Approval of 5 hydropower plant in the Orkla-Grana Basin

Decision and background information

24 October 2016

Background

EKOenergy sales are increasing gradually, and in the last months, several market players have suggested us to approve Norwegian hydropower plants (mainly for export, but possibly also for local sales).

We were not convinced by the proposals we got, and started to look by ourselves for suitable hydropower plants.

Focus on Orkla-Grana

One of the documents we used in that search is the NVE report from 2013 "NVE-rapport 49:2013". The report is a national screening of power plants and includes suggestions for prioritisation of future actions.

The report is based on a study which has estimated how important environmental benefits can be achieved through cost-effective measures. The main aim has been to make societal trade-off gains of possible environmental improvements in waterbodies, in relation to the social costs in terms of reduced renewable and flexible power. In the report it is concluded which waterbodies should be prioritized in the audit.

The report has 4 ranks for prioritizing where the lowest prioritizing is given to the most sustainable power plants/waterbodies. This is what the report says about the low 2.2 prioritizing: "*Waterbodies with important environmental values, but which have limited remaining environmental challenges, or where special considerations limits the measures which in practice can be implemented."*

The power plants on the Orkla-Grana are in this category 2.2. The fact that Orkla is not prioritized means that there has already been conducted extensive studies and measures to reduce the negative impacts on the water course. (Miljødirektoratet 1a, 2013). Moreover, these rivers are amongst the best Salmon rivers in Norway, despite the presence of hydropower.

Description of the power plants

There are 5 hydropower plants that regulate the Orkla-Grana water course. From upstream to downstream: Ulset, Litjfossen, Brattset, Grana and Svorkmo. The last of of the five power plants begun production in 1985.

These 5 power plants are owned by KVO fellesskapet which is then again owned by energy companies; Trondheim Energi A/S, TrønderEnergi A/S, Eidsiva A/S and Nord Østerdal Kraftlag Andelsverk. The power plants are Ulset, Litjfossen, Brattset, Grana and Svorkmo.

Restrictions (since 2013): From Björset Dam there is a minimum water flow of 20 m3/s from spring floods until the 31st of August, and then 10 m3/s from 1st of September to 31st of October. (Possibly down to 8 m3/s). The minimum water flow rest of the year is 4 m3/s. There is required minimum water flow throughout the year from stream intakes in Øvre Dølvad, Innerdalsmagasinet, Falningssjøen, Ya, Eventjønnbekken. (Miljødirektoratet 1a, 2013)

<u>Ulset</u>:
Construction year: 1985
Production: 140 GWh
Installation: 35 MW
Type of turbine: Francis
Fall height: 325 m
Intakes: The powerplant uses a drop of 325 meter drop from the regulation reservoir Storsverjesjøen which is regulated between 879 and 868 m. In addition Falningsjøen is regulated between 873 and 825 m. The power plant also obtains/retrives water from two stream intakes, which reduces the amount of water in the river Ya. (Wikipedia and TrønderEnergi)

<u>Litjfossen</u>:
Construction year: 1982
Production: 155 GWh
Installation: 70 MW
Type of turbine: Francis

Fall height: 288 m
Intakes: The power plant uses a drop of 288 meters from regulation resevoir in Innerdalsvatnet to Storfossdammen which is the intake resevoir for Brattset powerplant. Water of Innerdal is dammed and is regulated 35 meters and can contain 153 million cubic meters of water. Litjfossen also retrieves water from several stream intakes. (Wikipedia and TrønderEnergi)

Brattset:
Construction year: 1982
Production: 390 GWh
Installation: 2 x 40 MW
Type of turbine: Francis
Fall height: 270 m
Intakes: The power plant uses a drop of 273 meter in the river Orkla from the intake reservoir Storfossdammen at the outlet of Litjfossen powerplant to outlet south of Berkåk. The majority is retrieved via tunnel from Innerdalsvatnet in Tynset which is first exploited in Litjfossen power plant. Water from Ulset power plant is also being used. The water is passed in a 14 km long tunnel from Storfossdammen to the power plant. It also retrieves water from several streams that flow into the main river. (Wikipedia and TrønderEnergi)

