

# CRUACHAN POWER STATION: SITE INFORMATION

## Key facts:

- Opened by HM the Queen in 1965
- 440MW capacity, one of only four pumped storage stations in the UK
- Located at Ben Cruachan, near Oban, Argyll
- The turbine hall is constructed within the hollowed out mountain of Ben Cruachan



## An Introduction to Cruachan Power Station

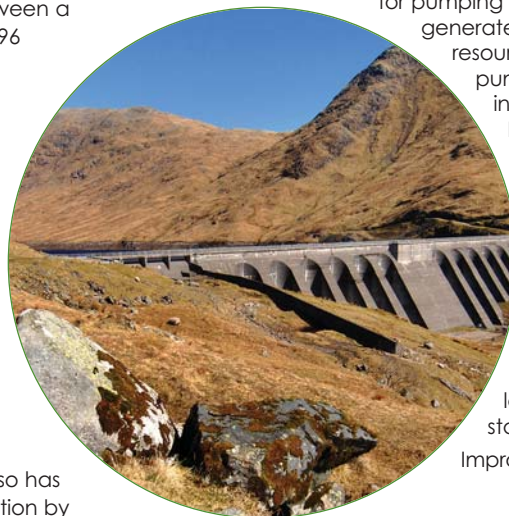
Cruachan Power Station plays an important strategic role in helping to secure the nation's electricity supply.

Because it is a pumped storage power station, it is able to temporarily store energy using clever management of water resources between a reservoir high in the Argyll hills and Loch Awe, 396 metres below.

Using its reversible turbines, the station pumps water from Loch Awe to fill the upper reservoir at times when the demand for electricity is low and it is therefore cost-effective to do so. When demand and therefore prices rise again, the stored water can be released through the plant's turbines to meet the increased electricity usage.

The station is also very responsive, which aids its effectiveness in meeting these daytime peaks. The four turbines can go from 'spinning reserve' – where the turbines are turning in air and awaiting the rush of water – to generating full load within thirty seconds.

In normal conditions the plant runs for only short periods to meet increases in demand, but it is capable of operating continuously for around 20 hours if necessary. Cruachan also has the ability to operate like a conventional hydro-electric station by using rainwater from its catchment area and around 10% of its annual generated output is produced in this way.



*Cruachan Dam*

## Reducing our Environmental Impact

Cruachan is a green provider of electricity. Because it is powered by water, its operation does not directly result in emissions to air of gases such as carbon dioxide (CO<sub>2</sub>) or sulphur dioxide (SO<sub>2</sub>).

The station is a net consumer of electricity as it uses up more power for pumping water and spinning its turbines than it actually generates. To offset this, the station is tackling its use of resources and new, more energy-efficient motors and pumps have been fitted as part of a recent investment across the station's four generating units. Energy usage is also monitored to help the plant identify all possible savings.

Another key consideration is ensuring water quality. While Cruachan has an excellent record on environmental protection, it has nevertheless invested heavily in improving its readiness in the unlikely event of an oil spill or leak. As a result, new oil skimmers have been installed in the low level gallery of the machine hall and work continuously to skim any oil leaks or spills.

As an additional precautionary measure, four oil interceptors work like septic tanks to trap any leak or spill before it enters the water system and alarms are fitted to the interceptors to alert station staff in the event of a spill, allowing early intervention.

Improved bunding has also been put in place around the transformers and oil tanks at the station, at the dam and at the tailrace at Loch Awe.

Cruachan Power Station operates to conditions set out in a Controlled Activities Licence that is issued and enforced by the Scottish Environment Protection Agency (SEPA). The station also operates an Environmental Management System that is certified to the standard ISO 14001 and also has published a site biodiversity action plan (BAP).

*The control room*



## The Hollow Mountain

Cruachan's machine hall is the size of a football pitch and built inside the hollowed-out rock of Ben Cruachan. Construction of the 'Hollow Mountain' involved the excavation of 220,000 cubic metres of rock and soil and around 1,500 workers were employed at the peak of this major civil engineering project.

Reached by a tunnel about seven metres wide and four metres high, the main cavern houses four generator/motor sets that are capable of generating 440 megawatts (MW) of electricity – enough to supply more than 225,000 homes. The cavern is also home to the transformer halls, a viewing gallery for visitors and a computerised control room from which the plant is monitored and controlled.

