Glendoe Hydro Electric Scheme
United Kingdom

Client

Scottish and Southern Energy plc,
Perth, Scotland

Project

100 MW high-head power plant

Service Provider

Pöyry Energy Ltd.
as designer for
Hochtief (UK) Construction Ltd.

Services

- Tender design
- Contractor's engineer
- Detailed design of civil works
- Review of suppliers' designs for electro-mechanical equipment
- Geodetic observations

Execution Period

2006–2008

Project Description

The Glendoe hydro-electric facility is located in the Monadhliath mountains, near the southwest end of Loch Ness, close to Fort Augustus and Inverness. The reservoir, which is impounded by a concrete faced rockfill dam, is at elevation 630 mAOD when completely full. The net head of the scheme is 605 m, which is the highest head of any UK hydro scheme.

A 6.3 km long headrace tunnel leads from the reservoir to a cavern powerhouse. The 1.5 km long tailrace tunnel discharges into Loch Ness.

The natural catchment of the reservoir is restricted to 15 km^2.

An additional catchment of 66 km^2 is obtained by diverting water from other basins into an aqueduct system comprising 17 intakes, various aqueduct pipelines and an aqueduct tunnel consisting of cut and cover as well as drilling and blasting sections.

The cavern powerhouse is located around 250 m below ground level.

The powerhouse incorporates a single 100 MW Pelton turbine with 6 jet nozzles. The average annual output is predicted to be180 GWh.

The tailrace and headrace tunnels were drilled by a tunnel boring machine (TBM) with various radii and slopes. The tunnels are all unlined due to the existence of good rock.

The pressure rise in the upstream waterway is low since water jets can be diverted by the turbine deflectors in a short time. A surge shaft is therefore not necessary.

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Glendoe Hydro Electric Scheme

Key Data

Dam

Type	Concrete faced rockfill dam (CFRD)
Max. height above foundation	32.10 m
Crest length	910.6 m
Crest elevation	632.0 mAOD
Design capacity of side channel spillway	120 m^3/s

Reservoir

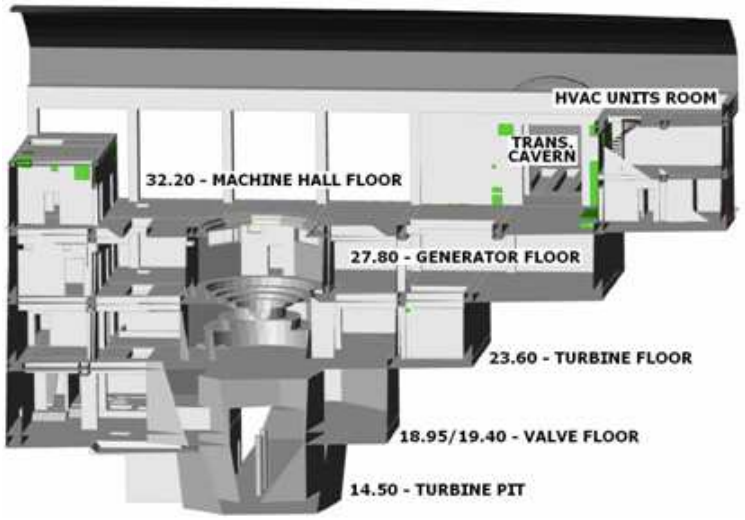
Catchment area	15 km^2
Mean inflow	0.8 m^3/s
Full supply level	630.0 mAOD
Max. flood level	631.4 mAOD
Min. operating level	624.0 mAOD
Gross storage	13.0 Mm^3
Reservoir (usable)	8.0 Mm^3
Area	1.5 km^2

Aqueduct system

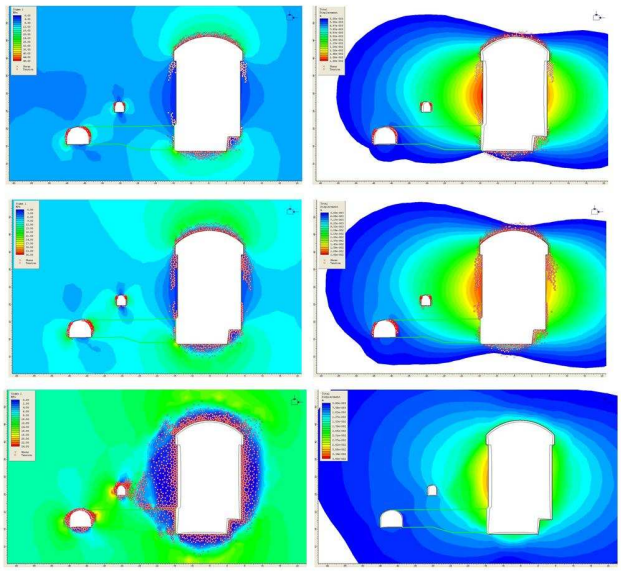
Additional catchment area	66 km^2
Additional mean inflow	3.2 m^3/s
Aqueduct tunnel	
• 'D' shape	4.8 m high x 5.0 m wide
• Length drill and blast sections (4)	7.6 km
• Length cut and cover sections (4)	1.1 km
• Discharge	14.0 m^3/s
Aqueduct pipeline	
• Length (main)	4.4 km
• Length (secondary)	3.8 km
• Diameters (main)	1.8 / 2.0 m
• Diameters (secondary)	0.75 / 0.9 / 1.2m
• Discharge	8.4 m^3/s
• Intakes	17
• Coanda screen types	15
• Tyrolean weirs	2

Waterways

Net head	605 m
Surge tank	not necessary
Tunnel lining	unlined
Excavation	Tunnel boring machine (TBM) Ø5.00
Headrace tunnel	
• Diameter	5.0 m
• Length	6.3 km
• Slope	11.7%
Tailrace tunnel	
• Diameter	5.0 m
• Length	1.5 km
• Slope	0.05%



Longitudinal section and cross-sections through powerhouse
Length = 46.6 m, Height varies between 9 and 32 m, Span = 19.5 m



GSI = 65 rockmass. Analysis of effect of decohesion on stresses, plastic zones and deformations in the power house. Without support. With 0% decohesion (top), 50 % (middle) & 90% decohesion (bottom)

Powerhouse

Type	cavern
Size (LxWxH)	47x19.5x32 m
Design head	605 m
Turbines	1 Pelton 6 orifice
Average discharge	18.6 m^3/s
Installed capacity	100 MW
Annual energy	180 GWh