chapter 24 of the SEC regulates the validity and review of concessions. The conditions for operation stipulated in a concession have legal force against all parties and are granted without time limit.[9] The operation of a hydropower station is therefore not directly restricted by any new substantive legislation that seeks to change the operating conditions stipulated in the granted concessions.[10] Roughly 90% of the 3700 concessions for hydropower production currently in force to regulate hydropower stations and dams in Sweden were granted according to the Swedish water law of 1918, which remained in force until 1983, or earlier legislation (SOU 2009:42). To change any of the operational conditions specified in a granted concession, an active intervention is required by either a public authority with a right to bring a claim to court, in the shape of a concession review hearing, or the hydropower operator, usually by initiating a concession modification hearing.

Procedural laws in the SEC regulating concession review hearings

A concession can be reviewed or even revoked for various reasons. The most relevant for the purposes of this study are if the water operations lead to significant damage, or if review or revocation is required to comply with Sweden's obligations as a result of its membership of the EU.[11] Thus far there have been no cases in Sweden of a judicial process to revoke a hydropower concession, although at the time of writing it appears that a petition for a concession revocation might be initiated for the Långforsen dam (SVT 2012).

A concession review can also be initiated if the water operations contribute, in a significant way, to the breaking of an Environment Quality Norm (EQN), or if it becomes evident that measures previously decided to protect fishing are inappropriate. A concession review initiated by a public agency is in essence treated in a similar way as a request to the LEC for a permit to engage in water operations. One formal difference compared to permits for water operations is that an Environmental Impact Assessment (EIA) is not required.[12] The responsible authority however must provide the necessary technical studies and documentation to convince the court that any proposed changes arising from a concession review – such as the imposition of a mandatory minimum flow or the construction of a fish passage – are technically feasible, reasonable, allowable and in line with the other substantive law of the SEC. The legal force of granted concessions and the application of the procedural law regulating hydropower concession reviews have shifted the burden of evidence from the operator of a hydropower station to the responsible public authority pursuing the concession review. The public authority initiating a concession review also has to pay the litigation costs of any opposition, excluding those of the operator.[13]

In sum, the legal force of the concessions means that the operating conditions specified in them are not directly altered by new substantive law or policy changes unless a judicial concession review is completed. A concession review is treated in court in a similar way as a hearing for a permit to engage in water operations. The burden of proof is on the agency initiating the review to demonstrate that the proposed measures are in line with the requirements of the SEC. When a concession granted according to the 1918 Water Law, or an older regulation, is reviewed, which represents around 90% of all the concessions in force in Sweden today, the extent of the polluter pays principle is limited to 5% of the value of the hydropower station's production. The agency pursuing the concession review in court must provide monetary compensation to the operator to the value of any loss of energy production above this level.

Procedural laws in the SEC regulating concession modification hearings

Modifications to a hydropower station or dam are treated as water operations for which a concession is required.[14] In concession modification hearings, the burden of evidence is placed on the operator, who must provide the information and evidence necessary for the court to decide whether the proposed measures are in line with the requirements laid out in the SEC. This includes specifying any remedial measures to be taken to mitigate the negative impacts of the activity or demonstrating why remedial measures are unreasonable

9 Chap 24:1 of the SEC

10 Under highly specific circumstances, such as those present in the case of the Klinte hydropower station (M676-12), the legal force of a granted concession has been altered to a limited extent. This ruling is not yet legally binding since the case has been appealed.

11 Chap 24:3 and 24:5 of the SEC

12 Chap 6:1 of the SEC

13 Chap 25:3 of the SEC

14 Chap 11:2 and 11:9 of the SEC

in that particular case. The operator is required to pay the litigation costs of all the parties to the hearing.[15]

The operator also has an obligation to prepare and submit an EIA as part of its application to the LEC.[16] The process of consulting on and formulating the EIA is described in detail in the SEC. It includes consultation with the responsible CAB, which is the body that decides if the planned measures are likely to have a significant environmental impact. Individuals likely to be affected by a planned measure are always included in the consultation, which is extended to other public agencies, municipalities, organizations and relevant sections of the public if the measures are likely to have a significant environmental impact.[17] The EIA must, to the extent necessary with regard to the scope of the measures, contain the necessary information to fulfil its purpose,[18] which is to identify and describe the direct and indirect effects of the planned activity or measure on people, and the physical and living environment, and to enable an overall assessment of this impact on human health and the environment.[19]

The LEC must ensure that the investigations in the judicial inquiry take the required direction and have the required scope for the hearing.[20] This includes deciding whether the EIA satisfies the requirements laid down in the SEC. [21] If the court considers that the application is incomplete it can order the applicant to correct the fault and can rule that the fault must be remedied at the applicant's expense. If the fault is so serious that the application cannot be used as a basis for examination of the case, the court may reject the application.[22]

The direction and scope of concession modification hearings on water operations are somewhat unclear. Such hearings on those activities defined in the SEC as environmentally hazardous can be extended to examine the original concession in conjunction with the proposed change.[23] The basis for a decision on the appropriate extent of the examination includes the degree of environmental impact of the modification and its importance to the activity as a whole. The age of the original concession, technical and environmental developments in the field and the extent of the environmental disturbance that can be observed are also aspects to be taken into account when deciding on the extent of the examination (Prop 2004/5:129). No equivalent provision exists specifically for water operations in the SEC, but the same provision regulates the legal force of concessions for both water operations and environmentally hazardous activities.[24]

Legal precedent

Legal precedent develops from the reasoned court decisions that clarify, among other things, how laws and legal concepts should be interpreted and applied. In traditional legal studies, legal precedent together with the written legislation, the history of the legislation and other legal sources form the basis for an analysis of the legislative system of an area of study (Darpö 2010). A large number of rulings by the Land and Environment Court of Appeal (LECA) guide the application of Swedish environmental legislation (Darpö 2006).

Legal precedent is codified in specific court rulings. It is not always well established and can be contested in various areas of environmental legislation. One example of a ruling that is considered to have created a precedent in the area of water operations relates to the extent of examination required for dam safety measures. In the Lagfors dam case (Court case number M 5367-08), the LECA concluded that applications to the court concerning water operations with the sole purpose of maintaining or improving dam safety should not result in an examination of the entire concession.

An in-depth analysis of legal precedent in relation to water operations is beyond the scope of this report. It is however crucial to include legal precedent in the analysis since court rulings and legal precedent related to water operations had a long history before the SEC was passed. This has led to a situation in which different activities regulated under the SEC, such as water operations and environmentally hazardous activities, are treated differently largely due to their distinct legislative history and legal precedent rather than the differences codified in the SEC (SOU 2009:42). This means that legal precedent forms part of the institutions regulating water operations, which cannot be analysed or understood based on written legislation alone.

15 Chap 25:2 of the SEC

16 Chap 6:1 of the SEC

17 Chap 6:4 of the SEC

18 Chap 6:7 of the SEC

19 Chap 6:3 of the SEC

20 Chap 22:11 of the SEC

21 Chap 6:9 of the SEC

22 Chap 22:2 of the SEC

23 Chap 16:2 of the SEC

24 Chap 24:1 of the SEC

5.5 OTHER SUBSTANTIVE LAW AND POLICIES RELATED TO HYDROPOWER

There are a number of policies and substantive laws at the national and EU levels related to hydropower. As is mentioned above, if the implementation of these substantive laws and policies requires a change to the operating conditions stipulated in a granted hydropower concession, legal action is required, which could take the form of a concession review hearing or a concession modification hearing.

Swedish Environmental Quality Objectives
The Swedish Environmental Quality Objectives form the overarching framework of Swedish environmental policy. They are political goals that are non-binding in nature. They consist of 16 environmental objectives, the majority of which are intended to be achieved by 2020. These objectives range from "natural acidification only", to "a good built environment" to "sustainable forests". The general idea is that the environmental quality objectives are to be achieved through voluntary initiatives, economic and educational instruments and – only in the final instance – legislation. There is however no direct mechanism that specifies how this is to be achieved, and no mention of the environmental quality objectives in the Swedish Environmental Code (Dalhammar 2008). Objective one, to "limit climate change" is relevant to hydropower production in that it is a renewable energy source which causes only limited emissions of greenhouse gases. Objective eight, "flourishing lakes and streams", is also relevant to hydropower, but it only applies to the select number of rivers and streams defined as of high conservation value – the roughly 700 identified as "nationally valuable water". Objective 16, "A rich diversity of plant and animal life", is relevant to hydropower in relation to aquatic plant and animal life.

A broad review of the Environmental Quality Objectives (SOU 2011:34) led to the development of stepwise goals in four areas, one of which is related to biodiversity. There has also been a government decision to align objective eight with the requirements of the water framework directive so that the lakes and streams identified as of high conservation value reach at least what are defined in the legislation as "good ecological status" or "good ecological potential" and "good chemical status" (Environment M2012/1171/Ma).

The Renewable Energy Directive
The Renewable Energy Directive (RES) (EC 2009/28) establishes a common EU framework for the promotion of energy from renewable sources. The goal of the Directive is expressed as a percentage of gross final consumption of energy, which means it can be reached by increasing production from renewable sources, decreasing production from non-renewable sources or a mix of both. There is an EU-wide target to produce 20 per cent of its energy from renewable sources by 2020, which is disaggregated into national targets. Sweden is required to move from a 39.8 per cent share for renewable energy in 2005 to a 49 per cent share in 2020.

Based on this requirement, the Swedish government has set a national goal of reaching at least a 50% share for renewable energy by 2020 (Prop 2008/09:163). The Renewable Electricity Certificate System is the most important tool for implementing the Directive and reaching Sweden's own renewable energy target. The certificate scheme provides subsidies for renewable energy production (see above). Certain hydropower production facilities are allowed to participate: small-scale hydropower facilities with a maximum installed capacity of 1.5 kW per production unit; new plants; plants that have resumed operation; the share of increased production capacity derived from renovations to existing plants; and plants that are no longer economically viable due to the requirements of authorities or the need for extensive refurbishment (SEA 2011).

The Water Framework Directive
The Water Framework Directive (WFD) (EC 2000/60) establishes a framework for the protection of inland surface water, transitional waters, coastal waters and groundwater. The WFD promotes sustainable water use based on the long-term protection of available water resources. Its aim is to enhance the protection of and improve the aquatic environment. The overarching objectives are that no water body in the EU should experience a decrease in water quality, and for all water bodies to achieve good chemical and good ecological status by 2015, although there is a mechanism for individual water bodies to extend the deadline for meeting these targets to 2027.

In Sweden, implementation of the WFD has resulted in a national monitoring programme that classifies the status of each water body according to a five-point scale, ranging from high quality to poor quality. The water quality requirements of the directive have led to the establishment of Environmental Quality Norms for all the water bodies in Sweden. In a six-year management cycle, five River Basin District Authorities (RBA) have been set up to monitor the development of water quality and develop River Basin Management Plans. These plans include a programme of measures required to achieve the EQN of good water status and ensure that no water body

experiences a decrease in water quality (Bothnian Sea 2009). Water bodies that have been heavily adapted for human use can be designated heavily modified waters, which are required to achieve a less strict EQN of "good ecological potential".

The Habitats Directive

The Habitats Directive (EEC 92/43) together with the Birds Directive form the cornerstone of the EU's nature conservation policy. The Habitats Directive is built around the Natura 2000 network of protected sites, which represent different special habitat types of European importance, and a strict system of species protection for over 1000 animal and plant species. The maintenance or restoration of "favourable conservation status" (FCS) is the overall objective for all habitat types and species protected by the directive. In simple terms, FCS could be described as a situation in which a habitat type or species is doing sufficiently well in terms of quality and quantity and has good prospects of continuing to do so in future (Environment 2007).

The Habitats Directive is implemented in Sweden by the Species protection regulation (SFS 2007:845). Sweden has to report to the EU on the state of its protected species and habitat types. Various species protected by the Habitats Directive have an unfavorable conservation status in part due to the influence of hydropower production, such as the freshwater pearl mussel, the thick shelled river mussel and the freshwater salmon (Sohlman 2007). Threatened species and habitat types should be conserved through designated protected areas and sustainable land and water management.

The Eel Regulation

The Eel Regulation (EC 2007) establishes a framework for the protection and sustainable use of the stock of European eel in the light of research showing that eel stocks are below safe biological limits. The regulation must be implemented by an eel management plan in each member state, with the objective of allowing the escape to sea of at least 40% of the silver eel biomass relative to the amount which would have escaped in the absence of anthropogenic impacts on the eel. The regulation has been implemented in Sweden through an eel implementation plan (Regeringskansliet Jo2008/3901), which includes a voluntary declaration of intent between the major hydropower operators and the Swedish Board of Fisheries with the aim of ensuring a 40% survival rate for silver eel that have to pass at least one hydropower station.

6 THREE CHANGE PROCESSES IN HYDROPOWER CONCESSIONS

This chapter examines both types of concession change process: concession modification hearings, initiated by the operator, and concession review hearings, initiated by a public authority. Three hydropower concession change processes are analysed: two modification hearings and one review hearing.

