

snowy 2.0

Project Update

Snowy 2.0 – pumped-hydro project
December 2018



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THE MODERN SNOWY HYDRO

Snowy Hydro is a dynamic energy company supplying electricity to more than one million homes and businesses.

Since the days of our pioneering past, Snowy Hydro has grown into the fourth-largest retailer in the energy market.

Snowy Hydro operates the Snowy Mountains Hydro-electric Scheme (nine power stations including pumped storage at Tumut 3 Power Station and Jindabyne Pumping Station), along with other power assets across New South Wales, Victoria and South Australia.

We have a total generation capacity of 5,500 megawatts (MW) and offer energy insurance and other products that provide supply security and price certainty to customers in the energy market.

Snowy Hydro also owns the electricity and gas retail companies Red Energy and Lumo Energy, and the utility connections business, Direct Connect.

We have embarked on the exciting Snowy 2.0 project, which will significantly expand the Scheme to meet future energy needs in a changing and increasingly lower emissions economy.

The logo for Snowy Hydro, featuring the word "snowy" in green and "hydro" in blue, with a blue swoosh underneath.The logo for Red Energy, featuring the word "red" in red and "energy" in red, with a red starburst graphic to the right.The logo for Lumo Energy, featuring the word "LUMO" in white inside an orange circle, with "ENERGY" in white below it.The logo for Direct Connect, featuring the words "DIRECT CONNECT" in white inside a red speech bubble, with "MAKES MOVING EASY" in black below it.

ABOUT SNOWY 2.0

Snowy 2.0 is a pumped-hydro expansion of the existing Snowy Scheme which will significantly add to our existing energy generation and large-scale storage capabilities.

Snowy 2.0 will increase the Scheme's generation capacity by 2,000 megawatts (MW). That's enough electricity to run 200 million LED globes at the same time. At full capacity, Snowy 2.0 will provide large-scale energy storage of 175 hours, or enough to power three million homes for a week.

The project will link two existing Scheme dams, Tantangara and Talbingo, through underground tunnels and an underground power station with pumping capabilities.

Hydro-power will be generated by falling water spinning Snowy 2.0's giant reversible turbines, which can also pump water in the opposite direction. Snowy 2.0's pumping capabilities work in a 'closed' system – water is recycled between the upper dam (Tantangara) and lower dam (Talbingo) so the same water can be used to generate power more than once, making the most of available water. Snowy Hydro already has pumped hydro capabilities at the Tumut 3 power station - it is proven technology used across the world.

The ability to store water and generate power on-demand means Snowy 2.0 can be 'switched on' very quickly. Snowy 2.0 will pump water using the excess electricity in the system at times of low demand. Then, when energy is needed most, the stored water will be used to generate electricity within minutes.

For example, if the wind is blowing in the middle of the night when consumers are asleep, Snowy 2.0 can use the wind energy to pump and then store the water in the upper dam. When households wake up and the demand for energy soars, Snowy 2.0 can quickly generate energy for the grid.

The first power produced from Snowy 2.0 is expected in late 2024. We expect its operating life to be consistent with the Snowy Scheme's existing assets, which continue to operate reliably and have been upgraded and technologically improved over the last 70 years.



Computer-generated graphic of a tunnel boring machine

WHY WE NEED SNOWY 2.0

The Snowy Scheme, with its 16 major dams, already has the capability to store huge amounts of energy. While this is sufficient for the current National Electricity Market (NEM), it will not be enough as we transition to a lower emissions economy. The NEM covers New South Wales, Queensland, Victoria, South Australia and Tasmania.

The supply of electricity in the future will be increasingly generated by renewable sources such as wind and solar, as coal-fired power plants progressively retire. The characteristics of renewables mean that supply doesn't always match demand, for example when there is no wind or sunshine.

Snowy 2.0 and its fast-start, clean hydro-power and large-scale energy storage will work together with renewables - by filling the gaps in generation and managing system instability - to provide Australian businesses and households with reliable, stable and affordable energy.

Snowy 2.0's added supply of generation will create extra competition in the NEM to help lower energy prices.

It will support renewables and increase the efficiency of the NEM by buying surplus energy from the new renewable plants, storing it as water (potential energy) in the upper dam and releasing it when electricity demand is high.

The water storage not only turns intermittent wind and solar energy into 'firm', reliable electricity, but ensures the stability and reliability of the NEM even during prolonged weather events, such as wind or solar 'droughts'.

