

The Hon Robert Stokes MP

Minister for Planning and Open Spaces

By email: <https://www.nsw.gov.au/nsw-government/ministers/minister-for-planning-and-public-spaces>

2 April 2021

Dear Minister,

Snowy 2.0 Transmission Connection Project Environmental Impact Statement

It is half a century since the last major high voltage overhead transmission line was constructed in a NSW National Park. Those years have seen a dismaying deterioration in the state of our environment: a huge increase in loss of native vegetation cover across NSW; increasing numbers of native species and ecological communities sliding towards extinction; and the undeniable signs of climate change in the form of global heating, drought, fire and extreme weather events.

As our State's environment deteriorates the role of National Parks has become increasingly important. National Parks, along with the other reserves that form our Protected Area Network (PAN), are the cornerstone of biodiversity conservation and the delivery of ecosystem services such as clean air and water. National Parks help protect threatened species and rare cultural sites, however they play just as important a role in ensuring 'common' fauna and flora species remain secure and natural ecosystem processes are maintained. The PAN has never been more important for the environmental sustainability of our State, and National Parks are our most precious legacy to the future.

NSW has a special place in the history of National Parks, having created second and third National Parks in the world. From the very first legislation establishing The National Park (now Royal) in 1879, a central tenant has been that extractive industries and industrial infrastructure have no place in National Parks. In NSW as across the world, any works within a National Park must fully account for the special statutory, environmental and ecological status of these lands.

The deterioration of the state of our environment and the associated increased importance of the PAN have profound implications for the EIS currently before you, which proposes the construction of overhead transmission lines through Kosciuszko National Park (KNP). As we will demonstrate in this submission, this EIS categorically fails to consider the purposes for which KNP was gazetted under the *National Parks and Wildlife Act*.

The last half century has also seen a major shift in international 'best practice' for the construction of transmission connections through areas of environmental sensitivity. While overhead towers and cleared easements may have been tolerable in National Parks fifty years ago, this is no longer the case. This submission demonstrates that best practice has shifted to the use of underground cables whenever traversing significant agricultural, community or conservation lands. Indeed, many nations are actively decommissioning overhead lines and replacing them with underground cables.

The shift towards underground cables informed the statutory Plan of Management (POM) for KNP. The POM, as approved in 2006, expressly prohibits the construction of any additional overhead transmission lines in KNP and requires that existing lines be rationalized or placed underground wherever possible. The POM was not intended to prohibit the construction of future transmission connections in KNP. Instead, it simply put Snowy Hydro Corporation and TransGrid on notice that they would need to adopt best practice and place any future connections through KNP underground.

NPA is appalled that, in 2021, any proponent would submit an EIS for the construction of overhead transmission lines through a NSW National Park. It is particularly shocking that TransGrid, acting on behalf

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of Snowy Hydro Corporation, would do so in the full knowledge that the statutory POM requires an underground option.

Snowy Hydro Corporation is responsible for funding TransGrid's assessment and construction costs. TransGrid has acknowledged to NPA that they were instructed to propose an overhead option by their client, presumably on the grounds of expected cost. Your colleague Minister Kean confirmed in recent budget estimates hearings that the differences in cost between overhead and underground options are the dominant issue.

Notwithstanding this clear motivation, the EIS makes no argument about the potential financial benefits of overhead transmission. The apparent reluctance to acknowledge cost as the primary driver has resulted in an EIS that attempts to make a frankly Orwellian argument that underground cables have a greater environmental impact than would overhead towers in a permanently cleared easement. The proposition is simply absurd, the lower environmental impacts of undergrounding are precisely why overhead transmission is no longer regarded as acceptable practice on the international stage.

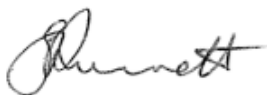
It would appear that this EIS has been unduly influenced by the perceived requirement to deliver the maximum commercial benefit to Snowy Hydro Corporation. The enabling legislation for the Snowy 2.0 project does require NSW to facilitate the issue of approvals, including the transmission connection, however NPA is not aware of any publicly available agreement regarding commercial benefits to Snowy Hydro Corporation. The reality is that underground options in no way compromise the delivery of a transmission connection, or as a tiny portion of the overall cost of Snowy 2.0, the overall viability of the Snowy 2.0 project. In our view the underlying financial issues have distorted the EIS process to the extent that the validity of any approval would be legally questionable.

This submission further argues that the EIS fails to adequately assess the environmental impacts of the proposed overhead transmission lines. In common with the preceding Snowy 2.0 Main Works EIS, the assessment of environmental impacts is almost exclusively focused on the construction footprint. This ignores the profound impacts associated with the fragmentation of habitat, loss of connectivity, disruption of ecosystem processes and introduction of weeds and feral species into a largely undisturbed portion of KNP.

Most importantly, once again the Snowy 2.0 project has generated an EIS that totally ignores the purpose and values of lands gazetted under the *National Parks and Wildlife Act* and treats KNP as though it has no legal protections or status beyond any other category of Crown Estate or private land. The proponent was obliged to find a transmission connection option that resulted in the lowest possible impact on a landscape of outstanding significance and importance for future generations. This EIS utterly fails to meet that objective. It is now your responsibility to **refuse the Snowy 2.0 Transmission Connection EIS** and require that a new EIS be prepared based upon an underground transmission technique.

I can be contacted at garyd@npansw.org.au or on 0432 757 059.

Yours sincerely,



Gary Dunnett
Executive Officer

National Parks Association of NSW
protecting nature through community action

The Snowy 2.0 Transmission Connection Project EIS is not in the Public Interest

Detailed Submission



**Fig 1 - Photomontage of proposed overhead transmission lines near Lobs Hole
Kosciuszko National Park (TransGrid)**



This Submission objects to the proposed overhead transmission connection through Kosciuszko National Park and contends that the circuits should be placed underground

Snowy 2.0 Transmission Connection Project EIS

“not in the public interest”

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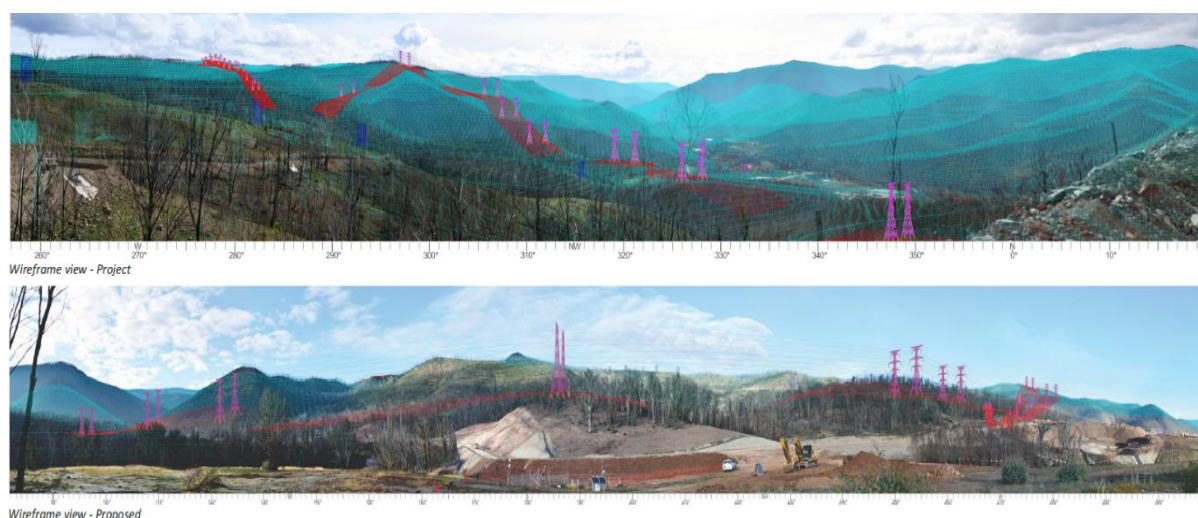


Fig 2 - Photomontage of proposed overhead transmission lines dominating the landscape (TransGrid)

Key Points

- The last major transmission line to be constructed in a NSW National Park was in 1976, and in Kosciuszko National Park (KNP) in the 1960's.
- Over the subsequent half century Australian and international standards have shifted to the use of underground cables in National Parks and areas of high environmental significance.
- The Plan of Management (POM) for KNP, the statutory plan that determines permissible activities within lands gazetted under the *National Parks and Wildlife Act*, expressly requires any additional transmission lines in the Park to be located underground and for existing overhead lines to be rationalised wherever possible.
- A recently exhibited amendment to the POM, which would lift the statutory prohibition on new overhead transmission lines, inappropriately, and in NPA's view, illegally, transfers responsibility for the protection of the core conservation values of KNP to this EIS.
- The proposed Snowy 2.0 lines would be far more intrusive than existing single-circuit transmission lines in the Park – comprising four 330 kV overhead lines, with two sets of massive steel lattice towers (up to 75 metres tall), traversing eight kilometres of Kosciuszko over a cleared swathe up to 200 metres wide. One hundred and forty hectares of KNP and Bago State Forest would be permanently cleared. The towers and lines would be visible over an astonishing 300 square kilometres.
- The EIS does not adequately acknowledge the special statutory purpose of lands gazetted as National Park, and as a consequence fails to assess the impacts of the proposal on the full range of values of protected areas, including ecosystem processes, connectivity of habitats, barriers to movement of native species, introduction and dispersal of weeds and feral species and wilderness character.
- By selecting an inappropriate transmission option that involves large scale clearance of native vegetation, disruption of habitat connectivity and wide scale introduction of threatening processes, the EIS comprehensively fails to protect the values of KNP and minimise the environmental impacts of the proposal.
- As well as selecting an inappropriate transmission option the EIS falls far short of the regulatory requirement to include 'an analysis of any feasible alternatives'. The EIS's consideration of underground alternatives is limited to the less promising options, indicating that they have been selected as 'strawmen' rather than subject to proper assessment.
- Connection to the existing Lower Tumut Switching Station, rather than the proposed Maragle Substation, has significant environmental, operational, financial and social benefits. This promising alternative has been rejected without justification.
- The EIS also fails to justify the scale of the proposed overhead option. Two lines on a single set of towers should suffice. The towers need not be so tall, the vegetation under the towers need not be cleared, and construction and ongoing maintenance could be performed by helicopters and drones, removing the need for access tracks.
- The EIS should be withdrawn and resubmitted with a proposal for an underground connection, in compliance with the POM and in keeping with world-best practice.
- NSW can do better than install old-technology, environmentally destructive, overhead lines in Kosciuszko National Park, one of our planet's iconic natural places.
- Approval of the EIS would set an appalling precedent whereby the NSW Government would signal that high impact transmission connections are acceptable in the most environmentally sensitive landscapes in our state.

1 Introduction – new overhead transmission lines are not in the public interest

The last high voltage electricity transmission line to be constructed in Kosciuszko National Park (KNP or “the Park”) was over half a century ago, before the Park was established in 1967.

The current Kosciuszko Plan of Management (POM), approved in 2006, expressly added the requirement for “*all additional telecommunication and transmission lines to be located underground*”. Clearly, the comprehensive five-year consultation process to update the POM decided that enough was enough – no more overhead transmission lines in Kosciuszko. The POM goes further, requiring existing lines to be rationalised wherever possible.

The prohibition of new overhead transmission lines in National Parks is standing policy throughout NSW, Australia and overseas. The western world has effectively banned new overhead lines from National Parks and is actively removing existing lines. The last major transmission line to be constructed in a NSW National Park was in 1976.

TransGrid was aware that any new transmission circuits in KNP must be underground before seeking the Secretary’s Environmental Assessment Requirements (SEARs) for this EIS. This statutory requirement is acknowledged by TransGrid in the EIS but disregarded, apparently with the agreement of the Government.

The EIS for the Snowy 2.0 Transmission Connection Project (“Project”) proposes overhead lines - not just one line, as is the case with existing lines in KNP, but four 330 kV lines. The proposed lines would be suspended on two sets of massive towers, up to 75-metres high, traversing eight kilometres of Kosciuszko over a cleared swathe up to 200 metres wide. One hundred hectares of KNP and forty hectares of Bago State Forest (BSF) would be permanently cleared. The EIS shows that the towers and lines would be visible over an astonishing 300 square kilometres. The scale and visual impact would be far greater than any of the existing transmissions lines through KNP.

TransGrid misrepresents the nature of the POM requirement for underground connections “*Despite the project not meeting the **POM goal** [NPA emphasis] of installing new electricity infrastructure underground, the project has sought to minimise adverse impacts on the values of the KNP and other users to the extent possible*”. The POM prohibition of overhead transmission is not an aspirational goal, it is a well-considered and legally binding policy empowered through the *National Parks and Wildlife Act 1974* (NPW Act).

The Government recently issued a draft Amendment to the POM (before the Transmission Connection Project EIS was exhibited) proposing to exempt Snowy 2.0 from the underground requirement. No justification was provided other than “*to ensure that all Snowy 2.0 operations undertaken after February 2022 are consistent with the plan of management.*” That is, the POM is to be brought into line with the TransGrid/ Snowy Hydro proposal. NPA has made a separate submission arguing that the exhibited amendment should not be approved, especially as it does not meet the minimum standards required under the NPW Act (Attachments D and E).

There are many underground alternatives. Examples are included in the Background Paper and Addendum to the [Open Letter to Ministers Stokes and Kean, 18 January 2021](#) (“Open Letter”) from two dozen environmental organisations and 50 experts calling for a comprehensive analysis of transmission alternatives and the adoption of an underground solution (Attachment A). This Submission draws extensively from the Background Paper and Addendum (Attachments B and C).

The EIS makes cursory references to some of those example alternatives, but avoids the more promising options and provides no comprehensive technical analysis. Thus, the EIS fails to comply with the *Environmental Planning and Assessment Regulation 2000* and the Secretary's Environmental Assessment Requirements (SEARs) by not analysing 'any feasible alternatives'.

Beyond the failure to seriously consider underground alternatives, the EIS proposes overhead lines of traditional design, with no examination of low-impact alternatives. The EIS is focussed on low-probability threats to Snowy 2.0's capacity to deliver uninterrupted maximum power. This excessively conservative approach overstates the risks and fails to balance them against the significant impacts on the Park. As a consequence, the proposed project is of an unnecessary scale and level of redundancy and environmental impact. Four lines are proposed when only two higher rating lines would be sufficient. Large swathes of vegetation are to be unnecessarily cleared permanently for extremely rare and usually inconsequential risks, failing to place the environmental impacts on the Park at the forefront of consideration of the Project.

The EIS claims to have mitigated the environmental impacts on the Park, but those mitigations consist of little more than the future preparation of an environmental management plan and sub-plans.

The EIS also fails to take due consideration of the cumulative impacts of the lines on top of both the other components of the Snowy 2.0 project and the existing transmission lines in KNP – the very reason for insertion of the requirement for all additional lines to be underground in the 2006 POM. The majority of the Snowy 2.0 Main Works are to be underground (power station and water tunnels). Likewise, the transmission connection component of Snowy 2.0 should be located underground to minimise further damage to the Park.

The EIS concludes *"This EIS demonstrates that the project could be undertaken without any significant long term impacts on the local environment. As such, the project is considered to be in the public interest"* (page vi).

Manifestly this is incorrect - the Project would result in significant long-term impacts. The ultimate determinant of what is in the public interest in Kosciuszko National Park is its Plan of Management, which prohibits additional overhead transmission lines. The NSW Government is being asked to again condone the stripping away of long-standing protections for Kosciuszko National Park for one highly contentious project.

More overhead transmission lines in Kosciuszko National Park are definitely not *"in the public interest"*.

1.1 TransGrid's investigation of underground alternatives

NPA and some of its engineering experts 'met' with TransGrid executives on 29 March 2021 to discuss the EIS. NPA questioned why the EIS did not include a fully developed underground proposal, consistent with the requirements of the POM.

TransGrid assured NPA that underground options were being assessed and system studies were underway on NPA's proposed alternative connection to Lower Tumut Switching Station (LTSS).

It is expected that these investigations will inform TransGrid's response to submissions on the EIS. However, NPA recommends that rather than being used for this purpose, the studies should be used to prepare a fresh EIS application for an underground connection.

PART 1 – INADEQUACY OF THE EIS

- 2 Additional overhead transmission is prohibited in Kosciuszko NP**
- 3 Proposed exemption for Snowy 2.0**
- 4 Further inadequacies of the EIS**
- 5 Context of Snowy 2.0 Project**

This Submission is divided into two parts.

PART 1 covers the requirement for additional transmission connections to be located underground in Kosciuszko National Park (in fact all NSW National Parks), the non-compliance of the EIS in this regard, and the Government's proposed exemption for Snowy 2.0.

It then demonstrates that the EIS process has been further compromised by failure to fully analyse feasible alternatives, address cumulative impacts and propose best-practice environmental damage mitigation measures.

The inadmissibility of cost as a consideration in assessing the EIS (and the POM Amendment) is then addressed, followed by comments on the context of the Transmission Connection Project as a component of Snowy 2.0.

PART 2 covers the technical aspects of the EIS, starting with the impacts of the proposed overhead lines and the inadequacy of the reasons provided in the EIS for the proposal.

The benefits of undergrounding are then summarised, together with references to underground projects across the world in areas of high conservation value.

The underground alternatives provided in the Background Paper are listed, followed by NPA's responses to the reasons in the EIS claiming that undergrounding is impractical. These responses cover each of the two possible connection points at the proposed Maragle Substation and the existing Lower Tumut Switching Station.

The final Chapter critiques the overhead line proposal, finding it to be excessive in scale and number of circuits and making no attempt to apply best practice design principles.

2 Additional overhead transmission is prohibited in Kosciuszko NP

2.1 Plan of Management

Kosciuszko National Park is reserved under Part 4, Division 3 of the NPW Act. All activities within the Park must be consistent with the KNP Plan of Management¹ (POM) in accordance with Part 5 of the Act.

The current KNP POM was approved in 2006 following five years of detailed research, assessment and stakeholder consultation. Both Snowy Hydro Corporation and TransGrid were involved in its formulation as major tenants in the Park and are bound by its requirements.

A POM is required to evaluate all potential threats and provide policies and actions to avoid the potential for those threats to degrade the identified values of the National Park. The KNP POM clearly identifies the construction of any additional overhead transmission lines as an unacceptable threat to the core values of the Park.

The POM is heavily influenced by the past and ongoing impacts of the previous generation of transmission line construction in KNP, which has resulted in long lasting adverse impacts including vegetation clearance, habitat fragmentation and the wide-ranging dispersal of weeds and pests into otherwise high quality areas of the reserve. It is notable that the ongoing management of vegetation within transmission easements is recognised as a threat to the values of KNP, and in fact TransGrid has been subject to compliance action to address poor easement management practices².

Most importantly, the POM reached a measured judgement that the overall values of KNP cannot be secured and protected if any more overhead transmission lines are constructed.

The POM balances the threats associated with overhead transmission against the possibility that Snowy Hydro and/or TransGrid (or any other developer) would have a future need for additional transmission connections. The POM does not prohibit transmission connections, it simply requires that any future connections be placed underground.

TransGrid's reference to the prohibition as a 'goal' misrepresents both the legal standing of the prohibition and the significance of the POM's judgement that any additional overhead lines would have permanent, significant and unacceptable impacts on KNP.

The current proposal to amend the POM in no way detracts from the logic and integrity behind the prohibition. It is telling that the EIS has made no attempt to grapple with the rationale for the POM requirement for underground transmission. In fact this is a fundamental failing of the EIS.

NPA's strong position is that POMs provide the primary strategic planning framework for areas within the Protected Area Network. POMs assess threats and appropriate mitigations at the bioregional and landscape scale.

In contrast, while EISs are required to consider 'whole of landscape' context and cumulative impacts

¹ "Kosciuszko National Park Plan of Management" 1 June 2006 <https://www.environment.nsw.gov.au/research-and-publications/publications-search/kosciuszko-national-park-plan-of-management>

² "Inquiry into Land Clearing by TransGrid", NSW Legislative Council, Parliamentary Paper Number 255, 21 November 2002
<https://www.parliament.nsw.gov.au/lcdocs/inquiries/2214/Committee%20Report%2021%20November%2020%20-%20Inquiry%20into%20L.pdf>

at the bioregional scale they are an imperfect mechanism for such assessment, being focused on the immediate construction footprint. An EIS is not the appropriately scaled tool for assessing the impacts of overhead transmission lines on KNP, but even if it were the proponent's failure to address the POM's rationale for requiring underground techniques renders this EIS incomplete.

2.2 The KNP POM requires additional lines to be underground

Section 12.6 of the KNP POM deals with "Electricity Transmission Authorities and Telecommunication Carriers". The overall thrust is to improve environmental standards, minimise the impact of current activities on the values of the Park, where possible reduce the impacts of existing infrastructure, and prohibit further major environmental damage (Figure 3).

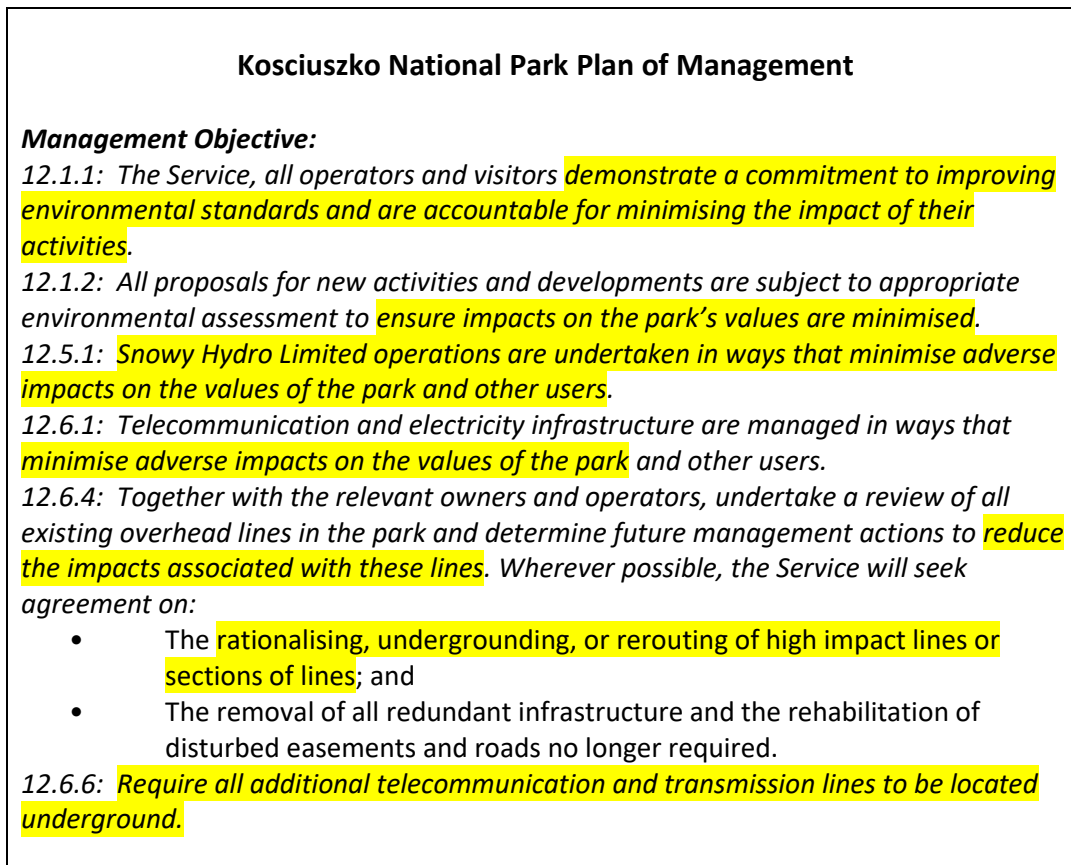


Figure 3 - Extracts from Chapter 12.6 of KNP POM

Snowy Hydro (and TransGrid) are required to minimise environmental impacts, consistent with the values of the Park. The POM requires that "Snowy Hydro Limited operations are undertaken in ways that minimise adverse impacts on the values of the park and other users" (12.5.1). Further, "telecommunication and electricity infrastructure are [to be] managed in ways that minimise adverse impacts on the values of the park and other users" (12.6.1).

In particular, Objective 12.6.6 "require[s] all additional telecommunication and transmission lines to be located underground". In fact the POM goes further, "wherever possible, the Service [NPWS] will seek agreement on the rationalising, undergrounding or rerouting of high impact lines or sections of lines" (12.6.4).

The requirements for undergrounding any additional transmission lines and rationalising existing lines were specifically added to the 2006 POM.

Snowy Hydro and TransGrid knew of the POM's requirements for undergrounding and Snowy Hydro should have factored undergrounding into the Snowy 2.0 Business Case. If not it cannot expect the Government to make an exception, purely to help save the Corporation some up-front expenditure.

2.3 It is long-standing practice to prohibit additional transmission lines in National Parks

No NSW National Park permits additional overhead transmission lines (Figure 4).

Royal National Park Policies, p63

It is a long term aim of the Service to reduce, and if possible, eliminate, the number of non-park power lines and other utilities (including roads used for their maintenance) held under lease or license within the three areas.

Blue Mountains National Park Policies, p91

The Service will formalise and update agreements for all essential works, facilities, and operations by other organisations (e.g. transmission lines, water pipelines and radio towers) and authorised access to inholdings (other than via public access roads) within the park in accordance with the Act and Service policy, with the specific aim of minimising adverse impacts on the park.

New works, facilities or operations proposed by any organisation or individual will not be permitted within the park unless they are consistent with the purpose of reservation of the park and the provisions of this plan and, for lands included in Warragamba Special Area, the provisions of the jointly sponsored Special Areas Strategic Plan of Management.

Wollemi National Park Policies, pp58-59

The Service will formalise and update agreements for all essential alien uses (e.g. transmission lines, water pipelines, vehicle access and radio towers) within the park in accordance with the Act.

Other alien uses which are not essential and/or not covered by formal agreements within 4 years, will be terminated and/or removed.

New works, facilities or operations proposed by any organisation or individual will not be permitted within the park unless they are consistent with the Act, the purpose of reservation of the park and the objectives of this plan.

Figure 4 – Sample National Park Policies prohibiting additional overhead transmission

2.4 The last transmission line built through a NSW National Park was 45 years ago

The NSW Minister for Energy and Environment, Hon Matt Kean MP, together with officials from the Department of Planning & Environment (DPIE) and the National Parks and Wildlife Service (NPWS), appeared before the NSW Government Legislative Council Portfolio Committee No. 7 – Planning and Environment, on 2 March 2021, and addressed questions on the Snowy 2.0 Transmission Connection³. Minister Kean stated:

³ "Hansard" <https://www.parliament.nsw.gov.au/lcdocs/transcripts/2524/Transcript%20-%20Tuesday%202%20March%202021%20-%20UNCORRECTED%20-%20PC7%20-%20Energy%20and%20Environment%20-%20Kean.pdf>

“But can I just also say that transmission lines through national parks are not unusual. There is a huge transmission line going through the Greater Blue Mountains World Heritage Area, taking electricity from the Mount Piper coal-fired power station into the electricity market; so this is not an unusual thing.”

The transmission line referred to by Minister Kean was built in 1976, before the declaration of the World Heritage Area, in 2000. In fact, it was the last major transmission line to be built in a National Park that NPA is aware of.

Contrary to the Minister’s comment, building transmission lines through a National Park **IS** a most ‘unusual thing’ – there have been none for nearly half a century.

In fact, in KNP the opposite has been the case, with overhead lines being undergrounded and removed to reduce their environmental impact:

- 1979: the overhead line from Perisher Valley to Charlotte Pass was undergrounded
- 1990’s: the overhead line between Khancoban and Tooma Dam was dismantled and a solar power system installed at the Dam

Also, the ‘huge transmission line’ the Minister referred to in the Blue Mountains is only half as huge as the proposed Snowy 2.0 connection – one double-circuit 330 kV line rather than two double-circuit lines for Snowy 2.0.

3 Proposed exemption for Snowy 2.0

The POM and EIS are inextricably linked. An approval of the EIS would need to be conditional on the POM being subsequently amended to exempt Snowy 2.0 from the statutory requirement for all additional transmission in the Park to be located underground.

As the EIS proposal is not compliant with the POM, at the least the EIS should have provided a compelling argument justifying an overhead connection and an exemption from the POM. The EIS fails to provide such justification.

Reprehensibly, the Government has exhibited a draft Amendment to the POM to exempt Snowy 2.0 and advised TransGrid that *"the KNP POM would be amended in due course"*.

3.1 POM Amendment to exempt Snowy 2.0

Three weeks before the release of the EIS, NPWS exhibited its [Kosciuszko National Park Draft Amendment to the Plan of Management – Snowy 2.0](#), inviting public submissions. The Amendment proposes an exemption for Snowy 2.0 from being required to locate telecommunication and transmission lines underground, in Section 12.6.6:

"Remove:

Require all additional telecommunication and transmission lines to be located underground.

Replace with:

Require all additional telecommunication and transmission lines to be located underground, except those constructed as part of the Snowy 2.0 project."

The (only) 'reason' given for the Amendment, appears under the heading *"Requirement to amend the plan"*:

"An amendment to the Kosciuszko National Park Plan of Management is required to ensure that all Snowy 2.0 operations undertaken after February 2022 are consistent with the plan of management."

The wording is misleading. It is the POM that is being amended so that **it will be consistent** with Snowy 2.0 operations after the expiry of the legislative exemption period (till February 2022) granted via the *Snowy Hydro Corporatisation Amendment (Snowy 2.0) Act 2018*. The Amendment is portrayed as a perfunctory action to enable what is currently prohibited by the POM to be legitimised for Snowy 2.0.

A circular email from NPWS, on 5 February 2021, adds that the Amendment is *"to ensure consistency between the plan of management and previous Government decisions on this matter"*:

"Subject: Public exhibition of Kosciuszko National Park Draft Amendment to the Plan of Management: Snowy 2.0"

The National Parks and Wildlife Service (NPWS) is currently exhibiting the Kosciuszko National Park Draft Amendment to the Plan of Management: Snowy 2.0. The park is in the Snowy Mountains region of New South Wales.

Recent changes to the Snowy Hydro Corporatisation Act 1997 have been enacted to enable the Critical State Significant Infrastructure Snowy 2.0 project to be undertaken. These enable leases, licences and easements to be issued for the project under the National Parks and Wildlife Act

1974. A number of leases and licences have been issued for the project with more expected to be issued over the project's development period. An amendment of the plan is required to ensure that the issuing of tenure under the National Parks and Wildlife Act 1974 and Snowy 2.0 construction and operations authorised under the Environmental Planning and Assessment Act 1979 can be undertaken in accordance with the plan of management.

A reference to above-ground transmission lines has been included in this amendment to ensure consistency between the plan of management and previous Government decisions on this matter."

3.2 NPA opposes Amendment

NPA has serious concerns about the probity and due process involved in the concurrent exhibition of the POM Amendment and this EIS. The Amendment is only 'necessary' if the EIS is approved.

NPA strenuously opposes the Amendment. In our submission (on 22 March 2021 - Attachment D) we contended there is no reason to exempt Snowy 2.0 from the POM's requirement for additional transmission circuits to be underground as there are numerous compliant alternatives:

"It is reprehensible that the exhibited amendment makes no attempt to address the reasons for the prohibition on additional overhead lines or to demonstrate how amending that prohibition would impact upon the landscape and conservation values of KNP. It is NPA's considered opinion that the amendment does not meet the requirements of Section 72AA of the National Parks and Wildlife Act and provides no basis for informed submissions or a valid decision by the Minister.

NPA can only conclude that it [the draft Amendment] has the sole purpose of providing commercial benefit to Snowy Hydro Corporation. Existing legislation and well-founded policies for the protection of KNP are being set aside to serve the demands of a developer.

NPA strongly recommends that the amendment be withdrawn and the prohibition on the construction of overhead transmission lines be inserted as a standard form of prohibition on new overhead transmission connections in all relevant POMs in NSW.

