

Vaksvikelva small hydro
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Introduction to project, from pre-diploma

The world is facing an energy crisis, and luckily Norway has access to a huge supply of renewable hydropower. However, when utilising this energy source, there is always a balance to consider between sacrificing nature versus gaining energy. The places which are most desirable for hydropower, are also often beautiful, picturesque landscapes; fjells & fjords, steep mountains, flowing rivers. In this dilemma, the infrastructure is often viewed upon as something to be hidden.

In contrast, people have utilised hydropower for thousands of years, often with structures ie. sawmills, that we now view as enrichment of nature, rather than blemishes.

I believe that this kind of approach still could be possible; developing the infrastructure as something that should be celebrated, something that could offer exciting possibilities and new experiences.

There has been a political interest in increasing

the use of small hydro in Norway. The Norwegian Water Resources and Energy Directorate (NVE) has estimated the total potential from small power plants to 25 TWh, which would be a 15% increase of the total electricity production in Norway. Several measures has been applied to stimulate the creation of these; economic funding of projects, increased research funding and simplification of application processes, which in turn has lead to a rapid increase of small hydro projects.

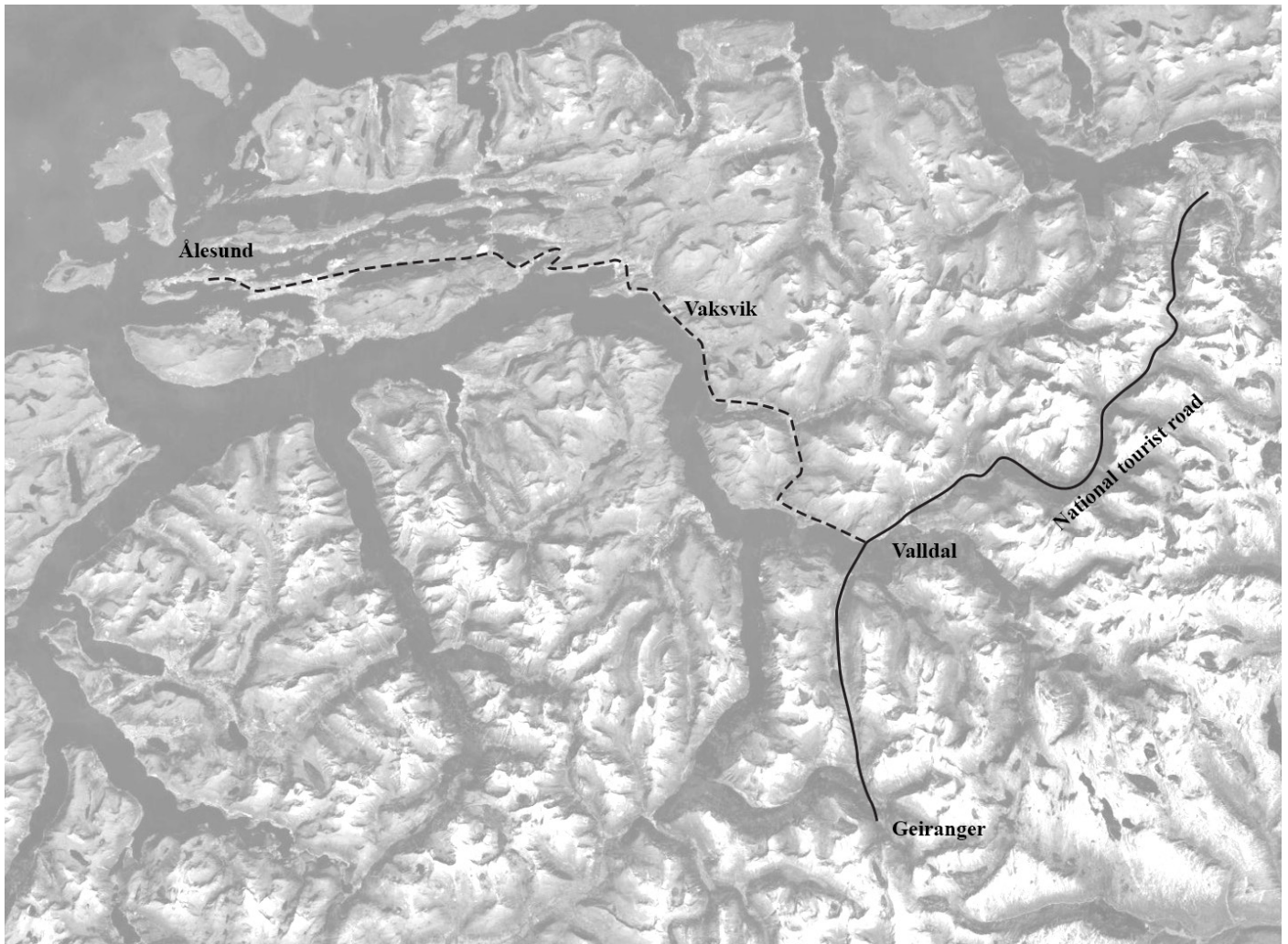
At the same time, Norway is building a lot of nice architecture in relation to norwegian nature, e.g. along the National Tourist Roads. These often offer very spectacular architecture, but are sometimes criticised of being “architecture with toilets”, architecture with no inherent function.

I believe it would be possible to combine these two typologies; creating new, much needed power stations with a designed with an intention to offer new experiences of nature.

Through the building of small hydro projects, previously unavailable nature becomes accessible. How can small hydro projects enrich the experience of their beautiful surroundings?

The power plants are situated in Norwegian forest, partly hidden away. By identifying the inside of the power plant as something unreachable, a duality between inside and outside became the main theme in the project. This duality was given form through materials used; split steel tubes in the power station makes the facade cold, closed and rejecting to the outside. The timber in the public buildings is in contrast friendly, inviting and warm to touch. The duality was further enhanced by contrasting the sculptural pipe facade to minimal, cross laminated timber.

The structure of the power stations were designed as portals for the added public program, forcing interaction between the viewer and the power plants.

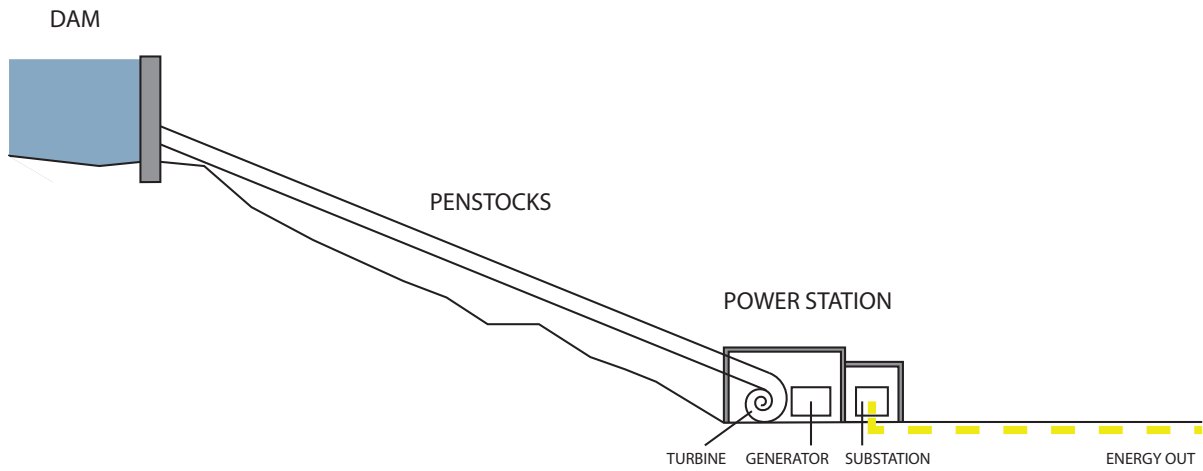


Map displaying closeness between Vaksvik and National Tourist Road to Geiranger - one of Norway's most famous tourist attractions. Vaksvik is situated in the middle between Ålesund and Geiranger.

