

Schematic outline of the 3,251-long hillside penstock, showing the position of various structures along its route

OPERATION

The water dam passed final approval inspection on 18–19 June 1929. During its first year, MVE I operated at half-peak capacity but still supplied 1,709,687 kilowatts of power to the distribution network. Just for comparison, the EÚW power station at Andělská Hora produced 27,813,283 kilowatts over the same period. In the following years, its annual power production remained around 1.5 million kilowatts. The station changed operators several times after World War 2. In the years 1961–1996, the station was owned by the North



MVE I plant room with the Pelton wheel

2012–2013 – general overhaul of the MVE I turbine system

Bohemian Power Company (Severočeská energetika Děčín). Some of its electrical components were replaced in 1972 (switching station, block 5/10kV transformer, electrical parts of the automatic failure control system). Some minor structural repairs were carried out, including the replacement of the original roof tiles by aluminum plates. In 1996, The Labe River Basin Authority (Povodí Labe) took ownership of the power station; since then, the station is being operated by the facility in Jablonec nad Nisou, specifically by its Liberec operational branch. An automatic monitoring system was installed in 2001 to monitor the



MVE II plant room with the Francis turbine

meteorological, hydrological and operational properties of MVE Bedřichov (Rudolfov I and Rudolfov II). In the years 2012–2013, the high-pressure turbine system at MVE I was given a general overhaul, and electronic elements were added to the control mechanism of the Pelton wheel.

Due to its immense cultural and historical value, the Ministry of Culture declared the dam a national heritage monument in 2014. Between the years 2018–2019 state-owned enterprise Povodí Labe provided the complete renovation and conservation rehabilitation of the power station. The work was accomplished by Labská strojní a stavební společnost, s.r.o. Pardubice on the base of a project by HG Partner, s.r.o. Úvaly.

1/7/2014 – power station and dam declared a national heritage monument



ARTUR PAYR

(*1880 Bregenz, Austria – †1937 Prague) Architect, professor at the German Technical University in Prague. From 1898 to 1903, he studied at the Munich Technical University under the tutelage of Karl Hocheder and Friedrich von Thiersch, and went on to work in Weimar and Innsbruck. In 1917, he was awarded the post of professor at the German Technical University in Prague. His students included such prominent figures as Karl Winter, architect and designer of the town hall in Jablonec nad Nisou. Beside his teaching career, Payr was active in various Czech-German professional organizations. Apart from the Rudolfov power station, he received an assignment from Rudolf Preibisch, vice-chairman of the power station's board of trustees, to design his residence at No. 953-I Horova Street in Liberec. Payr designed several other hydro power structures, including the hydroelectric power station in Lomazice (built in the years 1919–1925 and flooded by water from the Nechanice dam in 1966) and the Březová dam near Karlovy Vary (designed in 1928, built 1931–1934).

2018–2019 – general reconstruction of the power station building and the pressureless penstock



The dam of Bedřichov reservoir on the Černá Nisa river

GPS coordinates:

N 50.7942503°, E 15.1093486°

Public transport: Take bus No. 18 to the stop “Rudolfov power station.” You may also walk approximately 4 kilometers, following the green tourist trail starting at the terminal station of tram lines 2 and 3 (“Lidové sady-ZOO”).

Operator: Labe River Basin Authority (Povodí Labe), state-owned enterprise, Hradec Králové, facility Jablonec nad Nisou, Liberec operational branch, www.pla.cz

More information on:

www.npu.cz/uop-li
[sekcje prezentace památek](http://sekcje.prezentace.pamatky.cz)
www.pla.cz



The dam of the levelling reservoir with an automatic valve stopper

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NÁRODNÍ
PAMÁTKOVÝ
ÚSTAV

ÚZEMNÍ ODBORNÉ PRACOVISŤE
V LIBERCI



The overall view of the power station from the northwest side.



LIBEREC-RUDOLFOV

Hydroelectric Power Station

DESIGN AND CONSTRUCTION

In the second half of the 19th century, the foothills of the Jizera Mountains were plagued by a series of disastrous floods which culminated in 1897. In an effort to prevent further flooding, an ambitious project to build a system of flood control dams was launched. The first two to be constructed were the Harcov reservoir in Liberec, followed by the dam reservoir in Bedřichov on the Černá Nisa river, built in the years 1902–1905. Two years later, Ulrich Huber, water management specialist and co-author of the dam project, sent an operational report to the Mayor's Office in Liberec regarding the possible utilization of water power on the Černá Nisa river beneath the Bedřichov dam. In 1910, the company Ganz & Co., based in Leobersdorf, Austria, created the first version of the project, which involved the use of a Pelton wheel with the estimated output of 300 kilowatts and a backup combustion engine. The project placed the power station higher upstream compared to its current location, but counted with the water being supplied through a pressured pipeline utilizing the natural downward slope of the terrain. The outbreak of World War I put a temporary damper on the construction, but interest in the project was renewed shortly after the war ended.