The concession modification hearings for Edensforsen hydropower station and Furudal dam are analysed in section 6.1. These hearings were initiated by the concession holder to seek permission for measures to, among other things, increase power production.

The concession review hearing on Hedeforsen hydropower station is analysed in section 6.2. This hearing was initiated by the Legal, Financial and Administrative Services Agency in order to create conditions for upstream and downstream fish migration at the hydropower station.

6.1 HYDROPOWER CONCESSION MODIFICATION

As is discussed above, the Swedish hydropower sector is undergoing important renovations due to the age of its existing installations. The majority of Swedish hydropower stations were built in 1950–1980, and several of the production units in hydropower stations are approaching the end of their life. Appendix 1 shows examples of the range of renovations that have been carried out to existing hydropower stations. Many of these renovations do not require a modification to the existing hydropower concession, since they do not affect the operating conditions stipulated in the concession. In some cases, however, there is an opportunity to increase efficiency gains by carrying out an extended renovation that includes changes which modify these conditions. Such changes include increasing the swallowing capacity of the turbines, as in the case of Edensforsen hydropower station, and increasing the head (i.e. the vertical distance the water travels) of the hydropower dam, of which Furudal dam provides an example.

6.1.1 Edensforsen hydropower station concession modification

In this case, the operator initiated a concession modification process for a turbine retrofit to increase the swallowing capacity of the hydropower station from 240 m^3/s to 340 m^3/s. This modification will create an increase in production capacity of 10 MW and an increase in power production of 11 GWh/year. The increased swallowing capacity makes more intense, short-term regulation possible. The application was sent to the Land and Environment Court in February 2009 and the legal process lasted until May 2011, when the

Extensive refurbishment and extended refurbishment

In this report, an **extensive refurbishment** is characterized as a renovation and update of the machinery in a hydropower station. This includes new and more efficient turbines, generators and other equipment. New equipment reduces the energy losses in the transformation of the kinetic energy of the flowing water into electrical energy, leading to increased electricity production without a change in the amount of water that is diverted into the hydropower station. An extensive refurbishment typically leads to an increase in energy production of roughly 5% of the total production of the hydropower station.

An **extended refurbishment**, as characterized in this report, often includes the measures that are taken as part of an extensive refurbishment, but in addition measures that require a modification of the operating conditions stipulated in the original hydropower concession. This can include increasing the swallowing capacity of the turbines, causing an increased diversion of water, changes that allow for an increased head of the dam and changes to the inflow of the water way. Depending on the measures and changes implemented, the increase in electricity production can be substantial – at times 20% or more. As the changes require modifications to the original concession, a concession modification hearing is needed to implement them.

If we put new equipment into an old power station, then we might get 5 per cent more production… if, on the other hand, we use a different technique, like constructing new waterways, maybe using more of the drop, then we can often get up to 20 per cent more production (Head of hydropower production)

Supreme Court decided not to give the LFASA leave to appeal the ruling of the LECA.

Before the court application, there was a consultation process consisting of a meeting with concerned stakeholders on 26 June 2008. Written documentation was also sent to the CAB at Västernorrland, the municipality of Sollefteå and the Swedish Board of Fisheries (SBF).

Including appendices, the application by the operator consisted of just over 40 pages: the main application of 13 pages, a technical account of 10 pages, an EIA of 7 pages and an account of the consultation of 4 pages, as well as maps and a stakeholder inventory.

The operator's main arguments were that the water operations have concessions regulating activity dating from 1948 and 1954, and that the increased swallowing capacity is the only modification to the granted concession. It was argued that the proposed modification would have a positive impact on the environment, and constitute good long term-management of resources since the increase in renewable energy production would reduce the use of fossil fuels. The use of oil-free bearings in the turbine was described as the use of the best available technology. The modification was deemed to lead to higher benefits than costs since the cost of refurbishing for additional electricity production was lower than the average value of the additional energy produced. It was acknowledged that the modification would lead to an increase in the period when the riverbed is dry below the hydropower station, but no negative effects on the environment were identified and it was argued that no modification to the permitted regulation of the hydropower station was involved. The EIA and technical account contained similar information and arguments to the application. The decision of the Västernorrland CAB was included in the account of the consultation. It stated that the changes did not constitute a significant environmental impact, which meant that the consultation process could be relatively limited in scope, as laid out in the SEC.

The main argument of the LFASA was that the scope of the application and the EIA had not been given a delimitation fit for its purpose, which is specified as a hearing that results in provisions in line with the general rules of consideration of the SEC for the entire water operations in question. The LFASA further argued that the lack of provisions to meet the demands of the WFD – an EQN of good ecological potential and no deterioration in the water bodies connected with the hydropower station – provided support for this argument and grounds for rejection of the application. In its opinion, the fact that the proposed modifications would result in a production increase for the operator and a concession which significantly increases the right to divert water into the hydropower station provided grounds for a comprehensive examination of the totality of the water operations in line with the SEC. As support for their interpretation of the legal precedent regarding the extent of examination, the LFASA cited the Boliden dam case (Court case number M 10104-04), arguing that the decision of the LECA supports this interpretation. The predominantly dry riverbed below the hydropower station has been classified as a water body with poor ecological status and the LFASA argued that the proposed modification would divert more water from the riverbed to the further detriment of its ecological status. The water in the dam above the station has been classified as heavily modified with an EQN of good ecological potential.

The LEC granted a permit for concession modification, allowing the refurbishments and increased swallowing capacity of the turbines, based on the information provided in the application and the EIA. The main reason for the ruling was that, according to water law, the legal force of the existing concession means that the original provisions can only become the focus of a hearing in a concession review initiated by a public authority. The court further argued that the legal arguments of the LECA in the Boliden dam case regarding the extent of examination cannot lead to a radical change in legal practice regarding the extent of examination in concession modification hearings to the detriment of the operators. Such a change would in the court's opinion not be consistent with the rule of law. The court made reference to the Lagfors dam case (Court case number M 5367-08), where the LECA came to the conclusion that applications to the court for water operations with the sole purpose of maintenance and improving dam safety could not result in an examination of the whole concession for the water operations in question. The court further found that the water operations would not lead to additional damage to the riverbed as a result of the additional period when it was dry, and that any demands that arise from the application of the WFD could be examined elsewhere. All in all, the water operations were considered environmentally positive because of the reduced risk of oil spills and the increase in the production of renewable electricity, leading to more benefits than costs from the proposed modification.

In its appeal to the LECA, the LFASA argued, in addition to the arguments put forward above, that an extensive examination of the regulated water operations is the main provision in the SEC when an application for a modification to operations is heard in court. The

LFASA further argued that if this constitutes a radical change to legal practice, it was brought about by the implementation of the SEC. The LFASA cited the ruling on Citybanan (Court case number M 8597-06) in support of its claim. This ruling established that it is the court that decides on the extent and scope of an application and EIA, to ensure that they are in line with the aims of the SEC. The LFASA also cited the EIA directive (EEC 85/337) in support of its argument. In its view, the question of the required extent of examination has no relation to the question of the legal force of the existing concession, since this question is only relevant at a later stage when possible adjustments to the provisions in the existing concession are discussed. The LFASA argued that the outcome of the appeal was important as guidance on the correct application of the law. During the process in the LECA, the LFASA complemented its petition to the court to reject the application with a secondary petition to send the case back to the LEC for a hearing on the water operations according to the general rules of consideration in the SEC. The LFASA argued that the requested modification to the swallowing capacity of the turbines constituted a new concession for water operations by the operator, which should be heard under the SEC. The case of Furudal dam was used to support this argument.

The operator contested the demand by the LFASA for an extensive examination in the LEC, arguing that it was clear from the SEC that limited examinations are possible for modifications to a concession for water operations. Chapter 11:2 of the SEC specifically mentions that modifications to and reparations of water facilities constitute water operations. The operator also stated that there are clear rules for concession reviews for amendments to granted concessions. In its correspondence with the LECA the operator specified that the proposed modification to the swallowing capacity would lead to 13 extra days in which the riverbed would be dry below the hydropower station. Regarding the possibility of new demands emanating from the WFD, the operator argued that the modifications sought did not alter the current status of the water bodies concerned or make it more difficult to achieve the required EQN. In addition, the operator argued that decisions related to the WFD were not relevant to the questions being heard in court. Two documents questioning the implementation of the WFD and the establishment of the EQN were provided by the operator. In relation to the secondary petition by the LFASA, the operator argued that the ruling on Furudal dam provides no guidance since the Furudal dam case constituted a modification to the water management provisions in the concession, which in the operator's view was not the case here. The operator made reference to the Billsta case (Court case number M 1848-08), where the LEC ruled in line with the operator's argument and the LECA rejected the appeal by the LFASA. The operator also presented the court with a calculation of characteristic stream flow conditions at the hydropower station provided by the Swedish Meteorological and Hydrological Institute (SMHI). Since times series data were only available from 2003, which was too limited to calculate characteristic stream flow conditions, the SMHI used data from other areas with comparable flow dynamics to provide a robust calculation. The result gave 31 m^3/s as the average low flow of the river. The operator later presented new information from the water regulating company in Ångermanälven providing characteristic flow from 1993–2009 to claim that the average low flow at Edensforsen was 19 m^3/s.

The LECA affirmed the ruling of the LEC and observed that the operator already had a concession for the existing water facilities and the water operations that were currently being pursued. The LECA agreed with the LEC that a concession review is required before the provisions granted in the original concession can become the focus of a hearing. The court concluded that the entry into force of the SEC had not affected the operator's pre-existing rights granted by the original concession. Nor did the court agree that the new requirements arising from the implementation of the WFD imposed any direct restrictions on the concessions granted to the operator. The LECA also stated that the operator had emphasized that no water management provisions were affected by the modifications sought in this case. In the light of the above, the LECA ruled that an expansion of the hearing to include the provisions regulated in the operator's granted concession was in this case not compatible with the rules of the SEC, its provisional regulations or legal precedent. Nor was it, according to the court, possible in the current case to prescribe protective measures that restrict the operator's rights granted in the original concessions. In the light of these considerations, the opinion of the Västernorrland CAB that the planned measures did not constitute a significant environmental impact, and the scope of the operator's EIA, were coherent and the LECA found no reason to reject the EIA. According to the LECA, the one remaining issue was whether it would be possible to prescribe protective measures in line with chapter two of the SEC, such as a minimum flow in the riverbed below the hydropower station as a share of the increased diversion of water resulting from the increased swallowing capacity of the station. It ruled that the environmental benefits of the very limited additional minimum flow, 0.25 m^3/s, that can be attributed to the additional production would be too limited in relation to their cost, and were therefore deemed unreasonable.

In the ruling, one Appeal Court Judge expressed a dissenting opinion, arguing that the scope of the EIA should be expanded to provide information on likely minimum flow to enable a decision on whether and at what level such a minimum flow would be reasonable.

In its rejected application for leave to appeal to the Supreme Court, the LFASA restated its arguments and in addition claimed that the LECA had built its judgment on the operator's erroneous statement that no water management provisions would be affected by the proposed modifications. In support of its claim, the LFASA attached the ruling on court case number M 12-99 – the latest ruling on the water management provisions of Edensforsen hydropower station, which establishes both the regulated head of the dam and the swallowing capacity of the turbines in the same paragraph. The LFASA argued that the proposed increase in the swallowing capacity of the turbines was therefore a modification to the water management provisions and should principally be treated as a new concession for water operations. As such, it should be heard according to the rules established in the SEC. The LFASA argued that legal precedent has developed according to this view, and cited the Furudal and Sunnerstaholm (Court case number M 8983-08) cases as illustrations of legal precedent.

Summary of the Edensforsen case in line with the analytical framework

B) The operator
i) The standard consultation process required by the SEC for the formulation of an EIA was carried out to inform concerned stakeholders. No out of court agreement was attempted or made prior to the concession modification process.

ii) The operator made reference to chapter 24:1 of the SEC to affirm the legal force of the original concessions granted in 1948 and 1954. The operator argued that the legal force of the original concession and chapter 11:2 on the rules of consideration of the SEC meant that a modification to a hydropower station constitutes water operations, and that only a limited examination of the proposed modifications was required. The operator also argued that the proposed modifications did not modify the granted regulation of the hydropower station since they did not constitute a modification of the water management provisions in the original concession. The operator cited legal precedent from the Billsta case (Court case number M 1848-08) to support its argument.

The operator argued that the proposed modifications did not alter the current status of the adjacent water bodies or make it more difficult to achieve the EQN set out in the WFD. The operator also argued that decisions related to the WFD were not relevant to the questions being heard in court. The operator stated that the proposed changes would have a positive effect on the environment since they will lead to an increase in the production of renewable energy. It also specified that the use of oil-free bearings in the renovated turbine constitutes best possible technology in line with chapter 2:3 of the SEC.

