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CATASTROPHIC ACCIDENT AT THE SAYANO-SHUSHENSKAYA HPS

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Worldwide, about 20% of all electricity is generated by hydropower. Hydroelectric power plants convert the kinetic energy contained in falling water into electricity.

The decision to build the power station was taken in 1960. On November 4, 1961, geologists reached the area, and an exact location was chosen.³ Construction started in 1968 and the plant was opened in 1978. It was partially reconstructed in 1987.⁴ The plant was designed by the Saint Petersburg branch of the Hydroproject (Gidroproyekt) institute, Lengidroproyekt.

In 1993, the power plant was privatized and RAO UES became the main shareholder. In April 2003, the Government of Khakassia by the initiative of the governor Alexei Lebed filed a suit to invalidate the deal.⁵ In April 2004, the East Siberian Arbitration invalidated the deal; however, it was overruled by the Supreme Arbitration Court.

The plant was closed after accident on 17 August 2009. The turbine 6 was restarted on 24 February 2010.⁷

It was the largest power plant in Russia and the world's sixth-largest hydroelectric plant by average power generation.

The station's constructions include the dam, a power plant building located near the dam, and an additional spillway which is under construction. The arch-gravity dam is 245.5 metres (805 ft) high. It has a crest length of 1,066 metres (3,497 ft), crest width of 25 metres (82 ft), base width of 105.7 metres (347 ft) and maximum head of 220 metres (720 ft). It consists of a solid left-bank dam 246.1 metres (807 ft) long, a power dam 331.8 metres (1,089 ft) long, a spillway dam 189.6 metres (622 ft) long and a solid right-bank dam 298.5 metres (979 ft) long. It is by far the larger of only two gravity-arch dams in Russia. Water pressure for the dam is approximately 30 million tons, of which 60% is neutralized by the dam's own weight and 40% is carried to rock on the bank

The dam is constructed to "safely" withstand earthquakes up to 8 on the Richter scale, and was recorded by the Guinness Book of World Records for the strongest construction of its type.

The dam supports the Sayano-Shushenskay Reservoir, with a total capacity of 31.34 km³, useful capacity of 15.34 km³ and surface area of 621 km² (240 sq mi).



Economic value

The station is the largest one contributing to peak consumption in the Unified Energy Systems of Russia and Siberia. More than 70% of generated electrical power goes to Rusal's four smelters in Siberia.

In years of heavy rainfall, about 1,600–2,000 GWh are lost due to lack of high-voltage line transmission capacity, and some water bypasses the turbines. To avert this, a new aluminium plant was started on 15 December 2006.

There were problems with increasing water filtration through dam concrete also. In 1993 a French company "Saltenbash" impregnated dam constructions with resins after which the filtration was reduced and situation improved substantially. In later times the impregnation was repeated by Russian companies.

In 1996 the concrete was repaired on the reservoir side at levels from 344 to 388 meters¹⁸ At the same time, the soil under the dam and supporting it from sides, was impregnated to decrease the water filtration.

Accidents

1979 accident

On 23 May 1979, spring flood water entered into the machine hall and flooded the first working turbine unit. The turbine was restarted on 4 July 1979. The dam had not yet been completed.

1985 accident

A powerful spring flood destroyed 80% of the concrete spillway bottom plate, tearing apart 50-millimetre (2.0 in)-thick anchor bolts and carving seven meters deep into the bed rock.

1988 accident

A powerful spring flood destroyed the spillway well. As a result, working headway for the future was reduced by five meters.³

2009 accident

Main article: 2009 Sayano-Shushenskaya hydro accident Wikinews has related news: The most powerful hydroelectric plant in Russia experienced a hydraulic shock and a breakdown

Sayano–Shushenskaya hydroelectric power station in 2007

On 17 August 2009, the station suffered a catastrophic accident that caused flooding of the engine and turbine rooms and a transformer explosion.⁹²⁵²⁶ As of 4 September 2009, 74 people were confirmed dead while one person is listed as missing.

Power generation from the station ceased completely following the incident, with the resulting blackout in residential areas being alleviated by diverting power from other plants. Aluminium smelters in Sayanogorsk and Khakassia were completely cut off from the grid before power supplies were replaced using alternate power sources. Russia warned that in the longer term it might lose up to 500,000 tons of aluminum output due to the power shortage, and called for accelerating the construction of the Boguchanskaya hydroelectric power station to replace lost generating capacity.

The accident caused an oil spill with at least 40 tones of transformer oil released, spreading over 80 km (50 mi) downstream of Yenisei.

On the day of the accident, turbine № 2 worked as the plant's power output regulator. At 8:12 the turbine № 2 output power was reduced by an automatic turbine regulator, and it entered into a powerband unrecommended for the head pressure that day. Shortly afterwards the bolts keeping the turbine № 2 cover in place were broken. Under water pressure (about 20 atmospheres) the spinning turbine with its cover, rotor and upper parts jumped out of the casing, destroying the machinery hall equipment and building.

Pressurised water immediately flooded the rooms and continued damage to the plant. At the same time, an alarm was received at the power station's main control panel, and the power output fell to zero, resulting in a local blackout. But it took 25 minutes to manually close the water gates to the other turbines; during that time they continued to spin — without load

17 August Russia has experienced an accident on the power of energy release, surpassing the Chernobyl 4 times. At the Chernobyl NPP "pulled" reactor with capacity of 1 gigawatt, and the Sayan-Shushenskaya GES one blow freed capacity 4.4 gigawatts. At the power

plant were put out of nine out of ten generating units and part of the machine room. An earlier version that could be the cause of the accident impacts was rejected.

Now the basic version of specialists - access to prohibitive operating modes of the 2nd of the hydraulic unit.

Rostekhnadzor now trying to create a mathematical model of the turbine at the time of the accident. Then, after a powerful water attack, hydraulic weighing fifteen hundred tons of took off and flew, turning the blades overlap and scratching the walls, and the 7th and 9th hydraulic units continued to operate, creating a centrifugal force of its rotation, sucking water into the turbine hall.