Electrical power for the numerous industrial plants in the valley of the Černá Nisa river, as well as the towns of Kateřinky, Rudolfov a Bedřichov, was provided by the *Liberec Electrical Power Company (Elektrischen Überlands-Werkes reg. Genossenschaft m. b. H. In Reichenberg – EÜW)*, using an underground power cable at a 5kV voltage running from the Andělská Hora coal-fired power station. Power loss during transmission was nearly 30 percent, and the power station could no longer satisfy the ever-increasing demand. This led to a renewed interest in building a hydroelectric power station directly in the Černá Nisa valley, right in the heart of the industrial area. A *Consortium for the Construction of a Power Station at the Bedřichov Dam* was established, spearheaded by Ludwig Hamburger. Hamburger introduced a concept of two turbine-generator systems: a high-pressure system (known today as MVE Rudolfov I) and a medium-pressure system with an equalizing basin (currently MVE Rudolfov II). On 15 August 1924, Hamburger was granted a water dam construction permit, and on 19 May 1925 transferred the permit to EÜW (with the town of Liberec as a majority shareholder). The Liberec-based company *Ed. Ast, Stroner & Co.* was chosen as the general contractor, with *Pittel & Brausewetter* and *L. Bill & Co.* as subcontractors. Completion date was set for late 1927, but the structure did not pass approval inspection until the summer of 1929. The project was accompanied by a major scandal, having run hugely over its initial budget of 7,505,999 Czech korunas, to 26,159,378 korunas.

POWER STATION DESCRIPTION

The Rudolfov hydroelectric structure includes a sluice and a diversion structure below the Bedřichov dam; a pressureless underground penstock with two storage tanks and aqueducts; a water lock; pressure pipes; MVE I power station; equalizing basin; MVE II power station; and a gravel check dam above the equalizing basin on the Černá Nisa river.

28/6/1906 – the Bedřichov dam on the Černá Nisa river passed inspection approval

Let's now look at the entire structure in detail. The penstock runs from a sluice with a rough rack not far from the lower side of the Bedřichov dam. The penstock is a covered, U-shaped gully, made of concrete (reinforced concrete wherever it runs in an aqueduct), 1 meter wide and 1.23 meters high at its central point. It runs across a forest terrain for over 3 kilometers. Apart from the actual gully, covered by concrete slabs and buried in soil, it was necessary to build two reservoirs to catch silt from the left-side affluents to the penstock; the penstock runs in a short aqueduct over these reservoirs. The pressureless section of the penstock ends at a water lock with an equalizing chamber, a desludging sluice gate, an overflow and a fine rack. A pressure pipeline runs toward the power station from this point, first on concrete pillars above ground level, and underground in the section directly over the station. The riveted steel pipe with a diameter of 700 mm, 675 mm and 650 mm in the upper, middle and lower section respectively, was supplied and laid by the company



Flanged, riveted pressure pipe, ready for installation. Left: Rudolfov I power station. Right: area for the future equalizing basin; far right: part of the stone quarry opened solely to provide material for the dam construction, 1926

Breitfeld, Daněk & Co. from Blansko, and measures 1,173 meters in its entirety, with an elevation difference of 170 meters. Pressure testing was carried out on 22 December 1926.

The MVE I turbine system began providing electrical power to the EÜW distribution network on 1 January 1927. The three-phase synchronous Siemens Schuckert generator, installed since 9 August 1926, operates at a rated speed of 500 revs per minute, an apparent output of 1,200 kVA, a 5,500 V voltage, and a power factor of $\cos \phi = 0.5-1$. The generator is powered by a twin Pelton wheel with a horizontal shaft, manufactured by J.M. Voith. Maximum usable flow is 0.650 cubic meters per second, at a gradient of 171 meters and a 980-kilo-watt output. The turbine has a rated speed of 500 revs per minute; the turbine runners are made of special cast iron material with screwed-on impulse blades (commonly known as runner buckets). The jet stream is brought to the buckets through two nozzles. The turbine is regulated both mechanically and hydraulically, by a coaxial needle reducer and a jet deflector. As an additional means of regulation, the turbine was initially equipped by a braking nozzle that moved in an opposite direction to the rotation of the runner, but this component was removed in the 1950s.

The building of the MVE Rudolfov I station, divided into a plant room and a residential wing with three apartments for the station's staff, was designed by architect Artur Payr. All horizontal structures are made of brick, with reinforced concrete beams supporting the ceilings. The building's base is lined by granite blocks; the façade is covered by a coarse-textured mineral plaster known as "brizolit"; the multi-paneled

15/8/1924 – water dam construction permit granted to Ludwig Hamburger



Power station after the equalizing basin has been filled. Left of the Bridge: Alexander Spitz's facility, then known as Buschmühle. The route of the high-pressure pipeline is quite easily apparent on the hillside. Photo taken around 1928.