Snowy 2.0, along with the existing Snowy Scheme, will more efficiently deliver electricity to the major load centres of Sydney and Melbourne at times of high demand and it will produce less emissions than thermal generation, helping Australia meet its global climate change targets.

Snowy 2.0 is the least cost, large-scale energy storage solution for the NEM as the economy decarbonises, according to an independent economic analysis prepared by leading financial and economic consultants Marsden Jacob Associates.

If Snowy 2.0 is not built, the likely alternative to meet the needs of the market is a combination of gas peaking plants paired with commercial-scale batteries. This option would cost at least twice as much as building Snowy 2.0.

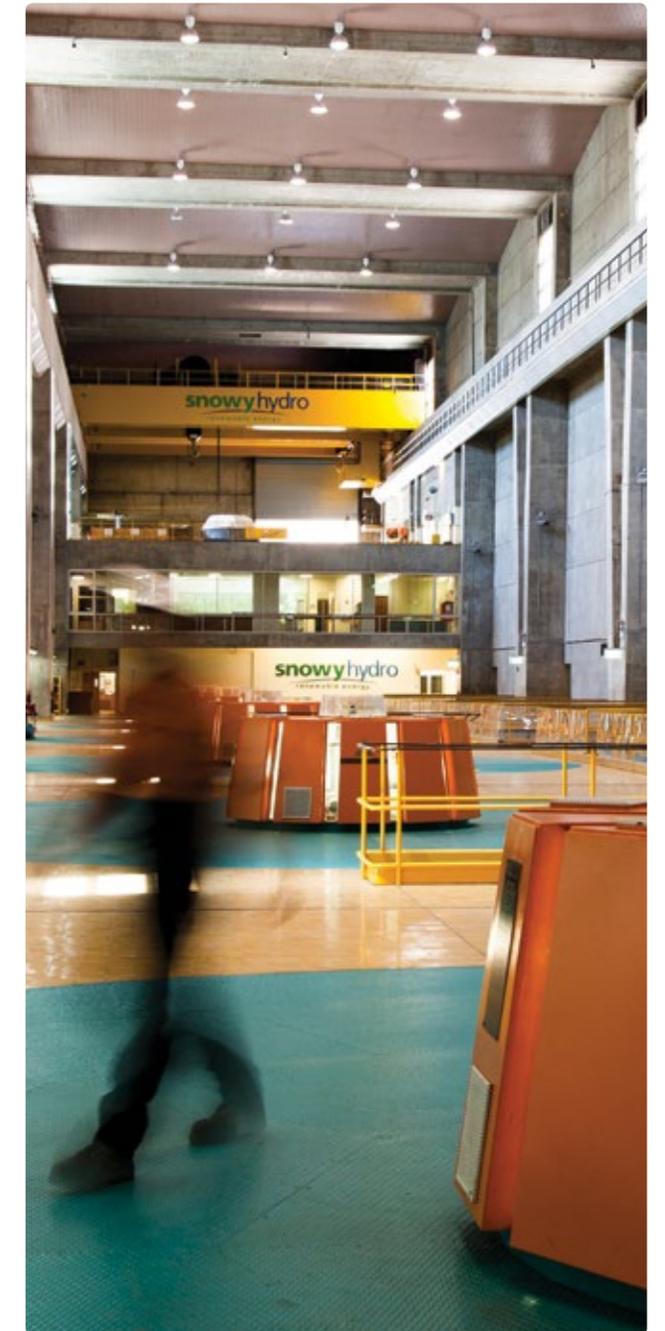


City skyline

KEY BENEFITS

- ◆ **System security and reliability** – large amounts of on-demand energy generation that can respond within minutes to changing market needs.
- ◆ **Lower energy prices** – putting downward pressure on future energy prices.
- ◆ **Supporting renewables** – Snowy 2.0 will physically and financially 'firm' renewables so they can enter into reliable supply contracts.
- ◆ **Lowest cost option** – if Snowy 2.0 was not built the likely alternative is a combination of gas peaking plants and commercial-scale batteries, which would cost at least twice as much.
- ◆ **Scale and central location** – Snowy 2.0 will be located between the major load centres of Sydney and Melbourne and central to planned renewable energy zones.
- ◆ **No changes to water** – Snowy 2.0 utilises two large, existing dams. There is no change to the Snowy water licence, or releases for downstream water users or environmental flows.