The operator argued that the proposed modification would lead to greater benefits than costs, which is required by chapter 11:6 of the SEC, since the cost of refurbishing the hydropower station was lower than the value of the increase in energy production that the modification will lead to.

iii) The main information provided was a 10-page technical description of the proposed modifications and renovation of the turbine and a 7-page EIA.

Calculations were provided by the operator from the SMHI, which specified that 31 m^3/s is the average low flow at the hydropower station. This number was later modified by the operator based on information from the water regulating company in Ångermanälven, which claimed that the average low flow is 19 m^3/s.

A) The LFASA
i) No agreements were made out of court or settlement attempted prior to the judicial concession modification process.

ii) The LFASA's main argument was that the EIA had not been given suitable scope to fulfil its purpose, which is a requirement according to chapter 6:3 of the SEC. The LFASA interpreted this purpose to be a hearing on the entire water operations in line with the provisions of the general rules of consideration of the SEC. This, combined with the lack of provisions in the application to meet the demands of the WFD for no deterioration and achievement of the EQN on good ecological potential in the adjacent water bodies, provided grounds for rejection of the application. The LFASA argued that the fact that the riverbed below the hydropower station would be dry for 13 extra days each year because of the modification, due to a reduction in the release of spill water, would be a deterioration in the status of the water body.

The LFASA further argued that the fact that the modification would result in a significant increase in production provided grounds for a comprehensive examination of the totality of the water operations in the light of the rules of consideration of the SEC. It argued that an extensive examination of regulated water

operations is the major consideration under the SEC when an application for a modification of operations is heard in court. The legal precedents created by the rulings on Citybanan (Court case number M 8597-06) and the Boliden dam case (Court case number M 10104-04) were cited.

In a secondary petition the LFASA requested that the water operations of the hydropower station should be examined in their totality according to the rules of consideration in the SEC, on the basis that the requested modification to the swallowing capacity of the turbines constituted a new concession for water operations. The legal precedents created by the ruling in the Furudal dam case and Sunnerstaholm case (Court case number M 8983-08) were cited.

The LFASA further argued that the claim that no water management provisions would be affected by the proposed modifications was erroneous, since both the regulated head of the dam and the regulated swallowing capacity of the station constitute water management provisions. To support this claim it cited the ruling on court case number M 12-99.

iii) The LFASA requested a comprehensive EIA that addressed the totality of water operations at the hydropower station.

C) The LEC and the LECA

i) The LEC ruled in favour of the operator and granted a concession modification in line with the information it had provided. The LEC specified that a concession modification hearing was permissible, according to the water law, and that the provisions granted in the original concession could only become the focus of a hearing as part of a concession review initiated by a public authority.

The court further found that the modified water operations would not lead to additional damage to the riverbed below the hydropower station and that the demands of the WFD could be tested elsewhere. In total, the modifications were considered environmentally positive due to the reduced risk of oil leakage from the turbine and the increase in production of renewable electricity, which will lead to more benefits than costs.

The LECA

The LECA reaffirmed the ruling of the LEC using similar arguments related to the legal force of the original concession, which in the opinion of the court was not changed by the entry into force of the SEC in 1999. The LECA also stated that the operator had emphasized that no water management provisions would be affected by the modifications sought in this case. According to the court, this fact made an extension of the examination to the provisions granted in the original concession incompatible with the rules of the SEC, its provisional regulations and legal precedent.

The LECA found no reason to reject the EIA presented by the operator. It argued that one aspect still to be resolved was whether any protective measures should be prescribed funded by a share of the increase in production, based on the increased diversion of water resulting from the modification. The LECA found that it would be unreasonable to do so given that the environmental benefits derived from a minimum flow that was based on a share of the increased production, 0.25 m^3/s, were too limited compared to the cost of such measures.

ii) The renovation costs and the legal costs arising from the court process in the LEC were paid by the operator. The LFASA had to cover its own costs arising from the process in the LECA.

6.1.2 Furudal dam concession modification

In this case, the operator initiated a concession modification process in connection with a variety of measures, including dam security measures and increasing the head of the dam by 0.3 m. The modification to the head was calculated to increase production by 0.26 GWh/year. The original concession stipulates a minimum flow of 0.02 m^3/s. The application was sent to the Land and Environment Court in May 2007 and the legal process lasted until May 2012, when the Supreme Court decided not to give the LFASA leave to appeal.

The consultation process prior to the court application consisted of three meetings on 10–28 November 2005. At these meetings, representatives of the operator explained the planned changes to representatives of the Dalarna CAB and the municipality of Rättsvik as well as other concerned stakeholders. Written documentation was also sent to the SBA, SEPA and the LFASA.

With appendices, the total application by the operator consisted of just over 120 pages: the main application (18 pages), a technical description (12 pages), the EIA (28 pages) and the account of the consultation (26 pages) as well as maps, technical drawings and a stakeholder inventory. The majority of the application dealt with dam security and other measures in relation to the dam. The account below focuses on the arguments in court related to the proposed efficiency increases at the hydropower station resulting from increasing the head of the hydropower dam.

In the application, the operator clearly specified that none of the proposed measures were dependent on each other and that the operator could decide not to carry out some of the measures specified in the application. The operator argued that the measures were permissible based on the cost-benefit calculation required in the SEC, since the costs of and damage related to the measures to increase the head had been calculated at 0.5 MSEK while the benefits from the increased electricity production were estimated to be 0.13 MSEK/year. The operator's calculations clearly showed that the benefits would be higher than the costs. The increased head was estimated to affect roughly 4 hectares of forest land, as well as a forest road in the area which the operator planned to raise. The operator stated that maintaining the original head would mean foregoing the increase in the efficiency of the hydropower station and the loss of the increase in the production of carbon dioxide free renewable energy. The EIA and technical description contained the same information as the application but in a greater degree of detail. It was stated in the EIA that the area in question is not part of any Natura 2000 area or nature reserve, and has not been identified as an area of national interest for nature conservation.

The decision of the Dalarna CAB was included in the account of the consultation. It stated that the modifications did not constitute a significant environmental impact, which meant that the consultation process could be relatively limited in scope, as laid out in the SEC.

The LFASA backed the arguments put forward by the SBF regarding the need for an increase in the minimum flow of the riverbed below the hydropower dam to the level of the average low flow of the river, 3 m^3/s, in the interests of fishing. This proposition is in line with the SBF's general opinion that the main riverbed from which water is diverted for hydropower production should have its minimum flow increased to the level of the current average low flow of the entire river.

The operator contested these demands, arguing that the requested modifications to the minimum flow had no legal basis in a hearing to deal with measures aimed at improving the safety of the hydropower dam. In addition, the relatively moderate increase in production that would result from the increase in the head would not provide room for any significant protective measures. It was argued that an increase in the minimum flow set at as little as 0.1 m^3/s would eliminate the benefits of the increase in production. The operator also indicated that it reserved the right not to make use of any concession granting an increased head of the dam if such modifications were dependent on an increased minimum flow in line with the demands made by the LFASA and the SBF.

The LEC granted a permit for concession modification allowing the dam safety measures and an increase in the head of the hydropower dam, based on the information provided in the application and the EIA. The court argued that the main part of the measures that the operator requested were aimed at improving dam safety and did not influence water management provisions or the water flow of the main stream below the dam. The LEC stated that the request for an increase in the size of the head of 0.3 m was separate from the dam safety measures. The LEC, however, found no reason to adjust the current provision for a minimum flow of 0.02 m^3/s, since the proposed modification led to only a marginal increase in the production of energy.

In its appeal to the LECA, the LFASA argued that provisions for a suitable minimum flow in the main river bed below the hydropower dam were absent from the existing concession, which resulted in the water operations causing damage to the natural environment in a way that was not compatible with the SEC. The LFASA also argued that the application to the court was inadequate in scope and that it was for the LECA to judge whether the scope of the application was appropriate. In the view of the LFASA, it was not possible to separate the totality of the water operations on the site from the requested modifications. The hearing and any protective measures should be decided based on the totality of the water operations at the Furudal dam. Taking account of the totality of these operations, the request for a minimum flow of 3 m^3/s should, in their view, have been approved by the court. In this way, the general rules of consideration in the SEC would have been fulfilled according to the LFASA.

In its response to the LECA, the operator, in addition to the arguments it had already raised, highlighted the fact that the question of minimum flow had been decided and given legal force in the concession granted in 1977. The operator also noted that the main reason for the concession modification was to implement dam safety measures and stressed that the argument by the LFASA that the entire water operation should be examined in court had no basis in legislation or legal precedent. The operator argued that a public authority would have to initiate a concession review process to achieve the proposed adjustment to the current level of minimum flow. The operator defended its right to implement parts of a new concession, such as dam safety measures, while choosing not to alter the head of the dam if the LFASA's petition for an increased minimum flow was successful. Furthermore, the operator contested the reference made

by the SBF to the LECA ruling on Hamrångeån (Court case number M 192-03), arguing it had no relevance to the current hearing since the case was about the establishment of new hydropower stations, not, as in this case, a hydropower dam with a valid concession. The operator also refuted the argument by the LFASA that chapter 16 of the SEC provides legal scope to attach provisions not requested by the operator to a concession modification hearing. The operator further argued that it should be in the general interest, including that of the LFASA, for measures to improve dam safety to allow for increases in the efficiency of renewable energy production, leading to lower CO2 emissions and helping to achieve greenhouse gas reduction targets.

In its correspondence with the LECA, the LFASA refuted the argument made by the operator that the legal force of the original concession was an impediment to achieving the provisions it demanded. In its view, the purpose of a hearing according to the SEC is to follow the general rules of consideration in order to achieved sustainable development generally. The LFASA also refuted the operator's right to only implement part of any new concession granted by the LECA. The LFASA argued that the provisions in chapter 16, allowing for a concession modification hearing for environmentally hazardous activities, and chapter 24, regulating reasons for a concession review, signify that the legal force of the original concession does not constitute a barrier to the proposed provisions. The LFASA pointed out that the operator had not provided any reasons why or evidence that the minimum flow requested by the LFASA was unreasonable, in line with chapter 2 of the SEC. The LFASA also pointed out that while a limited examination might be possible of purely safety improvement measures, the application went beyond safety improvement measures and a limited hearing for a concession modification was therefore not permissible. It was further argued that the requested minimum flow was necessary to meet the general rules of consideration of the SEC. The SBF supported the petition by the LFASA and argued that the operator should not be able to take advantage of the fact that environmental demands were limited at the time the original concession was granted. It argued that the ruling in the Hamrångeån case (Court case number M 192-03) supports this view.

The LECA ruled that the case should be remitted to the LEC for completion of the EIA and to hear arguments on the possible minimum flow provisions that could result from the new regulated head of the hydropower dam. The LECA found that the new head should in principle be regarded as a new concession for water operations and therefore be treated according to the provisions of the SEC. Specifically, the question of what level of protective measures, such as the level of minimum flow, would be reasonable according to chapter 2 of the SEC should be tested in court. The LECA specified that this hearing would not affect the legal strength of the original concession since the operator had the option to fall back on the original concession if it did not accept the provisions of the new concession. The LECA also ruled that the EIA did not contain all the necessary information, since for example it did not include a cost-benefit analysis of the requested measures and did not investigate the effect on fishing interests or the loss of electricity production resulting from a new minimum flow in line with the LFASA's petition. The court ruled that the EIA should therefore be expanded and the LEC should as a first instance decide what possible provisions on minimum flow should be implemented in the light of the new water management provisions.

The LEC, as a result of the ruling by the LECA, instructed the operator to complement its application with: information on the current and intended hydrological regulation of the dam; information in the EIA on the impact on the public interest of the new head and any possible environmental protection measures such as minimum flow; the information required to make a judgment on whether the protective measures would be reasonable, in line with chapter 2 of the SEC; and details on whether any EQNs have been issued for the water bodies, and how they would be affected by the increase in the head of the dam.

The operator, in reaction to the ruling by the LECA, asked for its petition for a new head to be revoked in order to avoid continuing legal and other costs, which in its view would not be recouped by the possible benefits from the increase in energy production. This petition, however, was contested by the LFASA which argued that an operator cannot revoke its petition if there has been a ruling in the case and the LFASA is not in agreement. As a result of the LECA ruling on the Edensforsen case,the operator decided to continue with the hearing on the possible provisions that could be prescribed as a result of a new head. The EIA supplement concluded that the new head could lead to temporary improvements for younger perch and roach and have a limited negative effect on the spawning and rearing habitat for perch, roach and pike. It argued that it was unlikely that a fish passage at Furudal would provide any benefits, since there are no suitable spawning grounds for salmon trout and grayling upstream of the Furudal dam. The EIA also concluded that a minimum flow of 3 m^3/s would be required to recreate a habitat suitable for grayling and salmon trout in the riverbed below the dam, and that roe and fry from these species would probably have to be planted in order to re-establish them.