In our view, the failure to address the relevant matters for a statutory amendment of a POM (Attachment E) renders it inappropriate and contestable. In any case, the proposed exemption for Snowy 2.0 in no way removes the underlying reasons for the current prohibition. Those reasons, particularly the adverse impacts of fragmentation, are entirely relevant to this EIS and the failure to address them is sufficient reason to refuse approval.

3.2.1 Approving overhead lines adds to the legislative exemptions granted to Snowy 2.0

The NSW Government has already agreed to exempt Snowy 2.0 from the *Biosecurity Act 2015* and the *Fisheries Management Act 1994* to condone the illegal transfer of pest fish and pathogens between Talbingo and Tantangara Reservoirs. This exemption will result in the infestation of the entire Snowy Mountains waterways and downstream rivers with Redfin Perch and other noxious pests and diseases.

A further exemption, this time to the POM, will only serve to consolidate the extraordinary, unprecedented concessions granted by the NSW Government for Snowy 2.0's environmental damage.

There is no justification for Snowy 2.0 being accorded special status ahead of any other developer, even if the NSW Government may feel obliged to do so in keeping with the share sale agreement

with the Commonwealth (see Attachment F).

3.3 TransGrid acknowledges inconsistency with POM, but NPWS assures it will be fixed

The EIS fully acknowledged that it ‘**must be** consistent with the KNP POM’, but is not:

“All activities within KNP must be consistent with the KNP PoM in accordance with the requirement of the National Parks and Wildlife Act 1974 (NPW Act, as discussed in Section 4.1.2). Consequently, the project is currently not consistent with the back country management zone as outlined in the KNP PoM.

Whilst an amendment to the KNP POM is required to support the construction and operation of an overhead transmission connection within KNP, this amendment had not been made at the time of writing this EIS.”

The EIS added that NPWS had advised TransGrid that the POM would be amended in due course:

“Notwithstanding this, TransGrid has consulted with NPWS who advised that the KNP POM would be amended in due course to reflect the requirement to connect Snowy 2.0 to the grid via an overhead transmission connection.”

It appears that TransGrid has considered it to be unnecessary to justify its non-compliant EIS in light of Government advice that the EIS proposal for overhead lines will be deemed compliant in due course through the granting of a specific exemption in the POM.

It also appears that the Government has already decided to approve overhead lines and hence both the EIS and the POM Amendment.

3.4 TransGrid obtain finance and sign the works contract

TransGrid has already obtained finance and awarded the works contract, no doubt based on an assurance from the Government that overhead lines are acceptable:

- On 27 November 2020, the Clean Energy Finance Corporation (CEFC) announced the finalisation of a \$125 million corporate debt facility with TransGrid⁴, “to design, construct, operate and maintain a new 330 kV switching station and associated transmission lines as part of its agreement with Snowy Hydro Limited to provide connection services for 30 years.”
- On 4 December 2020, the CIMIC Group (UGL)⁵ announced being awarded five electricity utility sector contracts “for more than \$112 million ... including the design and construction of a 330kV switchyard at Maragle in the Snowy Mountains, NSW for TransGrid. The contract includes building 10 kilometres of 330kV transmission lines to connect the switchyard and the Snowy 2.0 pumped-hydro project cable yard.”

TransGrid has followed the same pre-emptive path as Snowy Hydro, which awarded the \$5.1 billion Main Works contract 14 months before environmental approval was granted.

⁴ “CEFC and TransGrid Services in landmark investment to support Snowy 2.0 grid development” 27 Nov 2020 <https://www.cefc.com.au/media/media-release/cefc-and-transgrid-services-in-landmark-investment-to-support-snowy-2-0-grid-development/>

⁵ “UGL awarded more than \$112M in utilities contracts”, CIMIC, 4 December 2020 <https://www.cimic.com.au/en/news-and-media/latest-news/ugl/2020/ugl-awarded-more-than-112m-in-utilities-contracts>

3.5 DPIE assures that the EIS decision has yet to be made

In a Sydney Morning Herald article [‘Permanent stain’: NSW seeks to allow new powerline in Kosciuszko Park, 17 February 2021](#) DPIE attempted to downplay the issuing of the draft Amendment before exhibition and assessment of the EIS:

“A Department of Planning spokesman said the final decision on the transmission lines was yet to be made, adding that its “Environmental Impact Statement requires consideration of alternative designs, including undergrounding, to minimise impacts on the National Park Estate”.

The amendment to the management plan served to bring it *“in line with the existing Snowy 2.0 legislative framework [and] does not pre-empt the planning process”.*

Gary Dunnett, Executive Officer of the National Parks Association, though, said the spokesman’s comment was *“not surprising but totally disingenuous”.*

“Without the amendment to the [management plan] there would be no choice but to stick with an underground option,” Mr Dunnett said.

“This is the first time the requirement to put any new transmission through Kosciuszko National Park underground has been put to the test, and it appears the National Parks and Wildlife Service has simply folded, producing an amendment that would strip away the protections in the existing [plan],” he said.”

3.6 The only remedy is for a compliant EIS to be submitted

The only plausible explanation for issuing the draft Amendment before the EIS was exhibited, or approved is that the Government has already decided to approve overhead lines. There would be no need for an Amendment if the EIS for overhead lines is refused.

NPA considers that the processes for both the POM amendment and the EIS assessment are fatally flawed and have not complied with the necessary legal requirements. The only remedy is for the Government to reject the EIS, withdraw the POM Amendment, and insist on an underground proposal.

4 Further inadequacies of the EIS

In addition to failing to submit a compliant proposal, or at the very least provide a compelling rationale for its non-compliant proposal, the EIS has failed to comprehensively analyse feasible alternatives, address cumulative impacts and propose best-practice environmental damage mitigation measures.

The EIS assessment process (and the POM Amendment process) has also been compromised by the Government's focus on the cost of alternatives, despite the fact that cost is not a relevant factor.

4.1 Lack of analysis of alternatives

The *Environmental Planning and Assessment Regulation 2000* (Clause 7(1)(c) of Schedule 2) requires all EISs to include 'an analysis of **any feasible alternatives**' for a proposed project:

"7 Content of environmental impact statement

(1) An environmental impact statement must also include ...

(c) an analysis of any feasible alternatives to the carrying out of the development, activity or infrastructure, having regard to its objectives, including the consequences of not carrying out the development, activity or infrastructure"

This requirement is also included in the SEARs, *"In particular, the EIS must include a summary of the background to the project, including alternatives that were considered to the project"*.

As demonstrated later, the EIS provides some cursory comments on a few of the less promising underground alternatives, rejecting them without any concerted analysis. Failure to assess viable and lower impact alternatives is not consistent with TransGrid's statutory obligations nor the community's expectations that all reasonable steps will be taken to minimise the impacts on KNP.

As evident in Chapter 1.1, TransGrid is still actively investigating underground alternatives, some of which were suggested in the Open Letter before the EIS was exhibited.

4.2 Lack of analysis of cumulative impacts

Consideration of cumulative impacts by the EIS is summarised in Page v of the EIS:

"Cumulative impacts

The project would have a cumulative impact with Snowy 2.0 and other projects in the region during construction. The cumulative impacts would be associated with biodiversity, traffic and amenity (visual, noise and dust), water quality and bushfire risk. The project and Snowy 2.0 will implement mitigation measures to reduce or ameliorate these impacts and the majority of these impacts would be temporary and localised to the Lobs Hole Ravine area and would unlikely contribute to impact in the broader region.

During operation there would be a cumulative visual impact from Snowy 2.0 and the project due to more infrastructure being visible in the landscape around Lobs Hole Ravine area."

The EIS fails to provide details of the cumulative impacts of the lines on top of the Snowy 2.0 project, even though Ms Cecilia Kim of Snowy Hydro stated at the NSW Parliament Legislative Council

Regulation Committee on 29 June 2018 that a comprehensive assessment of the cumulative impacts of Snowy 2.0 (i.e. including the transmission connection) would be provided with each EIS⁶:

“each separate application [for parts of the Snowy 2.0 project] will consider the totality of the impacts. Snowy Hydro Limited and TransGrid will be required to undertake ‘a robust and comprehensive environmental impact assessment with respect to the works in question, including the cumulative impacts with respect to those applications’ (cl.1.66).”

Also, the EIS fails to mention or consider the cumulative impacts of the proposed transmission lines on top of the existing transmission lines in KNP. A number of Figures in this Submission show the numerous transmission line easement scars in KNP and BSF.

It was the presence of these existing lines that precipitated the addition of the prohibition of any new transmission lines in the 2006 POM, together with the requirement to rationalise, underground and reroute high impact lines in the Park. Preparation of the POM involved an exhaustive analysis of the cumulative impacts of transmission lines in the Park.

Clearly, the omission of a cumulative analysis also breaches the SEARS, which states:

“In particular, the EIS must include:

- *an assessment of the likely economic, social and environmental impacts of the project having regard to the requirements in any relevant Government legislation, policies and guidelines (see below), including:*
 - *the predicted impacts of the project, including any cumulative impacts”*

4.3 Lack of environmental mitigation measures

Throughout the EIS it is stated that steps have been taken to minimise environmental impacts. But few are identified, other than proposing to prepare a construction environmental management plan and concluding that there are no issues that would preclude approval:

“Environmental mitigation and management

To manage the potential impacts identified by the EIS, and in some cases avoid them completely, a range of mitigation measures have been identified that would be implemented during construction and operation. A construction environmental management plan (CEMP) including sub-plans would detail how specific environmental issues are to be managed during construction in accordance with the mitigation measures provided in the EIS. The CEMP would provide a framework for establishing how these measures would be implemented and who would be responsible for their implementation. The CEMP would also incorporate the conditions of approval from the NSW Minister for Planning and Public Spaces and Commonwealth Minister for the Environment, if granted” (page v)

Chapter 10.4 lists a number of obvious mitigating actions that have not been mentioned.

4.4 Cost cannot be a consideration in the assessment of the EIS

There are no technical reasons precluding underground cables, and their environmental impacts are much less than overhead lines. NPA can only conclude that the (unstated) reason for TransGrid

⁶ “Environmental Planning and Assessment Amendment (Snowy 2.0 and Transmission Project) Order 2018”
NSW Parliament Legislative Council Regulation Committee 29 June 2018
<https://www.parliament.nsw.gov.au/lcdocs/inquiries/2486/Final%20Report%20-%2029%20June%202018.pdf>

proposing overhead lines is an assumed cheaper up-front cost. Also, no doubt this is a major concern for Snowy Hydro, as it will be paying TransGrid for the connection.

However, the relative cost of overhead lines compared with underground cables is not a legitimate factor for the Government to consider when assessing the EIS, nor amending the POM. Cost is not included as a requirement in the SEARs nor is it one of the 23 matters that must be addressed when amending a POM (Attachment E). Cost is not mentioned in the EIS as a reason for the proposal nor in the POM Amendment. Rightly so.

However, the Government has stated, improperly, that relative cost is **the** major factor in its consideration of the EIS and POM.

4.4.1 The EIS makes no mention of relative cost of alternatives

In accordance with cost not being a legitimate consideration when assessing the EIS (or amending the POM), the EIS makes no mention of the relative costs for overhead and underground alternatives.

The only mention of cost in the EIS is the \$318 million Capital Investment Value (CIV) of the Project, excluding GST and land costs (Appendix K). No breakup is provided of the various components of the Project, nor estimates for ongoing operation and maintenance.

If TransGrid was to belatedly wish to include the relative cost of alternatives as a reason to support its proposal, then it will need to resubmit the EIS to enable submissions to be made on this assertion and its relevance.

4.4.2 The Government is (wrongly) focussed on relative cost

In their appearance before the NSW Government Legislative Council Portfolio Committee on 2 March 2021, the Minister and officials indicated that the Government has already agreed to overhead lines, and the POM Amendment is merely to formalise that arrangement (see Figure 5 for extracts³). Only after sustained questioning did the Minister relent a little and agree to look at (just) the relative cost of undergrounding.

From the responses, the cost impact on electricity prices and NSW consumers is the primary focus for the NSW Government. The environmental impacts on KNP hardly rated a mention. Mr Kean would only look at undergrounding *“where there is no material difference”* in cost. This was in effect his hurdle point before considering underground alternatives:

“My position is that where there is no great material difference between tunnelling and using overhead cabling, then of course we should look at that. But if there is a huge economic cost to be borne by the community by getting this cheap, reliable and clean energy into the grid, then obviously that will be a major consideration.”

Mr Kean did not refer to considering the ‘material difference’ in environmental impacts. At one stage he was not sure *“whether or not we will assess the [underground] alternate”*, seeking the advice of a DPIE official.

It is relevant to note that there are many instances where transmission circuits have been installed through areas of environmental significance for many times the cost of a standard overhead line design (Chapter 5). If cost is a relevant factor (which it shouldn’t be in the case of this EIS), then the hurdle for consideration needs to be far lower than ‘where there is no material difference’ in cost.

Mr Kean seems to have been pushed into 'looking at' underground options by the Open Letter. One would have expected that the Government would have been pushing TransGrid/ Snowy Hydro to not just consider, but propose, an underground connection in accordance with the Government's POM.

The CHAIR: Minister, I understand that the Kosciuszko National Park plan of management requires all additional telecommunication transmission lines to be located underground; that is of course in relation to Snowy 2.0. The plan of management also says that wherever possible the service will seek agreement on the rationalising, undergrounding or rerouting of high-impact lines or sections of lines. **Why has the Government granted an exemption to Snowy Hydro for its transmission lines?**

Mr MATT KEAN: Because we need to make sure that we get that cheap, reliable and clean energy into the system as soon as possible. ... We have got to get the balance right between making sure that we get that energy into the system but we do it in a way where there is minimum impact on the park. We are currently looking at how best to minimise the cost whilst at the same time having the least amount of impact on the national park. We are working through that process at the moment.

The CHAIR: I understand that it is nine kilometres of two massive far transmission lines, and I think everybody understands what that looks like if it goes over national parks. **Are you saying it is all about cost in terms of why an underground option was not considered?**

Mr MATT KEAN: We will consider the underground options. I know that the National Parks Association of NSW [NPA] has put up a proposal to tunnel the transmission lines; we will consider that. **But let me be very clear with the Committee, every dollar spent on this has to be paid by consumers so we need to find a way to have the minimum impact on consumer bills whilst at the same time doing what we can to protect the park. My position is that where there is no great material difference between tunnelling and using overhead cabling, then of course we should look at that. But if there is a huge economic cost to be borne by the community by getting this cheap, reliable and clean energy into the grid, then obviously that will be a major consideration.**

The CHAIR: You do know that the Snowy Hydro CEO, Paul Broad, said in 2018: The project's design - not the transmission lines - is being done in a way that minimises its environmental footprint. This includes putting the majority of the physical structures such as tunnels and the powerstation deep underground. The power station itself is going deep underground to minimise environmental impacts but nine kilometres of the transmission line is going to go above ground. I know that the environmental impacts on Kosciuszko National Park are very close to your heart. That is nine kilometres of massive clearings for two transmission lines. **How are you going to assess the alternative if I understand that Snowy Hydro has not been asked to present that alternative?**

Mr MATT KEAN: **Mr Hay, would you like to maybe comment on whether or not we will assess the alternate?**

Mr HAY: I think part of that is for the National Parks, and my colleague Mr Fleming can also talk about the process he runs through for that assessment ...

Mr FLEMING: There are two separate processes ... **The plan of management process—that is our process. That is not pre-empting any decision on the transmission line. That is giving effect to a government policy decision which was—I think, two or three years ago the legislation said—**

Mr MATT KEAN: **I have just seen the letter from the NPA. I think it is reasonable to consider whether or not undergrounding would add to material cost to consumers, so we are happy to look at that and I am happy to report back to you.**

Figure 5 – Extracts from Hansard of Budget Estimates Hearing

An assessment based on cost avoids consideration of all other relevant factors, such as the relative environmental impacts, safety, aesthetics, network reliability, electrical losses, vulnerability to bushfires and lightning, benefits to the NEM from other alternatives (see later). In fact it is

inconsistent with the principles of Ecologically Sustainable Development (ESD) for EIS assessment.

The hearing concluded with Minister Kean agreeing to report back to the Committee on ‘whether or not undergrounding would add to the material cost to consumers’.

The answer to that question is no. The transmission lines will be a Connection Asset purely to service Snowy 2.0, not a Shared Asset serving all consumers. Hence the lines will be paid for directly by Snowy Hydro, not pooled into costs of the grid.

Snowy Hydro has no means of passing on those costs to electricity consumers, in exactly the same way that it has no means of passing on the extra \$8 billion (NPA estimate) of costs compared to its initial \$2 billion estimate for Snowy 2.0. Ultimately that means Australian taxpayers will pick up the tab, which is most unfortunate. But this is the responsibility of the Commonwealth Government to address, as the shareholder of Snowy Hydro, not the NSW Government.

The preoccupation with cost for transmission stands in stark contract with NPA’s previous dealings with the NSW Government over the Snowy 2.0 Main Works EIS. Whenever NPA suggested cheaper alternatives to Snowy 2.0 the DPIE officials stated that was not a relevant issue in its assessment of the EIS as it was entirely a matter for Snowy Hydro and the Commonwealth Government.

We note that at our meeting with TransGrid on 29 March, four weeks after the Committee hearing, the TransGrid executives had no knowledge of the Minister’s commitment to report back on the relative costs of overhead and underground transmission, and were unaware of any request to provide advice.

4.4.3 Offset payment compensation inappropriate

Whilst on the subject of costs, the EIS is silent on the level of compensation to be paid by TransGrid to the NSW Government for the use of the Park and the temporary and permanent damage to the environment.

Section 7.1.5 of the EIS calculates preliminary ‘offset credits’ on the same framework as for the Snowy 2.0 Main Works. It then makes the sweeping statement that such payments will deliver long-term benefits for KNP:

“TransGrid proposes to use the same framework which has been developed for the Snowy 2.0 Main Works Biodiversity Offset Strategy (EMM, 2020) and included in the Snowy 2.0 Main Works Infrastructure Approval; namely, the proponent would make payments to the NPWS to offset the residual biodiversity impacts of the project, and NPWS would use these funds to enhance the biodiversity and conservation values of KNP. This framework for Snowy 2.0 would allow NPWS to carry out actions to substantially improve catchment health, strengthen ecosystems, protect threatened species and communities and deliver long-term strategic conservation benefits for the KNP (DPIE, 2020a).”

NPA regards reliance on offset payments as totally inappropriate in a protected area setting. The objective should be to avoid activities that incur this level of environmental impact.

5 Context of Snowy 2.0 Project

Whilst cost is not a legitimate factor in the EIS assessment and POM amendment processes, it should be viewed in the context of the financial cost and environmental impacts of the whole Snowy 2.0 project.

The Snowy 2.0 Main Works contract was awarded for \$5.1 billion. As noted earlier, many independent experts consider the final project cost will be around \$10 billion, when all components and related grid augmentations are included. Also, it is relevant to note that the Commonwealth Government has already contributed \$1.4 billion to the project, with Standard & Poors indicating that further financial support is likely⁷.

The cost of the Transmission Connection Project is \$318 million⁸, representing around 3% of the likely total cost of Snowy 2.0. In that context, and the criticality of a transmission connection, NPA considers that a low impact underground alternative would justify expenditure many times higher than \$318 million, especially in view of the considerably reduced environmental impacts and other offsetting benefits (Chapters 7, 8 and 9).

Examples of much higher expenditure for transmission circuits through areas of environmental significance include:

- the specially designed transmission line that traverses the World Heritage-listed Wet Tropics Rainforest near Cairns cost three times more than the standard design (Chapter 10.4.5)
- the underground section of the circuit through the Mariager Fjord and Gudenaa Valley in Denmark cost two and half times the cost of the overhead section (Chapter 7.2)

Snowy Hydro has vigorously promoted the environmental benefits of undergrounding new electricity infrastructure:

“We have the greatest respect for the Kosciuszko National Park. The [Snowy 2.0] project’s design is being done in a way that minimises its environmental footprint. This includes putting the majority of the physical structures, such as tunnels and the power station deep underground” (Mr Paul Broad, Managing Director).

Undergrounding most of the Snowy 2.0 project, especially the power station, comes at considerable extra complexity and expense, in the order of \$billions. It would be entirely inconsistent to underground the majority of Snowy 2.0’s physical structures to *“minimise the environmental footprint”*, but exclude the transmission component, arguably the most visible and intrusive.

The Project should also be considered within the wider context of HumeLink, and the entire length of the Snowy 2.0 connection to the main grid backbone.

The connection from Lobs Hole to Maragle is just nine km out of the total 379 km of new lines to Wagga and Bannaby (see later). That is, less than 3% of the total length of circuits needed to link

⁷ “Snowy Hydro credit rating downgraded”, ABCNEWS 29 September 2020
<https://www.abc.net.au/news/2020-09-29/snow-hydro-scheme-credit-rating-downgraded-rainfall-cost-blowout/12713252>

⁸ As a side comment, the CIV appears to be a high amount.

A ‘ball-park’ figure for double circuit 330 kV overhead lines, provided to NPA by transmission engineers, is \$3.5 million per kilometre. This would imply a cost for the nine kilometre connection from Lobs Hole to Maragle of around \$60 million. The Maragle Substation is likely to cost less than \$100 million.

The \$318 million CIV also seems to conflict with the recent announcements for a \$125 million corporate debt facility and (portion) of \$112 million for design and construction (Chapter 3.4).

Snowy 2.0 to the main grid backbone would be underground, leaving the remaining 97% as overhead lines. For underground alternatives to LTSS the percentage that would be underground is higher but still relatively minor, at around 12%. (This is not to imply that other sections of the new HumeLink lines through significant agricultural, community and conservation lands might not also warrant undergrounding.)

PART 2 – TECHNICAL CONSIDERATIONS

- 6 Overhead transmission**
- 7 Underground transmission**
- 8 Underground connection to Maragle**
- 9 Underground connection to Lower Tumut Switching Station**
- 10 The proposed overhead lines are excessive and not best practice**

PART 1 covered the inadequacies of the EIS.

PART 2 covers the technical aspects of the EIS, starting with the impacts of the proposed overhead lines and the inadequacy of the reasons provided in the EIS for the proposal.

The benefits of undergrounding are then summarised, together with references to underground projects across the world in areas of high conservation value.

The underground alternatives provided in the Background Paper are listed, followed by NPA's responses to the reasons in the EIS claiming that undergrounding is impractical. These responses cover each of the two possible connection points at the proposed Maragle Substation and the existing Lower Tumut Switching Station.

The final Chapter critiques the overhead line proposal, finding it to be excessive in scale and number of circuits and making no attempt to apply best practice design principles.

6 Overhead transmission

6.1 Overwhelming environmental impacts

Overhead transmission lines would cause significant environmental impacts, in addition to those from the Snowy 2.0 Main Works⁹, including:

- permanent 'disturbance' to 100 hectares (1 square kilometre) of KNP and a further 44 hectares of BSF, which is also an area of high environmental value and sensitivity
- habitat fragmentation and barriers for animal movement
- enhanced access for feral predators and increased dispersion of damaging weeds
- easements requiring regular clearing and introducing sources of erosion, landscape instability and weeds. Easements also provide avenues for feral pests such as foxes and pigs
- loss of native flora, including threatened species in currently undisturbed vegetation communities
- loss of native fauna, including threatened species such as the Yellow-bellied Glider, Eastern Pygmy Possum, Squirrel Glider, Gang Cockatoo, Greater Glider, Scarlet Robin, Flame Robin, Powerful Owl, Masked Owl and Booroolong Frog
- carbon emissions from vegetation clearance, ending sequestration across the permanently cleared areas
- jarring visual impacts of towers, wires, easements and access tracks, across the spectacular Yarrangobilly and Tumut River valleys and surrounding country for tens of kilometres
- a web of criss-crossing overhead lines at Lobs Hole from the four new lines in addition to an existing 330 kV transmission line (Line 02), which traverses a 3km stretch of the Yarrangobilly River
- an intense buzzing from corona loss, particularly audible at night and in foggy weather
- increased risk of starting bushfires, with substantial consequences - human, environmental, animal, property and financial¹⁰
- dumping of excavated spoil from the tower footings and access tracks in KNP and BSF
- weed transfer and erosion from the access tracks along the easement corridor
- destruction of the visual amenity of an outstanding remote alpine region

These impacts are associated with the initial construction of the towers, establishment of the easement, operation of the transmission lines and ongoing clearance of the easement. The impacts are spread across hundreds of hectares of currently intact natural landscape in KNP and BSF.

In contrast, the three primary undergrounding techniques have far more concentrated and lower environmental impact. The major part of the activity occurs underground, and in the case of tunnelling and directional drilling, surface impacts are restricted to the entry and exit points for the tunnel or cable segments for directional drilling. Trenching has a bigger impact, however once backfilled the cleared easement would be restricted to a width of around 10% - 15% of the clearance proposed in this EIS for overhead lines.

Unquestionably, overhead lines have significantly greater environmental impacts than underground cables.

⁹ ["Snowy 2.0 doesn't stack up"](#) NPA

¹⁰ *"The project would introduce additional risks for on-site ignitions which may result in a fire escaping to the surrounding state forests or KNP. These may arise from electrical failure, contact between conductors and vegetation, or hot works during construction or operation causing ignition at the project area"* Snowy 2.0 Transmission Connection EIS.

6.2 Far ranging visual impact

Figure 6, copied from Attachment B, depicts the most environmentally impactful underground technique, being trenching, with a cleared easement of around 15-20m compared to existing and proposed lines in KNP. Other underground techniques (tunnels and directional drilling) are less impactful, involving no above ground structures and no, or minimal, cleared easement.

Clearly, the proposed overhead lines are substantially more intrusive than the existing transmission lines and all underground techniques.

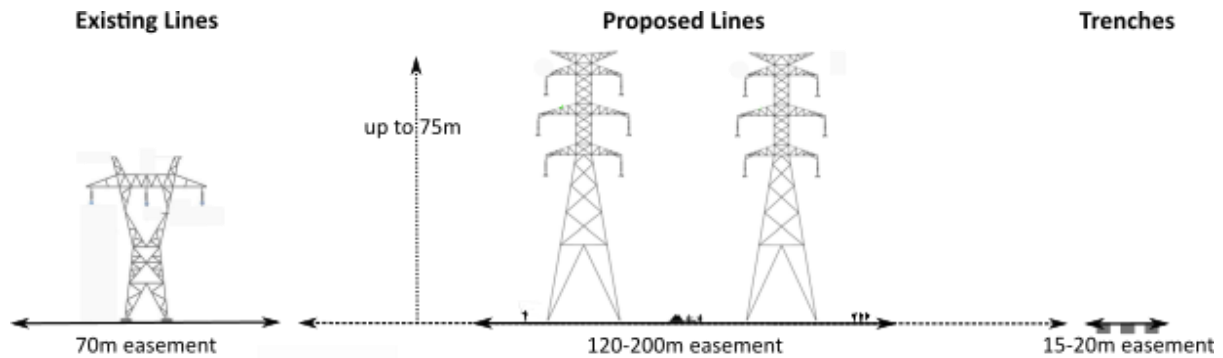


Figure 6 – Comparison of Existing KNP Transmission Lines, Proposed Lines and Trench

Figure 7, taken from Appendix H of the EIS (page 20), shows an area of approximately 300 square kilometres over which the proposed lines will be visible. The towers and lines will completely dominate the skyline in the Yarrangobilly and Tumut River valleys.

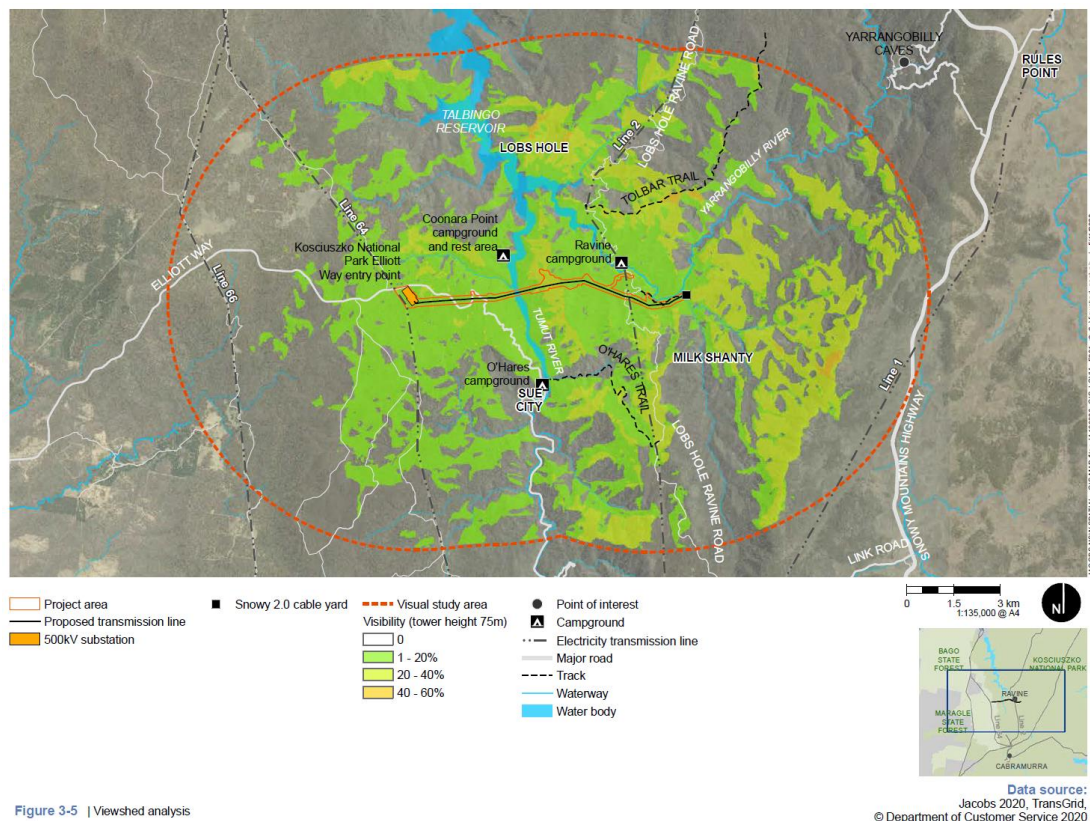


Figure 3-5 | Viewshed analysis

Figure 7 – Visibility of transmission lines across 300 km² (EIS App H)

The EIS acknowledges that little can be done to minimise the visual impacts of overhead lines:

“Opportunities for the mitigation of visual impacts are limited due to the nature of the existing topography and vegetation limiting the introduction of landscape screening.”

In contrast, the visual impact of underground options would be restricted to the immediate vicinity of the entry and exit points (tunnel and directional drill) or the trench easement. It is expected that a cleared trench easement would be sufficiently narrow to be largely obscured by surrounding vegetation.

6.3 Overstated operational risks

The scale and design of the proposed overhead transmission connection is based on an excessively conservative approach to potential threats to Snowy 2.0's output. In short, the towers are duplicated and located in an unprecedentedly wide easement to avoid any potential for loss or reduction in transmission during very infrequent events such as wildfire. This excessively risk adverse approach overstates the risks and fails to balance those minimal risks against the significantly increased impact on KNP.

This Submission demonstrates the infrequency of events such as wildfires and the limited consequences of affecting transmission for a few minutes or hours.

Ironically, all of the extreme events described in the EIS would be avoided by adopting any of the underground alternatives described below.

6.4 Inadequate justification for overhead lines

One would expect that, as the EIS is not compliant with the POM requirement for underground transmission, the reasons for overhead lines would be compelling - this is far from the case.

The EIS does not provide a consolidated rationale for overhead lines. The following 'reasons', dispersed throughout the documents, have been assembled and accompanied by NPA responses.