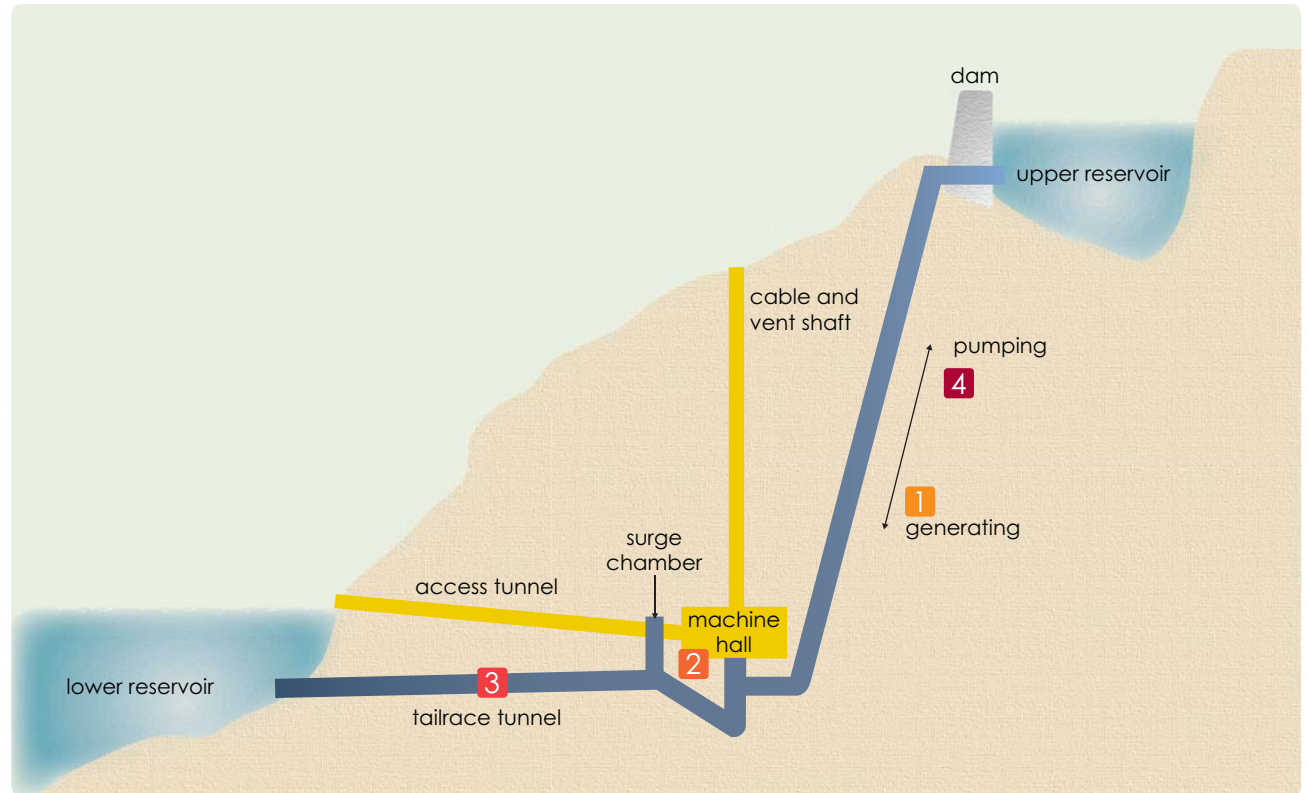


*Access to the turbine hall is through a 1km tunnel*

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The station's machine hall, containing the four turbines, is the same size as a football pitch



## How it Works

Cruachan's generators are powered by water from a reservoir on the slopes of Ben Cruachan, 396m above. The reservoir has a storage capacity of 10 million m<sup>3</sup> of water and has a catchment area of 23km<sup>2</sup>. A network of 19km of tunnels and pipes divert rainwater from streams into the reservoir.

The station can be used as a conventional hydro plant, using run-off water from its upper reservoir's catchment area, and around 10% of Cruachan's electricity is produced in this way. More usually, Cruachan works like an enormous rechargeable battery. Its reversible turbines use cheap electricity during the night to pump water from Loch Awe at the foot of the mountain to its upper reservoir, in readiness for charging the turbines to meet peak demand the following day. This water is essentially stored electricity that can be released at any time.

- 1 Each of the station's four generator/motors receives water from the upper reservoir via concrete lined shafts, known as penstocks. The water passes into steel pipes that terminate at main inlet valves.
- 2 When generation is required, the valves are opened to allow a rush of water to drive the turbines.
- 3 After the water passes through the turbines, generating electricity, it flows into a surge chamber then into Loch Awe along a tailrace tunnel that is seven metres in diameter and 975 metres long.
- 4 When pumping is required to refill the upper reservoir, the station's turbines are switched into pumping mode and started using a pony motor, which spins the machine from rest to synchronous speed in the pumping direction.

Full pumping speed can be achieved in eight minutes, with each generating set absorbing between 110 MW and 120 MW from the grid to pump water from Loch Awe to the upper reservoir.

Cruachan's upper reservoir

