



**snowy** 2.0

# Project Update

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Snowy 2.0 – pumped-hydro project  
May 2019



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## INTRODUCTION

This is an exciting time for Snowy Hydro and the local region, with our major pumped-hydro Snowy Scheme expansion project, Snowy 2.0, given the green light.

In recent months we have appointed civil, mechanical and electrical contractors, received the NSW Government's planning approval for the Exploratory Works program and shareholder approval of the project, and following all of that, we commenced construction.

At Snowy, we have a proud history and a strong vision. Snowy Hydro, supercharged by Snowy 2.0, will underpin Australia's renewable energy future and keep the lights on for generations to come.

Snowy 2.0 will provide the storage and on-demand generation needed to balance the growth of wind and solar power and the retirement of Australia's ageing fleet of thermal power stations. In short, it will keep our energy system secure and keep the lights on.

Snowy 2.0 is not only a sound business investment for Snowy Hydro, with more than 8% return on investment, it also represents the most cost-effective way to ensure a reliable, clean power system for the future. When it is completed, Snowy 2.0 will be able to deliver 2,000 megawatts (MW) of on-demand generation, up to 175 hours of storage, and create more competition in the energy market that will keep downward pressure on prices.

Last year Snowy Hydro contracted 888MW of wind and solar projects which gave us incredible insights into energy pricing. This process confirmed many of the assumptions of Snowy 2.0's business case, including that renewables are now the most economic form of new generation (even when firmed by hydro or gas).

Snowy Hydro's existing fast-start assets, and increased capacity with Snowy 2.0, will 'firm up' large amounts of intermittent renewables, coming in and out of the system to fill the gaps by generating energy at times of peak demand. Snowy Hydro are experts in hydro power. For decades we've been successfully operating our pumping capability at Tumut 3 Power Station and that has been invaluable, especially in years of drought.

So, after a two-year journey of research, planning, project design, preparation and a lot of hard work, we are incredibly proud to be underway with Snowy 2.0.

There is plenty to be done now that the construction phase has begun. We will continue to work through a detailed environmental planning and approvals process for the project's Main Works and will continue to engage with our many stakeholders, including the local community. I encourage you to read more about Snowy 2.0 in this booklet and of course, we welcome your feedback.



Paul Broad  
Managing Director and CEO  
Snowy Hydro Limited

## 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 current generation capacity of 5,500MW 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 are leaders and innovators in renewable energy. Snowy Hydro has signed contracts for 888MW of generation from eight wind and solar projects and started construction of Snowy 2.0. These are exciting additions to our energy portfolio and they will help meet future energy needs in a changing and increasingly lower emissions economy.

**We are committed to continuing to grow our portfolio of assets, to maximise competition in the National Electricity Market and deliver more value to consumers.**

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

## ABOUT SNOWY 2.0

Snowy 2.0 is a major pumped-hydro expansion of the 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 2,000MW. That's enough electricity to power 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 links two existing Scheme dams, Tantangara and Talbingo, through 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 2024-25, with progressive commissioning on the six units. Snowy 2.0's operating life is expected to be consistent with the Snowy Scheme's existing assets, which continue to operate reliably many decades after installation.



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, Australian Capital Territory, 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 transform intermittent energy into reliable energy so it's available on-demand, when customers need it. Snowy 2.0 will manage system instability by working in combination with wind and solar, creating 'firm' reliable and affordable energy for Australian businesses and households.

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 'firms up' intermittent wind and solar energy, it 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.

The cost and zero emission advantages of renewable energy can only be realised if a sufficient amount of energy from these intermittent renewable energy sources can be stored for later use when required.

Snowy 2.0 is the least cost, large-scale energy storage solution for the NEM as the economy decarbonises, according to independent economic analyses 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.

