# Tailrace tunnel pumping energy storage

## Overview

eme from Iberdrola is currently under construction in the north of Portugal. The energy storage and grid regulating plant is equipped with 4 reversible Francis pump turbines with nominal power of 220 MW and a gross head of 6 0 m, the discharge in turbine mode is 160 m3/s and in pumping mode 128.

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The Gouvães pumped-storage plant, between the Torno and Tâmega rivers, is an underground scheme that involves the construction of a 7.50 km-long power circuit (6.70 km underground), a powerhouse cavern to be equipped with four reversible Francis pump-turbines and several other large excavation.

Seawater pumped-storage power station (SPPS), as an efficient large-scale energy storage facility for marine renewable energies, has been incorporated into the key research tasks in the “13th Five-Year Plan” of hydropower development in China. The tailrace surge chamber is very important for the. How can tailrace tunnels improve pumped storage power stations?

The vertically curved tailrace tunnel can reduce the flow velocity, making the water flow more symmetrical as it passes through the intermediate separation pier, effectively improving the flow deviation of the middle channel. The research results can provide reference suggestions for optimizing the design of pumped storage power stations. 1.

Do pumped-storage power plants need a tailrace surge chamber?

To determine the conditions under which a pumped-storage power plant (PSPP) requires a tailrace surge chamber and to account for the time sequence superposition of water hammer vacuum, velocity head vacuum and head loss vacuum, we derived a new setting criterion using the rigid water hammer theory.

Can tailrace tunnels reduce flow channel discharge?

The research results show that keeping the shape of the tailrace tunnel unchanged, optimized separation piers can reduce the percentage difference in flow channel discharge from 15.93 % to 9.51 %; A vertically curved tailrace tunnel can also achieve a similar effect.

What happens at peak acceleration in a tail race tunnel?

At the time point of the peak acceleration in the tail race tunnel, all pumps face a full trip and the flow direction of the pumps reverse very quickly and leads to the peak discharge of 68 l/s (220 m3/s in prototype) into the surge tank creating the massive design surge in the upper chamber.

How is grid size refined in a tailrace tunnel?

Using a structured grid, the grid size is gradually refined in the tailrace tunnel segment and reservoir area, with a total of 40 layers in the boundary layer and a growth rate of 1.1. Due to the focus on the hydraulic characteristics near the inlet/outlet, grid refinement is required in this region.

Does tailrace surge chamber setting criterion affect the safety of PSPPs?

(25) as the setting criterion of tailrace surge chambersmay have an adverse impact on the safety of PSPPs. The reason for this result is that Eq. (25) is mainly aimed at early small-capacity conventional hydropower stations, where the total closing time of guide vane ( TZ) during the load rejection is generally short.

## Tailrace tunnel pumping energy storage


### From Gold Mine to Hydroelectricity - Kidston Pumped Storage

Construction of the Kidston PSH scheme is due to be completed in 2024 with electricity generation scheduled to start in 2025. In terms of sustainability, the project is re ...

### Schematic layout of a run-off river power plant with ...

The 880 MW pumped storage hydro power plant Gouvães, part of the Alto Tâmega hydro power scheme from Iberdrola is currently under construction in the north of Portugal. The energy storage and

### Snowy 2.0 makes strong progress

This shaft will be approximately 200m high and provide water storage when the power station starts up in pumping mode and pressure relief in the tailrace tunnel when the power station starts in generation ...

### HYDRAULICS OF THE TAIL RACE SURGE TANK OF ...

Abstract: The 880 MW pumped storage hydro

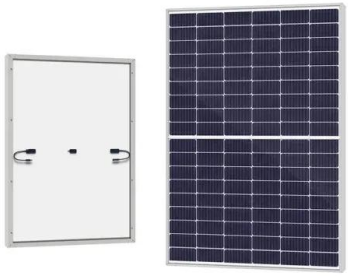
power plant Gouvães, part of the Alto Tâmega hydro power scheme from Iberdrola is currently under construction in the north of Portugal. The ...

## Hydraulic Design Challenges of High Head 880 MW Gouvães Pumped-Storage

The Gouvães PSPP includes a long headrace tunnel, a headrace differential surge tank with integrated safety gate, a long penstock, 4 reversible Francis pump-turbines of very low specific ...

## Research on the Setting Condition of Tailrace Surge Chambers ...

Seawater pumped-storage power station (SPPS), as an efficient large-scale energy storage facility for marine renewable energies, has been incorporated into the key ...



## Northfield Mountain (hydroelectricity facility)

Northfield Mountain is a pumped-storage hydroelectric plant and reservoir located on and under the similarly named Northfield Mountain in Erving and Northfield, Massachusetts. It is currently ...

## Ingula Pumped Storage Scheme

Construction of the Ingula Pumped Storage Scheme, a 1340 MW capacity hydroelectric plant, with an energy storage capacity of 21,000 MWh. Works include the construction of an intake canal, ...


## Hutchison Water , Star Pumped Storage

The Star Pumped Storage project, which will be the largest of its kind in Israel, is designed to produce 344 MW with commissioning scheduled for 2021. Pumped storage technology allows hydroelectric energy storage ...

## Surge Wave Propagation in a Common Tailrace Channel for ...

The new plant will mainly use the existing upstream (headrace tunnel and penstock) and downstream (tailrace channel and intake/ outlet work) hydraulic system. Therefore, special ...