6.4.1 No issues to preclude approval

“This EIS has been prepared addressing the Secretary's Environmental Assessment Requirements (SEARs) issued by DPIE on 1 November 2019 and focuses on the key issues of biodiversity, heritage, water, land, transport, amenity, air, hazards and socio-economic impacts. The EIS has not found any issues that would preclude the approval of the project by the consent authority.” (Page i)

Response: Finding no *“issues that would preclude the approval of the project”* blatantly ignores the statutory requirement in the POM that prohibits overhead lines and thereby precludes *“approval of the project”*.

The failure of the EIS to address the reasons for the POM prohibition clearly demonstrates the inadequacy of the assessment and therefore the stated conclusion. Also, the EIS fails to fully analyse underground alternatives that are technically viable and would result in substantially less *“biodiversity, heritage, water, land, transport, amenity, air, hazards and socio-economic impacts”*.

6.4.2 A proven method

“The overhead transmission connection approach is a proven method in the steep alpine terrain characteristic of the project area” (Page iii)

Response: Overhead lines were the most appropriate technique when the original transmission lines were constructed in KNP, decades before the development of modern tunnelling and directional drilling technologies. The fact that the technique is 'proven' has no bearing on whether it is the most appropriate in 2021. Best practice for areas of environmental sensitivity is underground cables, which are also a proven method.

6.4.3 Less excavation

"Compared to the other options, the overhead transmission solution would involve considerably less excavation works and spoil generation" (Page iii)

Response: The EIS provides no estimates of volume or type to allow assessment of the relative impacts. NPA notes that trenching and directional drilling would generate minimal spoil, in the first case because the excavated spoil is partly used to backfill the trench and in the latter because of the narrow diameter of the drill holes. The third underground technique is a dedicated tunnel. A five metre diameter tunnel over a distance of 9 km would generate less than 1% of the spoil volume from the Snowy 2.0 Main Works.

6.4.4 Safer worksites

"The overhead transmission connection would allow for safer worksites to be established, which would generally be confined to structure locations and along access tracks" (Page iii)

Response: Both overhead and underground transmission present safety issues, particularly in alpine terrain. However, there is no overriding problem with either method that cannot be managed through an appropriate WH&S Risk Management Plan and Risk Assessment Processes. The claimed safety concerns are surprising given that the Snowy 2.0 Main Works is an underground project of far greater scope and risk.

6.4.5 No long-term environmental impacts

"This EIS demonstrates that the project could be undertaken without any significant long term impacts on the local environment. As such, the project is considered to be in the public interest" (Page vi)

Response: This statement is demonstrably incorrect. In addition to the immediate impacts associated with the clearance of native vegetation and loss of habitats, the proposal imposes a permanently cleared strip through what is currently continuous natural landscape. The area under the proposed transmission lines will be subject to regular clearance to remove regrowth.

Linear structures such as transmission easements have pervasive environmental impacts on the surrounding natural habitats. They fragment habitat connectivity, impacting on species territories and provide opportunities for feral predators to access and predate upon native species. Linear disturbances act as vectors for the dispersal and encroachment of weeds. Contrary to the assertion, in a National Park context this type of linear development has a disproportionately high and permanent impact on the surrounding landscape.

The adverse impacts of transmission lines are readily discernable in the strong correlation of existing easements with weeds across KNP. An allied factor is the limited success of TransGrid in managing the ongoing impacts of their existing transmission easements on KNP and adjoining reserves. This is apparent in the long history of failure to comply with their environmental obligations in the PAN, which has previously resulted in multi-million dollar prosecutions².

The evidence is unequivocal - transmissions lines have serious environmental impacts in National Park settings, and TransGrid has displayed significant shortcomings in their management of the existing network of transmission easements. That is why the POM prohibits further overhead lines. The suggestion that the current proposal could be constructed or conditioned to avoid all of the inherent impacts associated with dissecting and fragmenting habitats within a National Park cannot be sustained.

6.4.6 Undergrounding not feasible

"The KNP POM policies and actions require that all additional telecommunication and transmission lines be located underground. Options to consider this were explored during the project development, however it was found that un[der]ground cabling would not ~~to~~ be feasible due to the depths and gradients involved" (page 11)

Response: The industry experts NPA has consulted on this issue categorically disagree that underground cabling is not feasible for this project. The depths and gradients involved are commonplace on an international scale, and far less than those involved in the Snowy 2.0 Main Works. The EIS as exhibited ignores international best practice without a convincing attempt to demonstrate any factors that might render underground techniques not feasible in this specific case.

It is apparent that the brevity with which this issue is addressed in the EIS is simply a function of a lack of serious intent to investigate underground options. As noted above, TransGrid's recent assurance that they are conducting further investigations into underground alternatives confirms the lack of assessment of such options in the exhibited EIS.

6.4.7 Less environmental impact, safer, less disturbance

No further reasons to those listed above were found in the EIS.

But another three 'reasons' are found in a Sydney Morning Herald article, [Snowy project to cut 'massive swath' through national park, NPA says, 20 January 2021](#), where a TransGrid spokesman denied the EIS had overlooked underground alternatives:

"Tunnelling, trenching and directional drilling were considered but ruled out following consideration of environmental impacts, safety and future disturbance for maintenance in mind"

Response: This paradoxical statement runs counter to our independent advice and international experience, which clearly demonstrate that underground cables cause the least environmental impacts and ongoing disturbance, and can be maintained with lower risks to personnel.

6.4.8 Cost can be the only reason, but is not a legitimate consideration when assessing the EIS

NPA concludes that, in the absence of any technical or environmental impediments, the real reason for the EIS proposing overhead lines is the cheaper up-front cost, though unstated. As discussed in Chapter 4.4, cost cannot be a consideration in the EIS assessment process.

6.5 Excessive design of overhead connection

Chapter 10 examines the overhead lines proposed and concludes that they are excessive in terms of scale, number of circuits and design.

7 Underground transmission

7.1 A common technology

High voltage underground cables are a viable alternative to overhead lines and are installed widely in cities and areas with high agricultural and conservation value. Almost all new transmission links are underground throughout Europe and much of Asia.

For instance, in 2010 the Netherlands introduced regulations that every additional kilometre of overhead line must be compensated by undergrounding an equivalent length of existing transmission lines. Many governments have instituted programs to underground existing overhead lines.

7.2 Underground examples

Examples of transmission lines that have been undergrounded partly or purely for environmental reasons, include:

- the 'Directlink Interconnector' between Mullumbimby and Terranora in northern NSW; 63 km long, 180 MW rating and costing \$100 million
- 'Murraylink', between Red Cliffs in Victoria and Berri in South Australia; 180 km long, 220 MW rating and costing \$177 million
- the 87 km, 220 kV cable along the edge of Western Port Bay to connect the Victorian desalination plant
- undergrounding 132 kV transmission lines at Olympic Park prior to the Sydney 2000 Olympics, mainly for aesthetic reasons for world-wide TV audiences, at a cost of \$37 million
- the 'Hinkley Connection Project' in the UK¹¹; 57 km long, consisting of 48.5 km of 400 kV overhead line and 8.5 km of underground cable "*through the Mendip Hills Area of Outstanding Natural Beauty (AONB¹²)*" [akin to a National Park]
- the 140 km, 400 kV Aalborg to Aarhus line/cable in Denmark¹³ is another example of using cables to protect areas of natural beauty along a portion of the route, albeit at a higher cost. Fourteen km (10%) of the circuit was installed underground, across the Mariager Fjord and through the Gudenaa Valley, costing €35 million (25% of the €140 million total cost)
- fifty underground cable projects are listed by Barber¹⁴ and Moorabool Shire Council¹⁵
- Attachment G provides some articles on international undergrounding projects for environmental reasons

Another recent Australian example is the announcement of a 200 km underground connection from Hazelwood (Victoria) to a 2,000 MW offshore wind farm in Bass Strait.

¹¹ "Hinkley Connection Project" <https://hinkleyconnection.co.uk/category/ourproject/>

¹² An AONB is an area of countryside in Britain that has been designated for conservation due to its significant landscape value. AONBs enjoy levels of protection from development similar to those of National Parks. .

¹³ "Underground High Voltage Cables: Wiring Europe for the Future" <https://www.stjornarradid.is/library/01--Frettatengt---myndir-og-skrar/ANR/ANR---Raflinur-i-jord/33-Underground-high-voltage-cables-Leonardo.pdf>

¹⁴ "Achievement and experience in service of long length High Voltage AC electrical links by insulated power cables" CIGRE Latin American Workshop 2013, Ken Barber
https://www.jicable.org/Other_Events/WETS_Brazil_13/slides/Presentation_Barber.pdf

¹⁵ "Comparison of 500 kV Overhead Lines with 500 kV Underground Cables" Moorabool Shire Council, September 2020
<https://www.moorabool.vic.gov.au/sites/default/files/largefiles/20200924%20MSC%20Transmission%20Comparison%20Overhead%20with%20Underground.pdf>

7.3 Snowy 2.0 underground cables

The Snowy 2.0 Main Works is already approved to install six sets of 330 kV, 450 MVA cables from the Snowy 2.0 underground Power Station to Lobs Hole Cable Yard in a multi-purpose tunnel used for emergency egress, cables, and ventilation. These cable sets (18 individual cables in total) will each be three km long – already a quarter of the distance to the proposed Maragle Substation.

7.4 Benefits of underground cables

Whilst the up-front capital cost of undergrounding is higher than for overhead lines, there are many offsetting benefits, including minimal environmental impact, higher reliability, lower losses, reduced maintenance, and less vulnerability to outages from bushfires, lightning and storms. Underground cables are:

- less prone to physical damage
- no exposure to weather events – bushfires, lightning, storms, extreme winds etc. Such events are expected to become more frequent and intense with climate change, causing more outages, physical damage, more repair costs and lost revenue, sometimes costing tens of \$millions from a single event (as was the case with the January 2020 bushfires for TransGrid and Snowy Hydro¹⁶).
- higher reliability, though taking longer to repair. (The longer repair time should rarely be a concern, as if one cable is out of service the remaining five generators/pumps can still operate up to a combined capacity of 1,670 MW).
- the loss of one cable circuit due to a fault should not result in the need to back off Snowy 2.0 output/load to cover a subsequent cable loss. Whereas the loss of a double-circuit overhead line from a fault (or bushfire or lightning strike) would result in backing off output/load to cover for a subsequent loss. Also, the proximity of two overhead double-circuit lines poses a system security risk that is not applicable for underground cables¹⁷.
- ready physical access for repairs and maintenance if in a tunnel
- lower operating costs (potentially one-tenth that of overhead lines¹⁸), though higher repair costs
- lower electrical losses (reputed to be around 30% lower)
- far less or zero easement clearing and maintenance cost
- little or no release of greenhouse gasses from vegetation clearing
- no potential to start bushfires, as can occur from overhead lines through fallen towers, conductor clashing or breaks, and subsequent insurance claims¹⁹
- and, most importantly, underground cables have substantially less environmental impact

¹⁶ The January 2020 bushfires resulted in outages for some days in the Snowy, and separation of the NSW/Victoria transmission networks. Damage to TransGrid's assets in the Snowy region was *"north of \$15 million to \$20 million, which was not insurable"* [TransGrid CEO]. Snowy Hydro lost supply capability *"costing the company millions"* [Snowy Hydro CEO].

¹⁷ "Queensland and South Australia system separation on 25 August 2018" AEMO, 10 January 2019 https://www.aemo.com.au/-/media/files/electricity/nem/market_notices_and_events/power_system_incident_reports/2018/qld---sa-separation-25-august-2018-incident-report.pdf

¹⁸ "Overview of the Potential for Undergrounding the Electricity Networks in Europe" prepared for the European Commission, 28 February 2003 https://ec.europa.eu/energy/sites/ener/files/documents/2003_02_underground_cables_icf.pdf

¹⁹ "Black Saturday bushfire survivors secure \$500 million in Australia's largest class action payout" ABC News, 15 July 2014 <https://www.abc.net.au/news/2014-07-15/black-saturday-bushfire-survivors-secure-record-payout/5597062>

and no visual blight²⁰, other than a relatively narrow easement if trenches are used.

In addition to the above benefits, all underground cabling alternatives allow the cables from the underground Power Station to be extended to the TransGrid connection point (Maragle or LTSS), avoiding the need for the Cable Yard and overhead transmission lines, thereby saving those environmental impacts and costs.

7.5 NPA alternative routes and options

The Background Paper (Attachment B) identified five example underground alternatives (Figure 8). No doubt there are others. The Addendum (Attachment C) examined Alternative D in more detail.

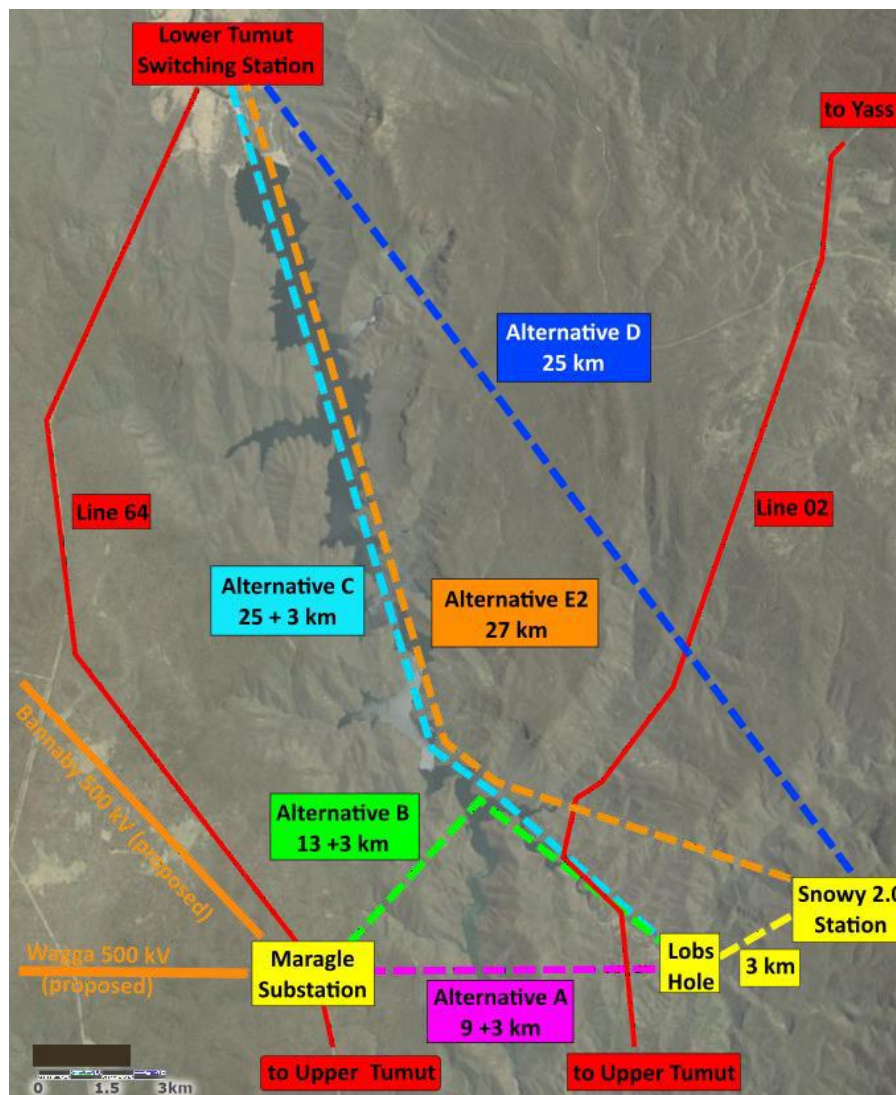


Figure 8 – Alternative Routes for Underground Cables from Snowy 2.0 to Maragle and LTSS

²⁰ “Valuing the social benefits of avoiding landscape degradation from overhead power transmission lines: Do underground cables pass the benefit–cost test? Ståle Navrud, Richard C. Ready, Kristin Magnussen & Olvar Bergland, 12 May 2008 *“the social benefits of avoiding negative impacts [from overhead transmission lines] on the landscape exceed the costs of burying the lines as underground cables ... based only on an assessment of the aesthetic impacts [urban setting]. Impacts of overhead power lines on wildlife and human health would likely make burial of power lines even more attractive.”* <https://www.tandfonline.com/doi/abs/10.1080/01426390802045921>

- A. extending the three km of underground cables from the Snowy 2.0 Station to Lobs Hole Cable Yard, generally following the direct route of the proposed overhead lines, for the remaining nine km to Maragle. The cables could be in a trench, HDD conduit or tunnel, or combination.
- B. laying cables in a trench from Lobs Hole along, or near, the road to the Snowy 2.0 excavated spoil dump in Talbingo Reservoir, at the junction of the Yarrangobilly and Tumut Rivers, and then via a trench/ tunnel/ HDD to Maragle (about 13 km). Approximately half the route is under the road and therefore of straightforward construction, with no additional clearing or environmental impact.
- C. as per Alternative B to the junction of the Yarrangobilly and Tumut Rivers, and then in, or adjacent to, Talbingo Reservoir to the existing Lower Tumut Switching Station (LTSS), located next to Tumut 3 Pumped Hydro Station at Talbingo (about 25 km). This alternative effectively relocates Maragle Substation to LTSS, with ongoing new connections to the main grid being constructed from LTSS, rather than from Maragle (see Figure 12).
- D. laying cables in a tunnel from the Station directly to LTSS (avoiding the need for cables from the Station to Lobs Hole).
- E. laying cables in the tailrace tunnel from the Station to its inlet at Talbingo Reservoir, and then via a trench/ tunnel/ HDD to Maragle (E1), or via the Reservoir to Lower Tumut SS (E2).

The EIS included some cursory comments on Alternatives A and C, rejecting them for spurious reasons (see later). The EIS made no mention of the more promising Alternatives B and D.

The EIS 'analysis' is termed 'high level' and is essentially a list of potential issues and challenges, leading quickly to the conclusion that undergrounding is too difficult. There is no question that undergrounding has challenges, but so too do overhead lines and every other aspect of Snowy 2.0. The challenges of underground transmission are dwarfed by those involved in the Main Works construction of 27 kms of 11 metre diameter water tunnels and an underground power station in two enormous caverns.

The following two chapters address the EIS's consideration of underground alternatives to Maragle and to LTSS, in turn.

7.5.1 Number of cable circuits

The EIS only considers four cable circuits from Lobs Hole Cable Yard to Maragle (or LTSS).

The proposed purpose of the Cable Yard is to 'convert' the six 330 kV cable circuits from the Power Station to four 330 kV overhead line circuits to Maragle.

If there is a cable connection from the Power Station all the way to Maragle (or LTSS) there appears to be no need to 'convert' from six to four cable circuits. It would be simpler and possibly cheaper to continue the six circuits all the way. This avoids the need for the Cable Yard and results in smaller and lower rated cables of longer drum length (and hence less joints), albeit six sets rather than four.

8 Underground connection to Maragle

NPA's responses to TransGrid's reasons against underground cabling to Maragle by each of the three techniques (trenching, micro-tunnelling or directional drilling (HDD) and tunnelling) follow.

8.1 EIS 'reasons' against trenched cable

Steep terrain and cleared easement

"Overall, the steep terrain and need for extensive excavation work means that this option is not suitable from an engineering or safety perspective and would create an area where only grass would be allowed to revegetate the area to prevent damage to the cables and thermal backfill."

Response: TransGrid only considered a direct route for trenching from Lobs Hole to Maragle (Alternative A). NPA agrees that such a route is likely to be impractical for trenching due to two steep ascents and one steep descent.

However, an indirect route that avoids steep inclines, such as Alternative B, is eminently practical. Alternative B involves laying cables in a trench (or partly HDD) from Lobs Hole along, or near, the road to the Snowy 2.0 excavated spoil dump in Talbingo Reservoir, at the junction of the Yarrangobilly and Tumut Rivers, and then via a trench/ HDD/ tunnel to Maragle (about 13 km).

Approximately half the route is under or near the road and therefore of straightforward construction, with minimal additional clearing or environmental impact. The remaining route from Talbingo Reservoir up to Maragle could take a gentle trajectory and is likely to be practical by trenching, though HDD or tunnelling may be better options. Possibly there are other better routes.

TransGrid refers to the cleared area above the trenches 'where only grass would be allowed to revegetate'. The 15 -20 m of cleared area above trenches is far less than the cleared area under the proposed transmission lines of up to 200 m in width.

8.2 EIS 'reasons' against micro-tunnelling and horizontal drilling

Hard rock and compromised cable ratings

"Consultation carried out by Snowy Hydro with micro-tunneling equipment manufacturers determined that micro-tunneling posed significant engineering challenges due to the expected underlying geology and the moderate to high strength rock conditions within the corridor. Due to the presence of hard rock and heterogeneous ground conditions along the corridor, there is also considerable risk that control of the HDD alignment for 12 individual cables would not be maintained to the required accuracy. Hence, the cable drift could extend beyond the intended easement corridor of approximately 30 metres wide. There is also a high risk that the required cable circuit ratings would not be achievable with this configuration and available cable sizes. This option would then need either two cables per phase (24 cables in total) or at least another circuit and the additional width that goes with these solutions."

Response: Micro-tunnelling is a common underground technique in all manner of terrain and rock conditions across the world. There is no apparent reason why it would not be practical for this project and a cursory dismissal on the basis of 'consultations by Snowy Hydro' is unsatisfactory.

Similarly, the claim that there is a 'high risk' that cable ratings would not be achievable, especially if there were six circuits rather than four, is unsupported in the EIS.

8.3 EIS 'reasons' against a cable tunnel

8.3.1 Vertical shaft infeasible

"Based on the depth required to pass beneath Talbingo Reservoir and the elevation of the connection point at Line 64, a deep vertical shaft would be needed within Bago State Forest at the western extent of the tunnel. The shaft would be approximately 600 metres in vertical height. At this stage a feasible option for cables of a suitable capacity and weight to negotiate a 600 metre deep vertical shaft to the substation has not been found.

Given the engineering and safety challenges with a major underground cable tunnel, coupled with the requirement for additional power supply during construction and operation and a waste rock storage location, this option was not progressed."

Response: TransGrid has only considered a horizontal tunnel from Lobs Hole and then a vertical shaft up to Maragle (see indicative dashed black line Figure 9). NPA would agree that this approach presents potentially insurmountable engineering challenges.

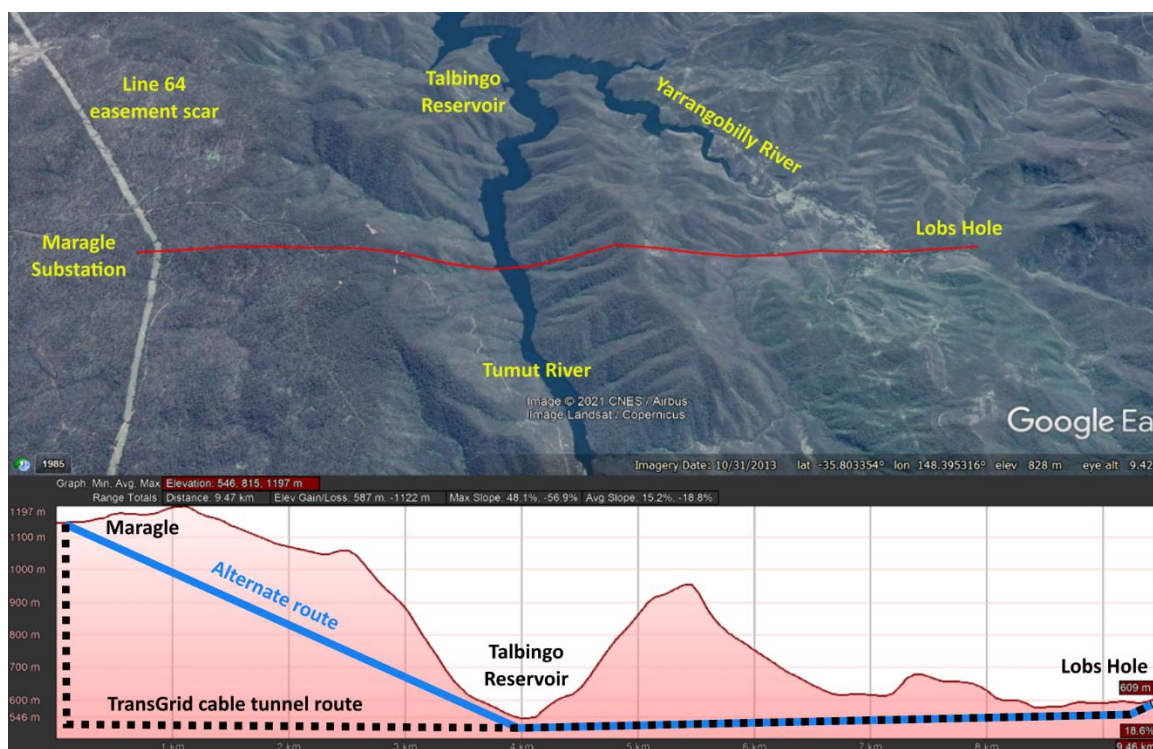


Figure 9 – Cable tunnel from Lobs Hole to Maragle

But why present the most difficult and impractical option, and use that as the reason to rule out tunnelling altogether?

The obvious approach would be to use a tunnel boring machine (TBM) that can bore at an incline. It would start at Maragle, bore a tunnel down to Talbingo Reservoir and then transition to a roughly horizontal tunnel to Lobs Hole (see indicative blue line in Figure 9).

This is the same technique for the Snowy 2.0 Main Works TBM that will bore the Main Access Tunnel from Lobs Hole down to the Power Station and then transition to the inclined pressure shaft up about 600 metres in vertical height to the surge tank at Marica.

The incline angle for a cable tunnel to Maragle is less than the Snowy 2.0 pressure tunnel, and therefore less difficult to bore. And a transmission tunnel 9 km long and about 4-5 metres diameter

is much less of a challenge than the Snowy 2.0 water tunnels, 27 km long and 11 metres diameter.

8.3.2 Unsuitability and unavailability of Snowy 2.0 TBM

“Snowy Hydro has advised that the Snowy 2.0 TBM’s were not designed for the conditions of the connection alignment and would not be suitable. Further, the Snowy 2.0 TBM’s would not be available for several years, which would impact the construction program for the project and significantly impact the operational timing for the Snowy 2.0 project.”

Response: No information is provided to support this comment. If suitable, one of the Snowy 2.0 TBMs ought to be available well before the construction program of Snowy 2.0 requires transmission connection. If not suitable, a much smaller, purpose-built TBM could be acquired in time to bore a tunnel and install underground cables.

8.3.3 Safety concerns

Earlier in this Submission we referenced TransGrid’s safety concerns with undergrounding.

The Main Works of Snowy 2.0 involves over 40 km of tunnels. If the transmission connection project were to also use the latest TBMs this should assuage any concerns on worker safety. Section 2.3.2 of the Main Works EIS promotes the technology and safety features of the three Snowy 2.0 TBMs – a transmission connection TBM and tunnel should be no less safe:

“Power waterway tunnels, chambers and shafts

The main power waterway comprises the headrace tunnel and the tailrace tunnel. However, there are several other underground tunnels, chambers and shafts that enable the transfer of water between the two reservoirs and through the underground power station. Most of the power waterway infrastructure will be established underground, with access to the surface provided via several access tunnels and portals.

For the headrace and tailrace tunnels in particular, two single shielded TBMs will be utilised.

A dual mode TBM will be used to excavate the headrace tunnel, capable of operating as a single shield TBM or operating in slurry mode to manage naturally occurring asbestos (NOA) material expected along the way. The choice of the shielded TBM has been driven by safety considerations during construction and a higher rate of advance. When compared with drill and blast, shielded TBM excavation provides almost no exposure of workers to an unsupported rock mass.

The TBMs will be fully equipped to perform the excavation, ventilation, lining, removal of excavated material. Geotechnical drilling or ‘probing’ as well as seismic reflection and geo-electrical surveys will also be conducted ahead of the TBMs to identify potentially critical areas with poor rock conditions, high fracturing or the presence of an aquifer. Application, where required, of pre-grouting and secondary grouting from the TBM to prevent excessive leakage and aquifer drainage during tunnel construction, as well as to consolidate the rock mass and reduce the risk of jamming the TBM, will be undertaken.”

9 Underground connection to Lower Tumut Switching Station

9.1 EIS reasons against submarine cables to LTSS

The EIS includes a 'high level' consideration of connecting Snowy 2.0 to the existing LTSS (Section 3.2.1.1 - page 20).

The only option considered is trenching from Lobs Hole to Talbingo Reservoir, submarine cables down the Reservoir to the Dam and thence trenching or HDD to LTSS (i.e. Alternative C).

The EIS fails to address the most obvious, and possibly best, LTSS alternative of a 25 km cable tunnel directly from the Power Station to LTSS (Alternative D). Such a tunnel is not extraordinary from an international perspective and is technically feasible (see Chapter 7.2).

Following are each of the reasons in the EIS against submarine cabling down Talbingo Reservoir to LTSS (pages 20-21), with NPA responses.

9.1.1 Impractical

'Use of submarine cables would minimise the amount of permanent impact to surface vegetation and visual amenity within KNP. However, an assessment of a submarine connection within Talbingo Reservoir determined that:

- > Laying submarine cables on the bed of Talbingo Reservoir is not practical given the presence of debris including large boulders, dead trees and other major impediments. Clearing a cable route along the bed would be extremely challenging and subject to a marine survey, which would require extensive submarine dredging and rock clearing operations along the entire length of the submarine route. Without a clear cable lay route, the submarine cables would not be able to be maintained in the event of a cable or joint failure"*
- > "Based on the estimated submarine cable run length of 22 kilometres and each cable length being two kilometres an estimated 160 submarine rated joint pits would be required. Given the high number of cable joints, the probability of cable joint failure is increased. Additionally, the joining of the cables would need to take place on the surface and would require a significant amount of slack to allow it to be placed back on the reservoir floor. During this operation, there is a significant opportunity for the cable and the joints to be damaged"*

Response: The EIS acknowledges that a cable connection to LTSS would minimise environmental impacts, but counters that it would be impractical.

Laying submarine cables in Talbingo Reservoir would be challenging, but not impractical. A route close to the bank of the Reservoir would allow for shallow dredging. Possibly the water level could be lowered for periods to allow easier access. The cables could 'hop' between cable jointing bays located on land intrusions into the reservoir, for ease of installation and maintenance of any jointing faults.

Submarine cables have been successfully installed in many testing situations around the world, including the 290 km Basslink Interconnector.

9.1.2 Cable drums too large to transport

- > "Each cable drum would carry approximately two kilometres of cable with a weight in excess of 120 tonnes. Transporting cable drums of this size and weight is not considered feasible from a road safety perspective and lack of suitable road infrastructure in this area"*

Response: Cable drums of acceptable weight would need to be purchased to allow for land transport. The Snowy 2.0 Main Works involves many very large and heavy transport loads. If six rather than four cable circuits were installed this would allow for longer cable lengths between joints.

9.1.3 Need for additional facilities, damage by boat anchors

- > *“The cables would be laid by vessel, which may require additional facilities in Talbingo Reservoir to be constructed for cable spooling and cable jointing*
- > *The submarine cable may be exposed to damage by boat anchor. As such, suitable cable protection would need to be installed to ensure damage is prevented*
- > *A permanent wharf, barge and cable storage facilities would need to be established at Talbingo Reservoir and would require ongoing maintenance and operational crews.”*

Response: Additional facilities would be needed, but this is not a significant issue. Overhead transmission also requires additional facilities to service the lines.

9.1.4 Minimal surface impact but considerable constraints

“Whilst this option may present minimal surface impacts within KNP, there are considerable constraints to the constructability of the submarine cable as outlined above.”

Response: A major advantage of underground/submarine cables is minimal surface impact, which should be the primary focus of the EIS.

There are challenges with undergrounding/submarine cabling, but none are insurmountable. Also, a connection to LTSS rather than Maragle has substantial offsetting benefits (see following).