While Snowy 2.0 is a significant expansion of the Scheme, the future NEM will need much more storage. In decades to come, Snowy 2.0 alone will not be enough – other pumped hydro projects, commercial and household batteries and demand management will all have a role to play.



Tumut 3 machine hall floor



Drilling activity in the Snowy Mountains

PROJECT ACTIVITY TO DATE AND ONGOING

The Snowy Hydro Board of Directors has approved Snowy 2.0 to proceed, subject to Shareholder approval.

Since we announced the Snowy 2.0 project, significant work has been carried out in a range of areas.

Project activities include:

- ◆ Geotechnical drilling program to collect information about the geology across the project route and at key sites.
- ◆ Extensive stakeholder and community consultation.
- ◆ Detailed project design work by Snowy Hydro and expert civil and mechanical and electrical companies.
- ◆ Preparation and submission of approvals including Environmental Impact Statements.
- ◆ Sourcing project funding.
- ◆ Working with the Australian Energy Market Operator (AEMO) and other stakeholders on the Integrated System Plan (ISP) for the future transmission needs of the NEM.

Snowy 2.0 has been recognised as a Critical State Significant Infrastructure (CSSI) project by the NSW Minister for Planning, under the Environmental Planning and Assessment Act 1979 (NSW).

The CSSI declaration is a framework that sets out the robust environmental assessment and approval process required for the Snowy 2.0 project. Construction on the main project works for Snowy 2.0 cannot begin until the relevant environmental approvals are in place.

Ahead of the main project, Snowy Hydro is proposing a program of Exploratory Works in the future cavern location. More information about these works can be found on page 18 of this booklet.



Kosciuszko National Park.
Inset: Main sites for the Snowy 2.0 project

BUILDING SNOWY 2.0

The project will involve underground excavation and tunnelling works between Tantangara and Talbingo dams to depths of up to one kilometre.

There will be surface works in several locations including at the intake-outlet structures, surge shaft and tunnel portal sites. A number of supporting works will also be required, such as establishing or upgrading access roads and electricity connections to construction sites.

CONSTRUCTION

About 27km of power waterway tunnels will be constructed to link Tantangara and Talbingo dams. The tunnels are about 10m in diameter and mostly concrete-lined to ensure longevity and low maintenance. Intake and outlet structures will be built at both dams.

The power station complex will be located approximately 850m underground. Two main caverns will be constructed:

- ◆ Machine Hall - approx. 240m (long) x 43m (high) x 27m (wide)
- ◆ Transformer Hall - approx. 294m (long) x 46m (high) x 18m (wide)

Six galleries run between the two halls and carry cables that connect the generators with the transformers.

To reinforce the structure where required, rock bolts of 15 to 20m in length will be drilled into the rock at the top and sides of each cavern. A mix of tunnel boring machines, as well as drill and blast techniques, will be used for the tunnelling and excavation.

MECHANICAL AND ELECTRICAL

The power station will consist of six reversible Francis pump-turbine and motor-generator units. Three units will be synchronous (fixed) speed and three will be variable speed. The units will be arranged in the power station in alternating order and in pairs will share a pressure shaft and penstock (the tunnel that feeds water into the units).