## (PDF) HYDRAULICS OF THE TAIL RACE SURGE ...

The 880 MW pumped storage hydro power plant Gouvães, part of the Alto Tâmega hydro power scheme from Iberdrola is currently under construction in the north of Portugal.

## Pumped storage: underground challenges

Pumped storage: the resurgence Pumped storage is resurging, thanks to intermittent renewables and the needs of energy storage. Norway can offer a macro solution of ...


## Glossary of Hydropower Terms

Pumped storage hydropower (PSH): Type of hydropower project where energy can be stored and generated by moving water between two reservoirs of differing elevations. Qualified Hydroelectric Facility: A facility owned or ...

## Snowy 2.0 ploughs ahead

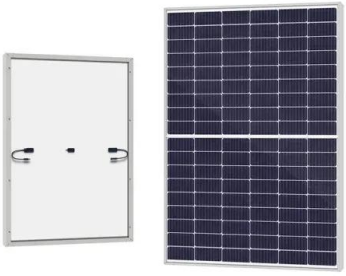
3 ???· This shaft will be approximately 200m high and provide water storage when the power station starts up in pumping mode and pressure relief in the tailrace tunnel when the power ...


## New design of tailrace conduits of hydropower plants

2. The new design of the tailrace conduits of hydroelectric stations, pump-storage stations, and pumping stations permits reducing the volumes of works and costs of the structures. Its use is ...

## Marmora Pumped Storage Project

The Marmora Pumped Storage Project is an innovative 400 MW energy facility set on abandoned mining land. Using a closed-loop system, it transforms a water-filled pit into a Lower Reservoir and reshapes waste ...

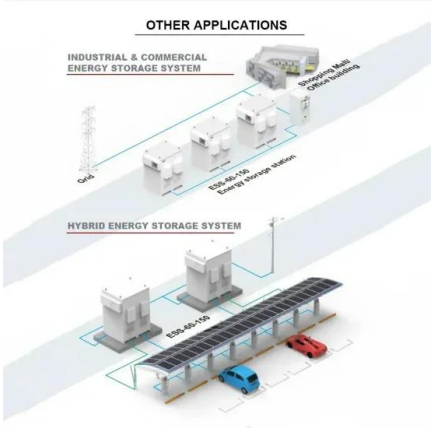



## White Pine Pumped Storage Hydro Project, US

It will extend more than 100ft from the tailrace tunnel. The underground waterways, which would connect the two reservoirs, will include a headrace shaft, a tunnel, a manifold, penstocks, draft tubes, and a ...

## Oven Mountain Pumped Hydro Energy Storage Project

When the system is in 'Pumping Mode', the water is released from the Lower Reservoir back into the tailrace tunnel and is pumped back to the Upper Reservoir to recharge the system.




## The boosterpump concept for reconstruction of hydropower ...

The need for electric energy storage in the ongoing energy transition with large-scale construction of renewable energy leads to increasing interest for upgrading existing ...

## Hydro Storage

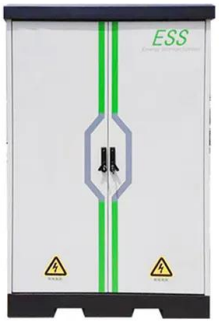
2- Pumped-Hydro Energy Storage Introduction Energy can be stored as potential energy o Consider a mass,, elevated to a height,, Its potential is: o Lifting the mass requires an input of ...

## Snowy 2.0 makes headway

This shaft will be approximately 200m high and provide water storage when the power station starts up in pumping mode and pressure relief in the tailrace tunnel when the power station starts in generation mode.

## Tail race

Figure 1. A tail race channel on a hydroelectric dam. [1] The tail race, containing tail water, is a channel that carries water away from a hydroelectric plant or water wheel. The water in this channel has already ...

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## BREIF SUMMARY OF BANDU PUMPED STORGAE ...

An underground power house with four numbers Francis type reversible pump-turbine of capacity 225/255 MW. rground ransformer cavern with four numbers 280 MVA. One 400 kV Gas ...


## System and method for pumped storage based on combination of ...

[0027] like figure 1 As shown in the figure, the system for pumping energy storage by utilizing abandoned open pit mines and underground shafts in combination includes ...

## From Gold Mine to Hydroelectricity - Kidston ...

Construction of the Kidston PSH scheme is due to be completed in 2024 with electricity generation scheduled to start in 2025. In terms of sustainability, the project is re-purposing existing infrastructure, ...


## Effects of separation pier shape and inflow conditions on the ...

The vertically curved tailrace tunnel can reduce the flow velocity, making the water flow more symmetrical as it passes through the intermediate separation pier, effectively ...

## MS Word Technical Paper Template

A third TBM will be used to first drive the main access and then relocated to drive the tailrace tunnel. The power/pump cavern complex at a depth of 800m includes a main turbine hall ...



## Schematic layout of a run-off river power plant with storage-tunnel ...

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## Hydraulic Design Challenges of High Head 880 MW Gouvães Pumped-Storage

The 880 MW pumped-storage power plant of Gouvães, which is part of the Alto Tâmega hydro power scheme from Iberdrola is currently under construction in the north of ...

## Optimization of a Shared Tailrace Channel of Two Pumped ...

Pump and turbine operations lead to head losses in the tailrace channel. Pumping discharge may be limited due to potential air entrainment into the pump shaft when the downstream reservoir ...

## Hutchison Water , Star Pumped Storage

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