In this project I wish to develop three small hydroelectric power plants in Vaksvik, along Storfjorden in Sunnmøre. Out of several power stations that applied for concession within the municipality, three were situated along Vaksvikelva.

Vaksvik is a small village in Ørskog municipality. Vaksvikfjellet, Vaksvik mountain, is very popular for skiing and hiking, as there are several skiing and hiking routes of varied difficulties. Vaksvikfjellet has very good snow conditions in winter.

POWER PLANT

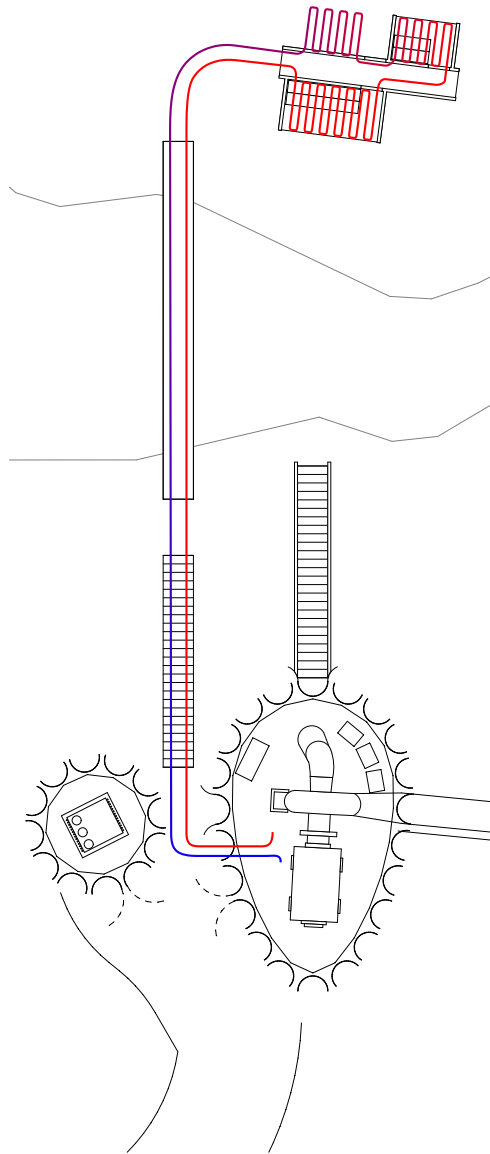


Power plants consist of three main structures - an intake dam (in small hydro only to provide a steady flow), penstocks and the power station, containing the turbine, generator and substation.

This leads to five sites in my project, as the intake dam of the first power plant is situated right next to the power station of the second.



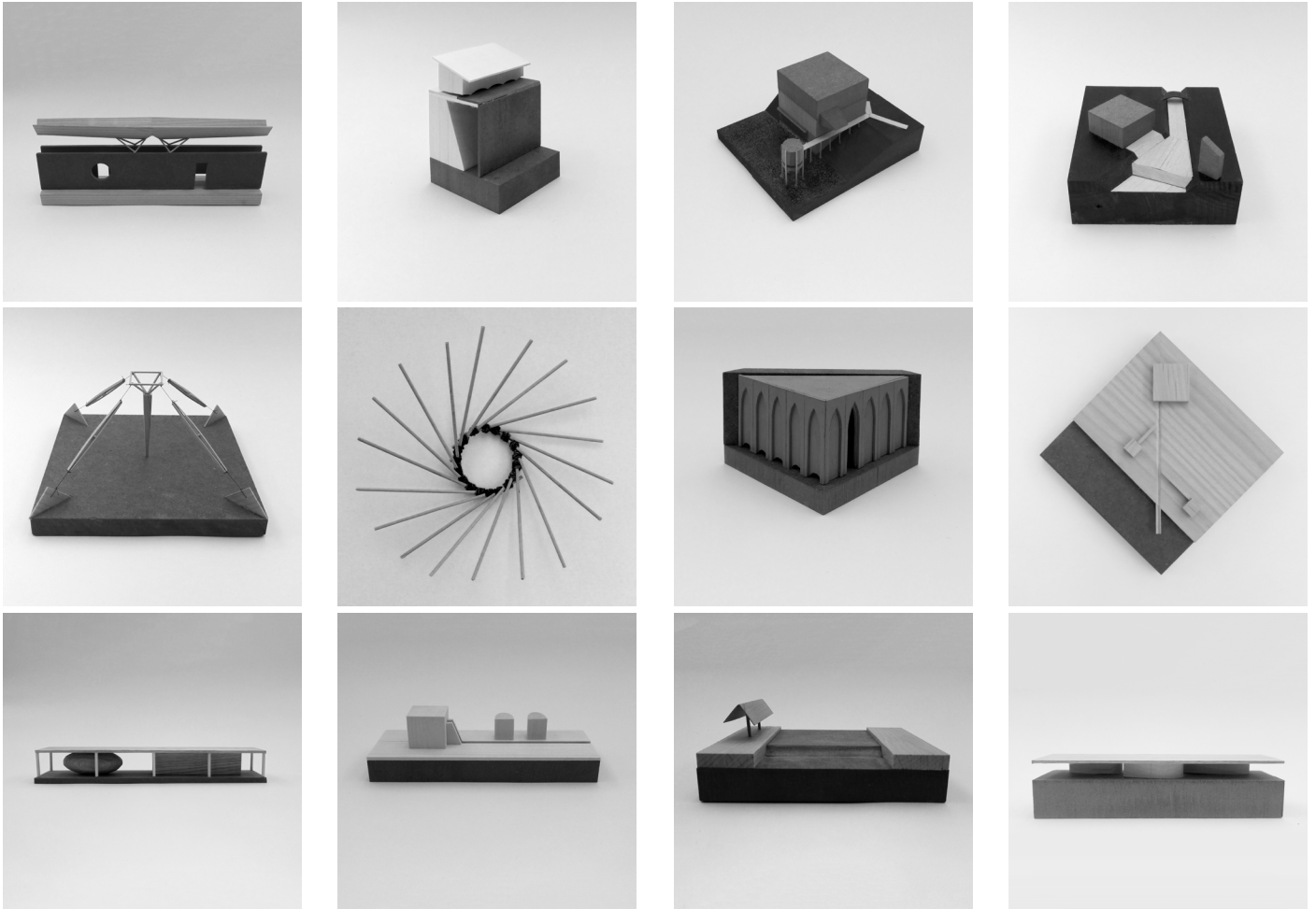
Map displaying sites (black squares), penstocks (solid red line), and hiking routes (dotted red line). Vaksvikelva runs all the way from a small mountain lake (654 m above sea level), down to Storfjorden.



In the process of converting mechanical movement - flowing water - into electric energy, about 5% turns into heat. From a power plant with an annual production of 15 GWh, this means energy enough to heat approximately 30 households is lost.

By applying water cooling to the machinery of the power station, heat becomes transferable and can be used to heat other spaces.

In my project I propose three alternate ways to utilise this excess energy for various attractions along Vaksvikelva in Ørskog.

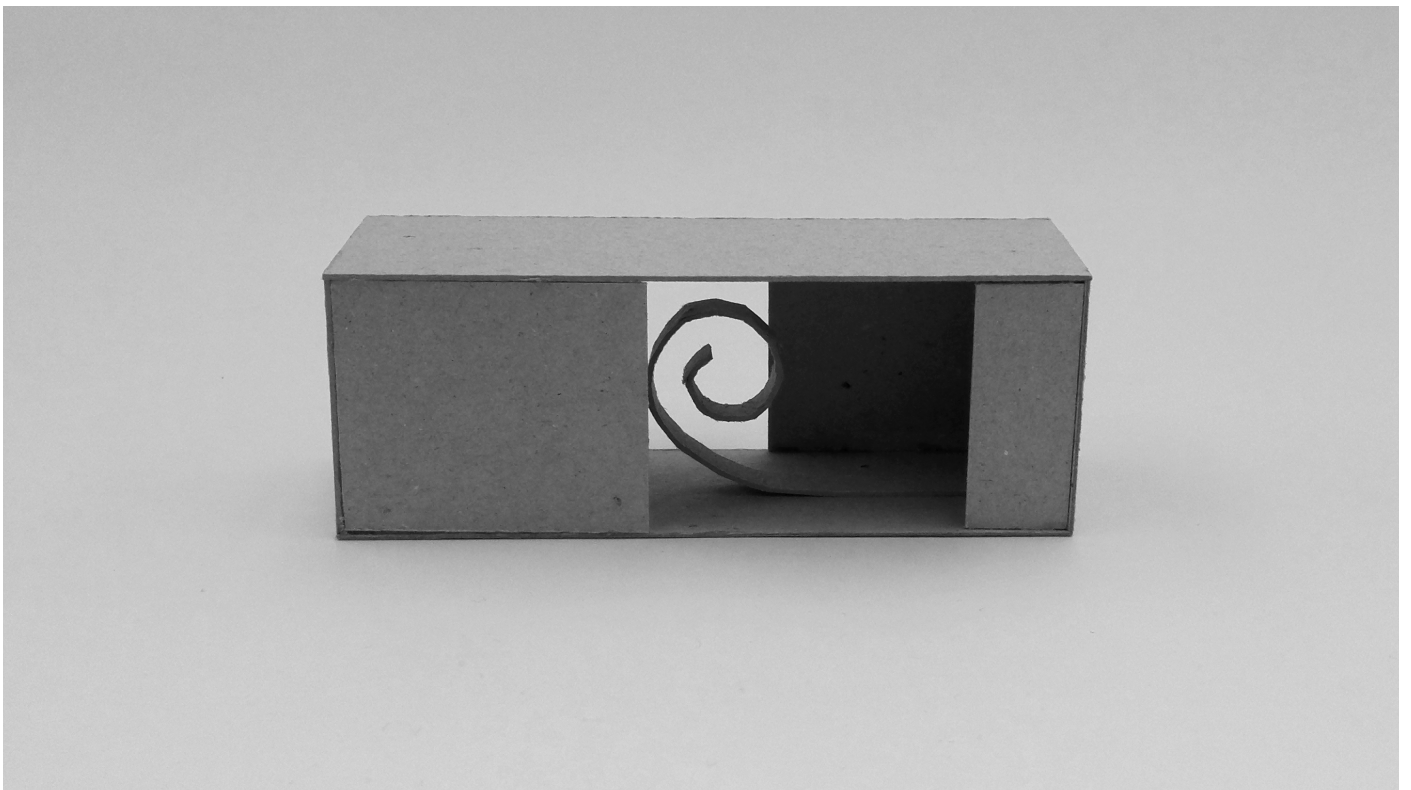


The architecture of the power plant was mainly conceived through model sketches and freehand sketches, identifying various relevant architectural themes;

- using steel pipes from penstocks as building material.



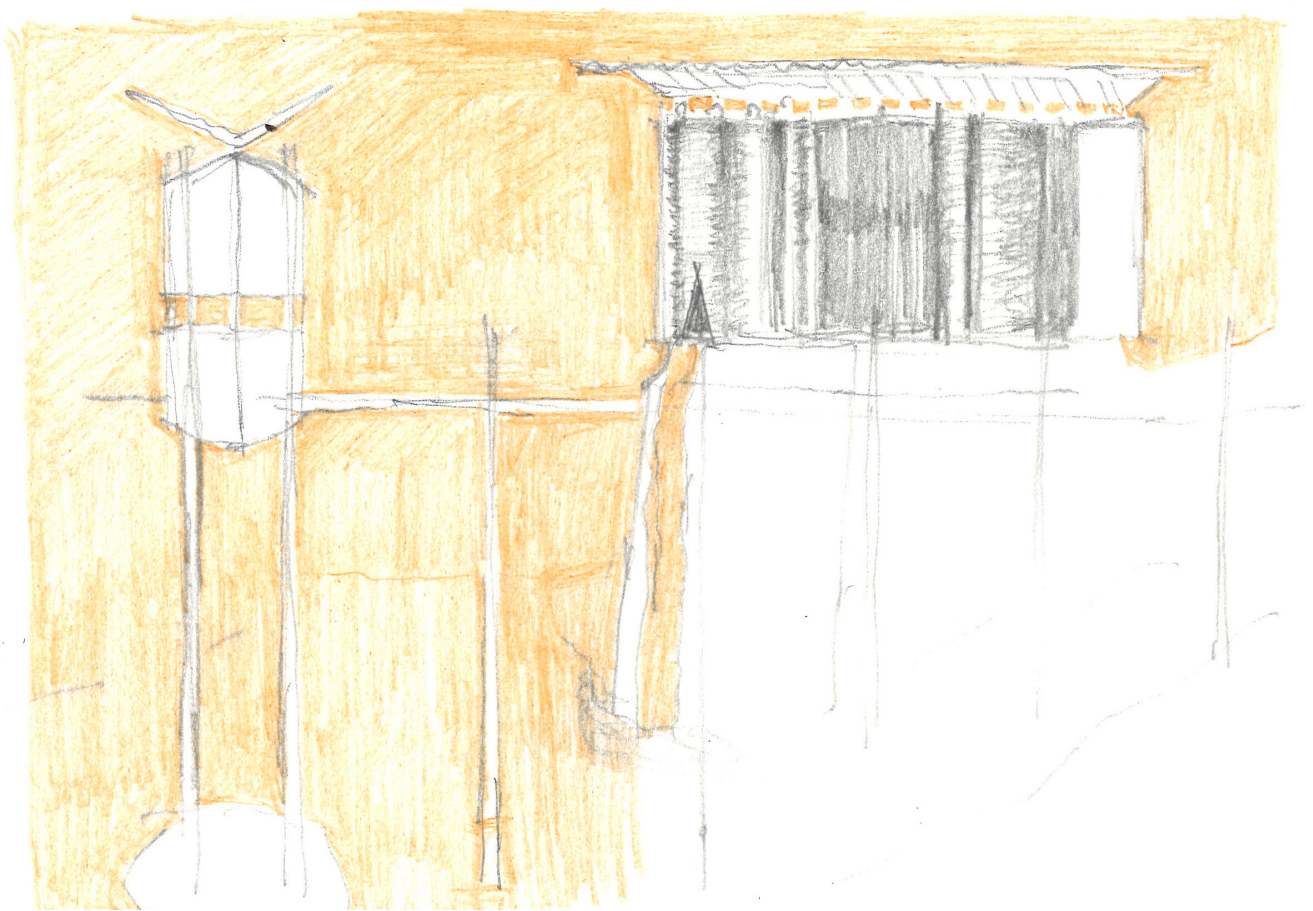
- arranging specific views of the machinery inside.

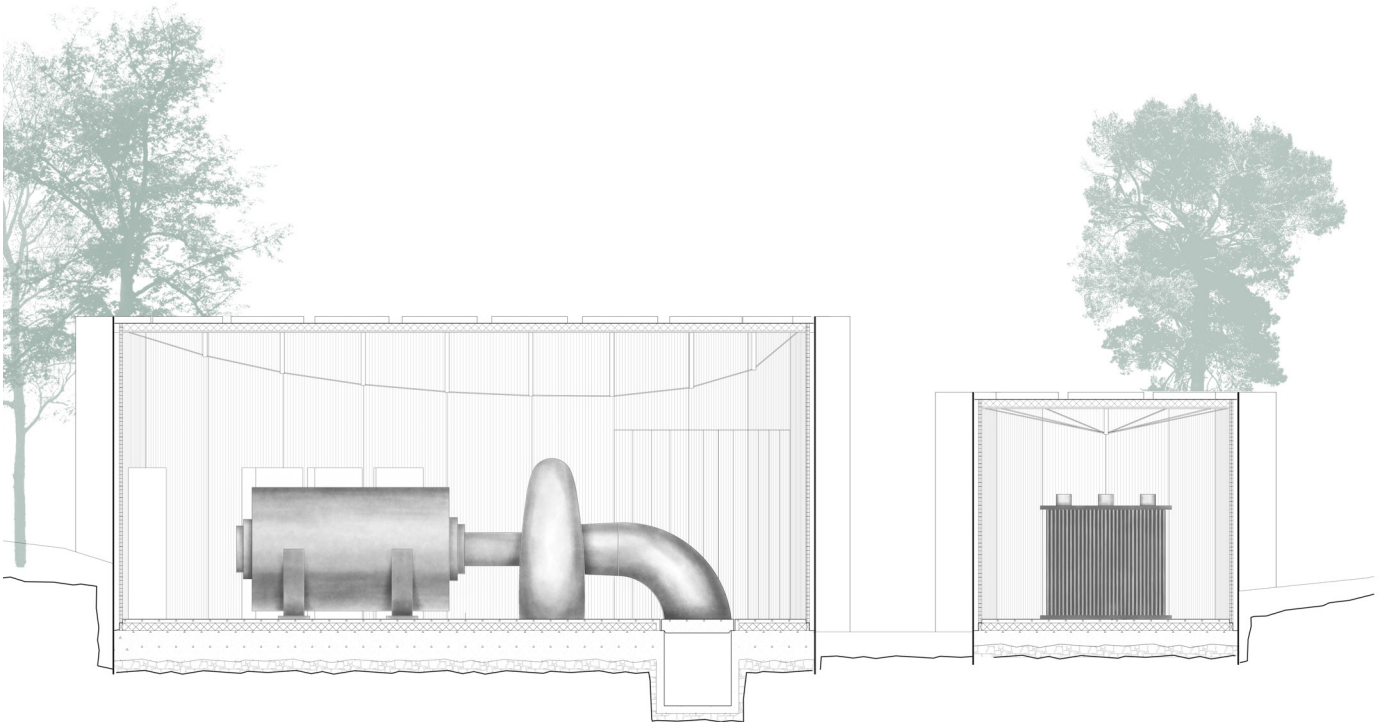
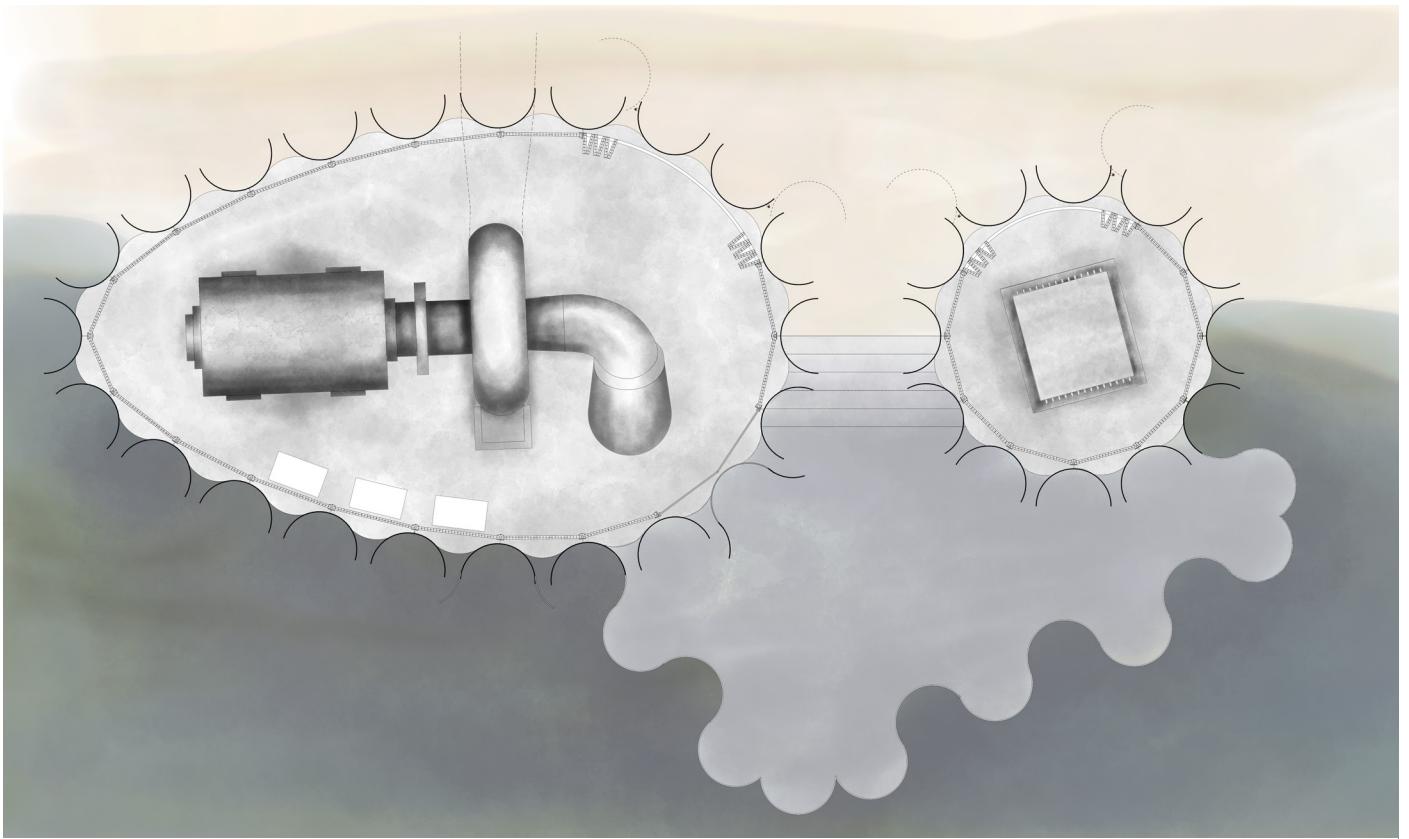


- the mysterious aura surrounding heavy machinery, and noise and humming caused by them.



- the duality and contrast caused by the power plant only communicating through facade (looking in), and the public program (looking out).



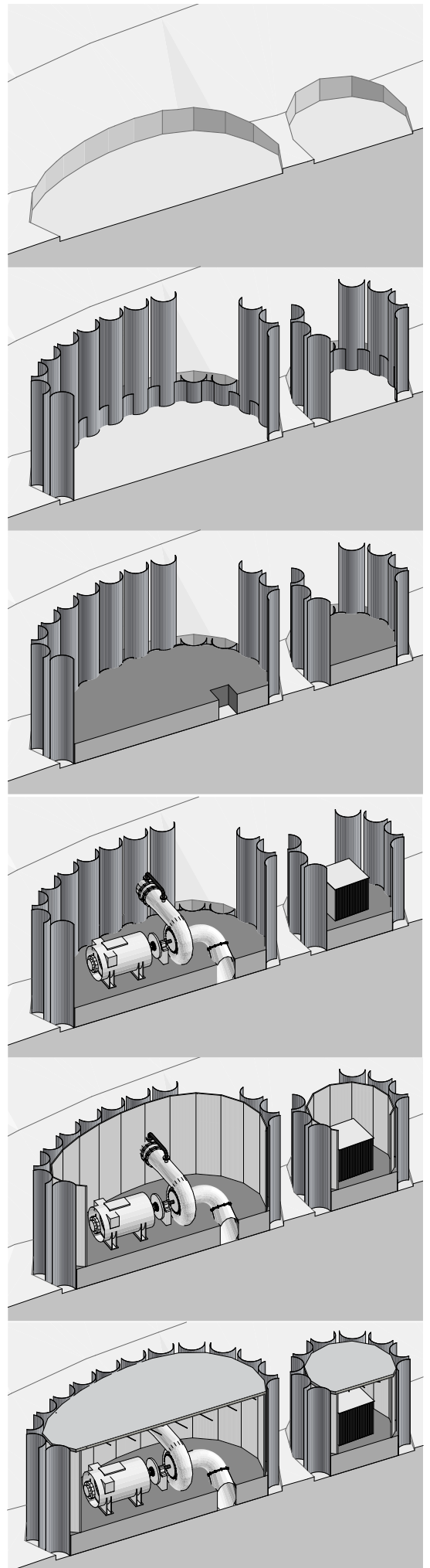
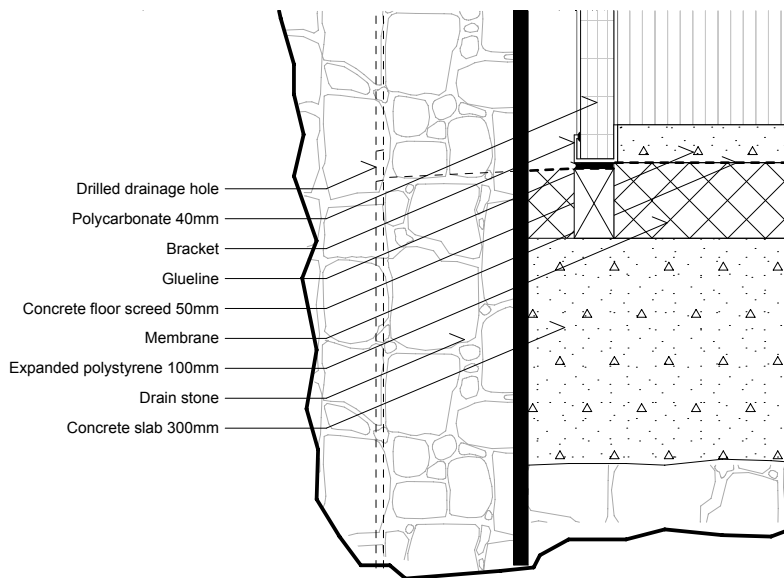
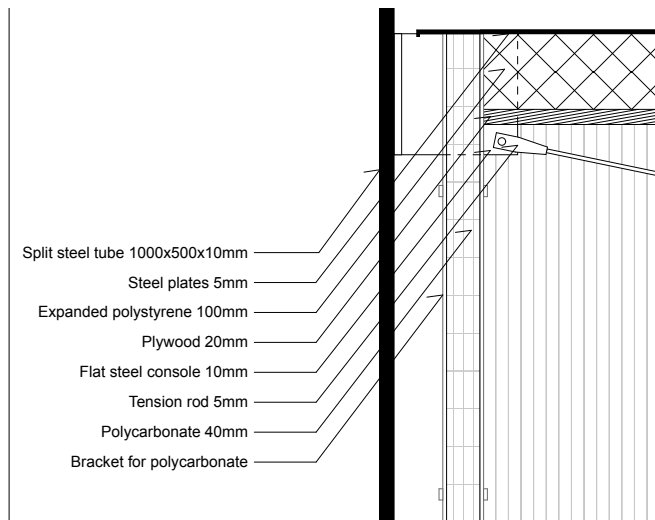


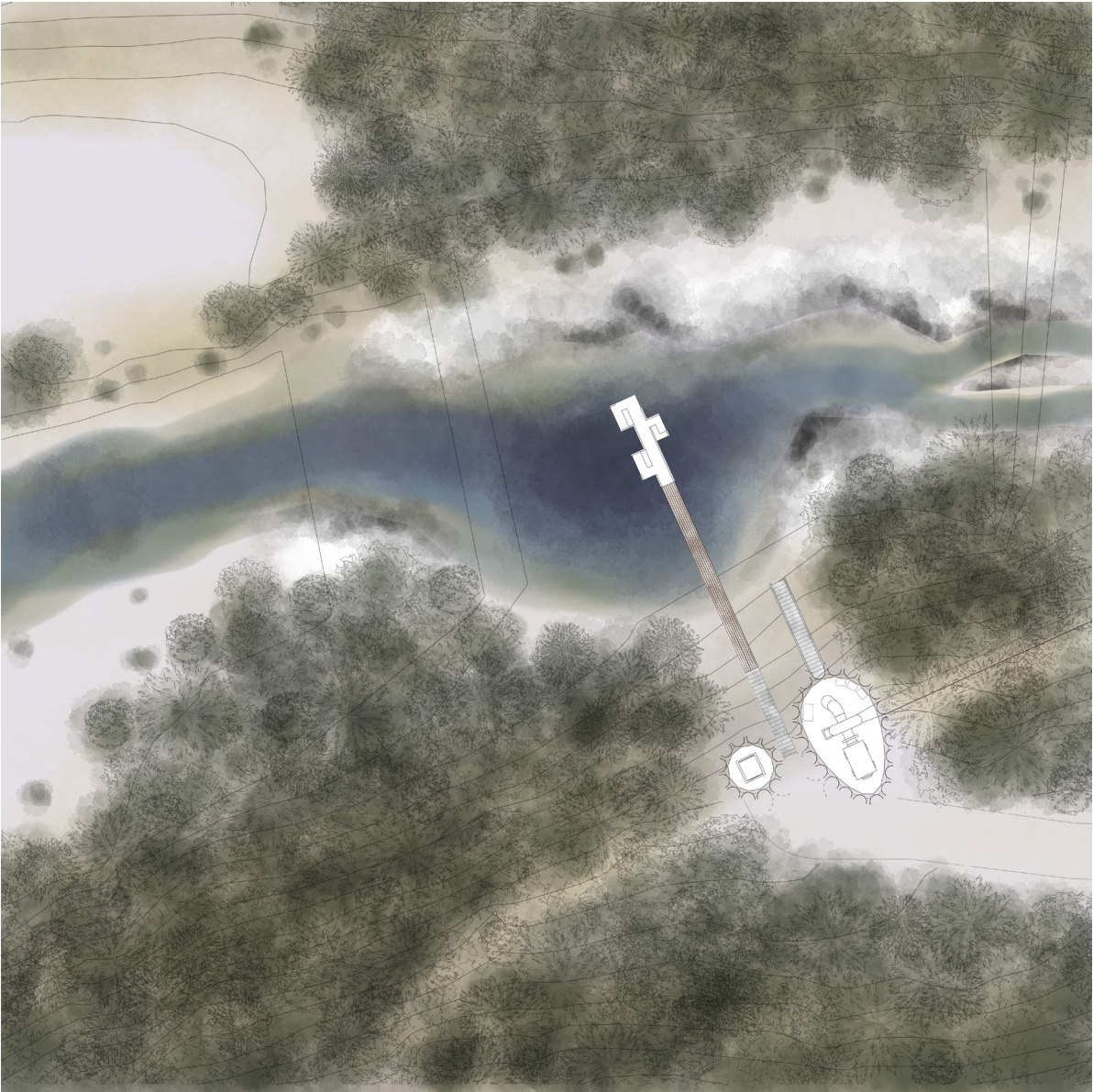
The walls of the power plants are built from the steel pipes used for creating the penstocks. They have a diameter of 1000 mm. These are split in half for saving material. The pipes carry an inner wall of polycarbonate, that serves provides rudimentary insulation, in case the power plant is out of service in the coldest periods of winter. The polycarbonate also lets light in, and enhances the contrast of the outside to the inside, by making the walls appear very soft from the inside.

The structure of the power stations were designed as portals for the added public program, forcing interaction between the viewer and the power plants. For instance, on the way approaching the warm pool, you have to pass between the machine hall and the substation. At the narrowest point sound will leak out and reverberate in the concave tubes. When you get into the pool, there is an opening in the facade of the machine hall, giving a view of the turbine and generator.

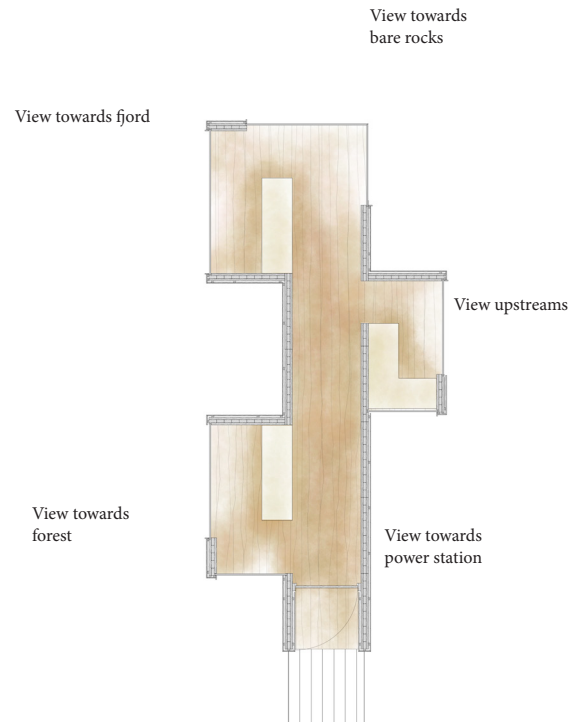
The pipe wall acts as a formwork for the heavy foundation (needed to avoid vibrations and to resist a heavy horizontal load, pushing on the valve of the turbine when it's closed).

The pipe wall has a welded on console, that carries the steel plates of the roof, carries the brackets for the polycarbonate wall, and is used to fasten the tension rods of the roof in.



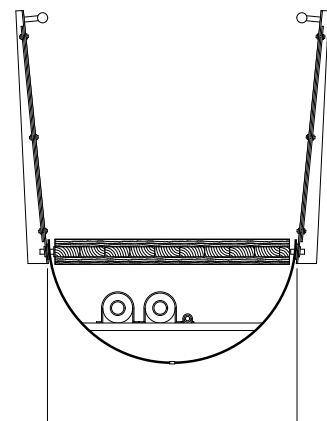


The first site (is very close to the fjord and the marina. It contains the first power station and a viewpoint of the river, heated by excess energy from the power plant. It marks the starting point for a hiking route along the river, a continuous experience from the pier and up into the forest and eventually the mountains.



The viewpoint is placed in the middle of the river. It balances on top of the bridge made from a split steel pipe.

It has three spaces; the first faces towards the forest and the fjord, the second faces upstreams of the river, and the third is open on three sides, giving view towards the fjord, and some beautiful large bare rocks in the river.

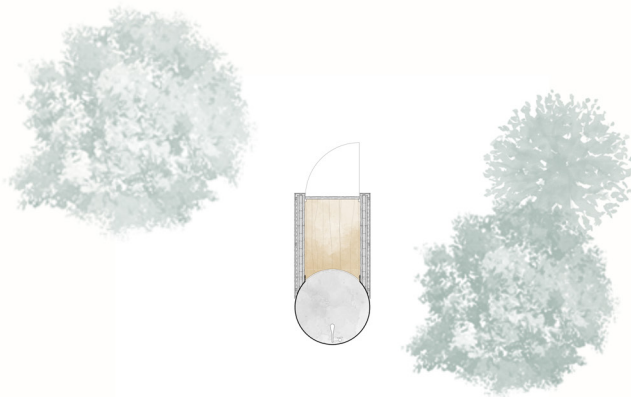




The second site is planned further up the river, closer to the village and embedded in the cultural landscape. It contains the intake dam for the first power plant as well as the second power station. They are situated right next to a small bridge connecting the two sides of the valley, making the site central for the village. The excess heat will here be used for heating an outdoor pool.



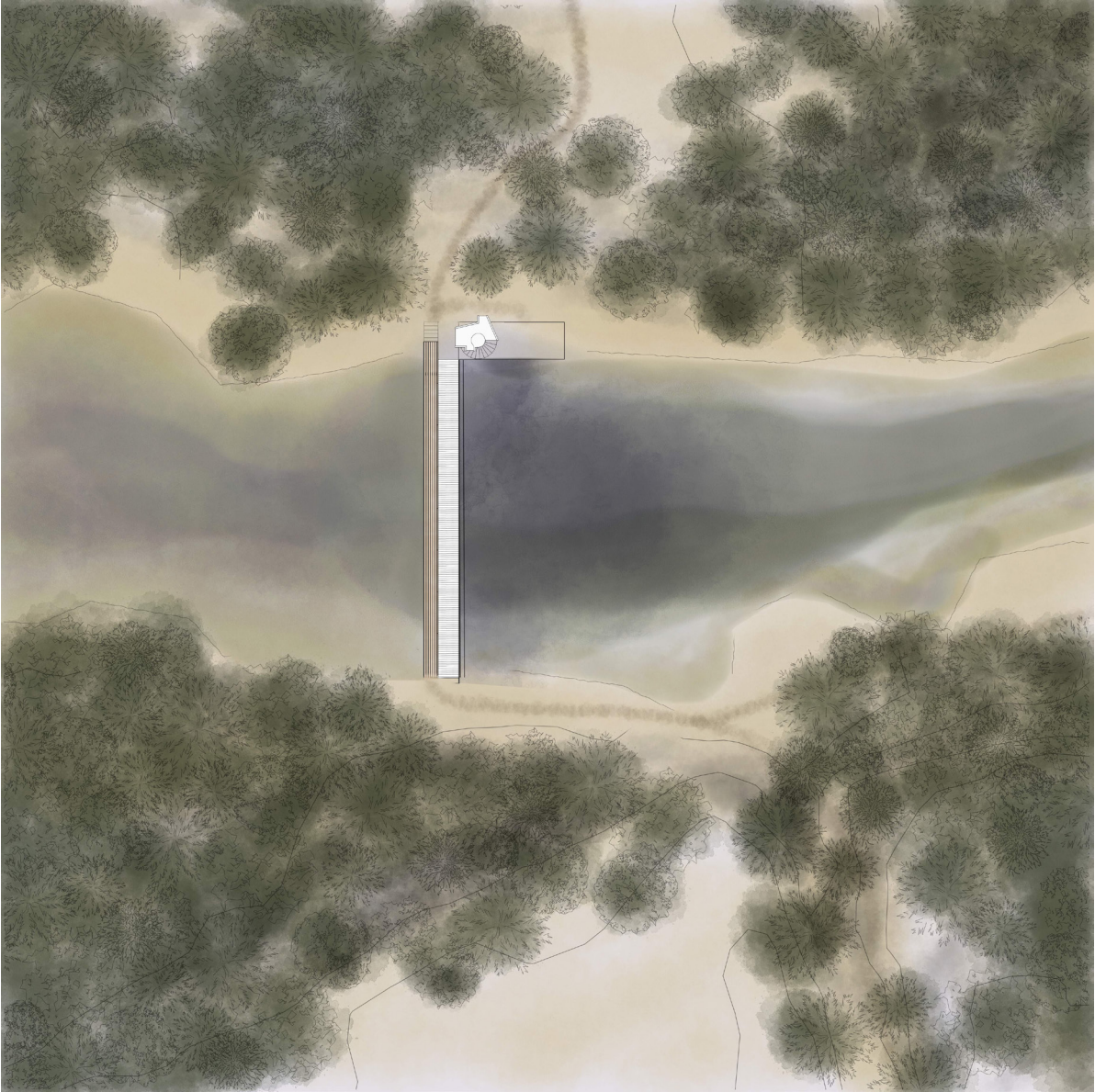
The pool is made from split steel pipes, making a waving line that both contrasts and blends with the still water of the dam.



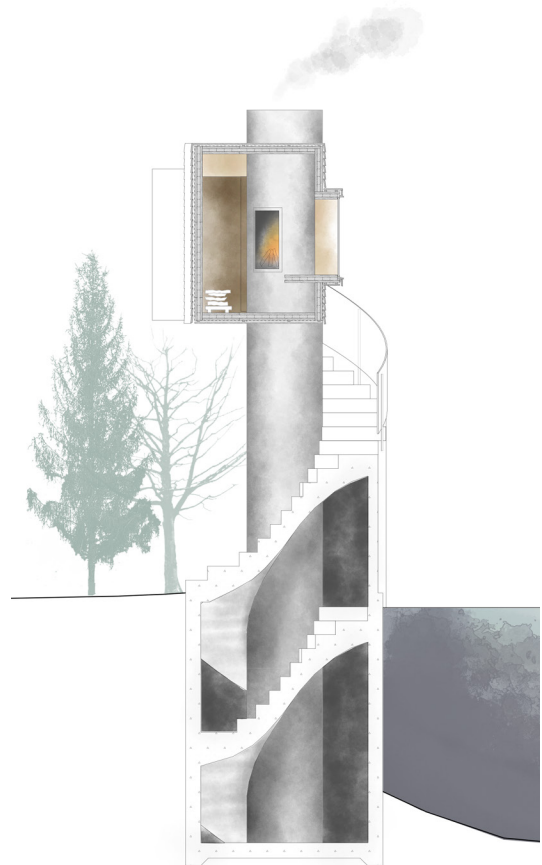
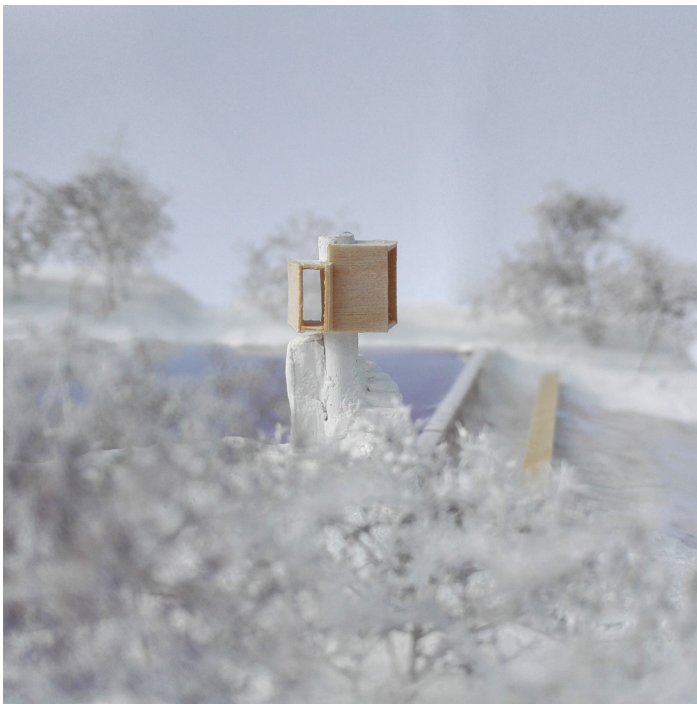
The shower is made of a steel pipe. A small changing room made of cross laminated timber cantilevers out from it.

A simple glass is glued on top of the steel pipe to provide skylight.





The third site is at the border between cultural landscape and the forest. It contains the intake dam for the second power plant, and the outlet works of the dam is used as a base for the lookout tower, and for a bridge crossing the river.

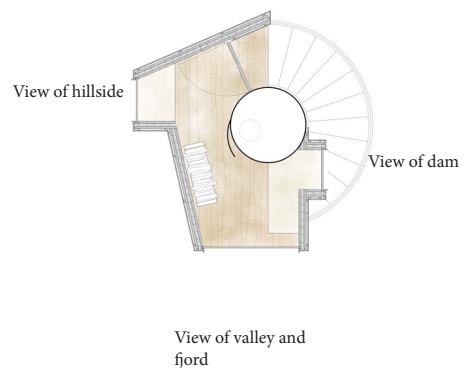


The lookout tower is placed on top of the outlet works of the dam.

A single steel pipe makes a column that the spiral stairs that leads down to the outlet works encircles. The stairs are continued on top of the outlet works, leading up to the lookout.

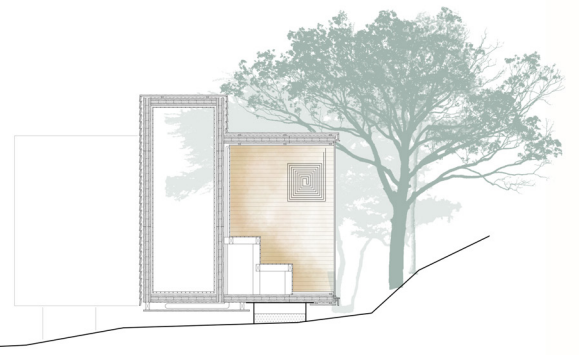
There are three windows in the lookout. One of them is facing towards the hillside when you enter. The main window gives the view of the valley and the fjord. The third faces back towards the dam.

Inside the lookout the steel pipe could be used as a fireplace.





The fourth site is enclosed in the forest, close to a camping site and several mountain farms. It contains the third power station and the excess heat will be used to heat a sauna close by the river.



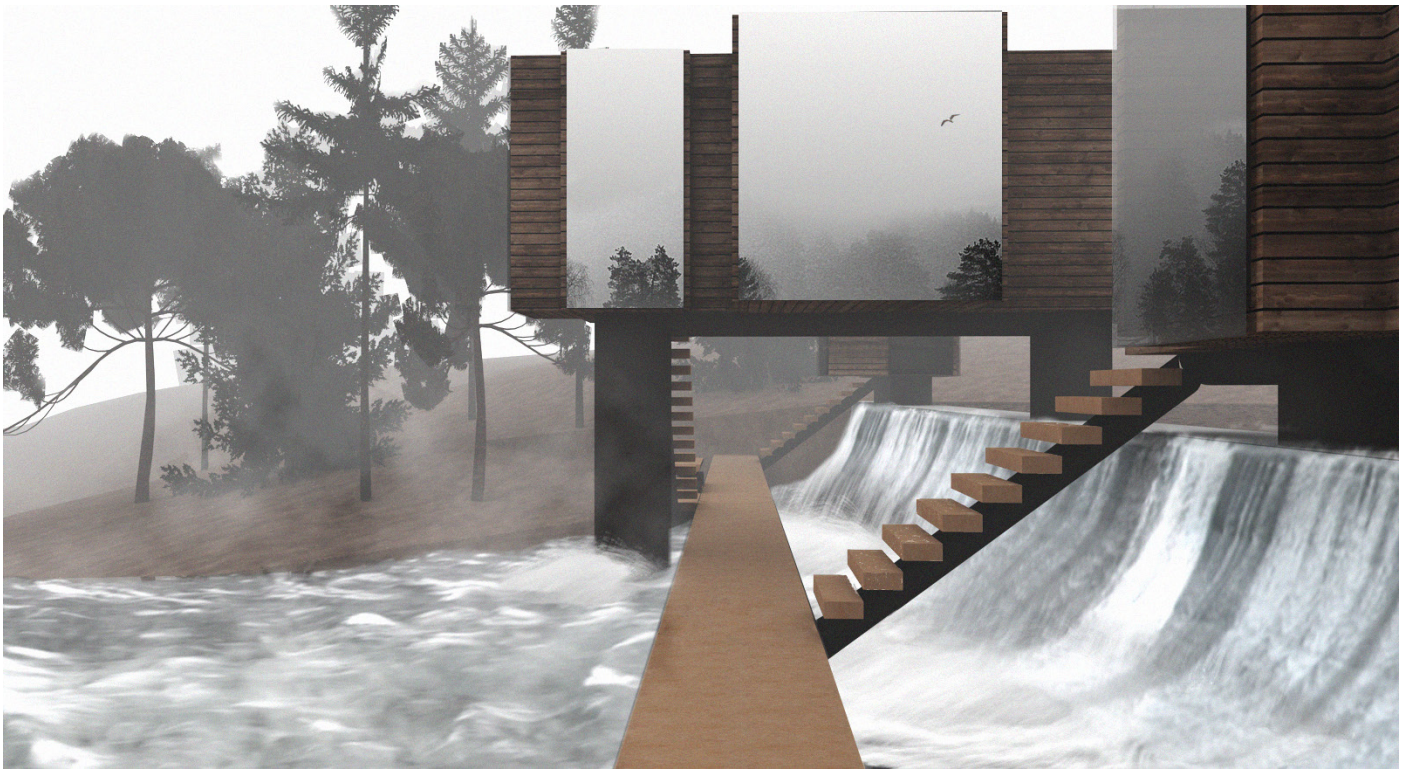
The sauna, showers and toilets are placed on the edge between the forest and the riverbank. The sauna itself stands on top of some large bare rocks that reaches out into the river. The sauna is carried by two large columns made from steel pipes.

The sauna and the power plant are facing each other on either side of the river, but are connected by a bridge. The power plant acts as a portal for the path on one side, and the showers and toilets makes a portal on the other.

The sauna has a narrow unclimatished space in the middle, that focuses the view towards the river, upstreams. There are two spaces in the sauna; one larger, suitable for small groups, facing the river, and one smaller, suited for one or two, facing back into the forest.



The fifth site is all the way up in the mountains and contains the intake dam for the third power plant. The structure of the intake dam is used as foundation for three self service cabins, and for a bridge crossing the river.. There are cabins for similar use in neighbouring municipalities that serves as popular hiking destinations.



The cabins are placed on top of the dam, using the concrete structure of the dam as foundations. Large steel tubes are cast into the retaining wall of the dam, lifting the cabins slightly over the water.

A bridge made from a split steel pipe crosses the river underneath the cabins, giving a dramatic view for people passing.

The cabins are of slightly different sizes, but all quite minimal. They all have views towards the valley & fjord, and towards the dam.