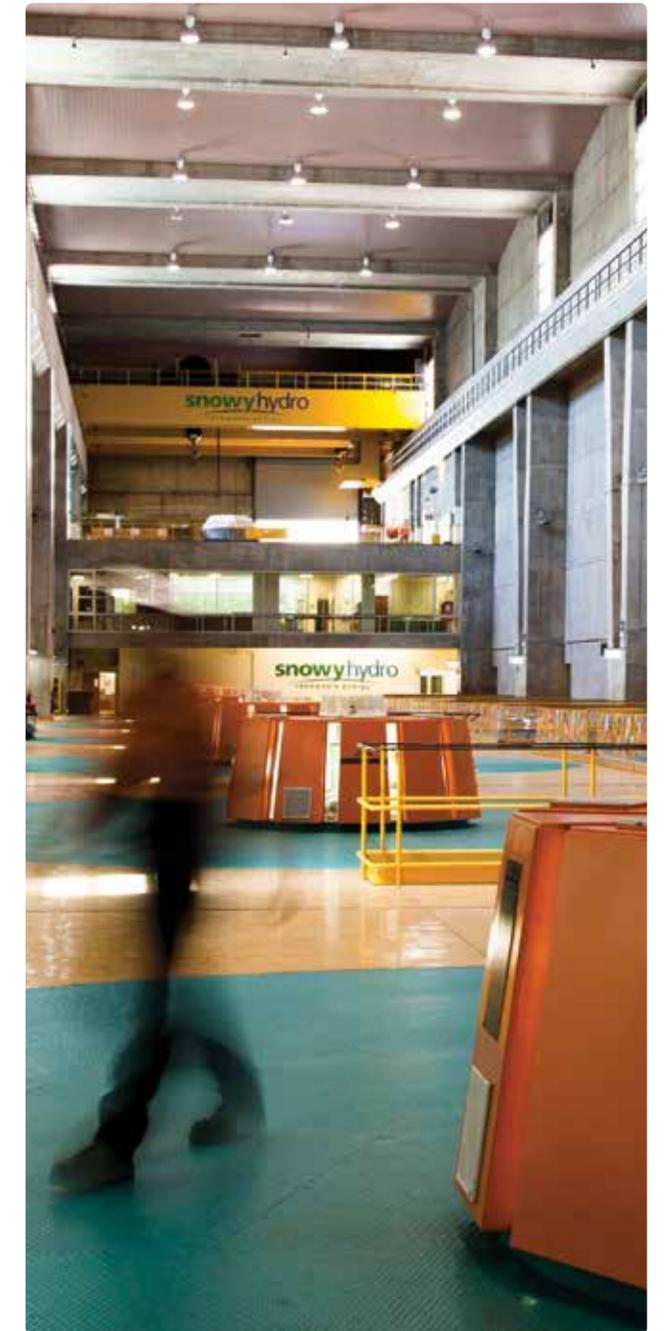


City skyline

## 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** – adding more energy supply puts downward pressure on future energy prices.
- ◆ **Cost effective large-scale storage** – modelled at \$25-35 per MWh (compared with batteries at \$195-254 per MWh).
- ◆ **Supporting renewables** – Snowy 2.0 will physically and financially 'firm' renewables so they can enter into reliable supply contracts.
- ◆ **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.
- ◆ **Less emissions** – provision of large-scale storage for zero-emission renewable energy sources.

While Snowy 2.0 is a significant expansion of the Snowy 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

