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BALANCING THE GRID

Loch Kemp Hydro Pumped Storage Scheme

About Statera

We develop and deploy assets to balance a high renewables electricity system.

Why we exist	The amount of renewable energy generation forecast to be installed in the UK by 2030 means a transformational shift in how the grid operates.
What we do	The projects we deliver are aiming to decarbonise the electricity system, while ensuring greater energy security.
How we're doing it	We build, own and operate flexible energy infrastructure that solves the issues of balancing grid supply and demand.

Purpose of Exhibition

We're inviting local residents to come along to view the plans and review changes to the Loch Kemp Pumped Storage scheme before application submission to the Energy Consents Unit Scotland next year.

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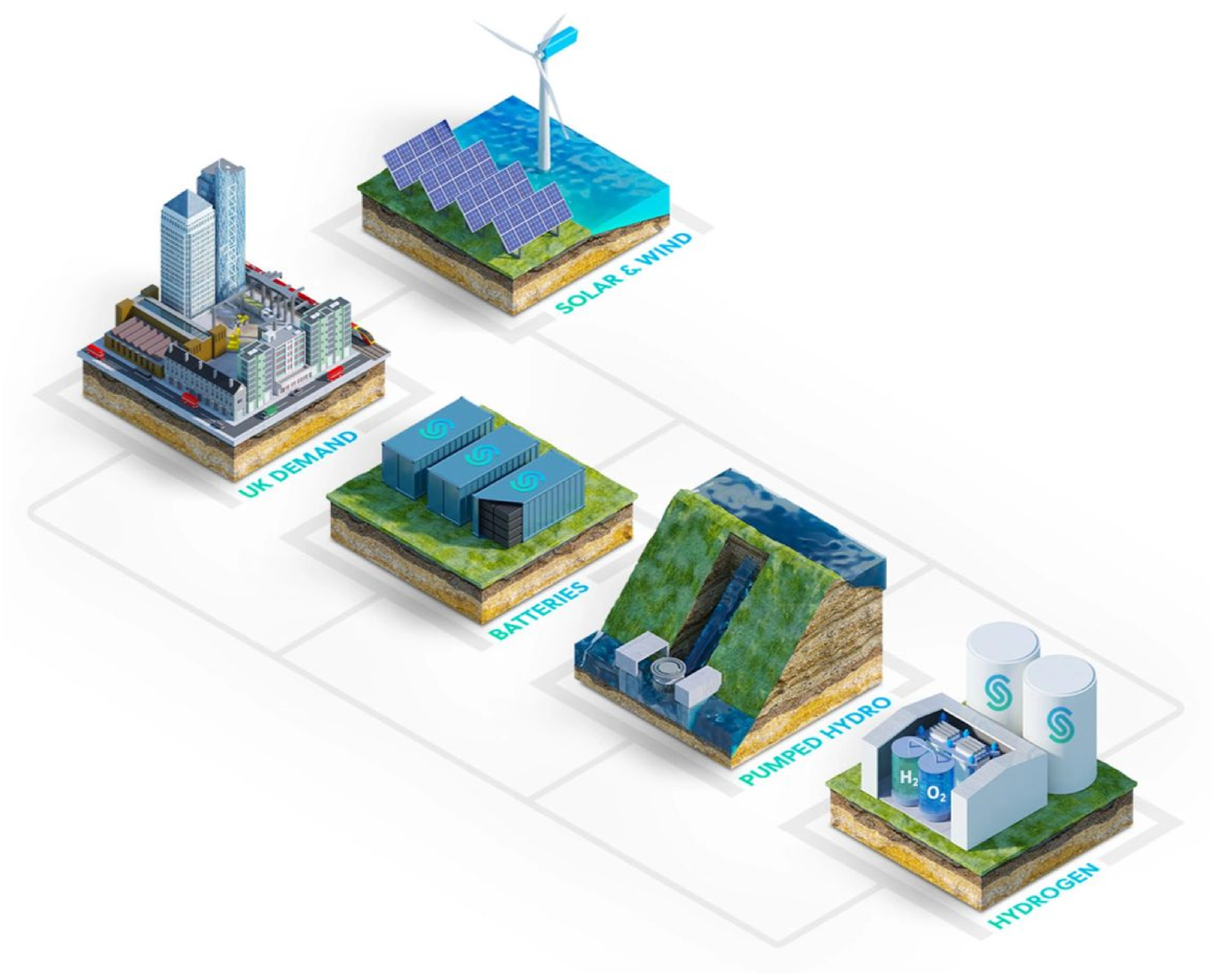
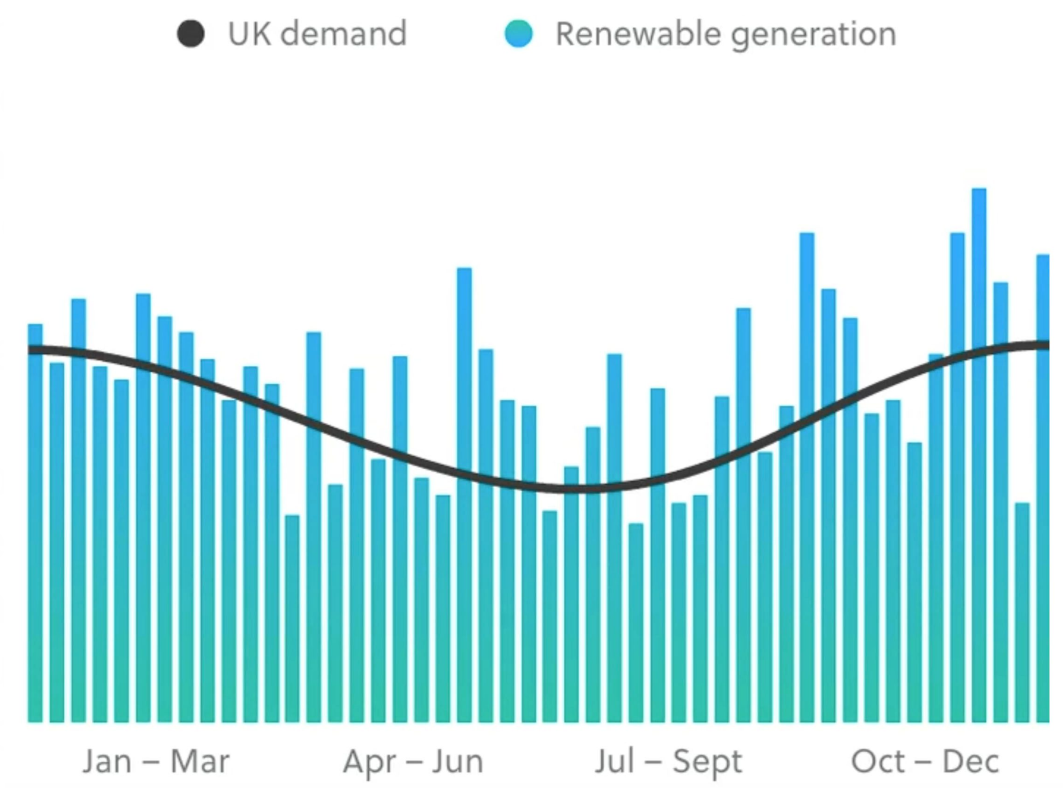
The renewable energy challenge