9.2 LTSS is superior to Maragle as the connection point for Snowy 2.0 and HumeLink

9.2.1 HumeLink

The proposed HumeLink project aims to reinforce the southern NSW network by connecting Wagga Wagga and Bannaby with two 500 kV circuits. It is expected to cost over \$2 billion.

One circuit is to go direct and the second is proposed to take a substantial ‘dog-leg’ deviation via Maragle to connect Snowy 2.0 to the main grid backbone. In Figure 10 the two HumeLink circuits are depicted by the ochre-coloured lines showing the land corridor within which the lines are proposed to be constructed.

Snowy 2.0 needs the HumeLink connections from Wagga and Bannaby to Maragle to transmit electricity both for pumping and generation:

“Importantly, the project [HumeLink] would allow the full capacity of the Snowy Scheme expansion to flow into the NEM” (EIS 3.1.2)



Figure 10 – HumeLink Current Proposal (ochre) compared with Alternative D3 (dark blue)

9.2.2 Alternatives C, D and E2

Alternatives C, D and E2 in the Background Paper connect Snowy 2.0 and HumeLink to LTSS, rather than the proposed new Maragle Substation. The Addendum further analysed Alternative D, the installation of 330 kV cables in a tunnel from Snowy 2.0 to LTSS.

Alternative D3 (depicted by the dark blue lines in Figure 10), would replace the dog-leg circuit with a second direct connection between Wagga and Bannaby, and two radial 500 kV lines would connect LTSS to Wagga beside the existing 330 kV line or replace that line altogether.

This Alternative is analogous to TransGrid's Option 2C in its PADR²¹, which was ranked 'equal-first' with the chosen Option 3C (the dog-leg deviation), at a similar cost, \$1.38 billion versus \$1.35 billion, and net benefit.

Conceptually, Alternative D3 appears to be the simplest and best HumeLink connection to LTSS but this needs to be fully examined.

9.2.3 The EIS's dismissal of LTSS is cursory and baseless

The EIS rejects LTSS as a suitable connection point for Snowy 2.0 and HumeLink because it introduces "an unacceptable risk" to network security from "simultaneous outages across multiple adjacent lines, such as [from] bushfire, lightning strike, structure failure". The EIS's 'analysis' and dismissal of the LTSS option is contained in just three paragraphs (page 22):

"Furthermore, whilst an expansion of the [Lower Tumut] switching station is feasible, this option

²¹ "Reinforcing the NSW Southern Shared Network to increase transfer capacity to demand centres (HumeLink), Project Assessment Draft Report, TransGrid 10 January 2020 https://www.transgrid.com.au/what-we-do/projects/current-projects/Reinforcing%20the%20NSW%20Southern%20Shared%20Network/Documents/TransGrid_HumeLink%20PADR.pdf

does not present a suitable point of connection for HumeLink.

Lower Tumut is an existing convergence point for multiple critical transmission assets. As the NSW jurisdictional network planner, TransGrid has identified Lower Tumut, and the immediate area of existing multiple paralleling transmission lines, as a critical network location. This locality presents a significant risk to the security of the NSW transmission supply (and the wider NEM) in the event of simultaneous outages across multiple adjacent lines (such as bushfire, lightning strike, structure failure). The development of additional 500 kV transmission lines converging into Lower Tumut has been deemed an unacceptable risk.

Due to the significant network security concerns related to connecting HumeLink into a substation at Lower Tumut, this option was not considered suitable and therefore was not further considered as a feasible option."

No further detail is provided to substantiate this assertion, which NPA's electricity industry experts consider to be highly misleading and spurious.

As outlined below, the risk of simultaneous outages of multiple circuits due to bushfire, lightning strike or tower failure at LTSS is minimal in the first place and the two HumeLink connections can be routed to avoid adding to that risk. In fact, the risk of such simultaneous outages would be higher at Maragle than LTSS.

9.2.4 Solution - simply don't install the new lines adjacent to existing lines

The easements for the five existing lines connected to LTSS can be seen in Figure 11. Three lines run north (to Wagga, Yass and Canberra) and two lines run south (to Murray and Upper Tumut).

The additional connections to LTSS for Alternative D would be cables from Snowy 2.0 and two 500 kV HumeLink lines from Wagga and Bannaby, or just Wagga for both (Alternative D3).

The four (or six) circuits from Snowy 2.0 would be underground, not exposed to weather events or tower failure, and hence would not add to the risk of simultaneous outages.

The two HumeLink connections could add to the risk of simultaneous outages if they were constructed adjacent to the existing lines. Simply, all that needs to be done is for the two HumeLink lines to run west, away from the existing lines.

Even if the HumeLink lines were installed near the existing lines, the increased risk of simultaneous outages across multiple circuits from bushfire, lightning or structure failure, could still be minimal, as explained below.

9.2.5 The standard NER obligation is to cover a single contingency

Under the National Electricity Rules (NER), TransGrid has a statutory obligation to plan and operate its network to withstand any single credible contingency – the 'n-1' standard. This includes outages of single transmission circuits due to bushfire, lightning strike, structure failure and equipment failure on the interconnected 330 kV and 500 kV networks.

"Credible contingency events

The following credible contingency events and practices must be used by Network Service Providers for planning and operation of transmission networks and distribution networks unless otherwise agreed by each Registered Participant who would be affected by the selection of credible contingency events:

- (a) *The credible contingency events must include the disconnection of any single generating unit or transmission line, with or without the application of a single circuit two-phase-to-ground solid fault on lines operating at or above 220 kV". (NER S5.1.2.1)*

"Stability

In conforming with the requirements of the system standards, the following criteria must be used by Network Service Providers for both planning and operation:

For stable operation of the national grid, both in a satisfactory operating state and following any credible contingency events or any protected event described in clause S5.1.2.1:

- (a) the power system will remain in synchronism;*
- (b) damping of power system oscillations will be adequate; and*
- (c) voltage stability criteria will be satisfied."* (NER S5.1.8)

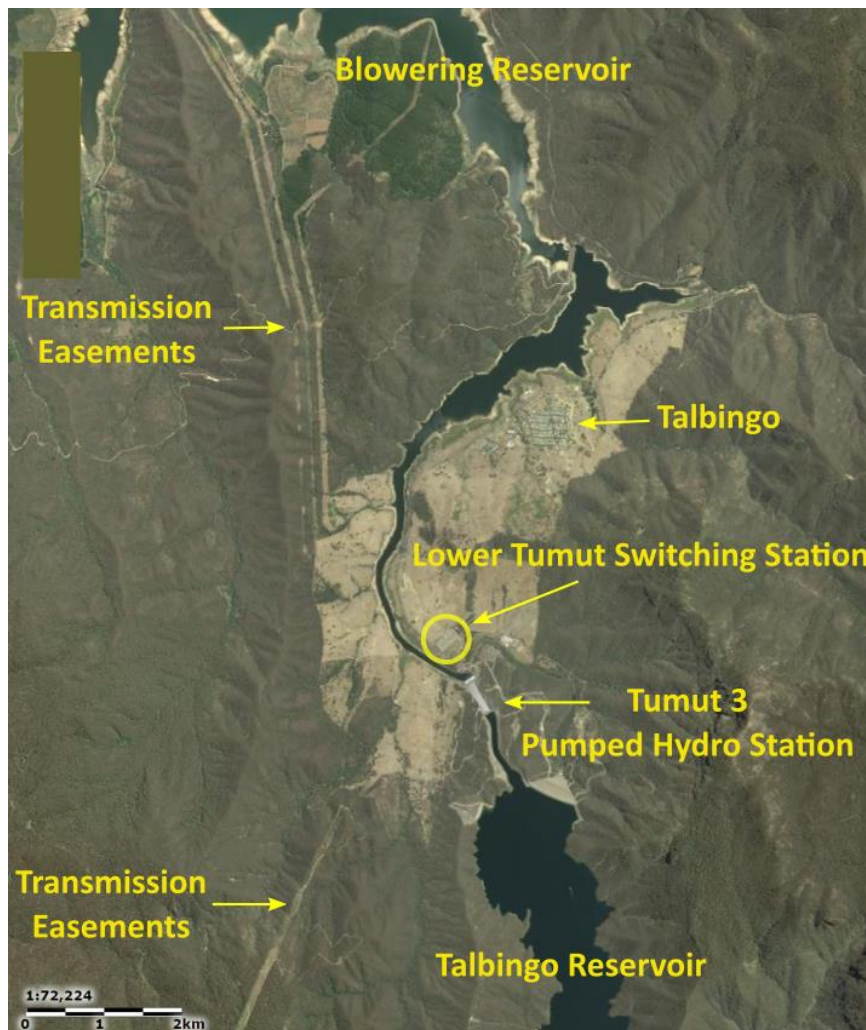


Figure 11 – LTSS is located in a cleared landscape with low bushfire risk

9.2.6 The EIS considers the risk of multiple outages at LTSS to be unacceptable with a HumeLink connection

The EIS seems to contend that a higher standard of reliability is warranted at LTSS as it is 'a critical network location' and already presents a significant risk to the NEM. The EIS goes further, and contends that the existing risk of multiple outages would be exacerbated to an 'unacceptable' level by the connection of the two 500 kV HumeLink lines.

The term 'critical network location' is not defined in the NER or in TransGrid's Transmission Licence. The EIS's criterion appears to be based on the number of transmission circuits converging on a switchyard rather than the practical likelihood or consequence of multiple circuit outages due to bushfire, lightning strike or structure failure.

The potential for multiple contingences and the actions to be taken are covered in the NER:

"Stability

In planning a network a Network Service Provider must consider non-credible contingency events such as busbar faults which result in tripping of several circuits, uncleared faults, double circuit faults and multiple contingencies which could potentially endanger the stability of the power system. In those cases where the consequences to any network or to any Registered Participant of such events are likely to be severe disruption a Network Service Provider and/or a Registered Participant must in consultation with AEMO, install, maintain and upgrade emergency controls within the Network Service Provider's or Registered Participant's system or in both, as necessary, to minimise disruption to any transmission or distribution network and to significantly reduce the probability of cascading failure." (NER S5.1.8)

Given TransGrid's apparent concerns with multiple contingencies at LTSS at present, one would expect that an emergency control scheme has already been implemented, as required under the NER. Can TransGrid confirm when an emergency control system was installed at LTSS and what form it takes?

It is noted that the EIS, HumeLink PADR, TransGrid's APR and AEMO's ISP2020 are silent on any requirement for LTSS or HumeLink to withstand multiple circuit contingencies.

If such a scheme has been implemented would it not be possible for it to be upgraded to address any additional risks from the connection of the additional HumeLink circuits? If a scheme hasn't been implemented, could the additional risk alluded to by TransGrid be resolved by an emergency control scheme?

9.2.7 The additional risk of multiple outages is considered to be negligible

The well-established protocol when there is a potential for multiple outages, such as a looming bushfire or lightning storm, is for TransGrid to advise AEMO. AEMO then takes steps to ensure the NEM can withstand such outages.

The EIS has not explained why the existing protocols and its emergency control system (assuming there is one), upgraded if necessary, cannot continue to cover any additional risks to LTSS from the HumeLink connections.

Following is a review of each of the three risks identified by the EIS that could precipitate simultaneous outages across multiple adjacent lines – bushfire, lightning strike and structure failure. NPA's experts consider such risks to be immaterial, bringing into question the EIS's "significant network security concerns".

9.2.7.1 Bushfire risk is low and manageable

9.2.7.1.1 Low frequency of bushfires

Major uncontrolled bushfires have occurred in KNP five times in the past eighty years - in 2020, 2003, 1980, 1964 and 1938 (EIS page 171). That is an average of once every 20 years.

As bushfires have never encompassed the entirety of KNP, the frequency of a fire impacting any particular region of KNP, such as the LTSS area, has been no more than a couple of times every century. Global warming is likely to increase the frequency in the future, but the expectation is that at worst a bushfire may impact the LTSS area maybe every few decades or so. It takes the bush at least that length of time to recover in such an elevated and fragile area.

9.2.7.1.2 Controlled burning would reduce the risk

The bushfires during January 2020 encompassed the Snowy 2.0 project area, so the next fire is unlikely to occur for another couple of decades or so – i.e. 2040 or later. Of course, regular controlled burning under and near the lines would mitigate the risk of future uncontrolled fires impacting the lines.

9.2.7.1.3 Low exposure of Lower Tumut to bushfires

Figure 11 shows that the area around LTSS is cleared of bush vegetation for a kilometre or two, except a small arc to the south east. There has been no history of bushfires threatening the Switchyard since its construction 50 years ago.

9.2.7.1.4 Pre-emptive action can be taken

Conceivably an uncontrolled bushfire could travel through an area with multiple transmission lines connected to LTSS. But such major bushfires can be foreseen, and pre-emptive action taken.

The lines in the path of the fire may still be left in service or at an extreme they could be de-energised (e.g. for the safety of fire fighters). Any such outages usually do not extend beyond a few hours or a day at most (every couple of decades or so).

9.2.7.1.5 Maragle presents a much higher bushfire risk

As shown in Figure 12, the proposed Maragle Substation is in the middle of Bago State Forest, where the bushfire risk is many times greater than at LTSS. The EIS notes the consequent need to separate the two Humelink connections:

“Due the areas of high bushfire risk the two 500 kV circuits should have separation up to five kilometres apart where reasonably possible. This is due to the criticality of the 500 kV network and to reduce the risk of an outage occurring on both circuits simultaneously.” (EIS 3.1.2)

All eight transmission connections to Maragle Substation (four lines from Lobs Hole, Line 64 both to the north and the south, and the two Humelink connections) traverse around 100 kilometres of densely forested land.

9.2.7.1.6 Overhead lines actually increase the risk of bushfires

Paradoxically, the EIS notes that the overhead lines will introduce additional risks for igniting bushfires:

“The project would introduce additional risks for on-site ignitions which may result in a fire escaping to the surrounding state forests or KNP. These may arise from electrical failure, contact between conductors and vegetation, or hot works during construction or operation causing ignition at the project area.” (page v)

Of course, underground cables introduce no such risks.

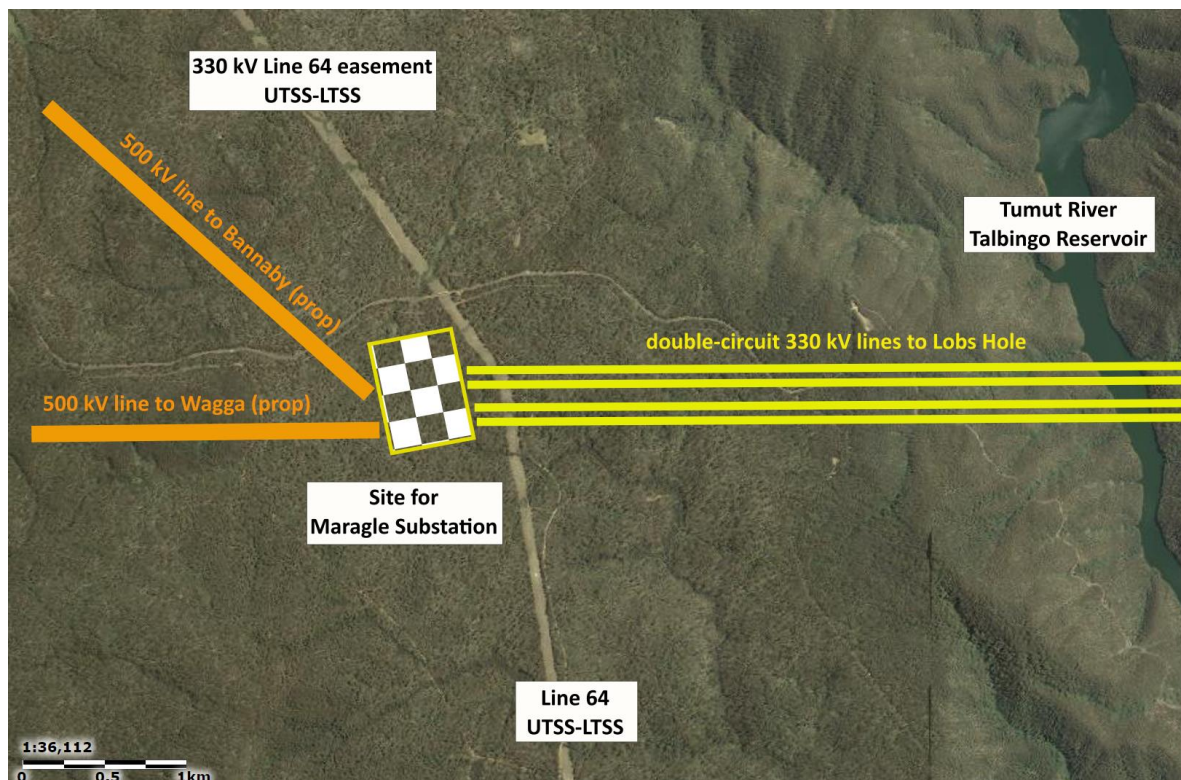


Figure 12 – Proposed Maragle Substation, Bago State Forest

9.2.7.2 Lightning strike risk is no more than normal

The likelihood of adjacent single-circuit lines being struck simultaneously by lightning is practically zero. Lightning outages of 500 kV transmission lines are rare due to their much higher insulation strength. Hence, the two 500 kV lines add practically no risk to simultaneous outages of multiple adjacent lines tripping from lightning strikes, especially if routed separately.

Of course, if the 500 kV lines were double-circuit, the risk of an outage of both circuits from a lightning strike is higher than if the lines were single circuit, but still exceptionally low (see Chapter 10.2).

9.2.7.3 Multiple structure failure risk is minimal

NSW has not experienced concurrent structure failures of multiple adjacent lines.

The new 500 kV lines would be constructed to the latest CB1 Australian standard with higher wind loadings and able to withstand credible weather events. Again, they would be most unlikely to be part of a simultaneous outage across multiple circuits, especially if constructed as single circuit lines.

Should TransGrid have concerns with structure failure, higher than normal design standards could be adopted for the new lines, such as those used in cyclone prone areas.

9.2.7.4 Other risks

One unstated concern could be the risk of a terrorist attack on the Switchyard or connecting lines.

That possibility applies to every substation in NSW and would be addressed by TransGrid's perimeter fencing and standard security measures. There are many other NSW substations that are far more critical than LTSS and susceptible to an act of terror. For example, once HumLink is completed, Bannaby and the two Wagga Substations are arguably more critical than LTSS.

Also, one could conjecture that a new Maragle Substation, isolated in the middle of a State Forest, would be more vulnerable to a terrorist attack than LTSS. A new substation also adds to the inventory of substations and risks.

9.2.8 Connection to LTSS is actually a better network option than Maragle

As outlined in the Background Paper and Addendum, connecting Snowy 2.0 (and HumeLink) to the existing Lower Tumut Switching Station rather than a new substation at Maragle offers significant benefits compared to connection to Maragle:

- it is cheaper to augment an existing Switching Station than build a new 'greenfield' Substation
- LTSS becomes a more substantial electrical hub, with improved flexibility, reliability, and transmission capacity
- shorter and more reliable connection of Snowy 2.0 to the main grid
- improved reliability, through reduced exposure to bushfires and lightning strikes
- lower transmission losses
- shorter HumeLink connections, saving hundreds of \$millions, and hence lower pass-through costs to electricity consumers
- substantially less impacts on local communities and landholders, avoiding up to 220 kilometres of new easements and 20 square kilometres of clearing (Alternative D3)
- no new substation, cable yard, overhead transmission line, easement, or access track in Kosciuszko National Park or Bago State Forest
- possible multiple use of the cable tunnel (if that option is chosen over a submarine cable), for communication cables, Power Station drainage, all-weather access and another emergency exit

The benefits of Alternative D for the NEM, AEMO, Snowy 2.0, the existing Snowy Scheme and TransGrid are summarised in Figure 9 of the Addendum (Attachment C).

Linking LTSS to HumeLink would increase the transmission capacity to/from LTSS, to the north, east, south and west of NSW. LTSS would become a more substantial electrical hub through a connection to the 500 kV network. The addition of one or two 500 kV connections (thermal capacity 3,000 - 6,000 MVA) adds to the existing five 330 kV lines (thermal capacity 5,000 MVA).

LTSS's flexibility and reliability would be improved through a doubling of its transmission capacity (with two 500 kV connections) and an increase from five to seven connections.

Connection of Snowy 2.0 to both the 330 kV and 500 kV grids through LTSS would be shorter than through Maragle:

- LTSS: Snowy 2.0's connection to the existing 330 kV grid would be 25 km. Connection to the to-be extended 500 kV grid is a further 90 km to Wagga (one or two lines).
- Maragle: Snowy 2.0's connections to the 500 kV grid total 382 km - six cables for 3 km, plus four 330 kV lines for 9 km, and then 110 km to Wagga and 260 km to Bannaby. Connection to the 330 kV main grid is the same distance (connection to Line 64 at Maragle does not constitute a solid connection to the 330 kV grid, as it is a single line, often heavily loaded).

LTSS provides Snowy 2.0 with a more reliable and redundant connection:

- LTSS: underground cables are more reliable than overhead lines and are not subject to interruptions from weather events and bushfires.
Also, if one of the six cables is out of service the Station's capacity is only reduced by 17% (to 1,670 MW). From LTSS there are six/seven transmission lines with a total thermal capacity

- of 8,000 - 11,000 MVA, providing substantial redundancy.
- Maragle: connection to the grid by four, then two overhead lines for 379 km, through lighting and bushfire prone areas, would be considerably less reliable. Also, two circuits provide far less redundancy. When one of the 500 kV lines is out of service, Snowy 2.0's pumping/ generation would need to be limited, possibly to 700 MW or lower, to avoid system security issues if the second line tripped.

Finally, augmenting LTSS should alleviate occasional transmission constraints to Sydney (and to a lesser extent, Melbourne) experienced by the existing Snowy generators. Snowy Hydro has referred to these constraints many times, claiming they cost \$millions in lost revenue and sometimes result in avoidable load shedding. Connecting to Maragle does not alleviate these occasional constraints by much, if at all.

9.2.9 Maragle connection actually introduces greater risks to Snowy 2.0 and the NEM

The Maragle option involves the development of substantial transmission infrastructure in a location and to a design with higher risks of multiple, non-credible transmission outages than is the case for connection to LTSS.

The Maragle option involves a new substation and eight transmission connections, all overhead lines, in the middle of a bushfire and lightning prone area. Collectively, the eight lines traverse about 100 kilometres of thick bush in KNP and BSF and are therefore much more vulnerable to bushfires than connections to LTSS.

The proposed four 330 kV double-circuit lines between Lobs Hole and Maragle are to be on two sets of towers about 70 m apart. The chances of all four lines being subjected to a multiple outage from a bushfire is greater than for the lines connected to LTSS (one group of three lines and the other well distant group of two lines).

Also, Appendix F notes that the proposed overhead lines are 'at comparatively higher risk of fire' due to their location on ridgelines:

"Assets located on ridgelines are recognised as being at comparatively higher risk of fire (NSW NPWS, 2008). The new transmission corridor would traverse mountainous terrain. Elevation ranges from 547 m AHD (at the Talbingo Reservoir crossing) to 1198 m AHD near the western end of the alignment. The alignment contains two major slopes with easterly aspects, and one with a westerly aspect.

Vegetation on west-facing slopes tends to be drier, and available as bushfire fuel for more of the year (NSW NPWS, 2008)."

The towers for the four lines are very tall (up to 75 metres), much taller than the standard single-circuit 330 kV towers (~40 metres) connected to LTSS.

Lightning is more likely to strike taller transmission structures and earth wires due to their height above the surrounding landscape. Taller towers are more likely to have a double circuit lightning outage due to a double back flashover occurring to both circuits on that tower from a single severe lightning strike (though this is rare).

Connecting Snowy 2.0 and HumeLink to Maragle provides no benefit to the NEM, other than an intermediate point for connecting Snowy 2.0 to the 500 kV grid and a link to the existing 330 kV Line 64 between Upper Tumut Switching Station and LTSS.

The HumeLink dog-leg deviation introduces drawbacks for the NEM by increasing the length of one of the two circuits between Wagga and Bannaby, thereby reducing the overall capacity of the Wagga-Bannaby link (due to unequal sharing of transmission), incurring additional transmission losses and increasing the susceptibility to outages from bushfires and lightning.

10 The proposed overhead lines are excessive and not best practice

As contended above, overhead transmission lines are incompatible with National Parks, are not permitted under the current POM, and should not be countenanced in the first place.

But to provide a more complete critique of the EIS, this Chapter examines the proposed overhead transmission connection to Maragle and concludes that it is excessive in terms of its scale, number of circuits and design.

The EIS proposes a traditional transmission line design as constructed in the mid-20th century. There is no analysis of alternative designs or operational protocols to mitigate the environmental impacts on the Park. A lower environmental impact could be achieved with two higher capacity circuits on one set of (possibly taller) towers, of a less intrusive design, strung over the uncleared bush canopy, constructed and maintained by helicopters and drones, with no access tracks.

Kosciuszko National Park warrants nothing less than an international best practice design for areas of environmental significance.

10.1 Two 330 kV circuits, on one set of towers, would be sufficient

The EIS states that Snowy Hydro (not TransGrid) has determined that four 330 kV circuits are needed:

“Snowy Hydro has determined that four circuits of 330 kV transmission would be required to transmit the full generation of 2000 MW of Snowy 2.0. This includes provision for an outage of one of the four circuits (this standard is referred to as ‘n-1’). This is important, as without the contingency supported by the fourth circuit, a failure on one of the circuits would result in a loss of output of Snowy 2.0, which could lead to shortfalls in generation across the NEM during periods of high demand.” (EIS 3.1.1)

The thermal capacity of a transmission line depends on many factors, such as the size and type of conductor, number of conductors per phase, ambient weather conditions, loading etc.

The existing 330 kV overhead lines in KNP are rated at around 1,000 MVA continuous (and around 1,100 MVA short-term emergency). If this design were replicated for the Snowy 2.0 connection, as appears to be the case, then three circuits, not four as stated in the above extract, would be sufficient under the ‘n-1’ reliability standard (i.e. maintaining service in the event of a single outage contingency).

A far better approach would be to design the circuits with a higher thermal rating. A rating as high as 2,200 MVA or so could be achieved by installing four larger conductors in each bundle (rather than two conductors for the traditional design). Four conductors per bundle would be similar to the 500 kV lines in operation in NSW, Victoria and overseas.

In this case two circuits, with a combined thermal rating of around 4,400 MVA, would be sufficient to transmit Snowy 2.0’s 2,000 MW capacity (pumping and generation) and cover a single contingency outage. Also, installing more conductors, or larger conductors, in each bundle reduces corona losses and audible noise.

Hence, one double-circuit line, rather than two as proposed, would meet the ‘n-1’ standard, resulting in an approximate halving of environmental impacts (and cost).

10.2 System Security considerations for one double-circuit line

Transmission lines are exceptionally reliable – underground cables even more so. A double-circuit transmission line is slightly less reliable than two single-circuit lines, but can still operate at exceedingly high and practically identical reliability standards.

10.2.1 Lightning-proofing

For a double-circuit line it would be prudent to take additional measures to minimise the chances of both circuits being tripped simultaneously by lightning strikes, including:

- single phase auto-reclose protection (SPAR) to clear double back flashovers
- larger or additional earth wires to increase conductor shielding from lightning strikes
- longer insulator strings
- stronger earthing connections at the towers

10.2.2 Structure failure

NSW has experienced very few transmission structure failures. However, it could be prudent to consider a higher design standard such as used in cyclone prone areas.

10.2.3 Double-circuit lines are extremely reliable

An example of a critical double-circuit line is the 330 kV interconnector between NSW and Queensland. It has been in operation since 2001 and has experienced only one simultaneous lightning outage of both circuits, which it turned out could have been avoided by better coordination of the SPAR protection between NSW and Queensland.

An even more critical double-circuit line is from Townsville to Far North Queensland including Cairns City, an international destination with over two million visitors every year. The region is supplied by a double-circuit 275 kV line, more than 300 km long, with a lower capacity 132 kV partial back-up line that also supplies the intermediate coastal communities.

The region is high risk due to frequent tropical cyclones, extremely high lightning activity, and being backed by world heritage listed rain forested escarpments and tableland. The double-circuit line passes over the rainforest canopy for some 16 kms on 75 metre towers (more details in Chapter 10.5). The line uses emergency control schemes including high speed SPAR and undervoltage protection and has reliably supplied Far North Queensland and Cairns City for the past 22 years.

These two lines are arguably more critical than the Snowy 2.0 connection and yet have been deemed to be, and proven to be, sufficiently reliable for double-circuit design.

10.2.4 Precautionary actions to minimise the impact of a subsequent outage

System security impacts for any single credible contingency are handled by AEMO applying long-established operational procedures.

If a tripped circuit on a double-circuit line was likely to be out of service for an extended time (e.g. more than about 30 minutes) the loss of the second circuit becomes a credible contingency and AEMO may need to make adjustments to the system. No action should be required if Snowy 2.0 was idle or generating/ pumping less than about 700 MW, as the NEM would usually be able to ‘handle’ the loss of this amount of generation/ pumping.

So, the worst-case scenario would be limiting Snowy 2.0’s generation/ pumping to around 700 MW for a sustained outage of one circuit. This would only impact Snowy Hydro if it wished to generate additional power on top of its existing 4,100 MW of hydro capacity plus around 700 MW from Snowy

2.0 – a most unlikely scenario, as discussed below.

The same scenario might apply if the double-circuit line was about to be exposed to a severe bushfire or lightning storm. That is, Snowy 2.0's output might be similarly limited to avoid system security issues were both circuits to trip simultaneously.

10.2.5 The two HumeLink connections present a similar situation

The same situation will arise from an outage of one of the two 500 kV HumeLink connections to Maragle – i.e. the trip of one line may necessitate transmission across the other being limited to about 700 MW in case it also trips. This is more likely to occur due to the significantly longer lengths of the HumeLink lines (110 km to Wagga and 260 km to Bannaby) compared with the 9 km of 330 kV Snowy 2.0 connections.

TransGrid and Snowy Hydro appear to accept these risks for the 500 kV connection but not for the 330 kV part of the connection where four circuits are proposed. This situation would not apply if Snowy was connected to LTSS and LTSS was radially connected from Wagga (Alternative D3).

It is noted that with the underground alternative, the loss of one cable reduces transmission capacity by only one-sixth (350 MW), which is well within the capability of the NEM to accommodate. Also, the LTSS alternative, with far greater redundancy, results in a further reduction of risk to Snowy 2.0's output capacity.

10.3 What if both circuits tripped simultaneously due to a non-credible contingency

The single contingency, 'n-1' standard, applied to double-circuit lines is for one circuit to trip, not both. Simultaneous tripping of both lines on a double-circuit tower is classified as an 'n-2' double contingency, with an extremely low risk. Such a standard is not applied to double-circuit lines in the NEM as it would incur 'gold-plating' and should be covered by an emergency control scheme.

However, it is informative to examine the consequences of such a double-contingency event, as Snowy Hydro or TransGrid may raise that extremely remote possibility to justify (three or) four circuits.

In this most extreme of worst-case scenarios:

The key issue is the likelihood of an unforeseen simultaneous outage of both circuits occurring at the very instant Snowy 2.0's generation was crucial to the NEM

There are several factors to consider, including that transmission lines are extremely reliable and rarely out of service, Snowy 2.0 will only generate intermittently and hardly ever at full capacity, the NEM is rarely under stress, and the NEM has inbuilt safeguards to counter the impact of such a non-credible event.

10.3.1 Transmission lines are rarely out of service

Forced outages of overhead lines are usually caused by bushfires and lightning strikes (underground cables are not affected by such events).

Bushfires are unlikely to occur any more than every two decades or so (see Chapter 9.2.7.1). The January 2020 bushfires encompassed the Snowy 2.0 project area and are most unlikely to re-occur for at least another couple of decades until there is sufficient regrowth to build up the fuel load.