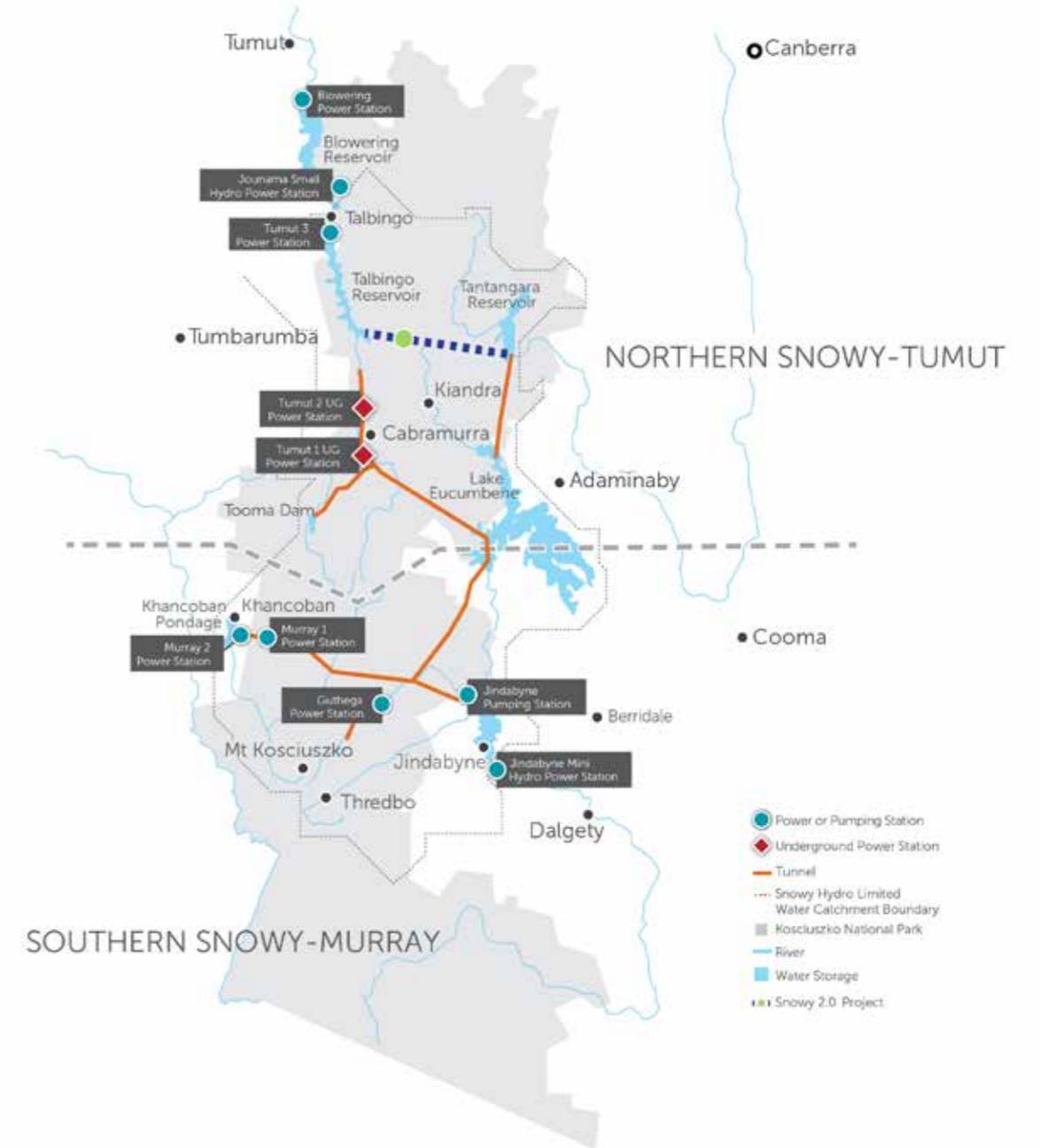
Snowy 2.0 is now underway, having been approved by Snowy Hydro's Board of Directors and its Shareholder. Following planning approval by the NSW Government, Exploratory Works have begun in the Lobs Hole area of Kosciuszko National Park (KNP). More information about these works can be found on page 18 of this booklet.

Since we announced Snowy 2.0 in March 2017, significant work has been carried out in a range of areas.

Project activities have included:

- ◆ Geotechnical drilling program to collect information about the geology of the tunnel alignment and at key sites.
- ◆ Extensive stakeholder and community consultation.
- ◆ Detailed project design work by Snowy Hydro and expert civil, and electrical and mechanical companies.
- ◆ Progressing through the planning approvals process, including preparing comprehensive Environmental Impact Statements.
- ◆ Sourcing project funding.
- ◆ Working with the Australian Energy Market Operator and other stakeholders on the Integrated System Plan for the future transmission needs of the NEM.
- ◆ Appointment of principal contractors to carry out the civil, and electrical and mechanical work.