PROJECT COST AND CONSTRUCTION SCHEDULE

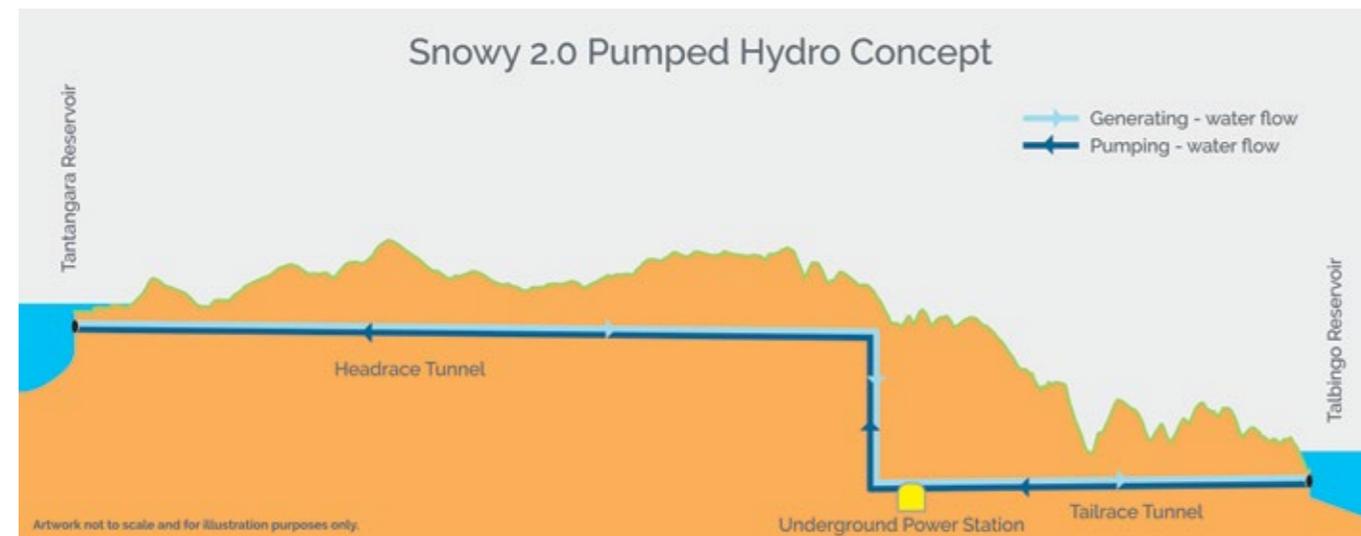
The 2017 Snowy 2.0 Feasibility Study cost estimate for the project was between \$3.8-\$4.5 billion. The 2017 Feasibility Study also estimated the first power generated by Snowy 2.0 would be in late 2024 and project completion was about seven years from final investment decision.

ACCESS

Access to the work areas for Snowy 2.0 will be provided using vehicles and also barges. Upgrades to some existing roads and tracks in the area will be required and new access roads may also be established where necessary. Where new access is required, areas of high conservation value will be avoided.

Barges will be used to bring very large equipment to site, requiring wharf facilities on Talbingo Dam.

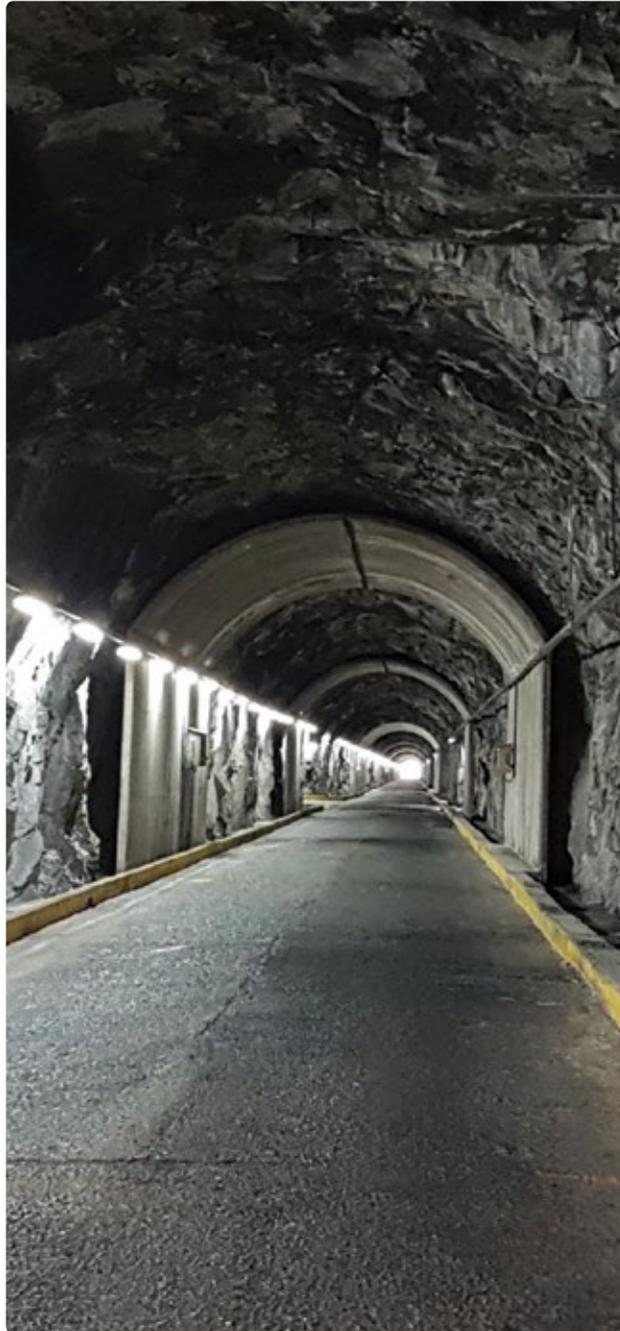
Due to the nature of the works and for safety reasons, public access will be restricted to some areas of Kosciuszko National Park (KNP) during construction. We will work closely with National Parks and Wildlife Service (NWPS) to manage park access, provide alternate access where possible, and restore access promptly following construction.



