MOTT MACDONALD

Pumped storage for energy management

Efficient and innovative solutions for making electricity when it's needed

The world needs smarter ways to generate and store energy

In today's evolving energy market, countries are returning to hydroelectric development as a source of clean, renewable power. These developments can also provide reliable, on-demand peak energy by integrating pumped storage hydropower capability with complementary power generation assets.

Electric power with stability and security

Increased power demand from industry and individual consumers can constrain future development and strain aging infrastructure. This is especially true where asset owners face operational limitations due to changes in environmental regulations.

As demand shifts to renewable energy, storage is increasingly important to power networks. Pumped storage provides a means for converting off-peak surplus generating capacity into hydraulic potential energy that can be turned quickly back into electrical power during periods of peak demand.

The use of pumped storage to complement thermal, nuclear, and renewable power generation brings stability, regulation, and security to an integrated power system.

Sustainable solutions for the future

Pumped storage is helping drive sustainable, integrated solutions that address the evolving social and environmental demands on new developments. The reserve capacity offered by pumped storage and conventional hydropower balance wind and solar facilities that offer more capacity but irregular output.

Mott MacDonald continues to deliver smarter, innovative solutions for power development. We work with owners and developers to provide optimized, cost-effective infrastructure that enhances grid stability and energy security.

Cover: At 663 feet (202 meters) high, the Chaglla Dam in Peru is one of the world's highest concrete-faced rockfill dams. The hydropower facility has an installed capacity of 462 megawatts. Mott MacDonald provided lender's engineer services and technical, financial, and contractual support.

Inside Cover: Electricity produced from the Devoll Hydropower Project in Albania will secure the country's energy supply and strengthen the stability of the national grid.

Turning a ghost town and an abandoned mine into clean power and new jobs

The Kidston project is the first in Australia to combine solar energy and pumped hydroelectric storage.

Opportunity

Kidston in northern Queensland was once the home of Australia's biggest and richest gold mine. The mine closed in 2001, leaving Kidston a ghost town.

Located in Australia's "red zone" of maximum solar irradiation, the Kidston area offered great potential for renewable energy. A 270-megawatt solar photovoltaic plant was built to take advantage of that.

In addition, two abandoned mining pits could be used for a pumped storage project. The Wises pit is 984 feet (300 meters) higher than the Eldridge pit, making the two well suited for power generation.

Outcome

The pumped storage project will be able to power about 280,000 homes. The emissions avoided are equivalent to taking 33,000 cars off the road.

In 2018, a government infrastructure fund awarded more than $370 million (500 million Australian dollars) to the project, the first in Australia to combine solar energy and pumped hydroelectric storage. This combination also shows potential for sites in North America.

Simon Kidston, executive director of Genex and a descendant of the Queensland Premier for whom the town was named, said, "Pumped storage hydro is the most efficient mature technology to store energy, and integrating this with solar and potentially wind over time, we can deliver the holy grail of renewable, which is dispatchable reliable energy."

Solution

As owner's engineer for a project to optimize the design of the pumped storage project, we saw the potential to use the Wises pit as the upper reservoir rather than build a new reservoir. This would help avoid the need for excess water management during construction.

We identified an alternative waterway and cost-cutting measures for the powerhouse, and explored the feasibility of variable-speed technology.