Grana:
Construction year: 1982
Production: 305 GWh
Installation: 75 MW
Type of turbine: Francis
Fall height: 460 m
Intakes: The power plant uses a drop of 460 meters from Granasjøen which is regulated between 650 and 610 meters. The water is led i a 10 km long tunnel from the resevoir to the powerplant. Water is also retrieved from several stream intakes, including Fjellbekken and Jøla. Below the powerplant the water is led in a 5 km long drainage tunnel (avløpstunnel) with outlet in Orkla by Grindal. (Wikipedia and TrønderEnergi)

Svorkmo:
Construction year: 1983
Production: 275 GWh
Installation: 34 MW + 20,5 MW
Type of turbine: Two francis turbines
Fall height: 98 m
Intakes: The power plant uses a 98 meter drop in the river Orkla from an intake at Bjørset in Meldal to Hongslo by Svorkmo. The transmission tunnel is about 15 km long.The power plant also retrieves water from several stream intakes so that water from Svorka and Raubekken are being exploited. The power plant doesn't have a regulation reservoirs, but takes water directly from the Orkla river with a inntake resevoir by Bjørset. Because of the small reservoir capacity the power plant is considered as a riverine. Thus, the running of the plant depends on the upstream power plants, inflows to the river Orkla and stream intakes and requirements relating to the minimum flow regulations. (NTNU 2009)

Salmon is doing well on the Orkla

There are several sources stating that the Orkla river is doing well - especially for salmon.

NVE 49/2013: *Orkla is a national salmon river and one of the most productive around Trondheim fjord. The water course is among the country's best salmon rivers in the capture quantity and has a population of big salmon. Orkla water course below Storfossen has great value for anadromous fish. The river is one of the 10 largest salmon rivers measured after capture (18-35 pr. year for the past 10 years). Inland fishing is of a certain value in the upper parts of Orkla and in the regulating reservoirs. There is continuously carried out monitoring of anadromous fish in Orkla. Salmon stocks are very good, which are among the best for regulated rivers in Norway. The population of lake trout (sjøørret) is reduced, the water course regulating is a co-contributing factor, but other influences are essential. Significant regulation of reservoirs has resulted in poor nutritional conditions for fish. Several nature types have been registered in the main river (nature types: kroksjøer, elveører, meandrerende elveparti, og dammer). These are marked as locally important. Few water associated red listed species in and along the water course have been registered. Minimum water flow maintains a water table in the river and it is believed that the river regulation has caused little damage to biodiversity. The regulation reservoirs in the mountains affect landscape and outdoor activities. The mountain areas are widely used for outdoor activities. Salmon fishing is an important part of outdoor activity linked to the water course. The Orkla-Grana water course is an important landscape element.* (Miljødirektoratet 1a, 2013)

The three main factors that affect the fish populations are water temperatures, water flow and fish regulations. (NINA Fakta, 2004)

In Orkla the summer temperatures are being reduced because of bottom water from the reservoirs. In Orkla river the water temperatures on average decreased by 0.5-1.5° C by the regulation, and as a result the smolt age has increased with 0.5 years and this leads to decreased smolt production. But in Orkla the smolt production increased by 85% after the adjustment/development. Before the regulation the winter water flow in Orkla was considered as a strong limiting factor for smolt production. The regulation secured, a higher and more stable winter flow that has provided greater permanent, water-covered production areas for food animals and fish. This factor is considered as the main reason for the increased smolt production. (NINA, 1995) (Statkraft Grøner, page 83) In report from 2004 it is said that the reduced water temperature in the summer after the hydro-power development, has increased the smolt age and thereby reduced smolt production. In the future this this effect will probably be moderated only by climate change. (NINA 1a, 2004) But this is then compensated for with the increased water flow.