Project cross-section illustrating Snowy 2.0's generating and pumping capabilities



Computer-generated graphic of an underground power station



Tumut 2 Power Station access tunnel

PLANNING AND APPROVALS

Snowy 2.0 is going through a comprehensive, well-established and transparent planning and environmental approvals process.

Only once the relevant approvals are in place can construction of the main project works begin. As a NSW Government CSSI-declared project, there is a clear and rigorous planning approval pathway that Snowy 2.0 must follow.

Comprehensive Environmental Impact Statements (EIS) are being developed for each phase of Snowy 2.0, addressing the project's environmental, social and economic impacts. The EIS are assessed by the NSW Department of Planning and Environment (DPE) as part of the approvals process.

Members of the community have an opportunity to review the EIS and make submissions during the public exhibition period. After reviewing submissions, Snowy Hydro prepares a report that responds to the issues raised.

The EIS and final reports are considered by DPE when making an assessment and recommendation to the NSW Minister for Planning. Approval from the Minister for Planning is required for Snowy Hydro to begin any construction works.

The Snowy 2.0 Exploratory Works EIS was lodged in 2018 and is awaiting determination; the Snowy 2.0 Main Works EIS will be submitted in the first half of 2019.

It is also likely that Snowy 2.0 will require approvals from the Commonwealth Government under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth).

WATER AND DAM LEVELS

The Snowy Scheme operates under a strict water licence issued by the NSW Government. Snowy 2.0 will not in any way impact on Snowy Hydro's continued compliance with the water licence.

There will be no change to Snowy Hydro's water release obligations from both the Murray and Tumut developments, and no change to environmental release obligations. Therefore, Snowy 2.0 will not have any impact on downstream water users or environmental flows.

Snowy 2.0 will also be less impacted by water inflows, so it will be less impacted by droughts. Snowy 2.0's pumping capabilities work in a 'closed' system - water is recycled between the two dams so the same water can be used to generate power more than once, making the most of available water.

It will also provide Snowy Hydro with more options to manage inflows and water shortages over the long term. Snowy Hydro will continue to operate Tantangara and Talbingo dams within existing Scheme operational and regulatory requirements, including the established operating target storage levels.

This means that the maximum and minimum operating levels of the two dams will not change due to Snowy 2.0. It is possible that the frequency of water level changes will increase as water is cycled between Tantangara and Talbingo.



Tantangara Dam and Reservoir

WORKFORCE AND BUSINESS OPPORTUNITIES

We expect Snowy 2.0 will bring many benefits to the Snowy Mountains region. These include opportunities for local businesses, improvements in local infrastructure and increased economic activity.

Many community members have told us they would like to become involved in the project, joining the more than 50 Snowy Mountains businesses and contractors who have already contributed.

A workforce plan is being developed and Snowy Hydro is seeking specialist contractors (through a tender process) to carry out the civil engineering and mechanical and electrical aspects of the build.

One of our key requirements is the provision of opportunities for local businesses and employment, along with implementation of an Australian Industry Participation plan.

To support the process, there is a Snowy 2.0 Business Directory. Visit snowyhydro.com.au/our-scheme/snowy20/business-opportunities/ to register your interest.

The Snowy 2.0 Business Directory will help Snowy Hydro and the principal contractors understand what technical capabilities, equipment, services and skills are available across the region.

The project workforce will grow from a small base in year one, to an estimated 1,000 – 2,000 at peak times. There will also be a large number of jobs generated indirectly by the project, both regionally and beyond.

The directly employed project workforce will be engaged on a fly-in, fly-out basis and accommodated in self-contained temporary camps close to work sites for productivity and safety reasons.



Local business opportunities will be available

ENVIRONMENTAL ASPECTS

Based on the proposed construction methodology and operational characteristics of Snowy 2.0, a range of potential environmental impacts are likely to be associated with the works.

These will be subject to a thorough investigation through the EIS process and appropriate measures will be developed to avoid, reduce and mitigate potential impacts.