In 2018, Snowy 2.0 was recognised as Critical State Significant Infrastructure (CSSI) 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 of Snowy 2.0 Main Works can only begin when the relevant environmental approvals are in place.



Kosciuszko National Park.

Up to 175 hours of large-scale energy storage at full capacity.

200 MW of energy

enough energy to power 200 million LED light globes

UP TO



direct and indirect jobs over the life of the project.

About 8,000 shipping containers of equipment and materials are needed for Snowy 2.0.



About 2.2 million meals will be served a year during peak construction.

More than 135,000 concrete segments will line the tunnels.



The generator will spin up to speeds of 500rpm, in less than 70 seconds.



— ABOUT —  
36km of 'high-vis' fabric for safety clothing each year during peak construction.



— ABOUT —  
600 vehicles and trucks will be bought for the project

Tunnel diameter of 10m is as high as a three-storey building.



## 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 intake-outlet structures at Talbingo and Tantangara dams, surge shafts and tunnel portal sites. A number of supporting works are also 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 entirely concrete-lined to ensure construction safety, operational longevity and low maintenance. Intake and outlet structures will be constructed at both dams.

The power station complex will be located approximately 800m underground. Two main caverns will be excavated:

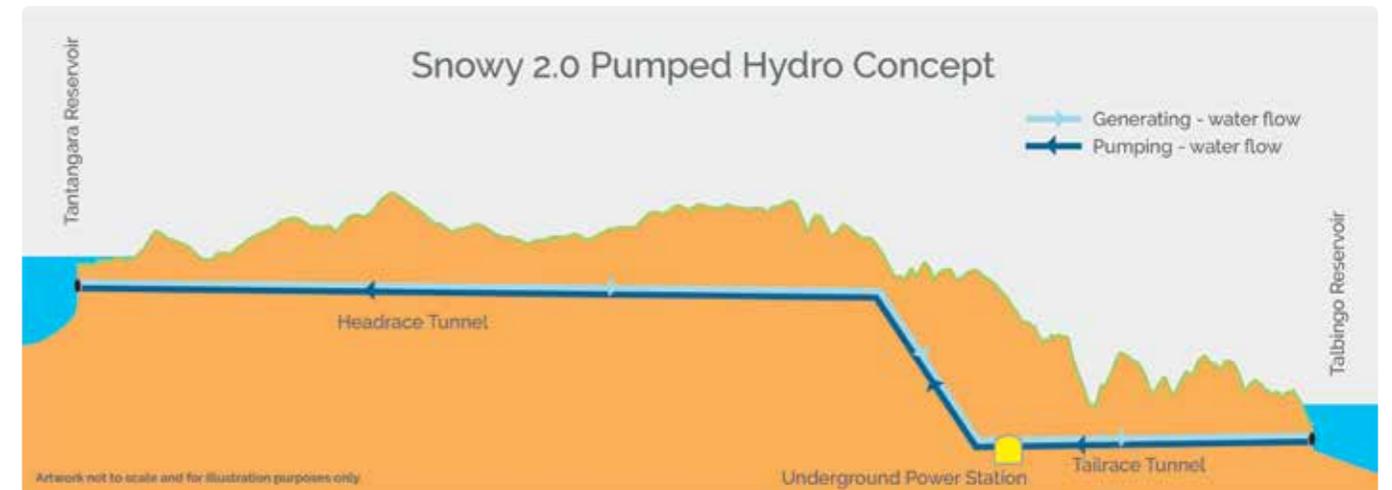
- Machine hall - approx. 240m (long) x 50m (high) x 30m (wide).
- Transformer hall - approx. 200m (long) x 50m (high) x 20m (wide).

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

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

### MECHANICAL AND ELECTRICAL

The power station will house six reversible Francis pump-turbine and motor-generator units. Three units will be synchronous (fixed) speed and three will be asynchronous (variable) speed. The units will be arranged in the power station in alternating order. There will be a single inclined pressure tunnel that is concrete-lined and will divert water into six steel-lined penstocks (the tunnels that feed water into the generating units).