Based on the EIA and with reference to the conclusions from the Edenfors case, the operator petitioned for the granting of a new head for the dam not to be linked to new provisions on minimum flow or the establishment of a fish passage. In its view, a minimum flow requirement of 3 m^3/s was unreasonable in the light of the limited increase in efficiency that the increased head of the dam would create. A minimum flow of more than 0.1 m^3/s would consume the increase in efficiency gained from the modification and such a limited minimum flow would not lead to any benefits for the riverbed below the dam. The operator argued that the Edensforsen case, which dealt with an increase in efficiency at a hydropower station due to an increased diversion of water, was comparable to the current case, which would augment energy production. The operator also stated that the water in the dam had not been classified as a water body according to the RBA, and that the increased head would not lead to a deterioration in the status of the dam water.

The LFASA responded that the operator had misunderstood the ruling by the LECA, since the new dam head should be treated as a new concession for water operations and not as a modification to the existing concession. The LFASA argued that if the LECA had been of the opinion that the ruling was for a concession modification there would have been no basis to remit the case to the LEC. In its view, the case revolved around what level of protective measures is reasonable according to chapter 2 of the SEC, in the light of the totality of the granted dam head at Furudal. The LFASA argued that the EIA did not contain the necessary information to decide on the need, size and reasonableness of minimum flow provisions. The LFASA also argued that the EIA should include information on whether the water operations meet the EQN set by the RBAs. The riverbed below the dam is a water body with moderate ecological status but the requirement is for good ecological status.[25] Based on this, the LFASA demanded that the court engage in a technical examination on site to observe the effects of flows of 3 m^3/s, 1.5 m^3/s and 0.5 m^3/s. On the comparison with the Edenfors case, the LFASA reminded the court that the concession was not permission to increase the head by 0.3 m but a new concession for hydropower production using the totality of the hydropower dam head. The LFASA also stated that the Edensforsen ruling had not become legally binding because the ruling had been appealed by the LFASA.

The Dalarna CAB argued that a minimum flow of 1.5 m^3/s or 3 m^3/s would be desirable in the riverbed below the dam. If that minimum flow were not granted by the court, the CAB argued that at least 0.1 m^3/s should be released to improve the conditions for fish and fauna on the riverbed.

The operator refuted the demand for on-site observation of minimum flows, arguing that all the actors were in agreement that there was a need for at least 3 m^3/s minimum flow for significant ecological benefits to accrue to the riverbed below the dam, which made on-site observations of the suggested flows unnecessary.

The LEC decided that as a consequence of the new hydropower dam head, a minimum flow of 0.1 m^3/s should be released into the river below the dam. As a basis for its decision, the court used the calculations provided by the operator which showed that at a minimum flow of 0.15 m^3/s, the economic benefits from the increase in energy production arising from an increase in the size of the head compared to the current head would be eliminated. The LEC therefore made a judgment on what level of protective measures was reasonable as a share of the increase in efficiency at the hydropower station arising from the new head. The court also referred to the secondary suggestion by the CAB that a minimum flow of 0.1 m^3/s would improve the conditions for fish and fauna on the riverbed as basis for its decision.

In its application for leave to appeal to the LECA, the LFASA asked the LECA to change the minimum flow provision from 0.1 m^3/s to 3 m^3/s. The LFASA argued that there was reason to question the correctness of the LEC ruling since the court judgment on reasonable protective measures was based on the gains in production from the increased head and not on the production from the totality of the hydropower head of the dam. Reference was made to the first LECA ruling, which stated that the new head of the hydropower dam should be regarded as a new concession for water operations and therefore subject to the general rules of consideration in the SEC. The LFASA also provided calculations showing that a minimum flow of 3 m^3/s represented 16.9% of the total energy production at the hydropower station, which in its opinion was a reasonable share.

The LECA decided not to give leave to appeal.

The LFASA appealed to the Supreme Court, arguing that the case was of significance for the application of the law regarding whether a judgment on reasonable protective measures can be restricted to just part of the water operations in a concession. The LFASA argued that it was of the highest importance that the rules of the SEC should have the intended effect in environmental hearings and result in environmentally motivated provisions regulating water operations. The LFASA

25 Oreälven (Water body SE678594-146586, www.viss.lst.se)

argued that the legal force of the operator's original concession was not infringed since the new, regulated head of the dam represented a new concession for water operations which the operator could choose whether to make use of. The LFASA asked for clarification of the correct application of chapter 2 of the SEC, regarding the reasonability of protective measures, to modifications that increase the efficiency of a hydropower station which principally represent a new concession for water operations. The LFASA argued that chapter 2 of the SEC should also apply to modifications to increase the amount of water diverted to the hydropower turbines. The LFASA stated that the protective measures decided in the case, a minimum flow of 0.1 m^3/s, represent only 3% of the minimum flow that both the operator and the LFASA specified was required for significant ecological benefits to accrue to the riverbed. It argued that if this becomes standard practice, the result would be that measures to prevent damage to the environment will never be implemented in such cases.

Summary of the Furudal case in line with the analytical framework
First round: up to the LECA remitting the case to the LEC

B) The operator
i) The standard consultation process required by law for the formulation of an EIA was carried out to inform concerned stakeholders. No out-of-court agreements were struck nor attempted.

ii) The operator argued that the proposals to modify the head leading to an increase in production were permissible, based on the cost-benefit analysis required by the SEC in chapter 11:6, since the costs and environmental damage were calculated at 0.5 MSEK while the value of the increase in electricity production would be 0.13 MSEK/year. A decision not to increase the head would lead to the loss of the increase in the production of carbon dioxide free renewable energy. The operator also argued that the proposed change would be in the general interest since it increased the efficiency of renewable energy production, which helps to reach Sweden's climate change-related emissions reduction targets.

The operator argued that the question of minimum flow had been decided and given legal force in the original concession dating from 1977, and that any requests to modify the minimum flow had no legal basis in a hearing dealing with measures to improve dam safety. It stated that the argument that the whole water operation should be tested in court, based on chapter 16 of the SEC, had no basis in legislation or legal precedent. It argued that a concession review hearing would need to be initiated to discuss the changes to the minimum flow requested by the LFASA.

The operator also argued that the moderate increase in production arising from the modification would not provide room for any significant protective measures, since a minimum flow of as little as 0.1 m^3/s would eliminate the increase in value derived from the increase in production.

iii) Various paragraphs of the EIA dealt with the proposed increase in the size of the head of the dam and its effects. In total these added up to around two pages of the EIA.

A) The LFASA
i) No out-of-court agreements were made or negotiated prior to the judicial concession modification process.

ii) The LFASA argued that provisions for a suitable minimum flow in the main river below the hydropower station were absent, which caused damage to the natural environment that was not compatible with the SEC. It further argued that it was impossible to separate the totality of water operations from the requested modifications and that therefore the application to the court had been given an unsuitable scope. The totality of the water operations of the hydropower stations should be the focus of the hearing and, with the totality of water operations in view, a minimum flow of 3 m^3/s would meet the general rules of consideration of the SEC.

The LFASA refuted the argument that the legal force of the original concession prevented consideration of the provisions requested by the LFASA, and argued that the purpose of a hearing according to the SEC is to apply the general rules of consideration in the code and sustainable development generally. The LFASA also made reference to chapters 16 and 24 to argue that the legal force of the original concession did not constitute a barrier to the proposed provisions, and that the application amounted to more than dam safety improvement measures.

iii) The LFASA pointed out that the operator had not provided any evidence to demonstrate that the request for a minimum flow of 3 m^3/s was unreasonable.

C) The LEC and the LECA
i) The LEC ruled in favour of the operator and granted a concession modification in line with the information it provided. The court specified that the requested increase in the size of the head of the dam was a separate request to the dam safety measures but, due to the marginal increase in energy production that would result from the

modification, found no reason to adjust the minimum flow of 0.02 m^3/s set out in the original concession.

The LECA ruled that the case should be remitted to the LEC for completion of an EIA and a hearing on the possible minimum flow provisions that could result from the new regulated head of the dam. The court found that the new head should be regarded as a new concession for water operations and as such should have reasonable protective measures, including minimum flow provisions, tested in court in line with chapter 2 of the SEC. The court also found that the legal force of the original concession had not been affected, since the operator still had the option of reverting to the conditions granted in the original concession if it did not want to accept the conditions attached to the new one.

The LEC, as a result of the ruling by the LECA, instructed the operator to complete the application and carry out an EIA with information on possible environmental protection measures, such as a minimum flow, information to allow a judgment on the reasonability of the protective measures, and whether there was an EQN issued for the water bodies in question and how this would be affected by the increased head of the dam.

Second round: the LEC hears the case after it has been remitted by the LECA

B) The operator

ii) The operator initially requested that the petition for a new dam head be revoked in order to avoid continuing with the legal process. When this was contested by the LFASA, and as a result of the ruling in the Edensforsen case, the operator decided to continue with the petition. It was argued that the Edensforsen case was comparable to this case and that the proposed minimum flow of 3 m^3/s was unreasonable in the light of the limited efficiency gains obtained from the increase in the head of the hydropower dam. It was also argued that the water body that supplied the dam had not been classified according to the WFD, and that the proposals would not lead to a deterioration in the status of the dam water.

iii) A complementary EIA of 7 pages was provided by the operator. The EIA concluded that a fish passage at Furudals hydropower dam would not create any benefits since there are no suitable habitats above the dam. The EIA also concluded that to recreate a habitat suitable for grayling and salmon trout in the riverbed below the dam, a minimum flow of 3 m^3/s would be required, in addition to planting roe and fry from these species in an attempt to re-establish them.

A) The LFASA

ii) The LFASA argued that the operator had misunderstood the basis for remitting the case back to the LECA, since the new dam head should be treated as a new concession for hydropower production and not as a modification to the existing concession. The level of protective measures that are reasonable in line with chapter 2 of the SEC should therefore be decided based on the totality of water operations and the total head granted at Furudal. In relation to the Edensfors case, the LFASA argued that the ruling had not become legally binding since it was being appealed by the LFASA. The LFASA also pointed out that the riverbed below the station had moderate ecological status and that it was a requirement of the WFD for it to have good ecological status.

iii) The LFASA asked for the EIA to be supplemented by further information to enable the court to judge whether the water operations meet the EQNs decided by the RBA, in line with the requirements of the WFD. The LFASA also requested an on-site technical examination to observe the effects of different levels of flow on the riverbed.

C) The LEC

i) The LEC ruled that a minimum flow of 0.1 m^3/s was reasonable and in line with chapter 2 of the SEC, based on the economic gains from the increase in the head of the hydropower dam. The court decided this based on the level of protective measures that were reasonable in the light of the increase in the dam head and not the totality of the dam head.

A) The LFASA

The LFASA made an application to appeal the ruling to the LECA and the Supreme Court, arguing that there was reason to question the correctness of the LEC ruling since the LEC decided the extent of reasonable protective measures based on the gains in energy production from the increased head and not the totality of hydropower production at Furudal. It emphasized that the LECA ruling stated that the new head of the hydropower dam should be regarded as a new concession for water operations and therefore subject to the general rules of consideration in chapter 2 of the SEC. The LFASA provided a calculation showing that 3 m^3/s represented 16.9% of the total energy production of the hydropower station, which in its opinion was a reasonable share. The LFASA also argued that the case was significant for the general application of the law on whether a judgment on reasonable protective measures can be restricted to apply to only part of the water operation in a granted concession.

The LFASA requested that the correct application of chapter 2 on the reasonability of protective measures should be made clear with regard to modifications that increase the efficiency of a hydropower station and that represent a new concession for water operations. The LFASA argued that this should also apply to measures that increase the diversion of water to hydropower turbines.

C) *The LECA and the Supreme Court* both denied the LFASA leave to appeal, which means the second LEC ruling has become legally binding.

6.2 HYDROPOWER CONCESSION REVIEW

Hedefors hydropower station was chosen as a case study to illustrate the concession review process because it is in an area of high natural value as identified by Swedish and EU environmental legislation, and because the court process was initiated without prior agreement between the parties involved. After the LEC rejected the proposed review, the parties reached an out-of-court settlement. This made a review possible after a relatively swift hearing in the LECA. As is noted above, prior agreement is one of the elements identified by the public authorities as necessary for an effective concession review process (Bothnian Sea 2008:16, LFSA 2005). The process for reaching such an agreement, and its terms, are therefore relevant to this study.

6.2.1 Hedefors hydropower station concession review

The LFASA initiated a concession review of Hedenfors hydropower station in order to create conditions suitable for upstream and downstream fish migration. The application sought to oblige the operator to construct a 525-metre long fish bypass channel with minimum flow requirements,[26] and to install a new fish weir, with reduced bar spacing, at the hydropower intake. The construction of a new ice spillway and plunge pool also formed part of the application. These modifications would lead to a decrease in energy production of approximately 1.14 GWh/year. The original concession dating from 1947 included a dormant condition that the operator would be obliged to install a fish weir if the SBF deemed it necessary. The application was sent to the Land and Environment Court in May 2009 and the legal process lasted until November 2011, when the Land and Environment Court of Appeal ruled in favour of the proposed concession review.