The project is expected to provide broad-scale environmental benefits through its long-term displacement of carbon-intensive energy generation, while at a localised level, impacts from surface works will be avoided where possible and minimised and offset through positive management actions.

Following construction, land that has been disturbed will be rehabilitated to ensure a safe and stable environment and to meet our development approval requirements. There are opportunities to positively offset any unavoidable local impacts for the benefit of the environment across Kosciuszko National Park.

A range of potential offset and contribution options are being considered and Snowy Hydro is very supportive of local stakeholder views, which are to ensure any offsets directly benefit the local area.

We're working with NPWS to identify opportunities for habitat improvement and catchment health works with a direct, positive benefit to the park's biodiversity and ecological processes.



Cabramurra Lookout

SOCIAL ASPECTS

As part of the EIS process, Snowy Hydro is undertaking a thorough Social Impact Assessment to address the potential impacts of the project on local communities and infrastructure, such as traffic, emergency services and education facilities.

Any potential impacts will be addressed and managed throughout the project and beyond. Snowy Hydro is working closely with local councils, NSW Government agencies and the local community so that project benefits become long-term gains and that Snowy 2.0 will leave a legacy for our local communities, just as the Snowy Scheme did some 70 years ago.



Talbingo Reservoir

RECREATIONAL USE OF THE PARK

Snowy Hydro is aware of the recreational usage of KNP by tourists and locals alike. While we will do everything possible to minimise disturbances and impacts on recreational areas, due to the nature of the construction works and for safety reasons, public access will be restricted in some areas while works are underway. On completion, the project area will be rehabilitated and returned in good condition.

TRANSMISSION

The existing transmission network was built many decades ago to carry energy from coal-fired plants to the market.

Our energy system is rapidly changing. In the future new transmission routes will be needed to connect new generation projects, renewable energy zones that are geographically dispersed and strategic storage projects right across the NEM.

The Australian Energy Market Operator (AEMO) is responsible for planning the national transmission network for the future. AEMO has released its inaugural Integrated System Plan (ISP) which provides the transmission system developments to meet future NEM requirements.

AEMO's ISP supports strategic storage initiatives such as Snowy 2.0, which is required to 'firm up' the rapidly growing renewable developments in NSW and Victoria, and indirectly, South Australia.

The proposed upgrades are to the shared transmission network that renewable energy generation and storage projects connect to as they come online.

There is a regulatory framework in place to fund the shared network upgrades. Snowy Hydro (as a generator) does not own or operate the shared network and for this reason, the cost associated with upgrading the shared transmission network has not been included in the Snowy 2.0 project costs.

However, the cost of the lines that are required to connect Snowy 2.0 to the shared network will be funded by the project, as they are connection assets to be used solely by Snowy Hydro.



Illustration showing existing and proposed solar/wind energy development and how they would relate to Snowy 2.0. This also shows how Snowy 2.0 connects to the main load centres north and south.

Source: AEMO Victorian Annual Planning Report 2017

SNOWY 2.0 EXPLORATORY WORKS PROPOSAL

Ahead of the main project, Snowy Hydro is proposing to carry out Exploratory Works in the Lobs Hole area of KNP, which will provide a greater understanding of the underground geological conditions at the likely location of the power station.

While we have conducted geological investigations from the surface, we have not explored the rock in-situ, at depth. During Exploratory Works, horizontal core samples will be taken deep underground so we can confirm the precise location and design of the underground cavern.

Finalising this aspect of the project will be one of our biggest challenges, so gathering additional geological data as soon as possible is critical.

The Exploratory Works include excavation of an exploratory tunnel to the proposed site of the power station cavern, establishment of a construction compound and supporting infrastructure, upgrade and establishment of access roads, excavated rock management and establishment of barge access infrastructure on Talbingo Dam.

Snowy Hydro has submitted an EIS for Exploratory Works. If approved, Exploratory Works could begin in early 2019. For more information visit snowyhydro.com.au.

COMMUNITY CONSULTATION AND PROJECT FEEDBACK

Snowy Hydro is committed to continuing to work closely with stakeholders and local communities to keep you informed about the Snowy 2.0 project and to seek feedback.

We've been out and about in the community hosting information sessions in towns across the region - look out for information about the next series of community sessions.

You can also get in touch with us directly via:

Email snowy2.0@snowyhydro.com.au

Mail Snowy 2.0 Community Relations,
PO Box 332, Cooma NSW 2630

Phone 02 6453 2888



Computer-generated graphic illustrating inside a power station



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