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

## PROJECT COST AND BUSINESS CASE

The project's construction cost remains in line with the figures from the 2017 Feasibility Study. The base contract cost is \$4.5 billion in real dollars, with fixed cost escalation over the six-year life of the project.

The business case for Snowy 2.0 is robust and reflects the ability of Snowy Hydro to fund the project on its own balance sheet. In response to Snowy Hydro's proposal to utilise retained earnings to fund the project, the Shareholder will make an equity investment of \$1.38 billion from 2020. Snowy Hydro will continue to pay shareholder dividends throughout the construction period and will fund the project through a combination of internally-generated cash flow and bank funding.

Snowy 2.0 is projected to provide a rate of return to Snowy Hydro of more than 8% and builds on the company's successful business model, which incorporates four distinct revenue streams:

- ◆ Storage products, which involve buying energy at low prices and selling at higher prices.
- ◆ Capacity products, which are a type of 'insurance' to provide price certainty to NEM participants, including generators and retailers, protecting them from price shocks.
- ◆ Firming products, where Snowy Hydro offers contracts that take an intermittent energy source such as solar or wind, and convert it into a 'firm' source of electricity with large-scale storage and on-demand energy generation.
- ◆ Retail diversification, which enables Snowy Hydro to supply capacity to its residential and commercial customers whose maximum demand for energy occurs at varying times of the day.

For more detailed information about the Snowy 2.0 business case visit [snowyhydro.com.au/our-scheme/snowy20/](https://snowyhydro.com.au/our-scheme/snowy20/)

## SAFETY

Safety is, and always will be, the number one priority for Snowy Hydro. Our safety vision and high expectations for the management of all safety risks will be adopted by all those working on the Snowy 2.0 project.

We will not compromise safety on any aspect of the project, including schedule. Before appointing principal contractors to Snowy 2.0, exhaustive due diligence was undertaken to ensure their safety systems, performance and processes were of the highest standards.

Snowy Hydro and all contractors on the project are committed to continuously monitoring and improving safety standards. We are also committed to sharing any safety learnings and improvements with the wider industry.



Staff at a Snowy 2.0 investigative drill site

## PRINCIPAL CONTRACTORS

Australian and global experts in construction, engineering and hydropower have been appointed by Snowy Hydro as the principal contractors for Snowy 2.0, following an extensive and competitive tender process.

The civil works will be carried out by Future Generation – a partnership between Australian engineering and construction firm Clough and tunnelling and hydropower specialists Salini Impregilo.

Voith Hydro, the electrical and mechanical contractor, will deliver the latest hydro-generation technology in the new Snowy 2.0 power station.

Australian company Leed Engineering and Construction has been awarded the contract for Exploratory Works pre-construction activities and roads.



Computer-generated graphic of the Snowy 2.0 power station

## 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 Snowy 2.0, joining the more-than 50 local businesses and contractors which have already contributed.

A workforce plan is being developed incorporating opportunities for local businesses, employment and training, along with implementation of an Australian Industry Participation plan.

A Snowy 2.0 Business Directory has been established to help Snowy Hydro and the principal contractors understand what technical capabilities, equipment, services, and skills are available from businesses across the region, and to maximise local opportunities.

To register your company's interest, visit: [snowyhydro.com.au/our-scheme/snowy20/business-opportunities/](https://snowyhydro.com.au/our-scheme/snowy20/business-opportunities/)

The Snowy 2.0 workforce will grow from a small base in year one, to around 2,000 at peak times. The principal civil contractor, Future Generation, will be responsible for hiring the project workforce.

These directly-employed workers 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.

In addition, it is anticipated there will also be a large number of jobs generated indirectly by Snowy 2.0, both regionally and beyond.

## PLANNING AND APPROVALS

Snowy 2.0 is subject to a comprehensive, well-established and transparent planning and environmental approvals process. The approvals process for Snowy 2.0 Main Works is now underway and only once the relevant approvals are in place can construction of these 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.

It includes preparation of comprehensive Environmental Impact Statements (EIS), addressing the project's environmental, social and economic impacts.

Members of the community have an opportunity to review the EIS and make submissions during the public exhibition period.