Before the application for a concession review, there had been an extensive consultation process with the actors involved as part of the Säveå project, which was initiated by the Västra Götaland CAB with the aim of improving the habitat for salmon, trout, eel and other migratory fish in the river (Säveåprojektet 2012). The project included plans to build fish passages at the Jonsered and Hedefors hydropower stations on the Säveå river. The first background reports on the Säveå project date back to 2004, when a project group was set up with representatives from the LFASA, the SBF, concerned municipalities, the hydropower operator, and nature conservation and sports fishing organizations in an attempt to find common ground and agreement.

One of the initial questions the group sought to answer was whether salmon had historically been able to pass Hedefors, or whether it had been a natural barrier for fish migration. A representative from the CAB and a fisheries consultant carried out research on this question, analysing photographs, historical maps and accounts from the area, and carrying out interviews with people living in the vicinity. The final, 72-page, report concluded that it is likely that salmon had been able to pass Hedefors historically (Länsstyrelsen 2005:60). The question of the technical feasibility and safety of building a fish passage in an area with such a steep slope was another important question discussed in the group. The first detailed ground stability investigation dates back to April 2007. It provides information related to the stability of the slope and concludes that the stability of the slope and the planned bypass channel are satisfactory.

The main question on which agreement could not be reached in the group was the amount of compensation that the operator should receive as a result of the review. In the negotiations, the LFASA and the other state agencies involved offered to cover the construction costs of the bypass channel and the new fish weir. The construction costs of the ice spillway, a safety improvement measure, would be shared equally between the operator and the state. For loss of production exceeding 5% of the value of total production, the LFASA and the other state agencies offered MSEK 5.1 in compensation to the operator. This offer was based on a calculation of the value of the production loss resulting from the review. The operator based its estimate of the value of the production loss on a different calculation, requesting compensation amounting to MSEK 9.99 for loss of production exceeding 5% of total production value, and MSEK

26 The application requests a stipulated minimum flow to the bypass channel of 2.3 m^3/s between 1 April and 15 November and 0.5 m^3/s for the rest of the year. Should the flow to the hydropower station at any point be less than the required minimum flow, the complete flow should be released into the bypass channel.

1.89 in addition as compensation for the increased maintenance costs resulting from the installation of the new fish weir. In total the operator therefore asked for MSEK 11.88 in compensation from the review. It was not possible to reach agreement on the level of compensation for production loss in the negotiations and the application for a review went to court without prior agreement between the LFASA and the operator.

The application by the LFASA consisted of just over 150 pages, including appendices. The various appendices were between one and 11 pages long, and included maps of the area, hydrological information on the river flow, an account of the benefits from the proposed review, a statement of foreseeable construction costs and a calculation of the loss of production in energy and monetary terms. The longer appendices were the original hydropower concession (24 pages), a technical description of the proposed fish passage (31 pages) and a detailed report on the ground stability investigation (66 pages).

The environmental value of the Säveå river was described in the application as "nationally valuable water" in line with EQO 8. The larger part of the river downstream from the hydropower station is a Natura 2000 area, according to the Habitats Directive, to a large extent due to the presence of a genetically unique salmon population. The proposed measures are deemed crucial for the long term survival of the salmon population, and to strengthen the eel population in the river by increasing the available spawning grounds from 6 to 11 hectares. The measures are therefore deemed important for the restoration and conservation of a river identified as nationally valuable and with rich fauna.

The fish bypass channel was planned on a steep slope where there would be a risk of landslides. A detailed ground stability investigation was carried out by an external consultant in line with the guidelines established by the national commission on slope stability (IVA 1995). The report, which formed part of the application, concluded that the stability of the slope and the planned bypass channel were satisfactory. The report stated that sheeting or L-shaped concrete support might be necessary to prevent hydraulic bottom heave at the lower part of the bypass channel and for some stretches of the planned channel. The report further stated that the issue of additional support structures should be addressed in the detailed planning of the bypass channel, there should be a work schedule for the building and excavations, and a technical memorandum should be produced describing the geotechnical and geohydrological conditions on site.

The technical description of the proposed fish passage provided details of the design and detailed technical maps of its construction and functioning, as well as details of the new weir and the ice spillway. The account dealt with many parts of the construction phase but made clear that various aspects, such as the excavation works, the handling of debris and drainage, would need to be decided and described as part of the detailed planning work on the construction. The costs of building the fish passage, a new fish weir and an ice spillway were calculated at MSEK 8.7, of which the LFASA on behalf of the Swedish state agreed to pay half.

The appendix contained a new consultancy report, which calculated the value of the loss of production eligible for compensation at MSEK 1.49. Various calculations were needed to arrive at this value: the actual production loss in KWh and the share of this which exceeds 5% of the total value of production, multiplied by a reasonable estimate of future energy prices and an appropriate rate of return on capital. As is noted above, it is the value of the production loss exceeding five percent of the total value of production that, according to law, must be compensated for by the state in a review hearing. The total energy loss as a result of the review was calculated at 1.14 GWh/year. The gross value of the electricity production was estimated to be 0.35 SEK/KWh in winter and 0.30 SEK/KWh in summer. The net value, which is the price after deducting production costs, is used as the basis for the calculation. This was estimated at half the gross value. The appropriate rate of return on capital was set at 6%. After adding the value of renewable electricity certificates, the proposed compensation to the operator was rounded up to MSEK 1.75. Using the same principles, the total value of the production loss can be calculated at MSEK 3.5.

The operator, in its reply to the court, disputed the review petition and argued that there was insufficient information provided in the application to enable the court to make a judgment. The operator disputed the claim that salmon had historically been able to pass Hedefors, and argued that the application was vague and unclear in a number of ways. It asserted that it was not possible to judge the reasonableness of the proposed measures based on the information provided. In order to be able to judge whether the proposed measures were reasonable, the operator stated that it would be necessary to specify and provide further details on the costs and benefits of the proposed measures and the planned execution of the construction of the fish passage and the fish weir. The issues of how the temporary cofferdam

was to be constructed, the required extent of support structures, and soil removal management during construction were three specific areas where the operator commented on the lack of information. Some modifications made by the LFASA to the costs of the planned measures were used as evidence of the need to improve the information on which to make a decision. In addition, it argued that the lack of knowledge regarding the risk of landslides was obvious and that further examination of ground water levels and pore pressure should be initiated, and data collected over enough time to be representative. A four-page technical memorandum was provided by the operator, which concluded that the proposed tracing of the fish passage and the proposed construction of the cofferdam were not feasible.

The operator further argued that the costs of the construction of the fish weir were unreasonable and that in order to be able to assess whether the proposed measures were allowable, the costs of all the measures and the total loss of production arising from the review would have to be included in the assessment. The relationship between the proposed ice spillway and the proposed improvements for fish was also questioned. The operator argued that the effects on the environment of the removal of material in the river as part of the construction of the fish passage should be evaluated.

The operator did not accept the calculation and offer of compensation made by the LFASA. It argued that the value of the electricity produced, the rate of return on capital and the total value of production had not been calculated according to accepted practice, citing the LEC ruling on the Åmot hydropower station (Court case number M 1119-08), and were therefore incorrect. It argued that the value of the production loss that should be compensated for was MSEK 7.6. The operator provided its own calculations of the total cost of the proposed measures, including production loss, maintenance costs and biodiversity improvement measures, arising from the review, which it argued was MSEK 46.3.

The LFASA, in its reply, stressed that the Swedish Environment Protection Agency, the SBF and the Västra Götaland CAB all supported the review application and that SEPA had stressed the national importance of the proposed project. The LFASA argued that the rationale and motivation for the proposed review had been further strengthened by Sweden's commitments arising from the passage of the Eel Regulation, the adoption of the Swedish national eel management plan and the entry into force of the WFD. It stressed that the Säveå river is an important breeding ground for both eel and a special type of Atlantic salmon, two species which are red listed in the Habitats Directive. In addition, the ecological status of the water body adjacent to the hydropower station[27] is classified as moderate due, among other things, to the fact that salmon are not present upstream of Hedefors. The required EQN, which should be reached by 2021 at the latest, is good ecological status.

The LFASA replied to the different questions and demands raised by the operator and, with reference to the available investigations, argued that they did not constitute an obstacle to a judgment in favour of the review petition. The LFASA specifically remarked that it is normal for some technical questions, such as the extent of the supporting structures, to be decided during the detailed planning of the project, and that this in no way could be used as an argument that there is not enough information about the area to agree the proposed changes. On the calculation of the value of production lost over 5%, the LFASA restated the arguments made so far. On the costs of the proposed measures, the LFASA argued that a comprehensive calculation had arrived at a cost of MSEK 10 for the fish passage and fish weir, and that the state would cover half the actual cost of their construction.

The LFASA also endorsed the separate application made by the SBF, that the fish weir be installed primarily as a result of the activation of the dormant condition in the original concession from 1947, and that the fish weir be installed as part of the review application put forward by the LFASA as a secondary option. The exact procedure that the SBF should follow to activate this dormant condition was not specified in the original concession, but the LFASA argued that it should be done and decided as part of the ongoing review process.

The LEC rejected the petition presented by the SBF that the operator should be obliged to install new fish weirs and the petition by the LFASA for a concession review. The court argued that the SBF did not have the authority to bring an independent action before the court, and that the petition should therefore be dismissed. The court was of the opinion that the application by the LFASA contained so many flaws that it could not be approved.

The court concluded that the lack of a detailed suggestion for the route of the fish bypass channel, the

27 Säveån - between Aspen and Sävelången (Water body SE 678594-146586, www.viss.lst.se)

lack of a detailed technical description of the works, including soil removal, and the lack of an account of the landslide risks during construction and of possible maintenance requirements made it impossible for the court, and therefore also the operator, to judge whether the costs the LFASA had estimated for its construction were reasonable.

The court also ruled that the petition for review should not be granted based on the argument that the benefits of the proposed fish bypass channel would be greater than the costs, including any possible negative effects on EQO, since this would lead to unspecific and therefore possibly excessive demands on the operator with regard to the execution of the measures and the creation of future liability to third parts.

The court reasoned that in order to decide whether the proposed measures were reasonable and allowable, future maintenance costs and possible liability for damage due to the new construction, along with the actual construction costs should be included in addition to the cost of the production losses arising from the review. The court further specified that it is the applicant that must provide the required documentation illustrating the benefits and permissibility of the proposed measures as well as the costs they will lead to, and that the background material required for these purposes will depend on the circumstances of the specific case.

The court ruled that the material provided showed that salmon had been able to pass Hedefors historically and that there was an important general interest, albeit one that was difficult to value in monetary terms, in favour of the construction of a fish bypass at Hedefors. This interest was opposed to the interests of the operator to produce as much electricity as possible, and to have a clear idea of the extent of its obligations and of the costs of these obligations.

After an on-site inspection with reference to the geotechnical investigation, the court decided that the construction and maintenance of the fish bypass channel involved technical difficulties and risks. These, in the opinion of the court, put great demands on the background material that formed the basis for the application, in particular the account providing details of how the construction works are to be realized technically.

The court shared the view of the LFASA that according to the SEC, the responsibility for the remedial measures lies with the operator, and that the offer by the state to pay half the costs of the weir and the bypass channel constituted a departure from the rules of the SEC. This, however, in the eyes of the court, has no bearing on the demand that the supporting material must be of such a character that the court can make an accurate judgment on the application, including the consequences of any new conditions this would impose on the operator.

In its appeal to the LECA, the LFASA emphasized the high ecological value of the river, and the relevant directives and environmental goals described above that speak in favour of a review of the concession for Hedefors hydropower station. The LFASA also argued that the installation of a new fish weir should be executed as part of the activation of dormant conditions in the original concession, as the SBF had petitioned the LEC. Legal precedent was cited from other cases where this has been done (e.g. cases VA 29/96 and M 2460-08). It argued this because the SBF has no authority to directly request the operator to install a fish weir.

The LFASA stressed that a total of MSEK 0.7 had been spent on the technical investigations into slope stability and on project planning, and that these show that there are no technical obstacles to constructing the planned fish bypass channel. In relation to the reasonableness and allowability of the planned fish bypass channel in the light of its construction costs, the LFASA argued that it had been established by the LEC that there was a high level of public interest in the bypass channel being constructed. This, in the eyes of the LFASA, should warrant the approval of the proposed measures even if the cost estimates of the operator – of MSEK 15, of which the state would cover half – were true.

The total cost of both the fish weir and the bypass channel was estimated at MSEK 10.4 by the LFASA. It argued that even if the costs for the two measures turned out to be double this figure, it would still be reasonable given the relative costs and benefits of the project. The LFASA stressed that the proposed measures were required to achieve good ecological status in line with the WFD, providing a further incentive for the proposed measures even if they come at a high cost. The LFASA also pointed out that concession review is the main tool available for public authorities to remove barriers to fish migration in rivers in order to live up to Sweden's commitments arising out of the WFD and the Eel regulation. It also argued that it is a crucial tool for accomplishing the EQO on flourishing lakes and streams and a rich diversity of plant and animal life. In the light of the above, it argued that it was important to receive

guidance and a ruling from the LECA on the questions raised in the case.