The potential for bushfires can be foreseen, and any transmission outage usually does not extend beyond a few hours or a day at most.

The short length of lines (9 km) also mitigates against frequent or extended bushfire exposure.

Lightning storms can usually be foreseen, and precautionary steps taken for alternate generators or battery storage being made available to cover a transmission or generator trip.

The chance of an unforeseen trip from bushfires or lightning strikes is remote. The chances of some other unforeseen event occurring that resulted in both circuits tripping and staying out of service for any length of time is even more remote.

10.3.2 Snowy 2.0 will only generate intermittently

Pumped hydro stations generate when prices are high and pump when prices are low. Snowy Hydro's modelling forecasts that generation will occur on average for 17% of the time (i.e. around four hours/day) till 2042, usually during the late afternoon/early evening peak period. Snowy Hydro's CEO stated that Snowy 2.0 will use the transmission system for even less time (10% for both generation and pumping)²².

Industry experts predict that Snowy 2.0 will generate far less than Snowy Hydro's forecast, due to Snowy 2.0's large losses (25% in the pumping/generation cycle) and slow response rate (minutes rather than milliseconds) compared to other energy storage competitors. AEMO's ISP forecasts Snowy 2.0 output will be less than half Snowy Hydro's estimate to 2042²³.

10.3.3 Snowy 2.0 will rarely operate at full capacity

Even if Snowy 2.0 generated for 10-15% of the time (averaging three hours/day), it's output could be anywhere between 1 MW and 2,000 MW. The Snowy 2.0 Feasibility Study states that Snowy 2.0 will operate at 2,000 MW for less than 87 hours per year²⁴ (i.e. <1% of the year).

Hence, the transmission capacity required by Snowy 2.0 would usually be far less than 2,000 MW. More relevantly, for around 90% of the time the lines will be transmitting zero MW from generation.

10.3.4 Snowy 2.0 is not the only generator in Snowy Hydro's fleet

Snowy Hydro has an existing generating capacity of 5,426 MW:

- 4,100 MW hydro, including the 1,800 MW Tumut 3 pumped hydro station
- 1,290 MW gas and
- 136 MW diesel

The times when Snowy 2.0 might be critical for the NEM, on top of Snowy Hydro's existing generating capacity, would be extremely rare.

²² "We've said this 150,000 times. Transmission is for the common good. Everyone benefits from it. We use it about 10 per cent of the time and the other 90 per cent it's used by everybody else, particularly on the renewable side." Mr Paul Broad, Snowy Hydro CEO [Behind Snowy's Battery Bet, Australian Business Review, 14 Sep 2019](#)

²³ [AEMO's Integrated System Plan: Does it leave Snowy 2.0 high and dry?](#) Victoria Energy Policy Centre, 10 August 2020

²⁴ "This analysis consequentially must be matched to the independent market expert's modelling of the Project's operation profile, which shows that in any given year prior to 2040, the Project will be operated at full capacity for less than 87 hours per year."

10.3.5 The NEM is rarely under stress

There are very few instances during a year when the electricity system is under stress and even less when the output from Snowy 2.0 might be crucial for avoiding load shedding. There would usually be reserve generation capacity available to meet the load and spare capability in the interstate interconnections.

The NEM will become even more resilient in future as large battery banks are installed around NSW, which respond within milliseconds to compensate for a loss of generating capacity (or loss of load in the case of the Snowy 2.0 pumps).

10.3.6 No need for back-up transmission circuits when pumping

There should be no need to account for times when Snowy 2.0 pumping needed to be backed off due to transmission constraints, as this would not be critical to the NEM.

Snowy 2.0 has a large water storage capacity and having its pumping limited due to a transmission constraint for a short time would have a negligible impact on the volume of water in the upper storage (Tantangara Reservoir). Not being able to pump would be exceedingly rare and any lost opportunity to do so should only have a minor commercial impact on Snowy Hydro.

10.3.7 Could the existing transmission line through Lobs Hole provide back-up?

The existing 330 kV overhead transmission line from Upper Tumut Switchyard to Yass Substation (Line 02), runs over Lobs Hole. It was routed through Lobs Hole/Ravine, in the 1960's, as a possible connection point for a future hydro station between Tantangara Reservoir and Talbingo Reservoir (i.e. a smaller Snowy 2.0), and is rated at just over 1,000 MVA²⁵.

Connecting Snowy 2.0 to Line 02, as originally envisaged, may provide additional capacity and emergency back-up.

It may also be possible to substantially increase the rating of Line 02 at some stage, by re-building.

10.3.8 Security considerations

The chance of a simultaneous trip of a double-circuit connection to the NEM at a time when Snowy 2.0 was generating 2000 MW is infinitesimal.

However, if it did occur what is likely to happen.

AEMO operate the system to withstand, at a minimum, an 'n-1' contingency. This is likely to be the loss of about 700 MW, the size of the largest generator on the network, plus a margin.

If Snowy 2.0 was interrupted at full load, the frequency control schemes across the NEM would automatically respond. The worst-case scenario would be about 1,300 MW of load being shed, with a significant portion being aluminium smelters on interruptible supply arrangements. It is likely that less than this amount would be disconnected due to automatic responses from on-line generators, spinning reserve units, large-scale batteries and interstate connectors.

The system should usually recover in a short time (seconds or minutes).

²⁵ "Transmission Equipment Ratings", AEMO <https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/data-nem/network-data/transmission-equipment-ratings>

Such a scenario needs to be viewed in the context of it being almost inconceivable in the first place – i.e. the likelihood of a simultaneous outage of both circuits occurring at the very instant Snowy 2.0's generation was crucial to the NEM.

10.3.9 Two 330 kV overhead circuits are sufficient

One higher capacity, double-circuit 330 kV line, designed to the highest standards, would enable Snowy 2.0 to operate at full capacity and completely satisfy the 'n-1' reliability standards. There appears to be no justification for four overhead circuits.

10.4 Reducing the impact of overhead lines

The EIS fails to include any analysis of alternative line designs to minimise environmental impacts.

Shorter towers, possibly of a pole design, no cleared easement, no access tracks, and construction/maintenance by helicopters and drones are some of the ways applied elsewhere that would substantially reduce the impacts. None of these are mentioned.

10.4.1 One set of towers, not two

Reducing from four circuits to two will eliminate the second set of towers. One set of towers would be less intrusive, with half the environmental impact, though still substantial and unacceptable.

10.4.2 Less obtrusive tower design

There are many alternatives to the traditional steel lattice towers that are more compact and shorter, and with less environmental and visual impacts, for example:

- NationalGrid has designed a T-pylon²⁶ that is claimed to be shorter, have a smaller footprint and a narrower easement than the traditional steel lattice towers (Figure 13).
- BOLD Transmission have a similar concept, using a tubular steel tower²⁷
- TenneT has a minimalist design tower called Wintrack²⁸
- Steel double circuit poles blend in better with the landscape and have been used elsewhere in NSW and south-east Queensland

Other measures that should be canvassed include:

- Painting – to reduce the contrast with the surroundings (though only of marginal benefit)
- Larger conductors or additional conductors per bundle to reduce humming/ buzzing
- Greylining the conductors to reduce shine
- Composite insulators

10.4.3 Tower height

The EIS canvassed two concept designs, both with excessively high towers, far taller than other 330 kV towers in NSW:

- i) Base Case - structure height of up to 75 metres, with clearing across most of the easement
- ii) Over Canopy Design – structure height of up to 94 metres, with no vegetation clearance

TransGrid preferred the Base Case, noting that the Over Canopy Design is feasible but with

²⁶ "What's a T-pylon", UK NationalGrid <https://hinkleyconnection.co.uk/whats-a-t-ylon-and-how-do-we-build-them/>

²⁷ "BOLD Transmission" <https://www.boldtransmission.com/products/>

²⁸ "Wintrack Pylon" https://www.tennet.eu/fileadmin/user_upload/Company/Publications/Corporate_Brochures/The_Wintrack_pylon_2012.pdf

significant constraints associated with:

“Asset and bushfire risk: As the amount of vegetation (fuel load) under the transmission lines increases, the risk of a bushfire causing a catastrophic failure of the four 330 kV circuits increases. The ability for TransGrid to respond to a catastrophic failure would also become more difficult as the vegetation under the transmission lines increases due to the inability to traverse the transmission corridor if required for urgent repairs. Therefore, it is beneficial to have a cleared corridor for responding to a catastrophic failure of the transmission lines.

NEM Risks: As the amount of vegetation under the transmission lines increases, the risk of a bushfire causing a trip of the transmission connection circuits increases. Should this occur, there is potential for the full loss of generation from Snowy 2.0, which could lead to voltage collapse and widespread consequences including load shedding across the NEM, which would likely require several hours to restore.”

The reasons for preferring the Base Case are unconvincing - the warning of voltage collapse and load shedding is highly exaggerated.



Figure 13 - Hinkley Connection Project 400 kV double-circuit (top left), BOLD Transmission 345 kV double-circuit (top right) and two 380 kV double-circuit Wintrack lines

As noted earlier, bushfires would pose a risk to the lines very infrequently. And when fires threaten, precautionary actions would be taken. If the lines were affected it would be only for a few hours or a day at most every couple of decades or so. It is stretching credibility to suggest a catastrophic risk to the NEM of voltage collapse and load shedding from a bushfire.

The Over Canopy Design would result in considerably less environmental impact on the surface. The extra height increases the visual blight, but one could argue that an extra 20 metres height on top of an already very tall tower would be more environmentally acceptable.

It's a case of choosing the better of two unattractive options, but the Over Canopy Design appears to be the least-worst choice from an environmental impact perspective.

Also, the suggested height of up to 94 metres needs to be critically reviewed in light of the infrequency of bushfires, over just 9 km of lines, and the mitigating measures available.

Minimal or zero clearing may be possible with towers of around 75 metres high, as is the case with the uncleared 40 metre high forest canopy under 75 metre towers for the Queensland 275 kV double-circuit line outlined in Chapter 10.5. Whilst that line is unlikely to be affected by a bushfire, that should also be the case for Snowy 2.0 lines, especially with periodic controlled burning of the easement corridor.

10.4.4 Excessive clearing

The EIS is contradictory on the easement width, indicating 120 – 140 m in some sections but 120 – 200 m in others:

“Transmission corridor. The portion of the disturbance area along the transmission line that is required to support construction. This is expected to be between 120 and 200 metres wide. The final easement would be surveyed following the completion of construction and is expected to be about 120 to 140 metres wide.” (EIS 1.3.1)

“Permanent bushfire protection measures. The vegetation removal for the project includes removal of trees and woody vegetation within the 120-200 m wide transmission corridor as required to provide safe clearance distance to the overhead conductors (but only to the extent that this is required to maintain safe clearances).” (EIS 5.1)

“This determined a worst case variable transmission corridor width ranging from approximately 120 metres to 200 metres.” (EIS 5.2.2.2)

A disturbance area up to 200 m wide is excessively wide. A permanent easement up to 200 m would be even more excessive.

In this fragile environment it would take many decades to revegetate those portions of the disturbed area not required for the ongoing easement. Why is such a wide area to be disturbed?

The better option is the Over Canopy Design, with no clearing.

10.4.5 No access tracks

The EIS proposes the construction of permanent access tracks along the easement. Due to the steep terrain in some sections, these tracks will involve significant cuttings and land-forming, and be an ongoing maintenance, erosion and weed transfer issue.

Once constructed, transmission lines require minimal observation and maintenance. Vehicles would use the tracks only a couple of times a year, if that.

Access tracks can be eliminated by constructing the lines by helicopters. This is a well-developed process in remote and precious areas around the world (see Figure 14), though it appears that TransGrid would not countenance use of helicopters for construction, due to a tragic fatality in the past.

Inspections and maintenance by helicopters and drones can also be performed without land vehicles, obviating the need for access tracks entirely (see Figure 15).



Figure 14 - Helicopter Construction BPA McNary-John Day 500 kV Transmission Project

10.5 An Example Transmission Project that protects the environment

During 1994-1999 Powerlink Queensland designed and constructed a purpose-built double-circuit 275 kV line that traversed 16 km of the World Heritage-listed Wet Tropics Rainforest near Cairns²⁹:

“Traditional transmission line construction methods, which would have required easement clearing and a network of access tracks for both construction and future maintenance, were unsuitable for an area with such significance”.

Design features included:

- 75 metre towers and lines above the 40-metre-high forest canopy
- No easement clearing
- No new access tracks
- Construction and subsequent maintenance by helicopter – each tower is fitted with a helipad
- Composite insulators, selected for superior pollution performance and minimum maintenance requirements in humid tropical areas. Composite insulators are lighter than ceramic or glass insulators and able to be carried in a single helicopter flight by maintenance crews
- A special track-mounted borer capable of use in all planes, as additional earthworks and site leveling at tower positions was not permitted

The design cost three times more than the standard, but was considered to be ‘an essential cost of business’ in such an environmentally valuable area:

“The Wet Tropics and Trinity Inlet sections of the transmission line cost up to three times more than a typical expenditure for a comparable open terrain line. However, Powerlink sees this as an essential cost of business. This world-class project has set new standards for Powerlink and other utilities in installing infrastructure in environmentally sensitive areas.”

²⁹ “Transmission Line Intersects Rainforest” T&D World, 1 April 1999

<https://www.tdworld.com/home/article/20968961/transmission-line-intersects-rainforest>



Figure 15 - Helicopter atop a transmission tower

Kosciuszko National Park is no less significant and valuable and warrants at least similar care. It too warrants a transmission connection that may well be three or more times the cost of the cheapest, but most environmentally destructive, option.

10.6 Conclusion

TransGrid has failed to assess alternative overhead transmission line designs or take any concerted steps to minimise the environmental impacts.

The number of overhead circuits could be halved, and the design modified to significantly reduce the environmental impacts from construction and ongoing maintenance.

However, this would not be to anywhere near an acceptable level. Overhead lines would still be far larger and more intrusive than existing lines in KNP.

**Within such special places as Kosciuszko National Park
only underground cables should ever be considered, as is required in the POM.**

Attachment A – Open Letter to Ministers Stokes and Kean 18 January 2021

The Hon Rob Stokes MP
Minister for Planning and Public Spaces

The Hon Matt Kean MP
Minister for Energy and Environment

Snowy 2.0 transmission must be underground

Dear Ministers,

You will soon be presented with an Environmental Impact Statement (EIS) proposing high-voltage overhead transmission lines through Kosciuszko National Park for the Snowy 2.0 pumped hydro station. We believe overhead transmission lines would cause extensive, unnecessary, and entirely unacceptable damage to the Park.

We urge you to insist on a comprehensive analysis of underground alternatives prior to the submission of the EIS, in accordance with regulatory requirements. The proposed option in the EIS must be for underground cables, not overhead lines. Overhead lines would cause environmental impacts that are totally incompatible with the national and international significance of Kosciuszko National Park.

In the absence of your intervention, we understand that four 330 kV overhead transmission lines will be proposed, suspended on two sets of steel lattice towers (up to 75 metres high). The lines would traverse eight kilometres of Park within an easement up to 200 metres wide. One square kilometre of National Park would be permanently cleared. The lines would be visible over a vast area, totally destroying the ambience and integrity of this remote and largely pristine region. This proposal is far more intrusive than any of the single tower lines constructed in Kosciuszko before the Park was established in 1967.

Underground cables may be more expensive, but they have several offsetting benefits including minimal environmental impact, higher reliability, reduced maintenance, and less vulnerability to outages from lightning, storms and bushfires.

Kosciuszko National Park is a special and irreplaceable place on our National Heritage List. Despite the damage of the past and present, it is one of the most majestic areas in Australia and one of our planet's natural icons. It has fundamental cultural significance for Indigenous peoples and is very much loved and enjoyed by all Australians.

The unique character and values of Kosciuszko must not be sacrificed for the cheapest transmission option, overhead lines, when viable and far less damaging underground alternatives are available, as outlined in the accompanying Paper.



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Emeritus Prof Russell Bridge BE(Hons1), PhD, FIEAust, FASCE	Foundation Chair of Civil Engineering, Western Sydney University; major contributor to Australian Standards for steel and concrete construction; former Director, Centre for Construction Technology Research
Dr Matthew Brookhouse AssDipAppSc, BSc(Hons), PhD	Senior Lecturer, Fenner School of Environment and Society, Australian National University; Project Leader, snow-gum dieback
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Alan Bull MIEAust, MACS	former Operator and A/Network Controller, TransGrid; System Control Division, Electricity Commission of NSW
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Peter Graham DipBus, PMD(Harv), MAICD	former Chief Executive Officer, Pacific Power; Chief Operating Officer, Fairfax Media; Chief Operating Officer, University of NSW
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Dr John Hewson AM BEc(Hons), MA, MA, PhD	Professor, Crawford School, Australian National University; former Leader of Liberal Party and Federal Opposition
Emeritus Prof Geoffrey Hope PhD, DSc	Professor of Natural History, Australian National University with expertise on the bogs and fens of Kosciuszko; Member, Scientific Advisory Panel on Wild Horses in Kosciuszko
Dr David Iverach BE(Hons), Grad Dip Fuel Technology, PhD	former CEO, Transfield Energy; Director General, Transport NSW; Principal Engineer, State Pollution Control Commission; Director, Perisher Blue; Director, Nam Theun Hydroelectric Project
Emeritus Prof Ian Lowe AO FTSE, BSc, DPhil, DSc	Science, Technology and Society, Griffith University; Adjunct Professor, Sunshine Coast University, Flinders University; former President, Australian Conservation Foundation
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Going underground with the transmission connection for Snowy 2.0

18 January 2021



Figure 1 - Photomontage of proposed overhead transmission lines at Lobs Hole, Kosciuszko National Park (TransGrid)



This Paper contends that the Snowy 2.0 transmission connection through Kosciuszko National Park should be placed underground

Going underground with the transmission connection for Snowy 2.0

1 Introduction

The Snowy 2.0 Transmission Connection Project (the 'Project') is to be built, owned and maintained by TransGrid, at Snowy Hydro's behest, and is the final component of the Snowy 2.0 pumped hydro development. The Environmental Impact Statement (EIS) is to be placed on public exhibition shortly.**Error! Bookmark not defined.**

Advice from TransGrid indicates the EIS will propose the construction of two double-circuit 330 kV overhead transmission lines. The lines will traverse nine kilometres of Kosciuszko National Park (KNP) and the neighbouring Bago State Forest (BSF) along an easement up to 200m wide. The lines will be visible over vast distances and permanently raze 1.5 square kilometres of native vegetation and fauna habitat across a largely intact and pristine alpine region.

It appears that TransGrid has assumed approval will be granted and has already secured finance for the Project and awarded the design/construct contract.

This Paper argues that minimising environmental impacts on KNP, not minimising the cost, should be the primary consideration in selecting the most appropriate transmission option. This rules out overhead lines. The EIS must analyse alternatives and propose the best underground solution.

The previous Main Works stage of Snowy 2.0 had numerous serious environmental impacts that were unavoidable if Snowy 2.0 was to proceed. However, this is not the case with the Transmission Connection Project - there are several viable underground cable alternatives that would significantly reduce the adverse impacts on KNP. Underground cables would be more expensive than traditional overhead lines, but with offsetting benefits, including much lower environmental impact, higher reliability, lower losses, less maintenance, and reduced vulnerability to lightning and bushfires.

Overhead transmission lines are incompatible with our obligations for the protection of Kosciuszko National Park, the Australian Alps National Heritage Place, the UNESCO Kosciuszko International Biosphere Reserve, Aboriginal cultural heritage, head-water catchments for south-east Australia's major rivers, unrivalled natural landscapes, and unique biodiversity.

NPA opposes the Snowy 2.0 project, as it doesn't stack up economically, technically, or environmentally ([NPA Website](#)). There are cheaper, more efficient, and less environmentally damaging energy storage alternatives. Notwithstanding our opposition to Snowy 2.0, this Paper focuses on minimising the environmental impact of the transmission component of the project on Kosciuszko National Park.

The Paper is based on information provided by TransGrid in November 2020. TransGrid was asked for additional information and clarification on several issues but has yet to respond. Accordingly, it is possible that the way the Project has been described in the Paper may not completely reflect the latest design by TransGrid.

The Paper provides background to an Open Letter to the NSW Ministers for Planning and the Environment from 24 environmental organisations and 50 expert engineers, scientists, environmentalists, academics and economists, calling for a comprehensive analysis of alternatives and the adoption of an underground solution. Many of the signatories to the Letter, and others, have made significant contributions to the Paper.

2 The Project

Information provided by TransGrid indicates the Transmission Connection Project to be proposed in the EIS involves:

- two double-circuit 330 kV overhead transmission lines (on two sets of side-by-side towers³⁰)
- traversing about eight km of KNP and one km of BSF, connecting the Lobs Hole Cable Yard (near the entrance to the Snowy 2.0 underground Station) with a new Substation (Maragle) in BSF (see the two parallel black lines and dark blue 'disturbance footprint' in Figure 2)
- twenty-one sets of steel lattice towers, each up to 75m high
- an easement varying from 120m to 200m in width
- a series of new access tracks (the green lines in Figure 2)

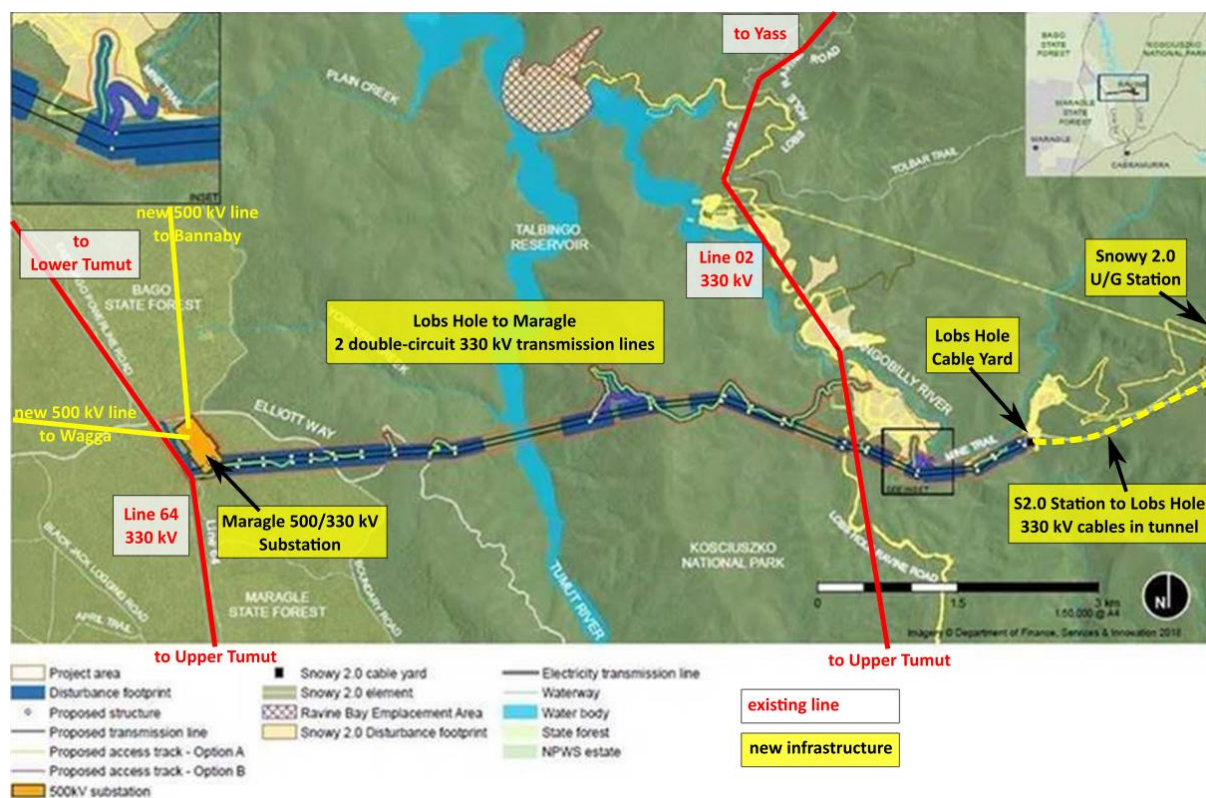


Figure 2 – Layout of Snowy 2.0 Transmission Connection Project

(TransGrid diagram – labels, existing transmission lines and Snowy 2.0 Main Works cables added)

3 Overhead transmission lines

Overhead transmission lines would cause significant environmental impacts, in addition to those from the Snowy 2.0 Main Works³¹, including:

- permanent 'disturbance' to 100 hectares (1 square kilometre) of KNP and a further 44 hectares of BSF, which is also an area of high environmental value and sensitivity

³⁰ There are proposed to be four 330 kV circuits in total, one circuit on each side of two sets of towers. Each circuit consists of three bundled conductors (for each of the three phases of alternating current), with each bundle consisting of two to four individual conductors. Each of the bundled conductors are suspended from one of three tower cross-arms. Each tower carries six bundled conductors. Also, two earth wires are strung from either end of a top cross-arm to attract and safely ground lightning strikes.

³¹ ["Snowy 2.0 doesn't stack up"](#) NPA

- habitat fragmentation and barriers for animal movement
- wide easements requiring regular clearing and introducing sources of erosion, landscape instability and weeds. Easements also provide avenues for feral pests such as foxes and pigs
- loss of native flora, including threatened species in currently undisturbed vegetation communities
- loss of native fauna, including threatened species such as the Yellow-bellied Glider, Eastern Pygmy Possum, Squirrel Glider, Gang Cockatoo, Greater Glider, Scarlet Robin, Flame Robin, Powerful Owl, Masked Owl and Booroolong Frog
- carbon emissions from vegetation clearance, ending sequestration across the permanently cleared areas
- jarring visual impacts of towers, wires, easements and access tracks, across the spectacular Yarrangobilly and Tumut River valleys and surrounding country for tens of kilometres



Figure 3 – Photomontage – Tumut River/Talbingo Reservoir Crossing (TransGrid)

- a web of criss-crossing overhead lines at Lobs Hole from the four new lines in addition to an existing 330 kV transmission line (Line 02), which traverses a 3km stretch of the Yarrangobilly River
- an intense buzzing from corona loss, particularly audible at night and in foggy weather
- increased risk of starting bushfires, with substantial consequences - human, environmental, animal, property and financial
- dumping of excavated spoil from the tower footings and access tracks in KNP and BSF
- weed transfer and erosion from the access tracks along the easement corridor
- the destruction of the amenity and attractiveness of this outstanding remote alpine region, with few visitors choosing to recreate in such a degraded area

Whilst the existing transmission lines in KNP, built before the National Park was established in 1967, are an eyesore and environmentally damaging, they are far less imposing and intrusive than the proposed lines (see Figure 4 – the campers and bushwalkers at the base of the towers indicate the scale). Compared to the existing lines, the proposed transmission lines will have:

- two sets of side-by-side towers, compared to one set of towers for the existing lines
- two circuits per tower (of three phases), compared to one circuit
- 28 individual wires strung between towers, compared to 8
- much higher towers (conductors strung vertically), compared to shorter towers (conductors strung horizontally)
- easements of 120 – 200m wide, compared to 70m

For comparison, Figure 4 includes a depiction of the most environmentally impactful underground technique, being trenching, with a cleared easement of around 15-20m. Other underground techniques (tunnels and directional drilling) are less impactful, involving no above ground structures and no, or minimal, cleared easement (Section 4.2).

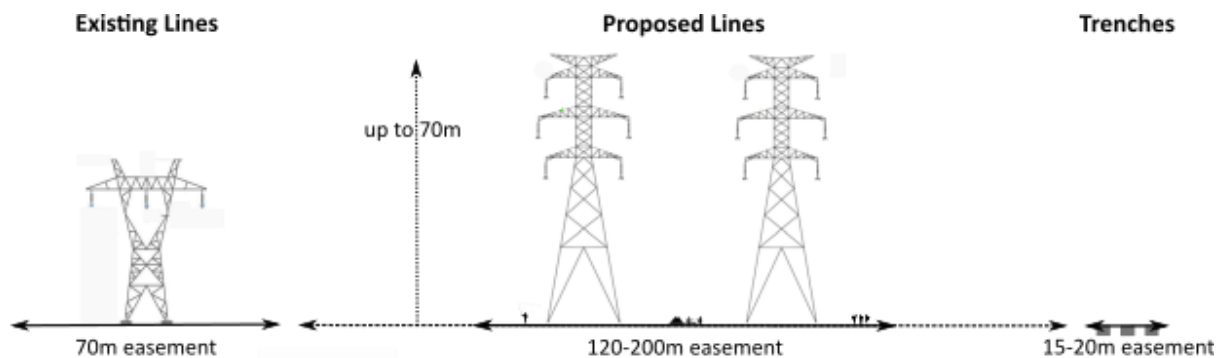


Figure 4 – Comparison of Existing KNP Transmission Lines, Proposed Lines and Trench

These environmental impacts compound an array of pressures on the ecological integrity and resilience of KNP. The alpine habitats have been subjected to historic damage, including clearing, grazing and unrehabilitated construction sites of the original Snowy Hydro-Electric Scheme³². They are now further challenged by global heating, rainfall variability, higher intensity storms, more frequent and greater intensity fires, feral horses, high impact recreational activities and the Snowy 2.0 project.

The January 2020 bushfires burnt one-third of KNP, including the entire route of the proposed lines. The burnt landscape is clearly visible in Figures 1 & 9. See the contrast with the pre-fire landscape in Figure 3. Recovery will take decades, leaving the area exposed to further damage from easement clearing and transmission line construction.

The cumulative impacts of these pressures risk large scale ecological collapse, and it is therefore imperative that every opportunity be taken to minimise any source of additional environmental damage.

4 Underground transmission cables

4.1 A common technology

High voltage underground cables are a viable alternative to overhead lines and are installed widely, particularly in cities and areas with high conservation value. NPA has been advised that almost all

³² "Rehabilitation of former Snowy Scheme Sites in Kosciuszko National Park" Gabriel Wilks, 18 October 2019 <https://site.emrprojectsummaries.org/2019/10/18/rehabilitation-of-former-snowy-scheme-sites-in-kosciuszko-national-park-update-of-emr-feature-2019/>

new transmission links are underground throughout Europe, in fact are mandated in some countries, and much of Asia. For instance, in 2010 the Netherlands capped the total length of overhead transmission and distribution – every new kilometre of overhead line must be compensated by undergrounding an equivalent length.

Underground cables can be installed in trenches, or tunnels or by under-boring (usually Horizontal Directional Drilling (HDD)). One or more of these techniques can be applied over a cable route, depending on the circumstances.

4.2 Underground example - urban

TransGrid recently obtained approval for a 20 km, 330 kV underground circuit between Potts Hill and Alexandria in Sydney³³, at a cost of \$285 million. The project involves the installation of two sets of three conduits, using a combination of trenches, HDD and cable bridges.

When installed in a trench the six conduits are to be arranged either flat or layered (triangular or stacked). A flat configuration trench is around 3m wide and 1.2m deep, whilst a triangular configuration trench is around 1.6m wide and 1.6m deep (Figure 5).