Concerning the water flow in Orkla Naturvernforbundet (biggest environmental NGO in Norwegian) published an article in 2004 stating that water regulation (the power plants) has had a positive effect on the salmon population in Orkla based on a report from Hvidsten (NINA 1a, report, 2004). (Naturvernforbundet, 2004). It is stated that the salmon production has increased with 10-30% after the regulation mostly due to higher winter water flow. There was also found negative impacts of the water regulation such as smolt (young salmon) going into the power plants' turbines.

But all taking into consideration the power plant developments in Orkla has been positive for the salmon population in Orkla. Hvidesten states that with new knowledge the conditions for salmon can be improved. The fact that new knowledge is being gathered and examined (the SafePass project - read section "challenges/problems" for more information) is seen as a good step in the right direction to improve conditions. (NINA 1b, news article, 2004). Above statements based on this report (NINA 1a, report, 2004)

In general, there seem to be no significant problems with migrating fish passing power plants, except for Svorkmo power plant. Results from previous studies of smolt input in Svorkmo power plant with smolt traps below Svorkmo power plants shows that one can expect that the proportion of smolts that migrate into the power plant increases with increasing proportion of the water taken from Orkla. In 2011 it was found that smolt went into the power plant. The statistical basis is small, but it suggests that more smolts go into the power plant when the proportion of operating water from Orkla to Svorkmo power plant increases. Average smolt input was approximately 25%. (NINA, 2012).

A salmon report from 2009 shows that the migrating salmon counted with the fish trap at Bjørset dam has been increasing compared to previous years and that the spawning target would be reached in 2009 (Miljødirektoratet, 2009, page 15).

A current project that is taking place (2016) is a project called SafePass which shows that actions are being taken to ensure better conditions for fish migrations through the power plants. Researchers in CEDREN (an interdisciplinary research center for environmental design of renewable energy) will together with European colleagues follow 100 salmon smolt and 50 støinger (female salmon ready to reproduce after a stay in the ocean) in the river Orkla in Sør-Trøndelag to see which swim routes they take. The results will be used as a basis to make suggestions about actions/measurements to TrønderEnergi to make it easier for the fish to get safely past the power plant. The research is party finances by TrønderEnergi. The investigations in Orkla is a part of CEDREN's SafePass Project which is the largest research effort on fish migration solutions ever in Norway. The results will also be used to find solutions for other rivers than Orkla in Norway and elsewhere. The SafePass project is partly financed by TrønderEnergi. (CEDREN, 2016).

Caveats

- The Orkla river is off course a heavily modified water course because of the 5 power plants and Bjørset Dam. On vannnett.no it is stated that all the regulated bodies are heavily modified (no information regarding Innerdalvatnet). Two of the four are artificial inland lakes. Below are some information about each of the regulated lakes retrieved from vannnet.no.

- Granasjøen, Falningsjøen, Sverjesjøen: Risk of not achieving environmental goal Deadline for goal was postponed (disproportionately costly). The ecological state of the lakes is weak because of large regulating height. Hydromorphological changes: the lakes are to a (very) high degree affected by the power plant (biological change).

See http://vann-nett.no/portal/Searchwater course.aspx?q=ORKLA&cat=All)

- Report from 2014 mentions that the minimum water flow is too low in some summers. (NMBU, 2014)

Decision:

EKOenergy allows that the electricity from the power plants of Ulset, Litjfossen, Brattset, Grana and Svorkmo can be sold as EKOenergy. All 5 power plants have the lowest rank in the national prioritizing of powerplants that has to be audited before 2022 (they are not prioritized).
Orkla river is one of the best salmon rivers in Norway.
All power plants have fish passes (mostly technical), and they have their problems but efforts are made to find optimal solutions for these problems via the SafePass project which is co-founded by TrønderEnergi A/S.

The decision is valid for 5 year.

The contributions of the Environmental Fund could be used for further nature restoration projects in Norway as well as in the countries where the electricity has been sold. (We didn't get any concrete suggestion about possible projects in the Okla-Grana basin, and at this stage, we prefer not to give a long list of projects which are unrelated to the Orkla-Grana basin)