Further technical assessments were commissioned by LFASA to review the existing technical reports on the bypass channel. These noted that the degree of technical description was considerably higher than is usual for such a court case. They recognized that a high level of detail is required to obtain an accurate estimate of the cost of measures, but argued that some detail should be left to the operator to decide on during construction. The reports acknowledged that the proposed measures were sizable and that the environmental consequences should have been better described. The technical assessments suggested that the application should be complemented by an account of the planned execution of the construction works on the bypass channel. This should include information on how the construction machinery could access the site safely and whether the spillways would have sufficient discharge capacity during the construction phase.

Two more consultancy reports were commissioned: a supplementary account of the proposed construction work on the bypass channel and a detailed estimate of the cost of the installation of the fish weir, excluding the construction of a steel cofferdam. The reports estimated that MSEK 10.3–12.7 would be needed for the two measures. The report on the construction of the bypass channel provided a detailed plan but explained that details still needed to be resolved before work could start on site.

The Swedish Geotechnical Institute (SGI) also participated in the appeal, both as a government authority and as a consultant hired by the operator to investigate the geotechnical material provided. The SGI judged the proposed measures technically possible, but argued that additional sensitivity analysis would be required as well as the establishment of a programme of control prior to starting work.

During the appeal process, the parties negotiated an out-of-court agreement. A primary explanation for this, for the LFASA and the other participating agencies, was that part of the funding from the EU, SEPA and the Swedish Society for Nature Conservation to pay compensation for production losses to the operator and for the construction of the proposed measures arising from the review was only available until 2013. There was a clear risk that the litigation might continue throughout 2012 and even into 2013, leaving too little time to carry out the measures. The calculation of the cost of production loss of the Åmot ruling, cited by the operator, had at this time also been confirmed by the LECA (Court case number 5404-09). This provided the basis for the LFASA and other state agencies to offer higher compensation for the production loss to the operator.

A contract was established between the LFASA, the Västa Götaland CAB and SEPA, on the one hand, and the operator, on the other. The contract stipulated that the operator would give its consent to the proposed review in line with the technical material provided. The operator would also assist with the execution of the measures proposed in the review and the planned creation of a nature reserve in the area. In exchange, all the construction costs arising from these measures, excluding the cost of the ice spillway and the plunge pool which are safety improvement measures, would be financed from various public sources – including funding from the SEPA and EU funds. It was agreed that the ice spillway and the plunge pool would be financed equally by the operator and public sources. In addition, the state agreed to compensate the operator to the sum of MSEK 7.35 for production losses over and above 5% of the value of the total production of the station and provide additional compensation of approximately MSEK 0.3 for the loss of renewable electricity certificates.

In revised estimates of the cost of the necessary construction, MSEK 6.3 was allocated for the construction of the fish weir and MSEK 7.85 for the bypass channel. In addition, MSEK 0.88 was set aside for project management.

After the agreement was signed by the parties, the technical concerns raised by the operator and its technical consultants were resolved in a dialogue with the technical consultant at the LFASA. The LECA sent a draft judgment to the parties for their comments. The main discussion thereafter related to how references should be made in the written ruling to the agreement made between the parties. The LFASA insisted that the LECA make an official ruling on the case, irrespective of what the parties had agreed out of court.

The LECA ruled in a three-page judgment that there was a basis on which to rule in favour of the proposed concession review in line with the common agreement reached between the parties. It specified that the ruling was valid on the condition that a nature reserve was created at Hedefors. The out-of-court agreement reached between the parties was attached to the court ruling as an appendix.

Summary of the Hedefors case in line with the analytical framework

A) The LFASA

i) The LFASA followed a strategy of attempting to reach an agreement with the operator prior to the judicial review process. This was done as part of the Säveå project, where agreement on the proposed measures was sought on a voluntary basis and technical questions were raised and discussed. The main area in which agreement was not reached in these initial consultations was on the compensation to be paid for production losses arising from the review. The LFASA and other state agencies involved proposed that the state should compensate the operator for the construction costs of the fish ladder and the fish weir as well as for half the construction costs of the ice spillway, a safety improvement measure. The LFASA and the other state agencies also offered MSEK 5.1 in compensation for production losses over and above 5% of the total value of energy produced at the station. When agreement was not reached with the operator, the case went to court in disagreement.

In the formal review petition, the compensation offered by the LFASA was reduced to half the construction costs of the fish ladder, the fish weir and the ice spillway. The compensation offered to the operator for the production losses was reduced to MSEK 1.75.

After the ruling by the LEC, and during the judicial process in the LECA, an out-of-court agreement was reached between the parties. In the agreement, the state agreed to compensate the operator for the construction costs of the fish ladder and the fish weir, and for half the construction costs of the ice spillway. The compensation to the operator for the loss of production resulting from the review was set at MSEK 7.35, with additional compensation for the loss of renewable electricity certificates.

ii) The LFASA made reference to chapter 24:5 of the SEC, which allows for a review of a granted concession to improve installations for the protection of fish to comply with the EQN and Sweden's obligations resulting from EU membership.

The LFASA made reference to the EQO of the river in question, Säveå river, which is categorized as "nationally valuable water" that should be restored. Reference was also made to the Habitats Directive, since the stretch of river downstream from the hydropower station is a Natura 2000 area due to the presence of a red-listed, genetically unique salmon population as well as red-listed eel. The conservation status of these two species will be improved as a result of the review, since the area suitable as spawning grounds will increase from 6 to 11 hectares. The LFASA used the Eel Regulation in support of the proposed review, which will improve the escape rate of eel to the ocean. The LFASA also made reference to the WFD, since the ecological status of the water body upstream of Hedefors is classified as moderate – due, among other things, to the lack of salmon upstream of Hedefors – and there is a requirement to achieve good ecological status by 2021. Finally, the LFASA referenced the dormant condition in the original concession from 1947, which stated that the operator should, at its own cost, install fish weirs on receipt of a request from the SBF.

iii) The LFASA provided a 72-page report that investigated whether salmon had been able to pass the Hedefors rapids historically, a 66-page technical report analysing ground stability in the area in question, and a 31-page technical description of the proposed fish passage and fish weir. Various additional maps and reports were produced and provided to calculate the value of the electricity loss, as well as a complementary account of the execution of the construction works on the bypass channel and a detailed estimate of the installation costs of the fish weir. The estimated cost of the consultancy reports and investigations prior to and during the review was approximately MSEK 2.

The estimated cost of construction of the fish weir and the fish bypass channel increased from MSEK 8.7 in the original review petition to MSEK 10.3–12.7 in these complementary technical reports.

B) The operator

i) The operator participated in discussions as part of the Säveå project, in which agreement was sought on a voluntary basis to the proposed measures, and technical questions were raised and discussed. The main area on which agreement was not reached during this consultation was the level of compensation for production losses arising from the review. The operator asked for MSEK 11.9 in compensation for loss of production exceeding 5% of the total value of production at the station as well as the increased maintenance costs arising from the installation of the fish weir. When agreement could not be reached with the LFASA and other participating public agencies, the case went to court in disagreement.

ii) The operator made reference to chapter 2:7 and chapter 24:5 of the SEC. Chapter 2:7 specifies that remedial measures to bring an operation in compliance with the SEC must be reasonable. Chapter 24:5 regulates the allowability of conditions arising from a concession review. The conditions must not be so intrusive that

hydropower operations can no longer be pursued or are significantly hampered.

The operator argued that it was in no way certain that salmon had ever been able to pass Hedefors historically. Furthermore, it argued that it was not possible to determine the reasonableness of the proposed measures based on the information provided by the LFASA on the costs and benefits of the review, that the construction costs of the fish weir were unreasonable and that all the costs, regardless of whether they were to be covered by the state, should be included in the calculation to determine the allowability of the proposed review. The operator also made reference to legal precedent in the form of the Åmot ruling (M 1119-08) in arguing for compensation for production losses in the amount of 7.6 MSEK.

ii) The operator provided a four-page technical memorandum which concluded that the proposed route of the fish passage and construction of the cofferdam were not implementable. The operator also provided a three-page assessment of the total cost of the proposals contained in the review, including production losses, maintenance costs and biodiversity improvement measures, which in the opinion of the operator added up to MSEK 46.3.

The operator argued that the information provided was insufficient to enable a favourable judgment to be granted. Further documentation was requested, specifying the costs and benefits of the proposed measures and further detail on the planned execution of the works. The operator also requested further examination of ground stability in the area in question, and of ground water levels and pore pressure – including data collection over a long enough period to be representative. The operator asked for information on the environmental impacts of the construction of the fish bypass channel and the fish weir.

C) The LEC
i) The LEC rejected the petition to activate the dormant condition on the installation of a fish weir, contained in the original concession on procedural grounds, arguing that the SBF did not have the authority to bring an independent action before the court.

The LEC argued that the application made by the LFASA was so flawed that it could not be approved. The lack of detailed information on which to base a decision on whether the proposed measures were reasonable and allowable as well as technically possible led the court to reject the application in line with chapter 22:2 of the SEC.

The court argued that future maintenance costs, possible future liabilities, actual construction costs and costs arising from the loss of electricity production should be quantified in the permissibility calculation. It also specified that it is the applicant that must provide the required documentation.

The court agreed that there was an important general interest, albeit one that is difficult to value in monetary terms, in favour of the proposed review, but that this cannot be used to argue that the benefits would be greater than the costs, including the negative impacts on EQO.

The LECA
i) The LECA ruled in favour of the proposed concession review based on the out-of-court agreement reached by the parties.

ii) The operator agreed to pay the 5% of the value of the loss of production, calculated at MSEK 6.3. The operator also agreed to pay for half the construction costs of the ice spillway, estimated at MSEK 0.5.

The state through different public funds agreed to finance all the other construction costs as well as the biological restoration efforts and follow-up measures, which at the time of writing are calculated at roughly MSEK 24. The state also agreed to compensate the operator for production losses above 5% of the total value of production (MSEK 7.3) and the loss of electricity certificates, amounting to approximately 0.3 MSEK.

7 ANALYSIS OF THE CONCESSION CHANGE PROCESSES

The above description of concession change processes shows that there are important differences in the arguments, evidence and actions of the participating organizations as well as the shape of the process when comparing concession modifications and concession reviews. No out-of-court negotiations were attempted in the concession modification hearings. The main discussion in court was related to the scope of the judicial examination in relation to the legal force of the original concession and the extent of the modifications proposed. The environmental value of the stretches of river in question was limited, as was the amount of technical and environmental knowledge provided in court.

In the concession review process, out-of-court agreement was attempted and eventually reached after an initial judicial process in the LEC. The main discussion was related to the quality and extent of the information provided as well as whether the proposed measures were reasonable and allowable (see section 5.4). The ecological value of the stretch of river in question was very high, and the technical and environmental knowledge provided in court was extensive in comparison with the concession modification hearings. After the application was rejected by the LEC and agreement had been reached out of court, the review was quickly granted by the LECA without major modifications.

Based on the above review of the three concession change processes, it could be argued that the main factor that shapes concession modification processes is the attempt to establish legal precedent related to the extent of the examination as part of a judicial hearing. In the concession review hearing, however, the main factor shaping the process is how the costs of the river restoration measures are to be shared between the operator and the state. In this section, the evidence in support of this analysis is connected to the intrinsic interests of the organizations active in the concession change processes and to the institutional framework in Sweden regulating hydropower concession production and change. The outcomes of the hearings and the process itself are discussed in the light of the government's stated goals in relation to hydropower.

7.1 LEGAL PRECEDENT IN THE CONCESSION MODIFICATION PROCESS

From the arguments of the participating organizations it is clear that the main question in the concession modification hearings was related to the appropriate scope and direction of the judicial examination. In other words: should there be an extensive examination of the totality of the water operations or a limited examination only of the modifications to the original concession? As is noted above, the appropriate extent and scope of a concession modification hearing for water operations is not clearly set out in the legislation. The space for court rulings that set legal precedent and establish practice on this matter is therefore increased and could have a significant impact on the future development of the hydropower sector. The extent of the examination in concession modification processes could have important implications for the number of extended refurbishments and the extent of river restoration measures that will be carried out.

If modifications that include extended refurbishments, such as increasing the swallowing capacity of turbines or increasing the head of a hydropower dam, lead to an extensive examination of the totality of water operations, or are treated as new concessions for water operations, then the substantive laws of the SEC and other legislation should be applied. More specifically, the rules of consideration in chapter 2 of the SEC should be applied in full. These rules establish that the operator has the burden of proof to show that its operations are undertaken in an environmentally acceptable manner, as well as the responsibility for applying the best possible technology and financing the necessary preventive and remedial measures in line with the polluter pays principle. This applies to the extent that compliance is not deemed unreasonable, taking account of the costs and benefits of the proposed remedial measures. The ruling of the LECA in the Furudal case appears to be in line with this way of thinking, since it states that the new head should be treated as a new concession for water operations according to chapter 2 of the SEC, including for deciding on remedial measures such as increasing the minimum flow. The court established that the legal strength of the original concession had not been affected since the operator had the option of falling back on the original concession if it did not want to accept the conditions stipulated in the new one.