Figure 5 – Trench for Two 330 kV 750 MVA Circuits – flat and triangular configurations (TransGrid)

4.2.1 Underground examples - environmental

Transmission lines are often undergrounded partly or purely for environmental reasons, such as:

- the 'Directlink Interconnector' between Mullumbimby and Terranora in northern NSW; 63 km long, 180 MW rating and costing \$100 million
- 'Murraylink', between Red Cliffs in Victoria and Berri in South Australia; 180 km long, 220 MW rating and costing \$177 million
- the 87 km, 220 kV cable along the edge of Western Port Bay to connect the Victorian desalination plant
- undergrounding 132 kV transmission lines at Olympic Park prior to the Sydney 2000 Olympics, mainly for aesthetic reasons for world-wide TV audiences, at a cost of \$37 million
- the 'Hinkley Connection Project' in the UK³⁴; 57 km long, consisting of 48.5 km of 400 kV overhead line and 8.5 km of underground cable *"through the Mendip Hills Area of*

³³ "Powering Sydney's Future: Potts Hill to Alexandria transmission cable project EIS" TransGrid, October 2019 <https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=SSI-8583%2120191010T060146.019%20GMT>

³⁴ "Hinkley Connection Project" <https://hinkleyconnection.co.uk/category/ourproject/>

Outstanding Natural Beauty (AONB³⁵) [akin to a National Park]

- the 140 km, 400 kV Aalborg to Aarhus line/cable in Denmark³⁶ is another example of using cables to protect areas of natural beauty along a portion of the route, albeit at a higher cost. Fourteen km (10%) of the circuit was installed underground, across the Mariager Fjord and through the Gudenaa Valley, costing €35 million (25% of the €140 million total cost)
- Fifty underground cable projects are listed by Barber³⁷ and Moorabool Shire Council³⁸

4.2.2 Snowy 2.0

Indeed, the Snowy 2.0 project will be installing six sets of 330 kV, 450 MVA cables (i.e. 2,700 MVA capacity in total) from the Snowy 2.0 underground Station to Lobs Hole Cable Yard (on the surface) in a multi-purpose tunnel used for emergency egress, cables, and ventilation. These cable sets (18 individual cables in total) will each be three km long – already covering one quarter the distance to Maragle Substation.

4.2.3 Underground alternatives for Snowy 2.0

This Paper contends that the cables to be installed from the Snowy 2.0 Station to Lobs Hole should continue all the way to Maragle Substation or the Lower Tumut Switching Station (SS). Five potential alternative options are described below (Section 4.2.1).

Underground cables could be installed in trenches, tunnels or HDD, or in combinations of the three:

- for those sections to be trenched, a flat cable configuration could entail three trenches (two circuits per trench, as per Figure 5), each about three metres wide, with two access ways between, resulting in a partially cleared easement of around 15 - 20m wide. Such an easement width is around 10% that proposed for overhead lines (see Figure 4). The easement could be narrower if the cables were layered, as illustrated in Figure 5.
- a tunnel for six sets of cables would typically be 3 - 4m diameter. No above ground clearing is required, just two portals at either end, resulting in minimal environmental impact. Tunnel spoil could be extracted from the Maragle end (or the Lower Tumut SS end for Alternatives C/D/E(2)) to avoid dumping in KNP.
- sections with HDD would require six bore holes. No clearing is required, except for cable jointing pits about every 1 – 1.2 km, though these would be installed below ground

4.2.4 Underground cable alternatives

Five underground alternatives for the transmission connection from the Snowy 2.0 Station are described below, with the indicative routes and lengths of the first four depicted in Figure 6.

A. extending the three km of underground cables from the Snowy 2.0 Station to Lobs Hole Cable Yard, generally following the direct route of the proposed overhead lines, for the remaining

³⁵ An AONB is an area of countryside in Britain that has been designated for conservation due to its significant landscape value. AONBs enjoy levels of protection from development similar to those of National Parks. .

³⁶ "Underground High Voltage Cables: Wiring Europe for the Future" <https://www.stjornarradid.is/library/01--Frettatengt---myndir-og-skrar/ANR/ANR---Raflinur-i-jord/33-Underground-high-voltage-cables-Leonardo.pdf>

³⁷ "Achievement and experience in service of long length High Voltage AC electrical links by insulated power cables" CIGRE Latin American Workshop 2013, Ken Barber
https://www.jicable.org/Other_Events/WETS_Brazil_13/slides/Presentation_Barber.pdf

³⁸ "Comparison of 500 kV Overhead Lines with 500 kV Underground Cables" Moorabool Shire Council, September 2020
<https://www.moorabool.vic.gov.au/sites/default/files/largefiles/20200924%20MSC%20Transmission%20Comparison%20Overhead%20with%20Underground.pdf>

nine km to Maragle. The cables could be in a trench, tunnel or HDD conduit, or combination.

- B. laying cables in a trench from Lobs Hole along, or near, the road to the Snowy 2.0 excavated spoil dump in Talbingo Reservoir, at the junction of the Yarrangobilly and Tumut Rivers, and then via a trench/ tunnel/ HDD to Maragle (about 13 km). Approximately half the route is under the road and therefore of straightforward construction, with no additional clearing or environmental impact.
- C. as per Alternative B to the junction of the Yarrangobilly and Tumut Rivers, and then in, or adjacent to, Talbingo Reservoir to the existing Lower Tumut SS, located next to Tumut 3 Pumped Hydro Station at Talbingo (about 25 km). This alternative effectively relocates Maragle Substation to Lower Tumut SS, with ongoing new connections to the main grid being constructed from Lower Tumut SS, rather than from Maragle (see Figure 8).
- D. laying cables in a tunnel from the Station directly to Lower Tumut SS (avoiding the need for cables from the Station to Lobs Hole).
- E. laying cables in the tailrace tunnel from the Station to its inlet at Talbingo Reservoir, and then via a trench/ tunnel/ HDD to Maragle (E1), or via the Reservoir to Lower Tumut SS (E2).

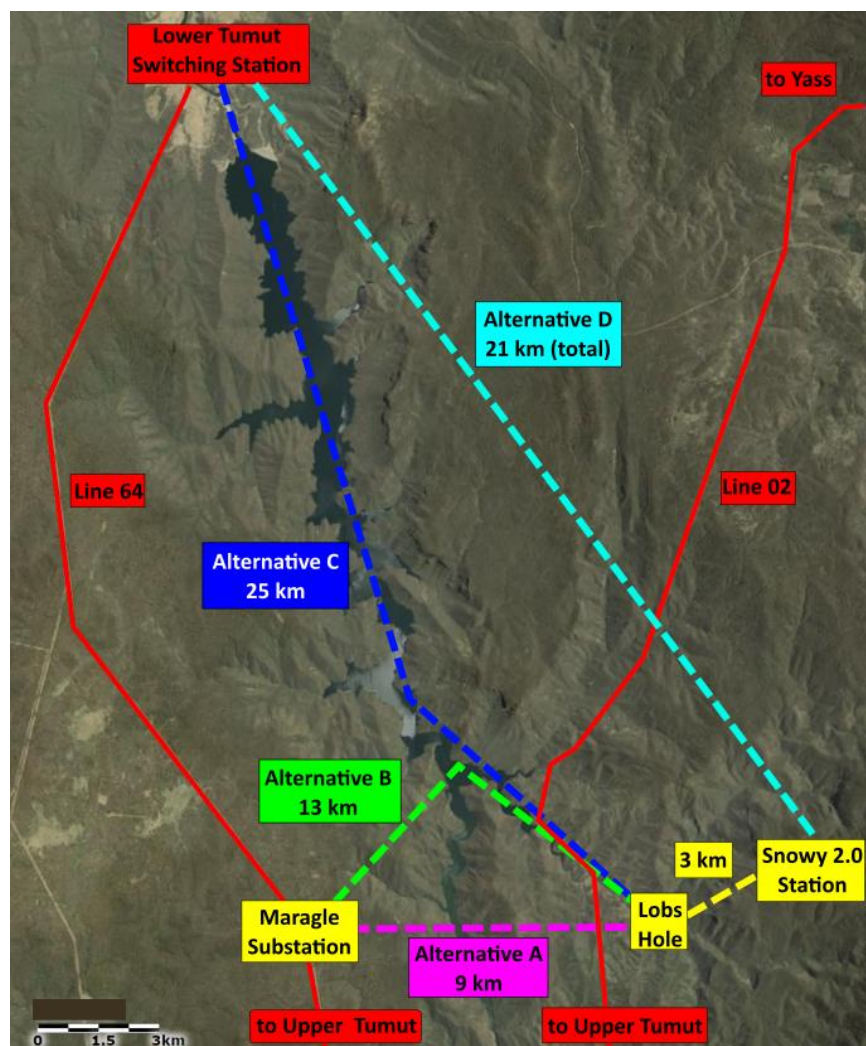


Figure 6– Four Alternative Routes for Underground Cables

A permutation on the first three alternatives would be to also connect the circuits to the existing 330 kV Line 02 running through Lob's Hole, to provide back-up transmission capacity in the event of an outage.

This Paper recommends that the above alternatives be comprehensively analysed by TransGrid. TransGrid should also use the full resources at its disposal to identify any additional underground options that warrant consideration. A preferred underground option should then be adopted and proposed for formal assessment through the EIS.

5 Obligation to analyse alternatives

The *Environmental Planning and Assessment Regulation 2000* (Clause 7(1)(c) of Schedule 2) requires all EISs to include 'an analysis of any feasible alternatives' for a proposed project:

"7 Content of environmental impact statement

(1) An environmental impact statement must also include ...

(c) an analysis of any feasible alternatives to the carrying out of the development, activity or infrastructure, having regard to its objectives, including the consequences of not carrying out the development, activity or infrastructure"

This requirement is repeated in the Secretary's Environmental Assessment Requirements for the Transmission Connection Project, which state *"In particular, the EIS must include a summary of the background to the project, including alternatives that were considered to the project"*.

It would appear that TransGrid has dismissed underground cable transmission options without any analysis, possibly as the higher construction costs would not be agreed by Snowy Hydro. Recent actions by TransGrid bear this out, with financing arranged and the design/construct contract having been awarded (Section 7).

Failure to assess viable and lower impact alternatives is not consistent with TransGrid's statutory obligations nor the community's expectations that all reasonable steps will be taken to minimise the impacts on KNP.

6 Project cost and context

6.1 Indicative cost of Project

At this stage TransGrid has not provided information on the cost of the Project.

However, an indication can be gleaned from the announcement by the Clean Energy Finance Corporation (CEFC) of a \$125 million corporate debt facility with TransGrid³⁹, *"to design, construct, operate and maintain a new 330 kV switching station and associated transmission lines as part of its agreement with Snowy Hydro Limited to provide connection services for 30 years"*. This debt facility of \$125 million appears to encompass the cost of the Project, covering three components - transmission lines, a switching station (possibly Lobs Hole Cable Yard), and operations & maintenance (O&M) for 30 years.

³⁹ "CEFC and TransGrid Services in landmark investment to support Snowy 2.0 grid development" 27 Nov 2020 <https://www.cefc.com.au/media/media-release/cefc-and-transgrid-services-in-landmark-investment-to-support-snowy-2-0-grid-development/>

A further indication of the cost of the Project is provided by the announcement by the CIMIC Group (UGL)⁴⁰ of being awarded five electricity utility sector contracts *“for more than \$112 million ... including the design and construction of a 330kV switchyard at Maragle in the Snowy Mountains, NSW for TransGrid. The contract includes building 10 kilometres of 330kV transmission lines to connect the switchyard and the Snowy 2.0 pumped-hydro project cable yard.”* The value of the Snowy 2.0/TransGrid contract was not disclosed but is likely to constitute the majority of the \$112 million.

A ‘ball-park’ figure for double circuit 330 kV overhead lines, provided to NPA by transmission engineers, is \$3.5 million per kilometre. This would imply a cost for the lines from Lobs Hole to Maragle of around \$60 million, and is the figure assumed in this Paper.

This Paper also assumes the total cost of the Project to be \$125 million, in line with the CEFC debt facility. This implies a cost for the 10-bay Lobs Hole Cable Yard (switching station) of around \$40 million, with O&M and financing costs making up the balance of the \$125 million.



Figure 7 – Photomontage - Lobs Hole (TransGrid)

A.1 Cost and benefits of underground cables

According to NPA’s expert advisors, underground cables typically cost between three to ten times more than traditional overhead lines and involve different design and construction challenges. The wide range is due to the vastly different circumstances and installation techniques that can apply.

This ‘rule-of-thumb’ suggests that Option A has an indicative cost of \$200 million to \$500 million. Detailed information is needed before a more definitive estimate could be determined, but estimates for all alternatives should be produced by TransGrid in its EIS analysis.

Cable prices are currently dropping whilst the cost for constructing overhead lines is increasing, as

⁴⁰ “UGL awarded more than \$112M in utilities contracts”, CIMIC, 4 December 2020
<https://www.cimic.com.au/en/news-and-media/latest-news/ugl/2020/ugl-awarded-more-than-112m-in-utilities-contracts>

evidenced by the Australian Energy Market Operator's (AEMO) recent adjustments to overhead transmission costs of +30% and recent higher tender prices. Tender prices are influenced by construction demand, so the forthcoming increase in transmission projects throughout eastern Australia (mostly overhead lines) may result in a further narrowing of the price gap between overhead and underground circuits.

6.1.1 General benefits of underground cables

Countering the higher cost of installing underground cables are several offsetting benefits, many with significant financial savings, including:

- less prone to physical damage
- no exposure to weather events – lightning, bushfires, storms, extreme winds etc. Such events are expected to become more frequent and intense with climate change, causing more outages, physical damage, more repair costs and lost revenue, sometimes costing tens of \$millions from a single event (as was the case with the January 2020 bushfires⁴¹).
- higher reliability, though taking longer to repair. (The longer repair time should rarely be a concern, as if one cable is out of service the remaining five generators/pumps can still operate up to a combined capacity of 1,670 MW).
- the loss of one cable circuit due to a fault should not result in the need to back off Snowy 2.0 output/load to cover a subsequent cable loss. Whereas the loss of a double-circuit overhead line from a fault (or lightning strike or bushfire) would result in backing off output/load to cover for a subsequent loss of the second double-circuit. Also, the proximity of the two overhead double-circuit lines pose a system stability risk that is not applicable for underground cables⁴².
- ready physical access for repairs and maintenance if in a tunnel
- lower operating costs (potentially one-tenth that of overhead lines⁴³), though higher repair costs
- lower electrical losses (reputed to be around 30% lower)
- far less or zero easement clearing and maintenance cost
- little or no release of greenhouse gasses from vegetation clearing
- no potential to start bushfires, as can occur from overhead lines through fallen towers, conductor clashing or breaks, and subsequent insurance claims⁴⁴
- and, most importantly, underground cables have substantially less environmental impact and no visual blight⁴⁵, other than a relatively narrow easement if trenches are used.

⁴¹ The January 2020 bushfires resulted in outages for some days in the Snowy, and separation of the NSW/Victoria transmission networks. Damage to TransGrid's assets in the Snowy region was "*north of \$15 million to \$20 million, which was not insurable*" [TransGrid CEO]. Snowy Hydro lost supply capability "*costing the company millions*" [Snowy Hydro CEO].

⁴² "Queensland and South Australia system separation on 25 August 2018" AEMO, 10 January 2019 https://www.aemo.com.au/-/media/files/electricity/nem/market_notices_and_events/power_system_incident_reports/2018/qld---sa-separation-25-august-2018-incident-report.pdf

⁴³ "Overview of the Potential for Undergrounding the Electricity Networks in Europe" prepared for the European Commission, 28 February 2003 https://ec.europa.eu/energy/sites/ener/files/documents/2003_02_underground_cables_icf.pdf

⁴⁴ "Black Saturday bushfire survivors secure \$500 million in Australia's largest class action payout" ABC News, 15 July 2014 <https://www.abc.net.au/news/2014-07-15/black-saturday-bushfire-survivors-secure-record-payout/5597062>

⁴⁵ "Valuing the social benefits of avoiding landscape degradation from overhead power transmission lines: Do underground cables pass the benefit–cost test? Ståle Navrud, Richard C. Ready, Kristin Magnussen & Olvar

In addition to the above benefits all underground cabling alternatives in Section 4.2 avoid the need for the Cable Yard and overhead transmission lines, thereby saving the Project cost of \$125 million.

6.2 Additional benefits of the proposed Alternatives connecting to Lower Tumut SS

Alternatives C, D and E(2) involve longer routes than the other alternatives as they connect to Lower Tumut SS rather than Maragle (see Figure 6). Alternatives C and E(2) are 28 km, including the leg from the Station to Lobs Hole. Alternative D is shorter, at about 21 km, and does not require the 3 km leg from the Station to Lobs Hole, so only entails an extra 18 km of cabling.

Although these alternatives involve longer routes, they offer a number of significant advantages to those through Maragle substation, as outlined below.

6.2.1.1 Augmenting an existing substation rather than building a new substation

These Alternatives circumvent the need for Maragle Substation by using the site of the existing Lower Tumut SS. Augmentation of existing substation infrastructure at a more accessible, well serviced location should result in savings in construction and ongoing maintenance, compared to a 'greenfield site' in the middle of a State Forest.

6.2.1.2 Shortens HumeLink, with significant financial savings

The proposed HumeLink project aims to reinforce the southern NSW network by connecting Wagga Wagga and Bannaby with two 500 kV circuits. It is expected to cost up to \$2 billion. One circuit goes direct and the second takes a substantial 'dog-leg' deviation via Maragle to connect Snowy 2.0 to the main grid backbone. In Figure 8 the two HumeLink circuits are depicted by the ochre-coloured lines showing the land corridor within which the lines are proposed to be constructed.

The routes for Alternatives C/D/E(2) run parallel with the proposed HumeLink lines to Maragle for about 20 km. Hence, terminating the two Snowy 2.0 connections at Lower Tumut SS (blue lines in Figure 8), rather than Maragle Substation, shortens their combined length by approximately 40 km. This would save about \$140 - \$200 million, depending on whether the lines are single or double

Bergland, 12 May 2008 *"the social benefits of avoiding negative impacts [from overhead transmission lines] on the landscape exceed the costs of burying the lines as underground cables ... based only on an assessment of the aesthetic impacts [urban setting]. Impacts of overhead power lines on wildlife and human health would likely make burial of power lines even more attractive."*
<https://www.tandfonline.com/doi/abs/10.1080/01426390802045921>

circuit and are suspended from one or two sets of towers.



Figure 8 – HumeLink (TransGrid diagram, with distances and Snowy 2.0 Alternatives added)

Snowy Hydro would not be the beneficiary of a reduction in the cost of HumeLink if the Australian Energy Regulator (AER) agrees with Snowy Hydro’s view that HumeLink should be paid for entirely by electricity consumers⁴⁶. However, many energy experts contend that Snowy Hydro should be required to contribute to HumeLink due to the extra 120 km of deviated lines that are needed to connect Snowy 2.0 to the main grid. Also the transmission capacity needed is substantial, as Snowy 2.0 will be the largest load (for pumping) to ever be added to the National Energy Market (NEM) and the largest generator for a quarter of a century.

Irrespective of how the AER adjudicates, either consumers or taxpayers will benefit from constructing less HumeLink transmission lines. This public benefit is therefore a significant offset to the additional cost of Alternatives C/D/E(2). When added to the avoidance of the Project cost, the total saving is around \$265 - \$325 million.

6.2.1.3 Improved reliability from reduced exposure to lightning and bushfires

The 40 km of overhead lines not needed are in BSF, a high-risk area for lightning strikes and bushfires. ‘Removing’ those lines would improve the reliability of both HumeLink and Snowy 2.0’s connection to the grid.

Avoiding the construction of new transmission lines in fire prone areas is consistent with the Snowy

⁴⁶ “We’ve said this 150,000 times. Transmission is for the common good. Everyone benefits from it. We use it about 10 per cent of the time and the other 90 per cent it’s used by everybody else, particularly on the renewable side.” Mr Paul Broad, Snowy Hydro CEO [Behind Snowy’s Battery Bet, Australian Business Review, 14 Sep 2019](#)

Hydro's CEO⁴⁷ assertion that new interstate interconnectors should only be constructed in non-forested areas west of the Great Dividing Range.

6.2.1.4 Potential network and financial benefits for Snowy Hydro

Linking Lower Tumut SS to HumeLink and the main grid would increase the transmission capacity from Lower Tumut SS, both to the north and the west. This may alleviate occasional transmission constraints to Sydney experienced by the existing Snowy generators⁴⁸, which have been claimed to cost \$millions in lost revenue.

TransGrid's proposal to deviate HumeLink through Maragle provides no additional transmission capacity for the existing Snowy Scheme, except possibly partly through the tie-in to Line 64.

6.2.1.5 Potential to further reduce HumeLink and address local opposition

There is significant community opposition to the HumeLink connections to Maragle, particularly in the Tumut/Batlow/Adelong region. The issue has been raised in State Parliament and spurred TransGrid to engage a specialist negotiator. Terminating the two lines at Lower Tumut SS may provide an opportunity to re-route the lines through less contentious areas.

It may be possible to eliminate one of the HumeLink connections altogether. A double-circuit 500 kV line between Lower Tumut SS and Wagga would have ample capacity (6,000 MVA) to transmit Snowy 2.0's full output/load. This new line would be in addition to the three existing 330 kV lines from Lower Tumut SS to Wagga, Yass, and Canberra, providing further transmission and back-up capacity. Cutting back to one 500 kV connection would address much of the opposition to the HumeLink proposal and reduce the length of the HumeLink deviations to connect Snowy 2.0 by a further 85 km.

A related possibility could be to use the existing 330 kV overhead transmission line and/or easement between Lower Tumut SS and Wagga (Line 051). This line could either be replaced by the double-circuit 500 kV HumeLink connection between Lower Tumut SS and Wagga or the new HumeLink line could be built beside it by widening the easement. Replacing the line seems the preferable option as then the only environmental impact of HumeLink would be taller towers, though possibly a few less towers, in place of an existing 330 kV line, but resulting in a three-fold increase in transmission capacity.

6.2.1.6 Environmental benefits

Finally, these Alternatives avoid the clearing of about 400 hectares (4 square kilometres) of BSF for the HumeLink lines, Maragle Substation, and the lines from Lobs Hole. Both the construction damage and ongoing easement and infrastructure maintenance impacts would be avoided.

⁴⁷ "The head of the nation's giant Snowy Hydro power scheme has warned rising bushfire risk along the east coast has spurred the need for critical electricity transmission lines to be built connecting Victoria and NSW, but through the west of the states in non-forested areas that are less prone to fires". The Australian Business Review, "Fire sparks Snowy Hydro call to link NSW, Victoria power", 9 January 2020 <https://www.theaustralian.com.au/business/fire-sparks-call-to-link-nsw-victoria-power/news-story/4543f7131e74e960691182020c73c609>

⁴⁸ "No; the transmission today is not enough for existing [Snowy output], so it obviously won't be enough for 2.0." Mr Broad, Snowy Hydro CEO, Senate Environment and Communications Legislation Committee, 21 October 2019

Alternative D could provide drainage from the Station. The cable tunnel from the Station to Lower Tumut SS could be designed to also act as a gravity drain for seepage water that will accumulate at the base of the Station, saving pumping equipment and piping. It would be particularly valuable in the event of a Station flooding incident.

6.3 Context

The latest Snowy Hydro forecast for the 'construction cost' of Snowy 2.0 is around \$5 billion (Snowy Hydro's initial forecast for the project was \$2 billion). Many independent experts consider the latest forecast to also be optimistic, with a more realistic total project cost of around \$10 billion, when all components and related grid augmentations are included.

This massive public expenditure is meaningless without the infrastructure to transmit power through and beyond KNP. The overhead transmission line Project option represents just over 1% of the total cost of Snowy 2.0.

The Project must be assessed in relation to the financial cost and environmental impacts of the Snowy 2.0 project in its entirety. In that context, NPA considers that a low impact underground transmission option would justify expenditures many times higher than the \$125 million for overhead lines.

The Snowy 2.0 project is already costing considerably more because of its location within KNP than if it were not in a National Park. The environmental conditions imposed, such as minimising construction footprints (e.g. using more expensive compact equipment for substations), avoiding sensitive areas, offset payments (\$100 million), waste management, monitoring etc have added many hundreds of \$millions to the cost. Insisting on the transmission connection being underground should be another 'standard' condition for developments within National Parks.

Simply, if a developer wishes to build an electricity transmission circuit or pipeline, road or any other infrastructure through a National Park then such a proposal should normally be rejected out of hand and only considered in exceptional cases, and then only if it were demonstrated that the installation resulted in the minimal possible environmental damage. Snowy Hydro/ TransGrid should not receive special treatment compared to any other developer or NEM participant.

It is notable that \$285 million has recently been allocated for a single 330 kV underground circuit in Sydney (Section 4.1.1). A similar willingness to invest in a low impact underground option to ensure that further damage is not inflicted on KNP is entirely appropriate.

Undergrounding transmission lines along portions of the route in areas of outstanding natural beauty is common practice (see the UK and Denmark examples in Section 4.1.2). The Project should be considered within the wider context of HumeLink, and the entire length for the Snowy 2.0 connection to the main grid backbone.

For Alternative A, the connection from Lobs Hole to Maragle is just nine km out of the total 220 km of lines to Wagga and the Wagga-Bannaby corridor (see Figure 8). That is, only 4% of the total length of circuits needed to link Snowy 2.0 to the main grid backbone would be undergrounded, leaving the remaining 96% as overhead lines. For Alternatives C/D/E(2) the percentage that would be undergrounded is higher but still relatively minor, at 12%.

Surely such a small percentage for the connection of Snowy 2.0 to the main grid being underground is reasonable - Kosciuszko National Park is unquestionably an area of outstanding natural beauty.

7 Snowy 2.0 staging

Consideration of the Transmission Connection Project EIS, and its alternatives, should have occurred concurrently with the Main Works EIS, enabling the impacts of the two major components of Snowy 2.0 to be assessed together⁴⁹. In fact, well before the release of the Main Works EIS, Snowy Hydro executives advised that a concurrent assessment of both components was intended.

However, there will be at least a 15-month gap between the release of the Main Works EIS in September 2019 and the EIS for the Transmission Connection Project. NPA is not aware of any technical reason for this extended staging and delay in the exhibition of the Transmission Project EIS.

Approval of the Main Works in June 2020 effectively guarantees that the Connection Project will also be approved. However, this presumption of approval must not mean automatic authorisation of whatever is proposed, especially the cheapest and most environmentally damaging option.

TransGrid is clearly assuming approval, as Project financing has been arranged **Error! Bookmark not defined.** (November 2020) and a construction contract awarded **Error! Bookmark not defined.** (December 2020). (It is noted that TransGrid has followed a similar presumptive path as did Snowy Hydro, which awarded the \$5.1 billion Main Works contract in April 2019, six months before the EIS was exhibited and 15 months before it was approved).

Revising the design to an underground option will take some time, delaying the start of construction, but this should not hinder Snowy 2.0's commissioning.

The latest Snowy 2.0 forecast is *"to start up in the June half of 2025, ahead of an 18-month ramp-up"*, resulting in full commissioning of the Station in 2027 and 'landscape rehabilitation' thereafter. When announced in March 2017, Snowy 2.0 was to be completed in 4 years after the Feasibility Study – i.e. by December 2021. Many industry experts consider this latest Snowy 2.0 forecast also to be overly optimistic.

It is notable that AEMO acknowledged the possibility of construction delays and assessed that Snowy 2.0 is not needed until at least 2029-30⁵⁰. Independent experts have further examined the AEMO forecast and determined that the existing 1,800 MW Tumut 3 pumped hydro station can accommodate the demand for Snowy Hydro storage until 2033⁵¹.

Nevertheless, if Snowy 2.0's latest construction forecast is achieved and the transmission connection

⁴⁹ "Kosciuszko: A Great National Park", Slattery & Worboys, May 2020. *"The impacts of the transmission lines will be huge but are not considered in the [Main Works] EIS. This fractured assessment process invites 'death by a thousand cuts' and obscures the true scale and impact of the project on Kosciuszko National Park."*

⁵⁰ The 2020 AEMO Integrated System Plan (ISP) included a sensitivity analysis of a four-year delay in the commissioning of Snowy 2.0 till 2029-30, concluding that *"the power system is relatively resilient to a delay, with minimal impact to the overall market benefits of the network development, as shown in Table 16 [Appendix 2]"*.

⁵¹ [AEMO's Integrated System Plan: Does it leave Snowy 2.0 high and dry?](#) Victoria Energy Policy Centre, 10 August 2020

needs to be completed by the start of 2025 for commissioning of the first unit, four years is ample time to design and construct underground cable circuits over such a short distance.

8 Conclusion

Kosciuszko National Park is a landscape of exceptional natural and cultural significance, protected for future generations.

Infrastructure development should not be permitted within KNP, but if genuinely unavoidable, it must be designed with the overriding objective of minimising environmental damage.

New overhead transmission lines have no place in any National Park, especially when there are practical alternatives with far less impacts.

The Snowy 2.0 Transmission Project EIS should adopt an underground connection.



Figure 9 – Photomontage - Lobs Hole (TransGrid)

Going underground in Kosciuszko National Park with the transmission connection for Snowy 2.0

Addendum A:

Further assessment of connecting Snowy 2.0 to the grid via
Lower Tumut Switching Station - Alternative D

4 February 2021



Figure 1 - Photomontage of proposed overhead transmission lines at Lobs Hole, Kosciuszko National Park (TransGrid)

Connecting Snowy 2.0 to the grid via Lower Tumut Switching Station Alternative D

1 Introduction

The Snowy 2.0 Transmission Connection Project (the 'Project') is to be built, owned, and maintained by TransGrid, at Snowy Hydro's behest and expense. It is an integral component of the pumped hydro development, comprising that section of Snowy 2.0's electrical connection to the grid that traverses Kosciuszko National Park (KNP). An Environmental Impact Statement (EIS) is expected in mid-February and is understood to propose overhead transmission lines.

On 18 January 2021 an [Open Letter and Background Paper](#) to NSW Planning Minister Stokes and Energy & Environment Minister Kean, signed by two dozen environmental organisations and fifty experts, called for alternatives to overhead lines to be comprehensively analysed and for an underground solution to be adopted.

The Background Paper identified five example underground alternatives, as depicted in Figure 2 (Appendix A provides a brief description).

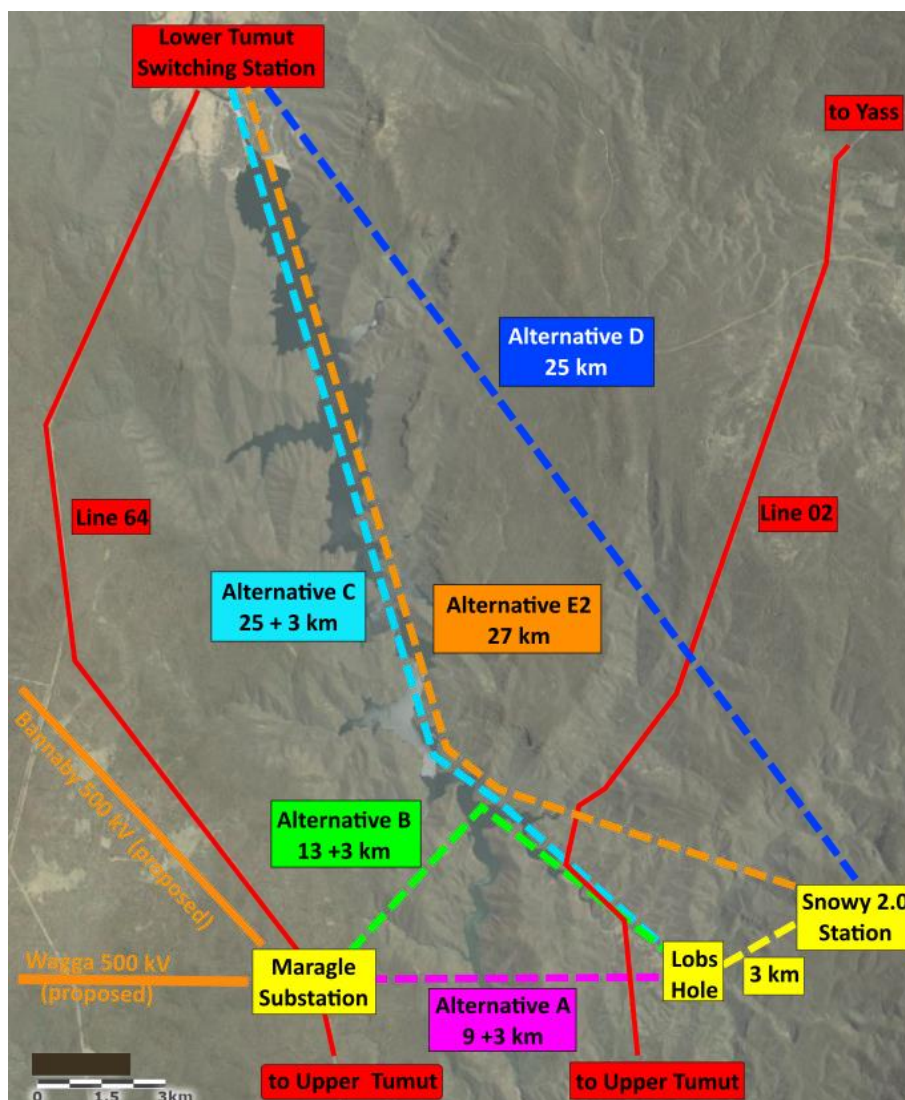


Figure 2 – Alternative Routes for Underground Cables from Snowy 2.0 to Maragle or LTSS

- Alternatives A & B connect Snowy 2.0 to a proposed substation at Maragle, just outside KNP, 'replacing' the overhead lines. From Maragle, 500 kV lines to Wagga and to Bannaby complete the connection of Snowy 2.0 to the grid (as part of HumeLink).
- Alternatives C, D & E2 connect Snowy 2.0 to the existing 330 kV Lower Tumut Switching Station (LTSS) instead, via different routes and underground techniques. From LTSS, 500 kV lines to Wagga (and possibly Bannaby) connect Snowy 2.0 to the 500 kV grid.