Water lock shortly before completion, 1926–27

windows have deep jambs; and the massive, flat main cornice carries a projecting hipped roof. The roof was originally covered in beaver tail tiles with segmented dormers; later, the tiles were replaced by bitumen shingles.

The equalizing basin by the power station contains water from the turbine effluent, mixed with water from the Černá Nisa river. Water is contained in the basin by an arched gravity dam made of granite blocks, 63 meters long and 14.6 meters high at its topmost point. The dam is 12.6 meters wide at the base and 2.9 meters wide at the top. Apart from a base outlet with a diameter of 0.8 m, water can also flow through a 12-meter wide spillway ending in a cascade, closed by a flap valve with a concrete counterweight. The basin can hold 25,100 cubic meters of water.

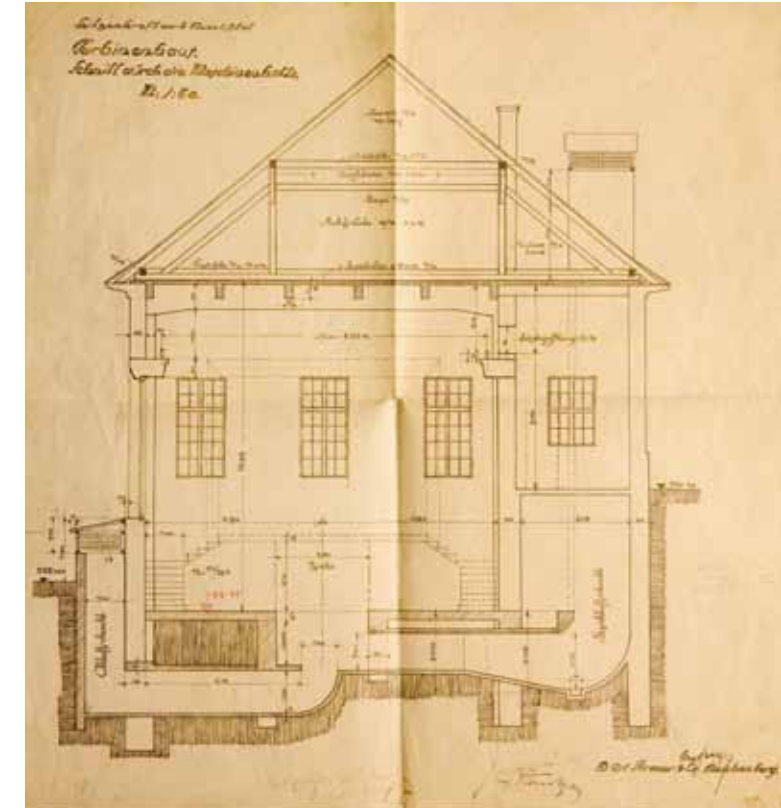
1/1/1927 – the turbine system at MVE I connected to the Liberec Power Station network



Pressure pipeline laying, 1926

20/7/1928 – the turbine system at MVE II connected to the Liberec Power Station network

The front side of the levee is adjoined by the plant room of the MVE Rudolfov II power station – a simple structure made of bare concrete blocks, capped with a reinforced concrete beam ceiling carrying a half-span roof. It contains a twin spiral high-speed Francis turbine, manufactured by J.M. Voith in 1927. Maximum usable flow is 0.466 cubic meters per second and 0.234 cubic meters per second respectively, at a gradient of 8.5 meters. According to the *List and Map of Water Dams*, published in 1930, the turbine operates at a rated speed of 500 revs per minute, with the output of 41 and 20.5 hp respectively. The turbine has a hydraulic regulation system, installed in 1958. The original asynchronous Siemens generator with the output of 50 kW was replaced in 1993 by an older model of a synchronous ELIN generator, operating at 308 V voltage and an output of 58 kW, connected to the turbine shaft by a belt.



Cross-section of the plant room and underground shaft

19/06/1929 – the entire hydroelectric structure passed final inspection approval

Approximately 400 meters above the equalizing reservoir, the Černá Nisa river is dammed by a gravel check dam in order to prevent sedimentary deposits to settle in the basin. The check dam, completed on 21 September 1928, is made of concrete, initially exposed but covered with a granite cladding since 1998–1999. The check dam is 22.3 meters long, 6 meters high, with a width of 4.1 meters at the base and 1 meter at the top. It has a sealed bottom outlet with a diameter of 0.6 m, and a 4.8-meter wide spillway, with the crest level lower by 0.6 m. Under normal conditions, water flows through 17 square openings in three horizontal rows, depending on the level of sedimentary deposits in the basin.

1/12/1996 – power station became property of the Labe River Basin Authority (Povodí Labe), based in Hradec Králové