If, on the other hand, the modifications lead to a limited examination in court then the conditions of

the original concession will be left intact and the rules of consideration in chapter 2 would only apply to the additional water that is diverted or the additional head that is created by the modified concession. The ruling of the LECA in the Edensforsen case and the second ruling of the LEC in the Furudal case, which became legally binding, appear to be in line with this line of thinking. Remedial measures for river restoration were deemed unreasonable at Edensforsen, and in the Furudal case, 0.1 m^3/s, too small to create any important ecological benefits.

The average Swedish operator has a concession for hydropower production that was granted some time around the middle of the 20th century. The conditions placed on hydropower production in these original concessions are often not in line with current environmental legislation. Remedial measures, such as fish passages and minimum flow requirements, are absent in most cases. In an extensive examination, water operations are examined in line with current environmental legislation, the burden of proof is placed on the operator and requirements for remedial measures could be one of the outcomes of a hearing. In order to comply, the operator would need to invest in remedial measures, and minimum flow requirements would reduce the amount of water that can be diverted from the river for power production. Such changes would reduce the profitability of the enterprise. Limiting the extent of examination of a concession modification hearing is therefore a strategy that is in line with the basic goal of profit maximization pursued by the operator, given the current institutional set-up governing hydropower production and concession change.

The strategy of the LFASA to push for an extensive examination in concession modification hearings is in line with its basic goal, given the current institutional landscape. As is noted above, the intrinsic interests of the LFASA can be stated as ensuring that hydropower concessions are in line with the requirements of the SEC at a minimum cost to the state. With an extensive examination during a concession modification hearing, the burden of evidence is placed on the operator as the initiator of the process. The polluter pays principle would also be applied to a greater extent in an extensive examination during a concession modification hearing, since the limit established for concession review hearings would not apply. Ensuring that the totality of water operations is examined according to current environmental legislation in a concession modification hearing would increase the number of hydropower concessions that are in line with the requirements of the SEC while significantly reducing both court costs and the compensation that would have to be paid to operators.

A more mixed picture emerges when trying to analyse where legal precedent appears to be taking the extent of examination in concession modification hearings in the examined cases. In the Edensforsen case, the LECA accepted the claim made by the operator that a change in the granted swallowing capacity of a hydropower station does not constitute a modification of the water management provisions of the original concession. Based on this claim, the court, with one judge expressing a dissenting opinion, found that the remedial measures derived from a share of the increase in production provided environmental benefits that were too limited in relation to their costs, and therefore deemed their imposition to be unreasonable. In the Furudal case, the LECA found that the new head of the hydropower dam should be considered a new concession for water operations and should be treated in court according to the rules of consideration in the SEC. After the case was remitted by the LECA, the LEC established minimum flow regulations as a share of the increase in hydropower production from the new head and not, as LECA appeared to have ruled, as a share of the totality of production of the new head of the dam. The second ruling by the LEC has become legally binding, since both the LECA and the Supreme Court denied the LFASA leave to appeal.

The impact of the EQN emanating from the WFD on the concession modification hearings reviewed was limited. The LEC and the LECA in both cases either did not mention the EQN, argued that the demands emanating from the WFD should be examined elsewhere, or stated that the measures caused no increased damage to the water bodies in question.

7.2 COST-SHARING IN THE CONCESSION REVIEW PROCESS

The actions and legal arguments of the organizations involved were very different in the concession review process compared to the concession modification processes. The examined concession review was a much more extensive, complex and confusing process in which the shifts were often difficult to follow. The hearing makes more sense, however, when the process is viewed primarily as a dispute over how the required costs of the new obligations resulting from the concession review should be shared.

Prior to the court application there was an extensive consultation process, which lasted for many years. It included representatives of the various organizations concerned, ranging from the operator to the national sports fishing organization. Various technical and environmental issues were investigated and agreement

appear to have been reached on all major issues except for the amount of compensation the operator should receive as a result of the changes introduced by the review. The state and the operator were in agreement that the state would cover the construction costs for the bypass channel and the fish weir, as well as half the construction costs of the ice spillway, a safety improvement measure. Agreement could not be reached in relation to the compensation the operator should receive for production losses exceeding 5% of the total value of the production of the station, so the case went to court in disagreement.

In court, the operator questioned virtually every aspect of the court application, ranging from whether salmon had ever been able to swim above Hedeforsen to the slope and stability of the site. In essence, the operator argued that not enough information had been provided by the LFASA to demonstrate that the proposed measures were reasonable, allowable and technically feasible. After the ruling by the LEC, which rejected the application in line with the arguments of the operator, out-of-court discussions were reinstated and agreement was reached. A contract was signed regulating how the costs of the review were to be shared. After agreement had been reached, the technical difficulties were dealt with swiftly and with only marginal technical adjustments. The review application was then granted by the LECA in line with the agreement made between the parties.

There was a big discrepancy in the arguments of the operator and the LFASA on their estimates of the loss of production that would result from the review. Because various assumptions are included in these calculations, which include estimates of the future price of energy and of future production levels, it is hard to arrive at a definitive answer. Different estimates of future electricity prices and appropriate rates of return on capital lead to very different conclusions about the appropriate level of compensation. The disagreements observed in court are in line with the basic interests of both parts, where the operator is trying to maximize the compensation for its production losses and the LFASA is trying to minimize the amount of compensation that the state has to pay.

The offer by the LFASA, on behalf of the state, to pay for the necessary remedial works resulting from the review, on the other hand, is difficult to comprehend in the light of the intrinsic interest of the LFASA: to ensure that hydropower concessions are in line with the requirements of the SEC at a minimum cost to the LFASA and the state. Chapter 2 of the SEC states that the polluter pays principles applies, which means that it is the entity causing the environmental impact that must pay for any remedial measures that must be taken. The offer made by the LFASA appears to go beyond the requirements of the SEC, since the main legislative limitation on the polluter pays principle when reviewing a concession granted according to the 1918 water law or earlier legislation is 5% of the value of total production.

Currently the burden of proof in a review process is on the LFASA, which must show the court that the proposed measures are reasonable, allowable and technically feasible. During the Hedefors hearing in the LEC, the main argument of the operator focused on questioning the technical and environmental information provided by the LFASA and arguing that it was insufficient to ensure that the requirements of the SEC in concession review cases were met. The provisions and procedures set out in the SEC put the operator in a review hearing in a favourable position. If it is in disagreement with the review, it can limit its activities to questioning the evidence and information that is being put to the court, with only a limited requirement to produce evidence or carry out any investigations of its own.

When the LEC rejected the review petition, the LFASA was left in a situation in which a substantial amount of resources had been invested in technical studies that were deemed insufficient by the court. The LFASA has a limited budget for concession reviews and, as one of the interviewees representing the LFASA in the Hedefors case explained, the Västra Götaland CAB had to cover the costs of some of the investigations, since such a large share of the LFASA budget for concession reviews had been dedicated to the Hedefors case. In addition, by continuing the judicial process in the LECA, the LFASA and the other state agencies ran a clear risk that the funding available to cover the costs of the measures resulting from the review would no longer be available. The out-of-court settlement, where the LECA ruling in the Åmot case provided guidance for increasing the offer of compensation for production loss, secured the consent of the operator to the review petition, which allowed it to be swiftly granted in the LECA and ensured that the project could be realized.

In the light of the burden placed on the LFASA in terms of procedures and the substantive legislation in the SEC regulating review hearings, it becomes evident that offering compensation for mitigative measures to the operator that appears to go beyond the requirements of the SEC is part of a logical strategy to try to reach agreement before initiating the concession review process. An adversarial review process could end up being more expensive and time-consuming than offering additional compensation to the operator. The Hedefors case illustrates the general view of the responsible public authorities that prior agreement is a necessary element of an effective concession review process (LFASA 2005,

Bothnian Sea 2008:16). The case further illustrated that there was a clear risk that the concession review would have been impossible to complete irrespective of the ruling of the LECA if the court process had continued without agreement. This is particularly the case since a continuing court process in the LECA would probably have outlasted the time available to use the funding granted for the project.

Hedefors is representative of the concession review process in that prior agreement was necessary for an effective concession review process. The Hedefors case, however, concerned a highly complicated dispute over ground stability and slope, which could have made it an exceptional case. Once the question of compensation was settled, the technical questions were rapidly resolved with only limited modifications to the initial technical plans, indicating that technical issues were not the main cause of the disagreement.

It also appears that Hedefors is a representative case in that the operator was compensated for the remedial measures that were part of the concession review. In a report by Hedeskog and Monsén (2012:13) on 90 concession reviews conducted between 1990 and 2010, of the 34 cases that included the construction of remedial measures such as fish passages, the state or the municipality concerned paid for 27 of them. A table of these cases can be found at appendix 2.

The strategy of questioning most aspects of the concession review makes sense in the light of the intrinsic interests of the operator, given the current institutional set-up. Since the SEC puts the burden of proof in a concession review on the LFASA, additional investigations must be financed by the LFASA. There is a possibility that the review will be delayed or, as was the case at Hedefors, rejected. In the case of Hedefors the LFASA and the state agreed to increase its compensation offer in order to reach agreement out of court. This limited the reduction in the profitability of the operation as a result of the review. The LFASA's strategy of reducing its offer of compensation to the operator in court compared to the offer made in the initial consultation process shows that there is a risk to the operator in opposing the review. This risk of a court ruling providing substantially less compensation from the state than the offer prior to court proceedings could be an important reason why many operators have reached an agreement with the LFASA prior to taking the concession review process to court.

The ruling by the LEC in the Hedefors case indicates that the test in court of the substantive rules of the SEC regarding the reasonability and allowability of the protective measures, as well as the required detail of the investigations, can be high. The important ecological value of Säveån is widely recognized in Swedish and EU legislation. Nonetheless, the review was rejected, in part because the LEC found that the information supplied was flawed and not sufficient to demonstrate that the environmental benefits would be higher than the costs, mainly a loss of renewable electricity production and the construction costs, resulting from the review.

The Hedefors case is illuminating in that it provides a clue as to why only 90 of the 3700 hydropower concessions in Sweden were reviewed between 1990 and 2010. The burden of proof on the public authority initiating a review in the interest of river restoration can be very high, and a high degree of detail can be required by the court in the technical investigations. In addition, the test in court to demonstrate that the proposed measures were both reasonable and allowable were in the examined case very high. The Hedefors case confirms that in practical terms it is very challenging and inefficient to try to push through a concession review without the agreement of the operator. This practical requirement could be part of the reason why the concession reviews that have been carried out have, as a rule, involved additional compensation to the operators over and above what appears to be required by law. Apart from the legislated threshold of 5% of the total value of production, beyond which the operator is compensated in a review, the construction costs of the necessary remedial works are also, more often than not, paid by the state.

7.3 THE CURRENT SYSTEM OF HYDROPOWER CONCESSION CHANGE AND THE GOVERNMENT'S STATED GOALS

As is noted above, three overarching government goals can be condensed from recent government terms of reference related to environmental considerations and hydropower: 1) for water operations to possess a concession that is in line with national and EU environmental legislation; 2) to maintain production capacity for Swedish hydropower; 3) to achieve the stated goals in an efficient way.

With the current rate of progress and institutional set-up regulating hydropower concession change, the first goal does not appear achievable, as concession review is virtually the only way to ensure that new national or EU environmental legislation is brought to bear on the operating conditions of a hydropower station with a concession

The prospects of using concession modification hearings to bring water operations at hydropower stations in line with national and EU legislation appear limited judging from the examined cases. As yet there appears to be no clear legal precedent to the effect that the entire concession for hydropower production should be examined in court when an operator seeks a modification to the granted concession. In the examined cases there are LECA rulings that could be interpreted as meaning that an extensive examination of the whole concession should be carried out in concession modification hearings, but other rulings seem to indicate that the court should carry out an examination that is limited to the proposed modifications.

Regarding the second government goal, it is demonstrated above that it would have been possible to carry out river restoration that would have led to the loss of 24 times as much hydropower production as part of concession reviews between 1990 and 2010 without losing production from Swedish hydropower in 2012 compared to the situation in 2003. In addition, the overall balancing capacity in Sweden would have increased with such a scenario since, except in a limited number of cases, most concession reviews have been carried out on small and medium-sized run of the river hydropower stations that provide little or no balancing capacity to the Swedish electricity grid. The increase in production between 2003 and 2012, which is outlined above, has mainly occurred in large-scale storage hydropower stations which have significant balancing capacity.

In addition, the results presented in this report on the extensive renovation of six large-scale (>10 MW) hydropower stations, see table 1 and map 1, support theoretical extrapolations that show the potential for an increase in production of 3000 GWh/year in the coming years from the renovation and refurbishment of existing large-scale hydropower stations in Sweden. This potential production increase, which will be achieved by renovating hydropower stations that are reaching the end of their lifecycles, shows that there is significant scope and opportunity to implement measures to align a significant proportion of Swedish hydropower concessions with current environmental demands and legislation without losing overall production and balancing capacity in Sweden's hydropower sector.

With regard to the government's third goal, some conclusions can be drawn on attempts to ensure the overall efficiency of reaching the stated goals through concession change processes based on the analysis of the cases in this report. Important efforts in recent years have gone into ensuring the efficiency of granting and reviewing concessions for energy production facilities in Sweden (SOU 2009:10, 2008:86). A lot of attention has been focused on administrative procedures and the processing of applications to build new energy facilities. The creation of the Land and Environment Court is one of several measures intended to increase the efficiency of concession processing and court judgments (Prop 2009/10:215).

The results from this report, however, highlight the reasons behind certain inefficiencies in the concession change process that do not stem from administrative or structural bottlenecks. The efforts by the actors active in concession modification hearings on hydropower production to establish legal precedent relating to the appropriate extent of examination can in many ways be traced back to the fact that this question is not clearly codified in the provisions of the SEC. This ambiguity in the legislation could be part of the reason why the judgments from concession modification hearings are repeatedly appealed, which causes delays and additional administrative costs, in order to establish a body of case law that can be used to argue that a legal precedent has been set. The LECA rulings on the Edensforsen and Furudal cases indicate that it is unclear at present whether unambiguous legal precedent will emerge in this area. This will continue to cause delay and inefficiency in hydropower concession modification processes in the future.

A second source of inefficiency in concession change processes can be extrapolated from the Hedefors review case. Given the current institutional framework, it can be a successful strategy for an operator to question the totality of the concession review processes in court if there is disagreement on the need to carry out a concession review. This means that the concession review process is not always carried out at optimum levels of effort and expense.

8 CONCLUSIONS AND POLICY SUGGESTIONS

This report comes to two major conclusions. The first is that there is now an opportunity to move away from the zero sum game that is perceived to exist with regard to hydropower production and ecosystem restoration on rivers affected by hydropower in Sweden. Production increases linked to extensive renovations at existing hydropower stations demonstrate that there is considerable scope for win-win situations in which ecosystem restoration efforts can be implemented without losing important hydropower production and balancing capacity.

The second conclusion is that a new focus on existing legal procedures and legislation could be needed to ensure policy implementation and the coherence of existing Swedish and EU environmental and energy legislation affecting hydropower production in Sweden. There is currently an important expansion of hydropower production occurring in Sweden arising from more or less extensive renovations of existing hydropower stations. This is due in part to the advanced age of existing stations in Sweden, but also a result of the implementation of the RES in the form of renewable electricity certificates for renovations. Since extensive renovation can take place within the stipulated operating conditions of the existing concession, there is no need for a concession change process to implement many of the measures to increase hydropower production at existing stations, such as the renovation and replacement of turbines and generators. It appears, however, that the ambiguity in the legislation related to the extent of examination that is required in concession modification hearings could reduce the incentives to engage in extended renovations, thus limiting the potential increase in hydropower production derived from renovations.

The situation is different in terms of river and ecosystem restoration to comply with Swedish and EU legislation in rivers affected by hydropower production. There has been only limited activity and implementation of measures carried out to ensure that hydropower concessions are in line with current Swedish and EU environmental legislation. The main barrier to ecosystem restoration in the Swedish context is the legal basis for hydropower concessions, which are granted without limit of time and are not directly restricted by any subsequent environmental legislation. At present, it appears that the only available process for changing the operating conditions of a hydropower concession to ensure that it is in line with Swedish and EU environmental legislation is to initiate a concession review in the Land and Environment Court. This has proved to be a slow process: only 2% of hydropower concessions were reviewed between 1990 and 2010.

Various policy and legislative changes are possible to tackle what could be viewed as an imbalance in implementation and improve the coherence of energy and environmental policies and goals. Procedural and legislative changes are currently being considered by a special investigator and legal professionals, who will present their findings in June 2013 (Dir 2012:29). This report makes one general policy proposal: to explore the establishment of a common, compulsory fund by all hydropower producers, set as a percentage of the production value of each hydropower station, to be used to finance the biodiversity restoration and river restoration measures arising from concession review hearings. This suggested change should lead to increased coherence and synergy of outcomes in the Swedish concession system and increase the efficiency of the process itself. As is argued in the report, one of the central issues in a concession review appears to be the question of how the costs related to lost hydropower production and the construction of necessary mitigation measures should be shared between the state and the operator. By creating a fund from which the necessary resources would be taken to compensate for production losses and the cost of the necessary mitigation measures, operators would not risk losing revenue by updating their concession and would have limited incentives to protract the judicial process or limit the amount of concession reviews being carried out. Such a change would mean that the review process could proceed much more efficiently, and balance biodiversity and renewable electricity production objectives on a case-by-case basis. The resources made available by the general compensation scheme could also be used much more flexibly, based on where the greatest biodiversity gains could be achieved. The size of such a fund would be a political decision.

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APPENDIX 1

Hydropower stations receiving renewable electricity certificates for the share of increase in production in existing stations 2012-07-03

Name of hydropower station	Number of production units	Number of production units renovated	Production increasing measures	Installed effect (MW)	Average production prior to renovation (GWh/year)	Production increase (GWh/year)
Bågede Kraftverk	1	1	Renovation of turbine	13.4	70.24	0.57
Båtfors kraftstation	2	1	New turbine, renovation generator, improved control system	42	195.3	8.1
Delary	1	1	New runner blade, renovation generator, improved control system	1.7	8.6	0.6
Edensforsen	2	1	New runner blade, improved control system, improved flow	71	321.6	10.9
Fjällsjö	1	1	Renovation of turbine, improved control system	13	57.1	0.7
Granö	2	1	New runner blade, improved control system	9.5	34.6	1.7
Gulsele	3	1	New runner blade, renovation of generator	68	320.7	7.3
Hammarforsen	5	1	New runner blade, new generator, flow improvements	79	534	16
IK1 Stadsforsen	3	1	New runner blade, new generator	132.5	864	17
IK32 Nämforsen	3	1	Improved sealing turbine	113	453	0.15
IK33 Kilforsen	2	1	Renovation of generator	298	1018	2
IK34 Lasele	2	2	New transformer	140	691	3
IK35 Långbjörn	2	2	Generator renovation, flow improvement	96	429.3	1.3
IK36 Stalon	1	1	New runner blade, renovation of generator	130	527	21
IK7 Näverede	2	2	New runner blade, renovation of generator, flow improvements	75	330	32
IK8 Stugun	2	2	Flow improvements	41	208.1	0.6
IK9 Järkvissle	2	1	New runner blade, renovation of generator	104	427	17
Krokströmmens kraftverk	3	0	Flow improvements	113	499.3	2.1
Krångede	6	3	New runner blade, renovation of generator	250	1595.9	26.5
NK1 Stornorrfors	4	1	New runner blade, renovation of generator	594.9	2488	24.6

Name of hydro-power station	Number of pro-duction units	Number of pro-duction units ren-ovated	Production increasing measures	Installed effect (MW)	Average produc-tion prior to renova-tion (GWh/ year)	Produc-tion increase (GWh/ year)
NK25 Vargfors	2	1	New runner blade	122	479	8
NK28 Bastusel	1	1	Unspecified renovation of turbine, renovation of generator	120	585.8	9
NK53 Gejmån	1	1	New runner blade, new generator	56.6	296.6	3.2
NK6 Grundfors	2	2	New runner blade, renovation of gen-erator	105	490.7	18.6
NK7 Stensele	1	1	New turbine, new generator, new transformer	57.6	254.20	12
Näsaforsens kraftverk	1	1	New runner blade	15	69.23	4.42
PK1 Porjus	2	1	Improved sealing wicket gate	474	1293	2
PK2 Harsprånget	4	1	Improved sealing wicket gate	830	2284	2
PK3 Ligga	3	1	New transformer	340	849.5	1.9
PK4 Messaure	3	2	New runner blade, renovation of gen-erator	442	1956	33.8
PK44 Randi	1	1	Improved sealing wicket gate	85	250	1
PK46 Letsi	3	1	New runner blade, renovation of gen-erator, improved control system	435	1993	15
PK5 Porsi	3	0	Flow improvements	274	1206	3
PK51 Ritsem	1	1	Improved sealing wicket gate	304	526	11
PK52 Vietas	2	1	Improved sealing wicket gate	306	1280	1
Sil	1	1	Improved control system	12	63,2	0.20
Skogsforsen	2	1	New runner blade	9	29.4	8.7
Skåpanäs	1	1	New runner blade, renovation of gen-erator, flow improvements	11	36.2	3.3
Storfinnforsen T12	3	1	New runner blade, renovation of gen-erator, flow improvements	115	536.1	5.9
Total					**25550.67**	**337.14**

APPENDIX 2

Overview of costs shared between the state and operator in concession review cases between 1990 and 2010 that have included the construction of physical mitigation measures such as fish passages

Hydropower station/dam	Court case number	Year of review	Physical measure(s)	Costs born by	Specified cost	Comment
Mariestads Valskvarn	VA 70/94:7	3/15/1995	Fish passage	The concerned municipality	Not specified	
Katrinefors	VA 72/94:6	3/15/1995	Fish passage	The concerned municipality	Not specified	
Alafors	VA 7/93:6	1/16/1996	Fish passage, fish weir	The state	Not specified	
Linebergsmöllan	VA 47/95:5	7/12/1996	Fish passage	The state	Not specified	
Marbäck	VA 54/95:5	7/12/1996	Fish passage	The state	Not specified	
Fyllings kvarn	VA 48/96:5	7/12/1996	Fish weir	The state	0.05 MSEK	Fish passage built in 1986 with public funds
Töcksmark	VA 88/97:5	6/17/1998	Fish passage	The state	Not specified	
Brittedals	VA 8/98	11/9/1998	Fish passage	The state	1 MSEK	
Spånga	VA 35/98	11/9/1998	Fish passage	The state	Not specified	
Boberg	VA 71/97:7	12/22/1998	Fish passage	The state	0.57 MSEK	
Mostorp	VA 70/97:7	12/22/1998	Fish weir	The state	0.075 MSEK	
Gonarps	M 612-99	9/14/2001	Fish passage, fish weir	The state	Not specified	Not specified in the court documents but confirmed by the operator of the station
Berte Qvarn	M 118-99	3/15/2002	Fish passage, fish weir	The state	0.65 MSEK	
Skälleryd	M 412-01	8/22/2002	Fish passage	The state	1.1 MSEK	
Ohs	M 210-02	11/15/2002	Fish passage	The state	0.3 MSEK	
Hemsjö Övre and Nedre	M 21-99	7/7/2003	Fish passage	The state	3-4 MSEK	2 fish passages
Treen	M 275-02	8/22/2003	Fish passage	The state	0.2 MSEK	
Järpforsen	M 276-02	8/22/2003	Fish passage	The state	0.15 MSEK	
Tving	M3101-04	6/23/2004	Fish passage	The state	0.6 MSEK	

Hydropower station/dam	Court case number	Year of review	Physical measure(s)	Costs born by	Specified cost	Comment
Blomsterström	M 3189-03	3/3/2005	Fish passage	The state	Not specified	
Gullspångs	M 3836-04	5/3/2005	Fish passage, renovation diversion dam	The state	2.9 MSEK	
Alsterån	M 4642-05	6/1/2006	Fish passage	The state	Not specified	
Ullervad	M 1499-07	4/25/2008	Fish passage	The state	0.16 MSEK	
Apelnäs and Bosgården	M 638-08	6/2/2008	Fish passage	The state	3.1 MSEK	2 fish passages
Gullsby	M 1293-08	5/19/2009	Fish passage	The state	2.3 MSEK	
Åmot and Reinholdsfors	M 1119-08	5/19/2009	Fish passage	The state	4.6 MSEK	2 fish passages
Karlshammar	M 1777-09	6/16/2010	Fish passage	The state	1.95-2.2 MSEK	Dormant condition until further investigation is provided to the court
Visskvarn	M 61-00	12/19/2000	Silver eel passage	The operator	0.01 MSEK	
Fredriksfors	M 5-99	12/20/2000	Fish passage	The operator	0.75-1.3 MSEK	Fish protection measures dormant in original concession. 2 additional fish passages built as a result of activation of dormant conditions in concessions of adjacent stations
Mållången	M 3-00	9/21/2001	Fish passage	The operator	0.8 MSEK	
Utansjö Bruk	M 123-01	12/12/2001	Fish passage	The operator	1 MSEK	
Sporrsjö and Vängelsjö	M 124-02	11/25/2002	Fish passage	The operator	0.9 MSEK	2 fish passages
Ormsjö	M 138-02	12/6/2002	Fish passage	The operator	Not specified	
Djupedala	M 300-08	1/26/2009	Fish passage	The operator	Not specified	

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