This Addendum further examines Alternative D, that is the installation of 330 kV cables in a tunnel from the Snowy 2.0 underground Station ('Station') to LTSS. Most of the commentary also applies to the other two LTSS alternatives (C & E2).

The advantages of Alternative D extend beyond the Project, which only covers the first nine kilometres of Snowy 2.0's connection to the main grid, totalling 382 km. Connecting to LTSS, rather than Maragle, provides opportunities to shorten, rationalise and improve the utilisation of the HumeLink legs of Snowy 2.0's connection to the 500 kV grid. It improves the capacity and reliability of transmission to/from LTSS. Environmental damage is substantially reduced in KNP, Bago State Forest (BSF) and across hundreds of kilometres of proposed 500 kV transmission lines. Adverse impacts on communities, including Tumut, Adelong and Batlow, are significantly mitigated.

Connecting to LTSS and having the opportunity to re-route the \$2 billion HumeLink proposal would deliver financial, operational, and environmental benefits - for the National Electricity Market (NEM), the Australian Energy Market Operator (AEMO), Snowy Hydro, TransGrid, electricity consumers, the environment (KNP and beyond), and landholders and communities along the routes of the proposed lines.

NPA and its expert advisors were taken aback by TransGrid's response to the Open Letter⁵²:
"Tunnelling, trenching and directional drilling were considered but ruled out following consideration of environmental impacts, safety and future disturbance for maintenance in mind. TransGrid always takes safety and environmental impact into consideration as a priority when planning its projects".

Paradoxically, the stated 'reasons' for preferring overhead lines are three of the primary advantages of underground cables. Compared with overhead lines, undergrounding has less environmental impacts, is safer, and incurs little or no future disturbance.

This Addendum has been quickly prepared in light of TransGrid's response and sustained support for overhead lines through KNP. Its purpose is to encourage a broader exploration of the various means of connecting Snowy 2.0 to the main grid by highlighting the potential advantages of one alternative. The Addendum is not comprehensive and some of its assumptions and statements may not be entirely accurate. Many of the issues raised are only on a superficial level. A detailed assessment, including load flow and stability studies, is necessary to determine the full implications.

A comprehensive *"analysis of any feasible alternative"*, covering technical, financial, environmental, and social issues, is essential for the integrity of the EIS process⁵³ and to ensure the best underground alternative is adopted for the benefit of all.

⁵² ["Snowy project to cut 'massive swath' through national park, NPA says"](#), Sydney Morning Herald 20 January 2021

⁵³ An *"analysis of any feasible alternative"* in an EIS is a requirement of the *Environmental Planning and Assessment Regulation 2000* (Clause 7(1)(c) of Schedule 2)

2 Current TransGrid Proposal

2.1 The Project - overhead line connection to Maragle

Preliminary information from TransGrid indicates that the EIS for the Transmission Connection Project will propose two double-circuit 330 kV overhead transmission lines traversing eight km of KNP and one km of BSF. The lines will connect the Lobs Hole Cable Yard (near the entrance to the Snowy 2.0 Station) to a new Substation (Maragle, in BSF).

At the two 'ends' of the Project are connections:

- from Lobs Hole Cable Yard to the Snowy 2.0 Station, via six 330 kV cable sets installed in a multi-purpose tunnel. The cable sets (18 individual cables) will each be three km long.
- Alternative D circumvents the installation of these cables.
- from the new Maragle 500/330 kV Substation to both Wagga (110 km) and Bannaby (260 km), via 500 kV overhead lines as part of the HumeLink project (see Figure 3).
- Alternative D 'shifts' Maragle Substation to LTSS and rationalises the HumeLink connections.



Figure 3 – HumeLink (TransGrid diagram, with distances and Alternative D1 added)

The Project cost is expected to be approximately \$125 million for the overhead lines, Cable Yard, and operation & maintenance ('O&M') for 30 years. Underground alternatives avoid this expenditure, together with some HumeLink costs, but incur other costs.

2.2 Proposed HumeLink deviation to Maragle Substation

The proposed HumeLink project aims to reinforce the southern NSW network by connecting Wagga Wagga ('Wagga') and Bannaby with two 500 kV circuits. TransGrid's preliminary cost estimate is \$1.35 billion (Option 3C in the PADR⁵⁴), though this seems low. Recent tender prices suggest the

⁵⁴ "Reinforcing the NSW Southern Shared Network to increase transfer capacity to demand centres (HumeLink), Project Assessment Draft Report, TransGrid 10 January 2020 <https://www.transgrid.com.au/what-we-do/projects/current->

cost of 500 kV lines is around \$3.5 million/km, indicating a total HumeLink cost of well over \$2 billion, after including new substations at Wagga and Maragle, and extensions to Bannaby Substation.

One HumeLink circuit goes direct between Wagga and Bannaby (250 km) and the second takes a substantial 'dog-leg' deviation via Maragle Substation (370 km) to enable Snowy 2.0 to be connected to the 500 kV grid backbone. In Figure 3 the HumeLink circuits are depicted by the ochre-coloured lines showing the land corridors within which TransGrid proposes to construct the lines.

The dog-leg deviation consists of two 500 kV lines connecting Maragle Substation, and thence Snowy 2.0, to the 500 kV grid:

Leg a Maragle to Wagga, about 110 km long

Leg b Maragle to the Wagga-Bannaby corridor just east of Gundagai, also about 110 km, and thence to Bannaby (a further 150 km, for a total distance of 260 km)

Were it not for Snowy 2.0, both 500 kV circuits would go direct between Wagga and Bannaby (250 km). Deviating to Snowy 2.0 adds a further 120 km [2x110 – 100] to HumeLink (24% extra length).

3 Alternative D proposal - underground connection to LTSS and re-routing HumeLink

3.1 Alternative D

Alternative D in the Background Paper entails:

- boring a tunnel from LTSS to the Station, approximately 25 km in length and around four metres in diameter. Boring from the LTSS end enables the excavated spoil to be extracted at Lower Tumut and disposed of outside KNP
- installing six sets of 330 kV, 450 MVA cables (total capacity of 2,700 MVA) - this is the same specification for the proposed cables from the Station to Lobs Hole Cable Yard
- terminating the two proposed HumeLink legs to Snowy 2.0 at LTSS, rather than at Maragle, thereby shortening the deviation
- further rationalising HumeLink for Alternatives D2 & D3 (below)
- potential use of the tunnel for drainage, communications, access to Snowy 2.0 from LTSS (Talbingo), and an emergency exit
- additional works at LTSS may be necessary to address higher fault levels and load sharing between the 330 kV and 500 kV networks

'Moving' Maragle Substation 20 km north to LTSS opens up a number of route options for the two deviated legs. Three Alternatives (D1, D2 & D3) are examined, but there are many others.

3.2 Alternative D1 (Figure 3)

Retain the routes of the proposed HumeLink deviation legs as far south as LTSS, where they are redirected east and terminated at LTSS.

The length of the two legs is reduced by about 20 km, to 90 km each, thereby shortening the HumeLink deviation by 40 km (20%).

[projects/Reinforcing%20the%20NSW%20Southern%20Shared%20Network/Documents/TransGrid_HumeLink%20PADR.pdf](https://www.transgrid.com.au/projects/Reinforcing%20the%20NSW%20Southern%20Shared%20Network/Documents/TransGrid_HumeLink%20PADR.pdf)

3.3 Alternative D2 (Figure 4)

Instead of two single-circuit 500 kV lines, construct a double-circuit line from LTSS beside the existing 330 kV Line 051 for the first 20 km. At each of the crossings with the proposed legs to Bannaby and to Wagga, branch into those legs and then continue for the remainder of those routes.

This Alternative branches into the two legs about 20 km north of LTSS, ‘moving’ about 40 km of new lines in the Batlow/Adelong/Tumut area to the existing Line 051 corridor. As with D1, the length of the two deviated legs is reduced by about 40 km, but with the added advantage of replacing 40 km of single-circuit lines with 20 km of double-circuit, and removing all lines through BSF, totalling about 70 route-km.

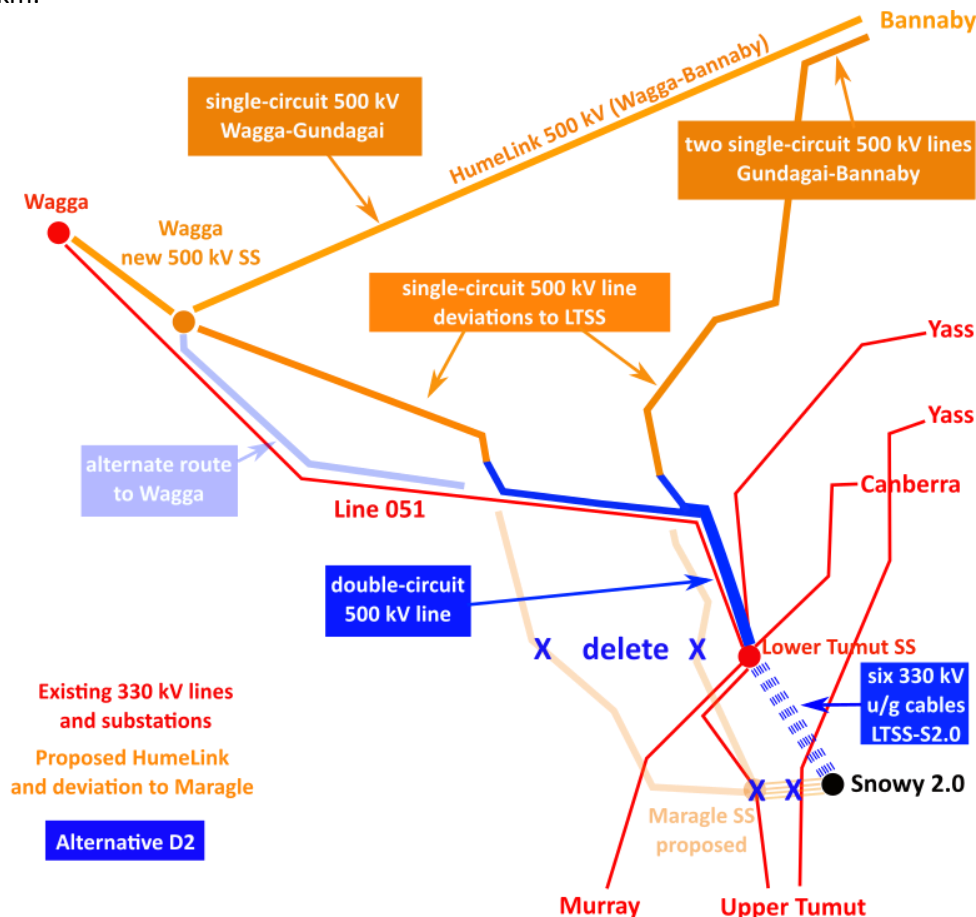


Figure 4 – HumeLink deviation to LTSS Alternative D2

A sub-Alternative is to continue the second 500 kV line all the way to Wagga beside Line 051, avoiding the need for a new easement for the remainder of Leg a.

3.4 Alternative D3 (Figure 5)

(D3i) Construct two 500 kV HumeLink lines directly between Wagga and Bannaby (250 km), with no deviations (as would have been the situation without Snowy 2.0 being built). Connect Snowy 2.0 by one or two legs from Wagga to LTSS (90 km) beside Line 051. The total length of 500 kV lines is 590 km (one leg from Wagga to LTSS) or 680 km (two legs).

This Alternative is analogous to TransGrid’s Option 2C in its PADR⁵⁴, which was ranked ‘equal-first’ with the chosen Option 3C (Figure 3), at a similar cost (\$1.38 billion versus \$1.35 billion) and net benefit.

Alternative D3 has the least environmental and community impact of all three alternatives, by deleting both deviated legs entirely (220 km). No new easements are required, other than a widening of the existing easement of Line 051 to accommodate one or two 500 kV lines and a widening of the proposed easement between Wagga and Gundagai to accommodate a second 500 kV line.

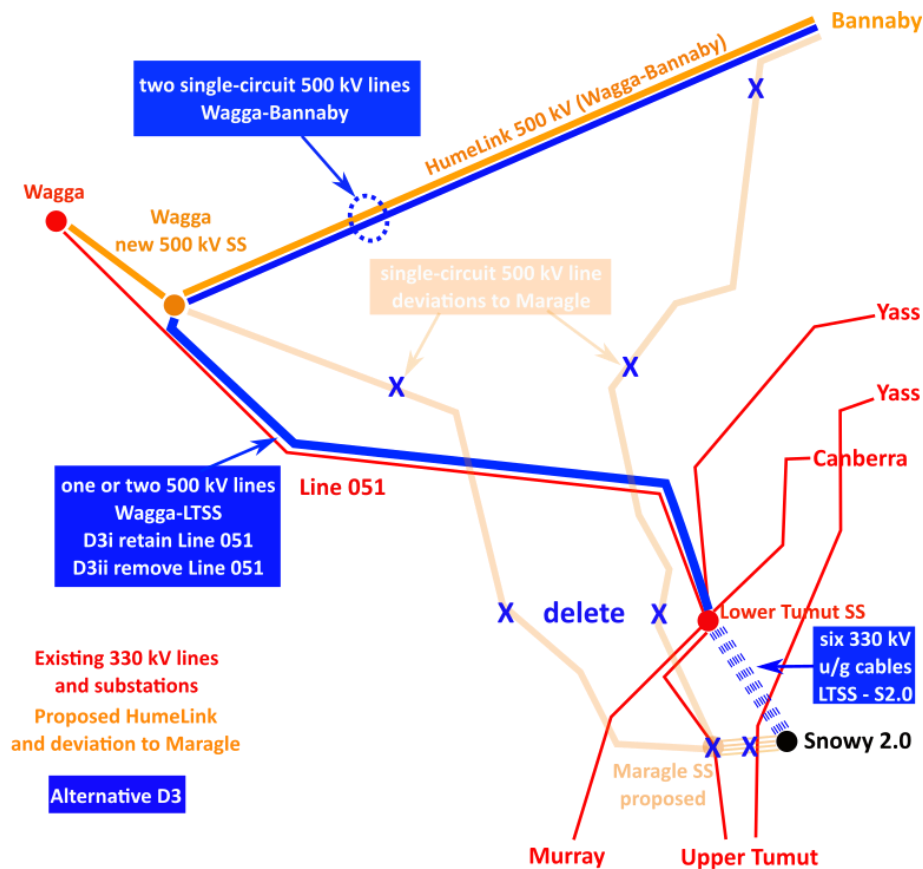


Figure 5 – HumeLink deviation to LTSS Alternative D3

(D3ii) A sub-Alternative would be to replace Line 051. If replaced by a single or a double-circuit 500 kV line, the additional environmental impact is limited to taller towers, with no new easements required for the deviation. Two single-circuit lines would require a wider easement and two sets of towers. This sub-Alternative would deliver an increase in transmission capacity of 2,000 – 5,000 MVA.

3.5 One or two legs LTSS-Wagga

A single 500 kV line from LTSS to Wagga has sufficient thermal capacity (3,000 MVA) to transmit Snowy 2.0's maximum generation/pumping load (2,000 MW). (It is noted that the stability rating would be less than the thermal rating).

A second line is required for the Maragle proposal to provide for redundancy and system stability, but may not be necessary for Alternative D.

One 500 kV line would increase the combined thermal capacity of LTSS from 5,000 MVA to 8,000 MVA, which is higher than the generating capacity of the existing Snowy Scheme plus Snowy 2.0 (6,000 MW). Though LTSS would not need to accommodate that full output, as a significant portion

‘goes south’ via the Murray Switching Station. Even if the 500 kV line were out of service, LTSS should be able to transmit the bulk of the Snowy Scheme’s output, including Snowy 2.0, in most circumstances.

These suppositions would need to be tested by power system analysis and an assessment of load sharing between the 500 kV and 330 kV networks.

It would be extremely rare for the Snowy Scheme to be operating at full output. Pumped hydro will make up 3,800 MW of the 6,000 MW Snowy maximum output and typically operates for a few hours a day, occasionally. The chances of the 500 kV line being out of service at the very same time that the Snowy Scheme was generating 6,000 MW is exceedingly small.

Is a second 500 kV line from LTSS to Wagga, costing around \$300 million, justifiable? If the Wagga-LTSS connection is classified by the Australian Energy Regulator (AER) as a Connection Asset, as contended above, then the decision on one or two lines would be for Snowy Hydro to make, as it would be paying for it.

3.6 Consideration of Alternatives

Consideration of these Alternatives and other permutations needs to take into account many factors, including network analysis, costs and savings, redundancy, topographies, land use, impacts on local landholders and communities, bushfire and lightning vulnerability, construction and maintenance, and of course environmental impacts.

This Addendum offers only preliminary comments on their respective merits though, as contended in the Background Paper, the reduction of environmental impacts on KNP alone is sufficient justification to choose an underground alternative.

3.7 Additional works at LTSS

Alternative D involves ‘moving’ the proposed Maragle 330/500 kV Substation to Lower Tumut. There would appear to be sufficient area adjacent to the existing Switching Station for the new Substation and connection of six 330 kV pump/generator cable sets and one or two 500 kV lines (Figure 6).

It may be necessary to install shunt reactors at the new Substation to compensate for the cable connections, but that should not be an issue.

Other considerations include whether the existing switchgear and equipment can handle the higher fault level resulting from the additional circuits and the load sharing between the 500 kV and 330 kV networks. It is noted that the proposed HumeLink connection to Maragle requires equipment upgrades at both LTSS and Upper Tumut SS. If the existing equipment at LTSS is not sufficiently rated there are several options.

At one extreme it may be economical to immediately upgrade the existing LTSS switchgear to enable integration with the new Substation and realise the network benefits outlined below. Or the installation of fault limiting devices between the 330 kV busbars may resolve any issues.

At the other extreme the new substation could be electrically isolated from the existing Switching Station for the time being and simply connect to the 500 kV grid at Wagga and Bannaby, with the same (serial) connection arrangement proposed for Maragle. Over time the existing Switching Station could be integrated with the new Substation as equipment came due for replacement. It is

noted the existing LTSS is 50 years old, though some equipment has been replaced recently. This approach would deliver some immediate benefits and realise the remainder over time.

4 Benefits of Alternative D

Contrary to TransGrid’s rebuttal of the Open Letter, undergrounding, whether by tunnelling, trenching or directional drilling, inflicts less environmental impact, is safer, and incurs little or no future disturbance, compared to overhead lines.

As stated in the Letter *“Overhead lines cause environmental impacts that are totally incompatible with the national and international significance of Kosciuszko National Park”*. Undergrounding in important natural areas is standard practice throughout Australia and overseas (see Section 4.1 of the Background Paper). The Background Paper also highlighted the inherent benefits of underground cables compared to overhead lines (see Appendix B).

It is also relevant to note that almost fifty kilometres of tunnels are being bored for Snowy 2.0, with just under half for purposes other than water transfer.

Alternative D is the shortest of the underground alternatives to LTSS (25 km), but longer than the routes to Maragle (12 - 17 km). Offsetting the extra 8 – 13 km of cables to connect to LTSS rather than Maragle are several advantages, outlined below.

4.1 Augmenting an existing substation rather than building a ‘greenfield’ substation

Alternative D circumvents the need for Maragle Substation by augmenting the existing LTSS to a 500/330 kV Substation. LTSS is next to Tumut 3 pumped hydro station and Talbingo township (Figure 6). Talbingo is a base for Snowy Hydro and TransGrid personnel and is readily accessible from the Snowy Mountains Highway.

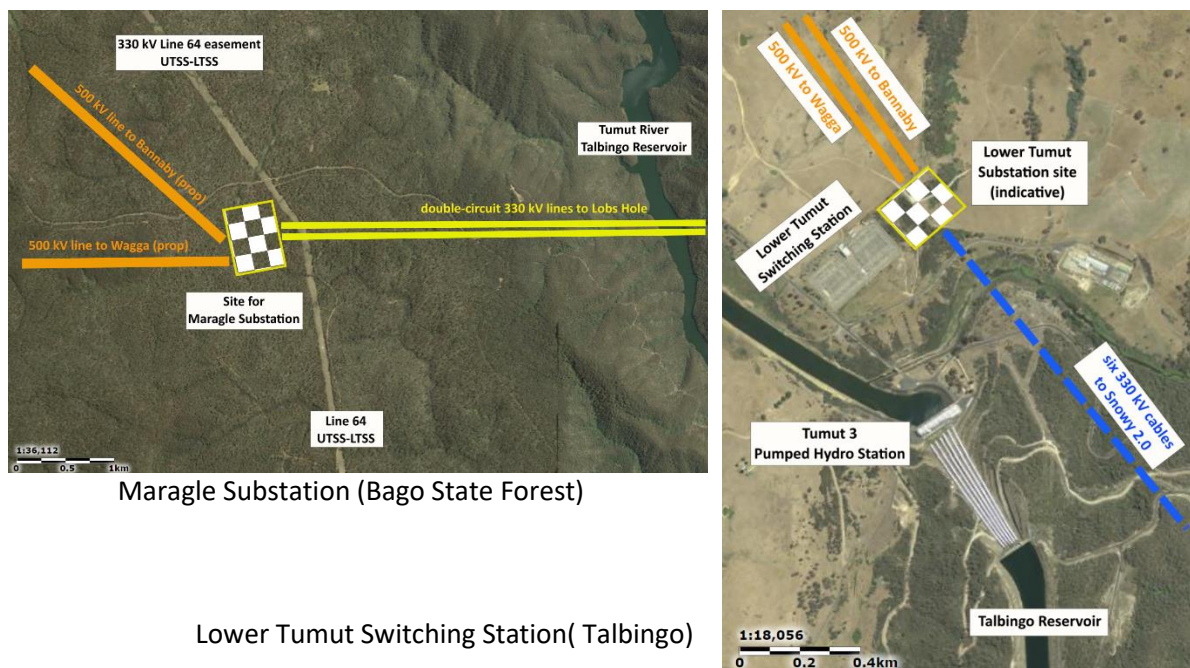


Figure 6 – Maragle and LTSS Sites for 500/330 kV Substation

Augmentation of existing substation infrastructure at a more accessible, well serviced location should result in savings in construction and ongoing maintenance, compared to a ‘greenfield site’ in

the middle of a State Forest. There should be ongoing efficiency savings for TransGrid and hence a lower 'pass-through' charge for consumers.

4.2 Network benefits

Diverting HumeLink to Maragle provides no benefit to the NEM, other than an intermediate point for connecting Snowy 2.0 to the 500 kV grid and a link to the existing 330 kV Line 64 between Upper Tumut Switching Station and LTSS. In fact, the dog-leg deviation introduces drawbacks for the NEM by increasing the length of one of the two circuits between Wagga and Bannaby, reducing the overall capacity of the Wagga-Bannaby link, incurring additional transmission losses and increasing the susceptibility to outages from lightning and bushfires.

On the other hand, connecting Snowy 2.0 and HumeLink to LTSS provides significant additional benefits for the NEM, AEMO, Snowy 2.0, the existing Snowy Scheme and TransGrid.

Linking LTSS to HumeLink would increase the transmission capacity to/from LTSS, to the north, west and south. LTSS would become a more substantial electrical hub through a connection to the 500 kV network. The addition of one or two 500 kV connections (thermal capacity 3,000 - 6,000 MVA) adds to the existing five 330 kV lines (capacity 5,000 MVA) to Canberra, Yass, Wagga, Murray, and Upper Tumut (see Figures 4 and 5).

LTSS's flexibility and reliability would be improved through a doubling of its transmission capacity (if two 500 kV connections) and an increase from five to seven connections.

Connection of Snowy 2.0 to both the 330 kV and 500 kV grids through LTSS would be shorter than through Maragle:

- LTSS: Snowy 2.0's connection to the existing 330 kV grid would be 25 km. Connection to the to-be extended 500 kV grid is a further 90 km to Wagga (one or two lines – see Section 3.5)
- Maragle: Snowy 2.0's connections to the 500 kV grid total 382 km - six cables for 3 km, plus four 330 kV lines for 9 km, and then 110 km to Wagga and 260 km to Bannaby. Connection to the 330 kV main grid is the same distance (connection to Line 64 at Maragle does not constitute a connection to the 330 kV grid, as it is just a single, often heavily loaded, line)

LTSS provides Snowy 2.0 with a more reliable and redundant connection:

- LTSS: underground cables are more reliable than overhead lines and not subject to interruptions from weather events and bushfires.
- Also, if one of the six cables is out of service the Station's capacity is only reduced by 17% (to 1,670 MW). From LTSS there are six/seven transmission lines with a total capacity of 8,000 - 11,000 MVA, providing substantial redundancy.
- Maragle: connection to the grid by four, then two overhead lines for 379 km, through lightning and bushfire prone areas, would be considerably less reliable.
- Also, two circuits provide far less redundancy. When one of the 500 kV lines is out of service, Snowy 2.0's pumping/ generation would need to be scaled back, possibly to 700 MW or lower when pumping, to avoid system stability issues if the second line tripped.

Finally, augmenting LTSS should alleviate occasional transmission constraints to Sydney (and to a lesser extent, Melbourne) experienced by the existing Snowy generators. Snowy Hydro has referred to these constraints many times, claiming they cost \$millions in lost revenue and sometimes result in unnecessary load shedding.

Deviating HumeLink through Maragle provides no relief for existing transmission constraints, except possibly marginally through the tie-in to Line 64.

4.3 A shorter HumeLink, with significant financial savings

4.3.1 Alternative D1

Simply ‘moving’ the termination point of the two deviated legs by 20 km north of Maragle shortens their combined length by approximately 40 km, saving around \$140 million.

As discussed in the Background Paper, the AER has yet to decide whether Snowy Hydro will be required to contribute to the cost of HumeLink. Snowy Hydro contends it need not, whilst many experts contend it should, especially due to the two extra 110 km legs needed to connect Snowy 2.0 to the grid. Irrespective of how the AER adjudicates, either consumers or taxpayers (as the ‘owners’ of Snowy Hydro) will benefit from shorter HumeLink legs to connect Snowy 2.0.

When this public benefit is added to the avoidance of both the Project and the cables from the Station to Lobs Hole, the total saving is over \$300 million (available to offset the additional works for Alternative D).

4.3.2 Alternative D2

Alternative D2 reduces the length of new easements by a further 20 km (net) in the Batlow/Tumut area.

4.3.3 Alternative D3

Alternative D3 adds a second 500 kV line directly between Wagga and Bannaby (+250 km). Also, it replaces both deviations to Maragle (220 km) by a 500 kV line, or two single-circuits or a double-circuit, from LTSS to Wagga (90 km) beside Line 051. Or Line 051 could be replaced altogether.

Conceptually, Alternative D3 is the simplest and would deliver cost savings additional to the \$300 million if a single line from LTSS to Wagga was sufficient.

It also simplifies the decision on apportioning HumeLink’s costs, with consumers paying for the two Wagga-Bannaby lines (Shared Asset) and Snowy Hydro paying for the Wagga-LTSS line(s) and LTSS Substation (Connection Asset).

Figure 7 illustrates the very much reduced easements required for Alternative D3 compared to the current HumeLink proposal.

4.4 Snowy 2.0 commissioning not contingent on HumeLink

Snowy 2.0 is now forecast to start commissioning in 2025 and continue over the following 18 months. As outlined in Section 7 of the Background Paper, this latest forecast represents a further delay and is also viewed by experts to be overly optimistic.

Nevertheless, if Snowy 2.0’s latest construction forecast is achieved, the transmission connection needs to be completed by early 2025.

Whilst this provides ample time to design and construct the underground cable connections to LTSS (or Maragle), there are doubts that the HumeLink legs from Wagga and Bannaby would also be completed. HumeLink is a massive project with considerable hurdles and exposure to delays, including finalising the routes, obtaining the necessary regulatory approvals, and then constructing

250 km of 500 kV line direct between Wagga and Bannaby and another 370 km via Maragle. Even if HumeLink were staged to place the Maragle legs as first priority the timing is tight.

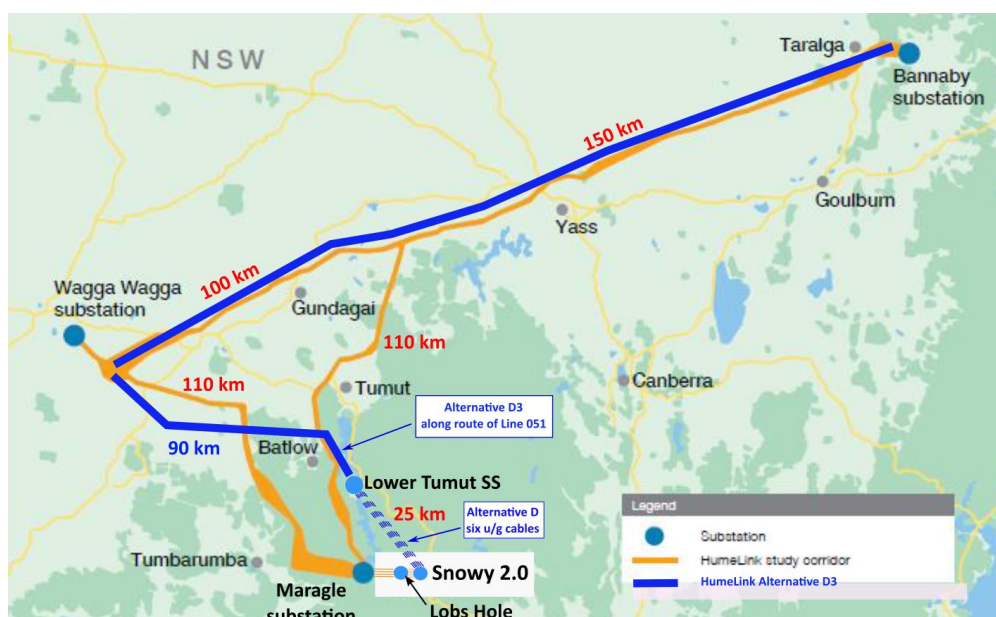


Figure 7 – HumeLink Current Proposal (ochre) compared with Alternative D3 (dark blue)

If the HumeLink legs to Maragle are delayed till after 2025, then Snowy 2.0 units could be progressively commissioned by the tie-in to Line 64. Though, its output would be restricted to well below full capacity. However, if Snowy 2.0 were connected to LTSS Snowy 2.0's commissioning would not be reliant on the HumeLink legs being constructed, and it could attain full output, though probably at the expense of Tumut 3.

