= Cruachan Power Station =

The Cruachan Power Station (also known as the Cruachan Dam) is a pumped @-@ storage hydroelectric power station in Argyll and Bute , Scotland . The turbine hall is located inside Ben Cruachan , and the scheme takes water between Cruachan Reservoir to Loch Awe , a height difference of 396 metres (1 @,@ 299 ft) . It is one of only four pumped storage power stations in the UK , and is capable of providing a black start capability to the National Grid .

Construction began in 1959 to coincide with the Hunterston A nuclear power station in Ayrshire . Cruachan uses cheap off @-@ peak electricity generated at night to pump water to the higher reservoir , which can then be released during the day to provide power as necessary . The power station is open to visitors , and around 50 @,@ 000 tourists visit it each year .

= = Location = =

The power station is on the A85 road , about 8 km or 5 miles west of Dalmally , on a branch of Loch Awe leading to the River Awe , which is the outflow from the loch , at its NW corner . There is a seasonally open Falls of Cruachan railway station nearby .

= = History = =

Construction commenced in 1959 , and the power station was opened by Queen Elizabeth II on 15 October 1965 . The concept was designed by Sir Edward MacColl , who died before it opened . The civil engineering works of the scheme were by James Williamson & Partners of Glasgow , and the main project contractors were William Tawse of Aberdeen and Edmund Nuttall of Camberley . Consultant electrical engineers were Merz & McLellan of Newcastle on Tyne . At the peak of the construction , there were around 4 @,@ 000 people working on the project . Thirty @-@ six men died in the construction of the power station and dam , and the cost of the scheme was GB £ 24 @.@ 5 million .

Cruachan was one of the first reversible pumped @-@ storage systems , where the same turbines are used as both pumps and generators . Previous pumped @-@ storage systems used separate pumps with a network of pipes to return water to the upper reservoir , making them much more expensive to build than conventional hydroelectric systems . Cruachan is predated by the smaller 232 megawatts (311 @,@ 000 hp) Lünerseewerk (de) of 1958 and the 360 megawatts (480 @,@ 000 hp) Ffestiniog Power Station of 1963 . It is one of four pumped storage schemes in the UK .

Its construction was linked to that of Hunterston A nuclear power station , to store surplus night @-@ time nuclear generated electrical energy . The power station was originally operated by the North of Scotland Hydro @-@ Electric Board , before being transferred to the South of Scotland Electricity Board . It has been owned by Scottish Power since the privatisation of Britain 's electricity industry in 1990 , and they are looking to increase capacity to 1 @,@ 040 MW .

Its early life was fraught with technical difficulties , but the size of the maintenance team has been reduced from 30 in 1989 to 12 in 2010 . Maintenance of the penstocks , which formerly required them to be drained , is now done using a remotely operated underwater vehicle .

In 2015 to commemorate the 50th anniversary of the station 's opening a BBC radio documentary " Inside the rock " covered the history of construction . BBC documentary ' Inside the Rock'

= = Design = =

The Cruachan station temporarily stores energy at times of low demand , and releases it at times of high demand , when electricity prices are higher , reducing the maximum power that must be provided by power stations . It is also used to cope with sudden surges in the demand for electricity , such as at the end of television programmes . Despite the use of some rainwater , Cruachan is not a net generator of electricity : it uses more energy for pumping water and spinning its turbines than it

generates .

Water is pumped from Loch Awe to the upper reservoir , 396 metres (1 @,@ 299 ft) above , during periods of low energy use (such as at night) , and then released during the day . The upper reservoir also receives rainwater , supplemented by a network of 19 kilometres (12 mi) of tunnels . Around 10 % of the energy from the station is generated from rainwater ; the rest is from the water pumped up from Loch Awe .

The station is capable of generating 440 megawatts (590 @,@ 000 hp) of electricity from four turbines , two of 100 megawatts (130 @,@ 000 hp) and two of 120 megawatts (160 @,@ 000 hp) capacity , after two units were upgraded in 2005 . It can go from standby to full production in two minutes , or thirty seconds if compressed air is used to start the turbines spinning . When the top reservoir is full , Cruachan can operate for 22 hours before the supply of water is exhausted . At full power , the turbines can pump at 167 cubic metres (5 @,@ 900 cu ft) per second and generate at 200 cubic metres (7 @,@ 100 cu ft) per second .

The power station is required to keep a 12 @-@ hour emergency water supply in order to provide a black start capability to the National Grid , to enable utilities to be restarted without access to external power .

= = = Turbine hall = = =

There are four Francis turbines , which operate as both pumps and generators . These are housed in a cavern within Ben Cruachan , which is 91 @.@ 5 metres (300 ft) long , 23 @.@ 5 metres (77 ft) wide and 38 metres (125 ft) high , with an adjacent transformer hall . The chamber is at a depth of around 300 metres (980 ft) , and is located within a hard granite intrusion . Construction of the power station required the removal of 220 @,@ 000 cubic metres (7 @,@ 800 @,@ 000 cu ft) of rock . Access to the hall is gained by a road tunnel 1 kilometre (0 @.@ 62 mi) long , 4 metres (13 ft) high and 7 metres (23 ft) wide , which is warm and humid enough to allow tropical plants to grow .

The transformers step up the voltage from 16 kV to 275 kV for transmission . Six oil @-@ filled cables carry the electric current up a cable shaft to a point in front of the dam , and from there it is carried on pylons to Dalmally 8 kilometres (5 @.@ 0 mi) to the east . The staircase in the cable shaft has 1 @,@ 420 steps , making it the tallest in Britain .

After passing through the turbines , the water enters a surge chamber designed to balance fluctuations in the level of water before entering the tailrace tunnel to Loch Awe , which is 7 metres (23 ft) in diameter and 935 metres (3 @,@ 068 ft) long .

= = = Reservoir = = =

The Cruachan Reservoir is 396 metres (1 @,@ 299 ft) above Loch Awe , and is contained by a dam 316 metres (1 @,@ 037 ft) long . The reservoir has a catchment area of 23 square kilometres (8 @.@ 9 sq mi) , and is capable of holding 7 gigawatt @-@ hours (25 TJ) of energy . Environmental restrictions meant that the dam had to have a " clean " structure , so the operational equipment is located within the dam wall itself .

The penstocks are a pair of tunnels , 260 metres (850 ft) long and inclined at 56 ° from the horizontal with a 5 @.@ 3 metres (17 ft) diameter , which then bifurcate into four steel lined 190 metres (620 ft) long , 2 @.@ 5 metres (8 ft 2 in) diameter shafts . The penstocks underwent a major inspection and refurbishment in 2003 .

= = Tourist attraction = =

The power station was listed by the conservation organisation DoCoMoMo as one of the sixty key monuments of post @-@ war Scottish architecture . In November 2012 , the power station received the Institution of Mechanical Engineers ' Engineering Heritage Award .

A visitor centre , refurbished in 2009 , is situated at the outflow to Loch Awe and receives around 50

@,@ 000 visitors a year .

The power station houses a three @-@ section 48 by 12 foot (14 @.@ 6 m × 3 @.@ 7 m) modernist mural in wood , plastic and gold leaf by English artist Elizabeth Falconer . The mural includes Celtic crosses , pylons , mythical beasts , and men of industry . The first section depicts the mythical Cailleach Bheur , who guarded the spring underneath the mountain . The middle panel commemorates fifteen workers killed when the roof of the turbine hall collapsed , and the final section shows the station working .