Project
Kidston pumped storage

Location
Queensland, Australia

Client
Genex Power

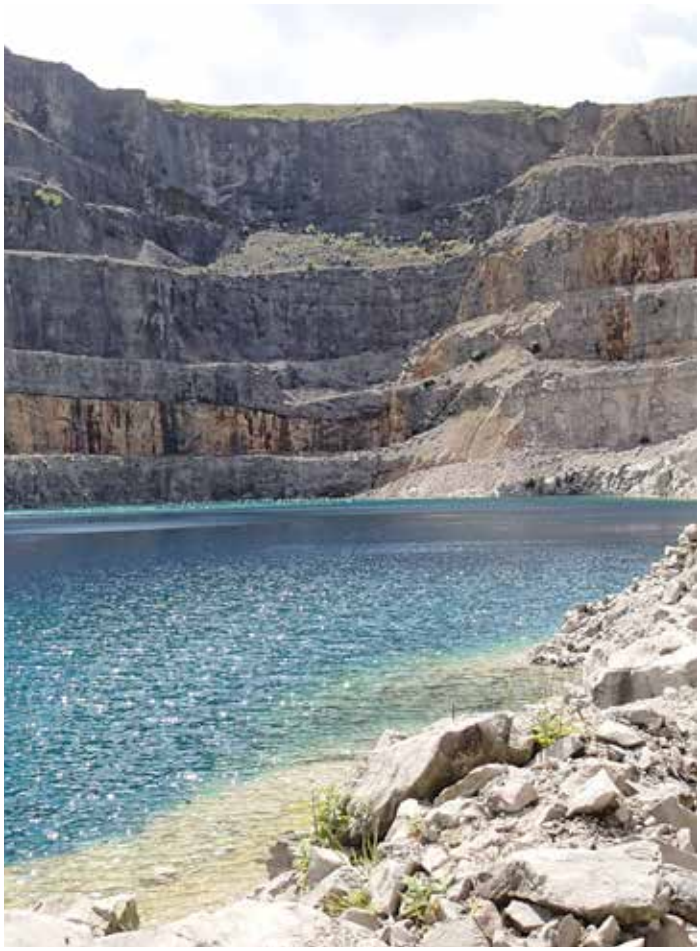
Expertise
Owner's engineering services, feasibility study

Emissions reductions equal

33,000

cars taken off the road

Smart storage options for North Wales



A former limestone quarry will become the upper reservoir of the pumped storage project at Halkyn Mountain.

Opportunity

Halkyn Mountain in northern Wales may have been mined for lead as early as 100 AD, by the Romans. The Grosvenor family took control of mining there in 1634. Lead mining continued until 1987, followed by large-scale quarrying of limestone.

Grosvenor Estates decided to explore the viability of creating a pumped hydroelectric facility, using an existing tunnel and one of two existing quarries as the upper reservoir.

Solution

Mott MacDonald undertook a study to examine the broad options for pumped storage generation. The study would consider the assets, constraints, and risks of this site, and would recommend up to three preferred options for further study.

We considered nine potential configurations. A high-level appraisal of each option weighed the key technical risks and constraints (land and mineral ownership and access, buildability, environmental and social impact, health and safety) against capital cost and generation potential.

Outcome

Two options were recommended for further study. Risks and constraints, project optimization, and energy output will be examined in more detail. Grid connection will be discussed with the local distribution network operator.

Project
Halkyn Mine pumped storage

Location
North Wales, UK

Client
Grosvenor Estates

Expertise
Conceptual design, feasibility study

Innovative energy solutions in the world's driest desert

Project
Valhalla photovoltaic/ pumped seawater storage

Location
Chile

Client
Confidential

Expertise
Due diligence assessment

Opportunity

In northern Chile's Atacama Desert, a photovoltaic plant known as Cielos de Tarapacá (Skies of Tarapacá) is being developed alongside a pumped storage facility called Espejo de Tarapacá (Mirror of Tarapacá).

The photovoltaic plant, 37 miles (60 kilometers) south of Iquique, will cover 4,077 acres (1,650 hectares) and generate 600 megawatts of electricity. The pumped storage facility, 62 miles (100 kilometers) south of Iquique, will have a capacity of 300 megawatts.

Solution

From 2016 to 2017, Mott MacDonald undertook a technical and business case review of this innovative energy project. The two plants are designed to operate in conjunction and deliver constant electrical power to the grid.

Outcome

During hours of sunlight, half the power production from the photovoltaic plant can be used to pump seawater up to the upper reservoir of the pumped storage facility. When the sun is down, the pumped storage facility will generate electricity and deliver it to the grid.

2,133 feet

(650 meters) above sea level in the Atacama Desert, Chile

A photovoltaic plant and a pumped storage facility will work together to deliver constant power to the grid.

Opening opportunities with connected thinking.

For more information, write to
americas@mottmac.com or call 800.832.3272.

mottmac.com