4.5 Lower transmission losses

Alternative D should result in lower transmission heating losses from:

- lower line loadings at LTSS and hence lower losses from adding one or two 500 kV connections (losses increase by the square of the current)
- shortening and rationalising the HumeLink deviation legs
- constructing both HumeLink connections by the most direct route along the Wagga-Bannaby “highway”, maximising the transmission capacity and avoiding the extra transmission losses from the deviated legs

Such lower losses would result in considerable savings to electricity consumers over the 100-year lifetime of the proposed infrastructure.

4.6 Improved reliability from reduced exposure to lightning and bushfires

Bago State Forest is a high-risk area for lightning strikes and bushfires. Alternative D1 results in 40 km of 500 kV overhead lines not needed in BSF. Alternatives D2 and D3 remove all lines from BSF, totalling about 70 route-km.

‘Removing’ those lines from BSF would significantly improve the reliability of both HumeLink and Snowy 2.0's connection to the 500 kV grid.

4.7 Reduces impacts on local communities and landholders

There is significant community opposition to the HumeLink legs to Maragle, particularly in the Tumut/Batlow/Adelong region. The issue has been raised in State Parliament and spurred TransGrid to engage a specialist negotiator.

500 kV lines are the tallest, bulkiest, and most imposing of all transmission lines in Australia, completely dominating the landscape for tens of kilometres.

There is little that can be done to address community concern if the lines must be built. The only changes would be minor alterations to line routes and tower placements, and cosmetic extras like tower painting. 'Community consultation' becomes a divisive process as landholders attempt to move the lines to someone else's property – an intractable and traumatic situation, especially for those whose lives are being so dramatically affected.

Terminating the two HumeLink legs at LTSS will shorten the lines and provide opportunities to re-route through less contentious areas.

Alternatives D2 and D3 offer significantly less impacts on landholders and local communities. Alternative D3 results in no new easements or lines, except for either a widened easement and 500 kV line beside Line 051 or no new easement if Line 051 is replaced.

4.8 Substantially less environmental impacts

Overhead lines should not even be contemplated in a National Park or area of natural beauty and environmental value. And only in the most extraordinary circumstance should underground cables be considered.

Connecting Snowy 2.0 to LTSS rather than Maragle will result in substantially less environmental impact in KNP, BSF and across hundreds of kilometres of other public and private lands. HumeLink can be shortened and rerouted.

The Project involves the clearing of 1.5 square kilometres (km²) of KNP and BSF. Additionally, HumeLink involves easements over 15 km² for the 220 km of deviated legs.

Alternative D avoids the Project clearing. Alternative D1 avoids a further three km² of clearing in BSF, and Alternatives D2 and D3 avoid almost double that amount in BSF.

Alternative D3i avoids approximately 110 km of new lines and easement (eight km²). Alternative D3ii, replacing Line 051, avoids nearly twenty square kilometres of easement.

4.9 Multiple use of cable tunnel

A cable tunnel running downhill from Snowy 2.0 Station to Upper Tumut SS can provide for other uses beyond housing transmission cables.

4.9.1 Communications cables

The tunnel provides for the installation of communication and control cables in a protected environment, not subject to external interference or weather.

4.9.2 Drainage

Underground stations are subject to water seepage, which is collected in pits and pumped away, usually into the tailrace tunnel. Such collection and extraction is critical for keeping the station operational and requires significant equipment, redundancy, and operational cost.

A gravity drainage system via the tunnel to LTSS negates the need for such equipment. It would also be particularly useful in the catastrophic event of a station flood that put all electrical equipment (including water pumps) out of action.

4.9.3 All-weather access to Snowy 2.0

Snowy 2.0 is in a very remote location. The main access is by the circuitous and steep 15 km long Ravine Track from near Three-Mile Dam on the Kiandra-Cabramurra Road. Lobs Hole is about 110 km from Cooma, the closest major town. The road is tortuous in sections and subject to closure by snow, fallen trees and landslips.

The cable tunnel could provide all-weather access from LTSS and Talbingo, if of sufficient width.

Snowy Hydro's current operating and maintenance personnel at Tumut 3 could be augmented by the staff needed to operate and maintain Snowy 2.0. They could be based and live at Talbingo or nearby (Tumut is only 40 km away). Minor equipment for repairs and maintenance could be transported from Talbingo.



Figure 8 – Sydney City East Cable Tunnel (3.5m diameter)⁵⁵

4.9.4 Emergency exit

Snowy 2.0 will have a Main Access Tunnel (MAT) and an Emergency, Cable and Ventilation Tunnel (ECVT). A third access tunnel is not needed, but a cable tunnel to LTSS would provide another exit. This could be useful in the event of a Station fire, with fumes and smoke flowing up the MAT and ECVT, or if access to those exits was blocked.

⁵⁵ "Cable tunnels under Sydney" Utility Magazine, 22 April 2014 <https://utilitymagazine.com.au/cable-tunnels-under-sydney/> 3.2 km, 3.5 m diameter, \$141 million, 132 kV cables

5 Conclusion

This Addendum highlights numerous benefits of connecting Snowy 2.0 by underground cables to LTSS compared to Maragle - financial, operational, environmental, social, and community - to all stakeholders (see Figure 9).

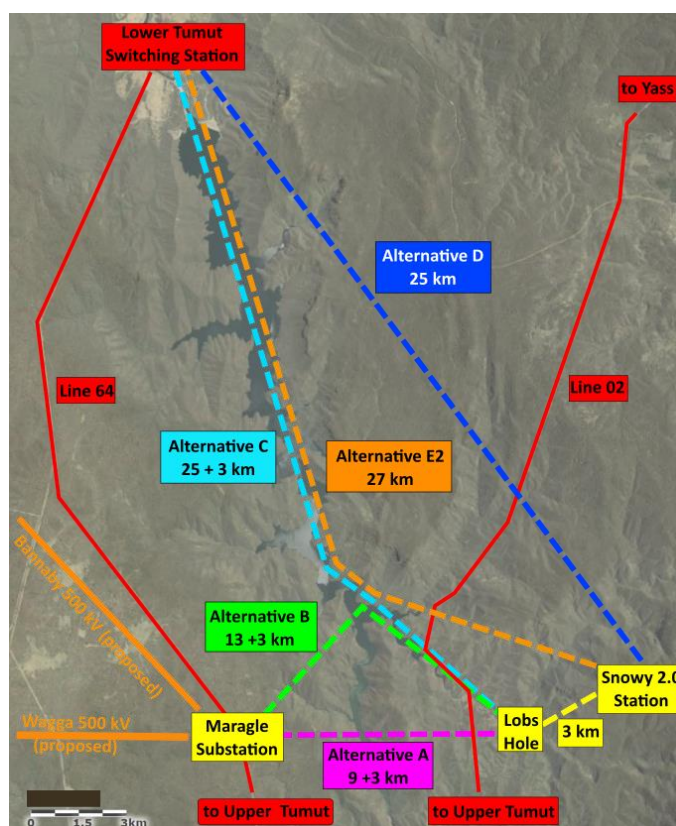
Alternative D, along with other underground alternatives, must be comprehensively analysed by TransGrid and Snowy Hydro in the EIS process and, as stated in the Open Letter, an underground alternative must be proposed.

NEM and AEMO	<ul style="list-style-type: none"> • LTSS becomes a more substantial electrical hub, with improved flexibility, reliability, and transmission capacity • the number of connections to LTSS increases from five to six/seven, and its transmission capacity increases from 5,000 MVA to 8,000 - 11,000 MVA • less transmission heating losses • a shorter, direct, more robust HumeLink connection between Wagga and Bannaby • reduced exposure to outages from lightning strikes and bushfires
Electricity consumers	<ul style="list-style-type: none"> • cost savings from: <ul style="list-style-type: none"> ○ a shorter HumeLink – savings on construction and O&M ○ less transmission losses • a marginally more reliable service from Snowy generators
The environment	<ul style="list-style-type: none"> • fewer and shorter overhead lines • no overhead transmission lines, easements, or access tracks in KNP or BSF • no substation in BSF (Maragle) • up to 20 square kilometres less clearing for easements and access tracks • substantially less new overhead transmission lines blighting the countryside
Local communities	<ul style="list-style-type: none"> • fewer transmission lines will result in less impacts on the local communities and people's livelihoods and wellbeing • opportunities to re-route some lines • ultimate opportunity (Alternative D3ii) of only replacing an existing 330 kV line with a new 500 kV line(s), limiting the impact to landholders along the existing line (not ideal, but better than other options and considerably better than the current proposal)
Snowy Hydro (taxpayers)	<ul style="list-style-type: none"> • improved transmission capacity to/from the entire Snowy Scheme, reducing constraints and occasional loss of revenue • far shorter and more reliable connection of Snowy 2.0 to the main grid • avoids scaling back Snowy 2.0's generation/pumping when one 500 kV line is out of service • reduced contribution to the cost of HumeLink (if AER deems that Snowy Hydro ought to contribute) • Snowy 2.0's commissioning/operation is not reliant on the HumeLink legs being completed in time • possible reduced costs for Station drainage and access
TransGrid	<ul style="list-style-type: none"> • augmentation of an existing substation (LTSS) rather than constructing a new substation in a remote location, with cost and operational benefits • less construction of new lines and less ongoing maintenance • less opposition to HumeLink from local communities <p>It is noted that as TransGrid is a regulated monopoly, all costs and savings for shared assets are passed on to the consumer. Costs and savings for connection assets, such as the cables to LTSS, are paid for by the client, in this case Snowy Hydro. Hence, cost savings to TransGrid will be passed through to consumers and taxpayers.</p>

Figure 9 – Benefits of Alternative D

Appendix A – Underground Alternative Examples (extracted from Section 4.2.2 of Paper)

- Alternative A extending the three km of underground cables from the Snowy 2.0 Station to Lobs Hole Cable Yard, generally following the direct route of the proposed overhead lines, for the remaining nine km to Maragle. The cables could be in a trench, tunnel or HDD conduit, or combination.
- Alternative B laying cables in a trench from Lobs Hole along, or near, the road to the Snowy 2.0 excavated spoil dump in Talbingo Reservoir, at the junction of the Yarrangobilly and Tumut Rivers, and then via a trench/ tunnel/ HDD to Maragle (about 13 km). Approximately half the route is under the road and therefore of straightforward construction, with no additional clearing or environmental impact.
- Alternative C as per Alternative B to the junction of the Yarrangobilly and Tumut Rivers, and then in, or adjacent to, Talbingo Reservoir to the existing LTSS, located next to Tumut 3 Pumped Hydro Station at Talbingo (about 25 km). This alternative effectively relocates Maragle Substation to LTSS, with ongoing new connections to the 500 kV grid being constructed from LTSS, rather than from Maragle.
- Alternative D laying cables in a tunnel from the Station directly to LTSS (avoiding the need for cables from the Station to Lobs Hole).
- Alternative E laying cables in the tailrace tunnel from the Station to its inlet at Talbingo Reservoir, and then via a trench/ tunnel/ HDD to Maragle (E1), or via the Reservoir to LTSS (E2).



Alternative Routes for Underground Cables

Appendix B – General benefits of underground cables (extracted from Section 6.2.1 of Paper)

Countering the higher cost of installing underground cables are several offsetting benefits, many with significant financial savings, including:

- less prone to physical damage
- no exposure to weather events – lightning, bushfires, storms, extreme winds etc.
- Such events are expected to become more frequent and intense with climate change, causing more outages, physical damage, more repair costs and lost revenue, sometimes costing tens of \$millions from a single event (as was the case with the January 2020 bushfires⁵⁶).
- higher reliability, though taking longer to repair. (The longer repair time should rarely be a concern, as if one cable is out of service the remaining five generators/pumps can still operate up to a combined capacity of 1,670 MW).
- the loss of one cable circuit due to a fault should not result in the need to back off Snowy 2.0 output/load to cover a subsequent cable loss. Whereas the loss of a double-circuit overhead line from a fault (or lightning strike or bushfire) would result in backing off output/load to cover for a subsequent loss of the second double-circuit. Also, the proximity of the two overhead double-circuit lines pose a system stability risk to a lightning strike that is not applicable for underground cables⁵⁷.
- ready physical access for repairs and maintenance if in a tunnel
- lower operating costs (potentially one-tenth that of overhead lines⁵⁸), though higher repair costs
- lower electrical losses (reputed to be around 30% lower)
- far less or zero easement clearing and maintenance cost
- little or no release of greenhouse gasses from vegetation clearing
- no potential to start bushfires, as can occur from overhead lines through fallen towers, conductor clashing or breaks, and subsequent insurance claims⁵⁹
- and most importantly, underground cables have substantially less environmental impact and no visual blight⁶⁰, other than a relatively narrow easement if trenches are used.

⁵⁶ The January 2020 bushfires resulted in outages for some days in the Snowy, and separation of the NSW/Victoria transmission networks. Damage to TransGrid's assets in the Snowy region was "*north of \$15 million to \$20 million, which was not insurable*" [TransGrid CEO]. Snowy Hydro lost supply capability "*costing the company millions*" [Snowy Hydro CEO].

⁵⁷ "Queensland and South Australia system separation on 25 August 2018" AEMO, 10 January 2019 https://www.aemo.com.au/-/media/files/electricity/nem/market_notices_and_events/power_system_incident_reports/2018/qld---sa-separation-25-august-2018-incident-report.pdf

⁵⁸ "Overview of the Potential for Undergrounding the Electricity Networks in Europe" prepared for the European Commission, 28 February 2003 https://ec.europa.eu/energy/sites/ener/files/documents/2003_02_underground_cables_icf.pdf

⁵⁹ "Black Saturday bushfire survivors secure \$500 million in Australia's largest class action payout" ABC News, 15 July 2014 <https://www.abc.net.au/news/2014-07-15/black-saturday-bushfire-survivors-secure-record-payout/5597062>

⁶⁰ "Valuing the social benefits of avoiding landscape degradation from overhead power transmission lines: Do underground cables pass the benefit–cost test? Ståle Navrud, Richard C. Ready, Kristin Magnussen & Olvar Bergland, 12 May 2008 "*the social benefits of avoiding negative impacts [from overhead transmission lines] on the landscape exceed the costs of burying the lines as underground cables ... based only on an assessment of the aesthetic impacts [urban setting]. Impacts of overhead power lines on wildlife and human health would likely make burial of power lines even more attractive.*" <https://www.tandfonline.com/doi/abs/10.1080/01426390802045921>

Attachment D – NPA Submission on draft amendment to KNP POM



Dr Andrew Growcock
Manager Planning and Evaluation
National Parks and Wildlife Service
By email to: npws.parkplanning@environment.nsw.gov.au

22 March 2021

Dear Andrew,

Proposed amendment to the Plan of Management for Kosciuszko National Park

The National Parks Association of NSW (NPA) was formed in 1957 and sixty-four years later we have 15 branches, 4,000 members and over 20,000 supporters. NPA's mission is to protect nature through community action. Our strengths include state-wide reach, deep local knowledge and evidence-based approach to conservation advocacy.

NPA **strenuously opposes** the proposed amendment to Section 12.6 of the Kosciuszko National Park (KNP) Plan of Management (POM), which would exempt the Snowy 2.0 Project from the requirement that 'all additional telecommunication and transmission lines (are) to be located underground'.

NPA disputes the accuracy of NPWS's claim (p2) that the proposed amendment 'is required to ensure that Snowy 2.0 construction and operations authorised under the *Environmental Planning and Assessment Act 1979* (NPW Act) and issuing of tenure under the NPW Act can be undertaken in accordance with the plan' (p2).

This incorrect assertion appears to rest upon the *Snowy Hydro Corporatisation Amendment (Snowy 2.0) Act 2018* rendering the construction of Snowy 2.0 permissible regardless of any inconsistency with the POM. This exemption is limited to a period of three years.

It would appear that NPWS has mistakenly taken this to mean that any construction works associated with Snowy 2 are permissible, regardless of the availability of construction techniques that are fully consistent with the POM.

TransGrid states in their Environmental Impact Statement (EIS) that 'TransGrid has consulted with NPWS who advised that the KNP POM would be amended in due course to reflect **the requirement to connect Snowy 2.0 to the grid via an overhead transmission connection**' (emphasis added). Similarly, your email announcing the exhibition of the amendment states 'A reference to above-ground transmission lines has been included in this amendment **to ensure consistency between the plan of management and previous Government decisions on this matter**' (emphasis added).

The suggestion that overhead transmission is a fixed requirement of the Snowy 2.0 project is deliberately misleading and manifestly incorrect. Transmission connection can be achieved through a range of underground options, involving the installation of cables in tunnels, trenches or by directional drilling (Attachment A). The fact that these underground options have significantly lower environmental impact than overhead transmission lines is precisely the reason why new overhead transmission is prohibited in the POM. Most importantly in terms of compliance with the *Snowy Hydro Corporatisation Amendment (Snowy 2.0) Act 2018*, the POM **does not prohibit new transmission connections**, only new overhead connections.

The preparation of the current POM involved an exhaustive analysis of existing and potential threats to the values of KNP by all stakeholders over the period 2001-2006. The construction of overhead lines and the management of vegetation under existing lines were identified as major threats to the values of KNP. In approving the POM, the then Minister confirmed that it was not appropriate to inflict any further fragmentation or habitat loss through additional overhead lines. The POM went even further, requiring that, 'wherever possible, the Service [NPWS] will seek agreement on the rationalising, undergrounding or rerouting of high impact lines or sections of lines' (12.6.4).

The prohibition of overhead transmission lines in KNP was entirely consistent with current and best practice across the Protected Area Network. No major transmission lines have been constructed in a NSW national park in the last half century. It is notable that the POMs for the parks that were impacted by prior construction, including Royal, Heathcote, Blue Mountains and Wollemi, all prohibit new transmission lines. International practice is to use underground cables whenever traversing environmentally sensitive areas. The POM's prohibition on new overhead transmission connections is far from regulatory overreach, but instead reflects long-standing best practice for protected areas.

It is reprehensible that the exhibited amendment makes no attempt to address the reasons for the prohibition on additional overhead lines or to demonstrate how amending that prohibition would impact upon the landscape and conservation values of KNP. It is NPA's considered opinion that the amendment **does not met the requirements of Section 72AA of the *National Parks and Wildlife Act*** and provides no basis for informed submissions or a valid decision by the Minister.

NPA rejects the suggestion that these issues are appropriately deferred to future assessment under the *Environmental Planning and Assessment Act*. This approach is inconsistent with the statutory role of the POM, the legislative instrument tasked with ensuring that parks are protected in perpetuity for the benefit of future generations. Environmental Impact Statements are notoriously poor tools for assessing the long term, cumulative impact of developments on the surrounding landscape or region. Responding to the impacts of multiple phases of overhead transmission line construction is a prime example where the 'whole of landscape' perspective of a POM is the appropriate regulatory mechanism. It is astounding that NPWS has so misunderstood this pivotal as to omit any consideration of the impacts of the transmission connection on KNP in the amendment.

The implications of NPWS's failure to appropriately address the impacts of the proposed overhead transmission lines upon the conservation objectives of the POM are deeply troubling. The Snowy 2.0 transmission connection project foreshadows a period of adjustment to the distribution network as coal fired stations retire and renewable generation expands. Public lands, including national parks, will inevitably be favoured for new lines. This amendment sets a clear precedent for the removal of any statutory protections against the construction of overhead transmission lines in national parks.

The consequences of the proposal on KNP are severe and permanent. The new overhead lines are far more intrusive than any previously constructed through an Australian national park. There will be two massive sets of 75 metre high towers traversing eight kilometres of KNP in a cleared swathe up to 200 metres wide. Vast areas of contiguous habitat will be fragmented and a hundred hectares of KNP will be permanently cleared. The visual impact of the towers and lines will extend over 25,000 hectares of KNP.

Minister Kean referenced the relative costs of overhead and underground transmission in recent Budget Estimates hearings. NPA strongly disputes the relevance of such considerations for the purposes of the proposed amendment. It is noteworthy that both Snowy Hydro and TransGrid were involved in the preparation of the current POM and fully aware of the need to plan for the increased cost of underground connection.

As an organisation that fought for the establishment of a Protected Area Network and a professional park management authority in NSW, we are appalled by this ill-advised and inappropriate

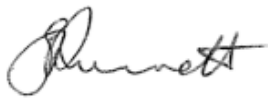
amendment. NPA can only conclude that it has the sole purpose of providing commercial benefit to Snowy Hydro Corporation. Existing legislation and well-founded policies for the protection of KNP are being set aside to serve the demands of a developer.

NPA strongly recommends that the amendment be withdrawn and the prohibition on the construction of overhead transmission lines be inserted as a standard form of prohibition on new overhead transmission connections in all relevant POMs in NSW.

TransGrid should be informed that the only acceptable means of transmission connection is as specified in the current KNP POM, that is, by underground cables rather than overhead lines.

I can be contacted at garyd@npansw.org.au or on 0432 757 059.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Dunnett', with a stylized flourish at the end.

Gary Dunnett
Executive Officer
National Parks Association of NSW
protecting nature through community action

Attachment E – Objectives and content of Plans of Management

72AA OBJECTIVES AND CONTENT OF PLANS OF MANAGEMENT (NPW Act)

- (1) The following matters are to be taken into consideration in the preparation of a [plan of management](#) for land reserved under this Act:
- (a) the relevant [management principles](#),
 - (b) the conservation of biodiversity, including the maintenance of [habitat](#), ecosystems and [populations](#) of [threatened species](#),
 - (c) the protection and appreciation of objects, places and structures of cultural significance, and tracts of land,
 - (d) the protection of landscape values and scenic features,
 - (e) the protection of geological and geomorphological features,
 - (f) the protection of [wilderness](#) values and the management of [wilderness areas](#),
 - (g) the maintenance of natural processes,
 - (h) the rehabilitation of landscapes and the reinstatement of natural processes,
 - (i) fire management,
 - (j) in the case of a [plan of management](#) for a [national park](#), [nature reserve](#) or [karst conservation reserve](#), the prohibition of the execution of any works adversely affecting the natural condition or special features of the park or reserve,
 - (k) the potential for the reserved land to be used by [Aboriginal people](#) for cultural purposes,
 - (l) the provision of opportunities for public understanding and appreciation of natural and cultural heritage values, including opportunities for [sustainable](#) visitor or tourist use and enjoyment of the reserved land,
 - (m) the [adaptive reuse](#) of buildings and structures,
 - (n) the appropriate (including culturally appropriate) and ecologically [sustainable](#) use of the reserved land, including use by lessees, licensees and occupiers of the land,
 - (o) the preservation of catchment values,
 - (p) the encouragement of appropriate research into natural and cultural features and processes, including [threatening processes](#),
 - (q) the identification and mitigation of [threatening processes](#),
 - (r) the statutory natural resource management, land use management plans and land management practices of land surrounding or within a region of the reserved land,
 - (s) the regional, national and international context of the reserved land, the maintenance of any national and international significance of the reserved land and compliance with relevant national and international agreements, including the protection of [world heritage values](#) and the management of world heritage properties,
 - (t) benefits to local communities,
 - (u) the social and economic context of the reserve so as to ensure, for example, that the provision of visitor or tourist facilities is appropriate to the surrounding [area](#) or that pest [species](#) management programs are co-ordinated across different tenures,
 - (v) the protection and management of [wild rivers](#),
 - (w) the impact of the management and the use of land acquired under Part 11 on the reserved land's management.

Attachment F – Government acceptance of overhead lines

1. Sale of Snowy Hydro shares (2 March 2018)

Prime Minister Turnbull announced on 2 March 2018 that the Commonwealth Government would become the sole owner of Snowy Hydro to “pave the way for the Snowy 2.0 pumped hydro project⁶¹”.

The purchase was based on an agreed fair market value of Snowy Hydro, determined by the three governments to be \$7.8 billion. The share transfer was completed in July 2018, with NSW receiving \$4.154 billion and Victoria \$2.077 billion.

One of the ‘key terms reached as part of the purchase’ obligated NSW to assist the Snowy 2.0 planning and approvals process:

“NSW will provide all reasonable assistance to Snowy Hydro in relation to its current and future operations (including planning and approvals process for Snowy 2.0)”

2. CSSI Declaration (9 March 2018)

The Order declaring the ‘Snowy 2.0 and Transmission Project’ to be Critical State Significant Infrastructure (CSSI)⁶² provides for the transmission connection to be overhead lines:

“Explanatory note

The Snowy 2.0 and Transmission Project is a proposed program of works for the expansion of the generating capacity of the Snowy Mountains Hydroelectric Scheme. Development proposed to be carried out for the purposes of Snowy 2.0 includes exploratory works, the construction of a new hydroelectric power and pump station, the construction of a tunnel between Tantangara Reservoir and Talbingo Reservoir and the construction of additional electricity power lines and substations”

Under power industry terminology overhead transmission lines are called transmission lines, or power lines, or just lines, whereas underground transmission cables are referred to as cables. The term ‘circuit’ is used when referring to either overhead lines or underground cables.

3. Snowy 2.0 Amendment Bill (28 November 2018)

The Snowy Hydro Corporatisation Amendment (Snowy 2.0) Bill 2018, provides for the transmission connection:

“Schedule 1 [4] inserts proposed section 39A into the principal Act to provide that a lease, licence, easement or right of way under Part 12 of the NPW Act over the Kosciuszko National Park or any other land reserved or dedicated under the NPW Act may be granted for the purpose of enabling TransGrid (or the holder of a transmission operator’s licence under the Electricity Supply Act 1995) to operate an electricity transmission system from the electricity generating works associated with the Snowy 2.0 project. The proposed section provides that TransGrid (or the holder of a transmission operator’s licence) is entitled to such a grant and contains other provisions regarding such grants.”

⁶¹ [Historic Snowy Deal](#), 2 March 2018

⁶² “Environmental Planning and Assessment Amendment (Snowy 2.0 and Transmission Project) Order 2018” <https://www.legislation.nsw.gov.au/view/pdf/asmade/sl-2018-82>

As the Bill does not refer to underground cables, as specified in the POM, it can be interpreted as overriding the POM and providing for overhead lines.

This is confirmed in the Transmission Connection EIS:

“As a transitional measure ahead of amendments to the KNP POM, clause 7 of Schedule 4 to the Snowy Hydro Corporatisation Act 1997 (SHC Act) provides that for a period of three years from the first Snowy 2.0 approval (7 February 2019 for Exploratory Works Snowy 2.0), section 81(4) does not operate to prohibit operations being undertaken in relation to the Snowy 2.0 project (which includes transmission) that are not in accordance with the KNP POM.

Despite the project not meeting the POM goal of installing new electricity infrastructure underground, the project has sought to minimise adverse impacts on the values of the KNP and other users to the extent possible.”

4. SEARs (1 November 2019)

The Title of the Secretary’s Environmental Assessment Requirements (SEARs) for the ‘Snowy 2.0 Transmission Connection Project’ (SSI 9717) provides for an overhead connection:

“The Snowy 2.0 Transmission Connection Project, which includes the development of transmission lines and associated infrastructure to connect the Snowy 2.0 Hydro project to the electricity grid.”

Yet the General Requirements in the SEARs includes a contradictory requirement to have regard to the POM:

“the EIS must include the relevant strategic context for the project having regards to State and Commonwealth legislation, policies and guidelines, including the Kosciuszko National Park Plan of Management 2006 and current initiatives to improve energy security and reliability in the National Electricity Market”

If the General Requirements were to prevail, the Transmission Connection needs to comply with the POM.

Attachment G – Articles on undergrounding for environmental reasons



National Grid unveils plans to bury cables underground

10 November 2014



Pylon cables will disappear from some of the most beautiful areas of England and Wales as part of a move by National Grid to reduce the impact of energy transmission on the landscape.

The wires will be put underground - at higher cost, but lower visual impact. Twelve stretches of pylons in eight areas of countryside have been shortlisted for the beauty treatment.

National Grid has responded by setting aside £500m, made available by energy industry regulator Ofgem until 2021, to bury high voltage cables, or screen them, or re-route them away from beauty spots.

Among the contenders for early investment are sites in four national parks: the New Forest, Brecon Beacons, the Peak District and Snowdonia and four areas of outstanding natural beauty in Dorset, the High Weald, the North Wessex Downs, and the Tamar Valley.

<https://www.bbc.com/news/business-29989654?print=true>

New Civil Engineer

Ofgem funds scheme to bury power lines beneath Scots national park

05 June 2019



Scottish & Southern Electricity Networks (SSEN) is to remove two long stretches of electricity pylons and bury power cables across the Cairngorms National Park, Scotland.

Two sections of overhead cabling totalling 12km will be removed, along with 46 steel lattice pylon towers. The power line will then be buried beneath the park.

Energy regulator Ofgem is providing £31m to remove pylons and cables from the Cairngorms National Park, as part of a £500M scheme to reduce the impact of energy infrastructure on protected landscapes.

Over 300 pylons in the Cairngorms were removed in 2017 as part of upgrades to another 220km power line that crosses the park.

<https://www.newcivilengineer.com/latest/ofgem-funds-scheme-to-bury-power-lines-beneath-scots-national-park-05-06-2019/>

Reimagining the Grid

September 24, 2016

Central Danish politicians established new guidelines that require undergrounding some 400-kV overhead lines.

In 2008, central Danish politicians established new guidelines for the expansion and undergrounding of the overhead transmission system in Denmark.

As the country's transmission system operator, Energinet.dk was required to replace some sections of the existing 400-kV overhead lines with underground cables within 10 years.

The new guidelines are particularly applicable to overhead transmission lines in areas with a beautiful environment of national interest and in populated areas.

From 2008-2016, Energinet.dk undergrounded three sections of the existing 400-kV overhead lines.

<https://www.tdworld.com/grid-innovations/transmission/article/20966809/reimagining-the-grid>

25-km, 400-kV Cable System Slated for Abu Dhabi

July 23, 2010

Prysmian has been awarded a new major contract worth around €250 million for the execution of a 400-kV power Extra High Voltage transmission turnkey project by Abu Dhabi Transmission and Dispatch Company (TRANSCO).

Prysmian will provide engineering, manufacturing, installation and commissioning of the 400-kV cable system (triple circuit route of 25 km for a total of 230 km of extruded insulation (XLPE) cable and related network components). The total project execution time is 24 months.

The new link is of high importance for the Abu Dhabi Emirate's power transmission system.

The underground cable system will replace the existing overhead lines resulting in a significantly lower environmental impact.

The project can be classified as the largest 400-kV underground cable system in the region and the largest EHV XLPE cable system in the world (in terms of contract value) ever awarded to a single supplier. "It is huge, complex and innovative as it will require also the adoption of micro tunnelling technology, a new application for power transmission projects in the region.

<https://www.tdworld.com/overhead-transmission/article/20959052/25km-400kv-cable-system-slatted-for-abu-dhabi>

Government targets eight of Japan's national parks to draw more overseas tourists

November 13, 2016

The Environment Ministry will introduce new measures to draw more foreign tourists to eight of Japan's national parks by 2020, when the country will host the Summer Olympics, according to ministry sources.

The ministry will also bury overhead power lines along cycling roads in Aso-Kuju National Park so riders can have better views and allow tourists to observe colonies of rare flowers and view terrain affected by natural disasters, including the series of major earthquakes that rocked Kumamoto in April.

It earmarked ¥20 billion in the second supplementary budget for fiscal 2016 through March, which was approved in the Diet last month, and the draft full-year budget for fiscal 2017.

<https://www.japantimes.co.jp/news/2016/11/13/national/government-open-off-limit-area-introduce-beautification-measures-draw-foreign-tourists-national-parks/>

Now, no overhead power lines through national parks, sanctuaries

May 3, 2018



NAGPUR: The state government has decided that from now on transmission lines passing through tiger reserves, national parks and sanctuaries will be done through underground cabling only.

The MSEDCL has been told to ensure and incorporate laying of new transmission lines through underground cables in their future proposals.

Moreover, the power company has been told to explore feasibility of converting existing overhead transmission lines to underground cables in a phased manner.

http://timesofindia.indiatimes.com/articleshow/64006955.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst