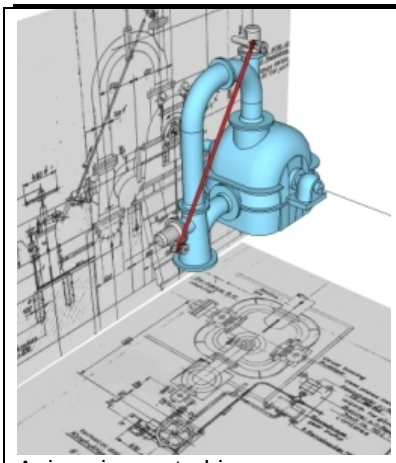

Animasjon av turbin

Rud 1 Minikraftverk
Sogndal i Sogn
Norge

Eier (client):
Kaupanger Energi AS

Eiere (owner) :
75% Kaupanger Hovedgård
25% Tyngdekraft AS.

Nøkkeldata (key figures)**:**

- H : 240 m
- Qm 0,175 m3/s
- Qt : 0,350 m3/s
- P : 660 KW
- E : 2,1 GWh
- Kostnad (cost) – 5,4 mill kr
- Spes cost 2,60 Kr/GWh

Byggetid (construction time)**:**
6 måneder (months)

Byggeår:
08/2007 – 2/2008

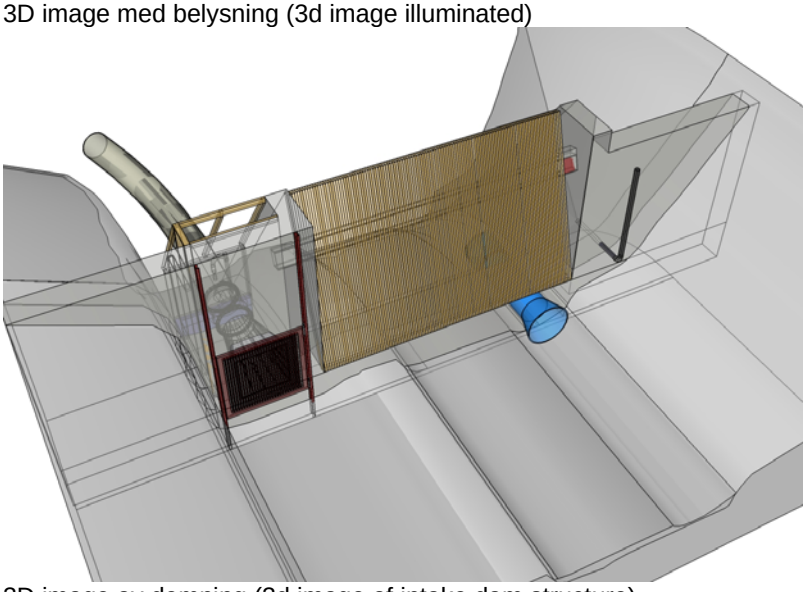
Idriftsettelse (commissioning)**:**
4/2008

Finansiering (financing)**:**
Landkredit Bank


3D image med belysning (3d image illuminated)


Fundament (foundation base)


Pelton turbinhjul (Pelton runner)


3D image av demning (3d image of intake dam structure)

Brief project description

Sofienlund is the responsible engineer for the whole project comprising the following main key design elements: initial planning and concession application, conceptual design, detail design of intake dam and intake structure, penstock, powerhouse, tailrace channel, complete electro-mechanical works and high voltage 0,69/22kV transformer. We will also be responsible for the commissioning.

The project will be a run-of-the-river project and is located on the western part of Norway named Sogn og Fjordane county. The small creek Rudsbekken has an average water flow of about 0,18 m3/sec. The turbine scaling will be Qt=2 * Qm => Qt 0,35 m3/sec. The plant is simulated to generate about 2 GWh annually with a residual water flow in the river equal to 5% og Qm throughout the whole year.

The intake is a concrete structure anchored to solid rock with rock bolts. The intake forms an integral part of the dam and reach a total height of about 5 meters and the crest length is about 15 meters.

The penstock is 1200 m with DN 500 pipes of PE and ductile cast iron as seen on the picture above. The total gross head will be 245m. The slope is quite steep at an average of about 12 degrees, but the topography comprises moraine soil almost all the way and there will only be one anchor block along the penstock between the PE-pipe and the ductile cast iron pipe. The penstock will be buried with a minimum of 1 meter overburden to keep it steadily on place.

The powerhouse has a solid foundation of concrete and founded in soil and gravel. The volume of the foundation has to withstand the dynamic water forces from the penstock at 70 ton. The top construction will be a wooden construction. The power plant has a water-level control.

The power grid almost 5 km away from the power plant and a 22 kV high voltage power cable has been buried all the way to connect to the power grid.

Project team

Project manager	Einar Sofienlund,
Hydrology	Einar Sofienlund,
Civil engineer	Jann Biedilae and Einar Sofienlund,
Mechanical engineer	Bjorn Undrum and Einar Sofienlund,
Electrical engineer	Einar Sofienlund,

Key figures

Rud 1 - Intake 247.5 & Outlet 3 moh => 244.5 m Head bto		
Catchment area	5.1	km2
Spesific runoff	0.035	m3/sek/km2
Mean runoff	0.180	m3/s
average minimum runoff	-	m3/s
Minimum waterflow summer	0.008	m3/s
Minimum waterflow winter	0.008	m3/s
.		
Intake	247.5	m.o.h
Outlet	3.0	m.o.h
Head bto	244.5	m
Head net (average Q)	243.0	m
Head net (max Q)	239.4	m
Turbine capacity, max	0.332	m3/s
Turbine capacity, min	0.003	m3/s
.		
Penstock, diameter	507	m.m.
Penstock, length	1 094	m
Installed capacity	0.661	MW
Power factor	2 893	timer per år
Energy equivalent	0.437	kWh/m3
.		
.	-	nat. hk.
.	-	nat. hk.
.		
Live storage	-	mill. m3
HRW	247.5	m.o.h.
LRW	245.5	m.o.h.
.		
Production, winter (1/10-30/4)	-	GWh
Production, summer (1/5-31/9)	-	GWh
Average annual production	1.7	GWh
.		
CO2 savings	1 400	tonn per år
.		
Development cost	4.7	mill kr
Spesific development costs	2.73	kr/kWh