After reviewing submissions, Snowy Hydro will prepare a report that responds to the issues raised. The EIS and final reports are considered by the Department of Planning and Environment when making an assessment and recommendation to the NSW Minister for Planning.

Approval from the NSW Minister for Planning and the Commonwealth Government, under the Environment Protection and Biodiversity Conservation Act 1999 (Cth), is required for Snowy Hydro to start the main project works.

The Snowy 2.0 Main Works EIS is currently being prepared and will be submitted during 2019.



Tantangara Dam and Reservoir

## 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 affected 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.

## ENVIRONMENTAL ASPECTS

Based on the proposed construction methodology and operational characteristics of Snowy 2.0, a range of potential environmental impacts is 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.

For example, the studies conducted for the Exploratory Works EIS identified changes to the project plans that improved environmental outcomes and which were adopted (such as changing access roads to avoid impacts to flora and fauna).

There will be broad-scale environmental benefits from Snowy 2.0 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 local environment.

Snowy Hydro will provide offset funding of \$10.5 million as part of the Exploratory Works conditions of approval. The NSW Government has allocated this offset funding to National Parks and Wildlife Service (NPWS), to support environmental and recreational initiatives in KNP.

We're working with NPWS to identify opportunities for habitat improvement and catchment health works that will have 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 evaluate the potential opportunities and impacts of the project for local communities and infrastructure, such as traffic, emergency services and training facilities.

Any potential impacts will be addressed and managed according to strict Government guidelines 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 original Snowy Scheme did.



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 decades ago to carry energy from coal-fired plants to the market. However, our energy system is rapidly changing and new transmission routes are needed to connect new renewable generation projects and geographically-dispersed renewable energy zones to the network.

The Australian Energy Market Operator's 2018 Integrated System Plan proposes future upgrades to the shared transmission network that will facilitate the many renewable energy generation and storage projects that are planned or under construction, including Snowy 2.0.

There is growing recognition of the need to bring forward critical upgrades.

If new lines are built now, the existing Snowy Scheme could deliver 1,200MW more energy capacity to the NEM, in time to mitigate the impacts of the Liddell power station closure in 2022.

There is a long-standing regulatory framework in place to determine funding of these 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 needed 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

Following a thorough and rigorous environmental assessment and approval process, the NSW Government approved the Snowy 2.0 Exploratory Works.

Exploratory Works are now underway in the Lobs Hole area of KNP, to gain a greater understanding of the underground geological conditions at the likely location of the power station.

While there have been geological investigations conducted 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.

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

Access restrictions are being introduced to ensure the safety of the public and construction workers. **Lobs Hole Ravine Road** and the **Lobs Hole remote camping area** are now closed to the public.

For more information about Exploratory Works visit [snowyhydro.com.au](http://snowyhydro.com.au)



Snowy 2.0 ground-breaking ceremony at Lobs Hole

## PART OF THE COMMUNITY

We are proud to be born and raised in the Snowy Mountains and for almost 70 years we've considered ourselves part of the community. Today, we employ 400 locals to manage the Snowy Scheme and are a major purchaser of local goods, products and services.

Snowy Hydro backs community organisations and local activities both big and small. We have a long track record of partnering with the community on a range of initiatives, including the Country Universities Centre Snowy Monaro, school nurse pilot program in Cooma and Tumut, Police Citizens' Youth Centres, Young Driver Training Program and the Clontarf Foundation. We invest millions of dollars in sponsorships and support about 40 local events throughout the Snowy Mountains region every year.



Cooma

## COMMUNITY CONSULTATION AND PROJECT FEEDBACK

Snowy Hydro will continue to work closely with stakeholders and local communities to provide information about the Snowy 2.0 project and to seek feedback.

We've been out and about in the community hosting information sessions and seeking feedback in towns across the region – look out for the next series of community sessions. This program of engagement will continue throughout the life of the project.

You can also get in touch with us directly via:

**Email** [snowy2.0@snowyhydro.com.au](mailto:snowy2.0@snowyhydro.com.au)

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

**Phone** 1800 766 992

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