Climate Change is driving the need for an urgent reduction in carbon emissions. As a result, the UK Government has committed to a Net Zero economy by 2050 and has set ambitious targets for renewable energy generation to deliver these carbon emission savings.

Renewable energy generation is low cost and carbon free but its output **is intermittent** and constantly fluctuating. The seasonal nature of both solar and wind output means they cannot be relied upon to perfectly meet electricity demand all year round. When output is too high generators currently have to curtail output to balance energy supply and demand due to electricity network constraints. This results in knock-on costs to the end consumer.



By storing excess renewable energy the UK can meet demand all year round.

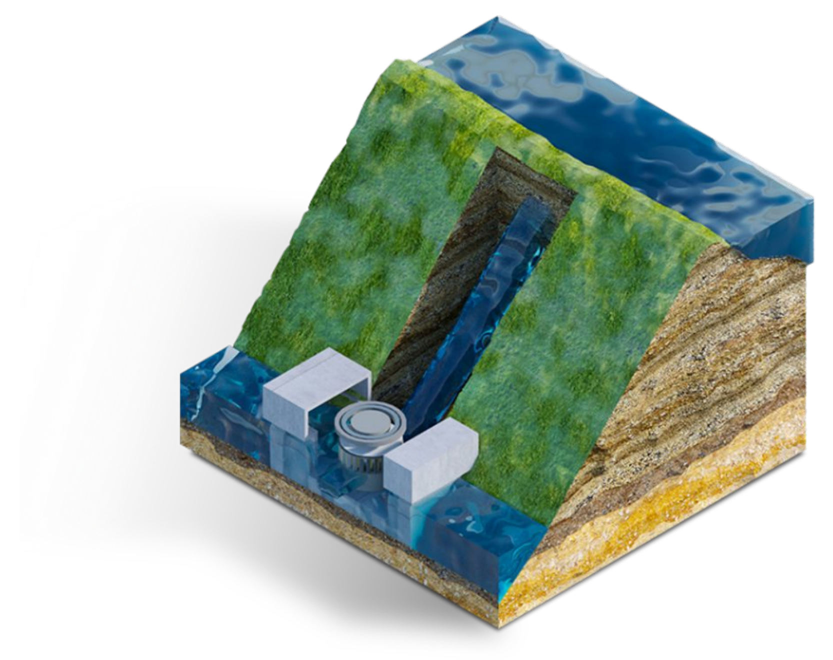
A range of flexible storage technologies are needed to accommodate the constantly fluctuating renewable output. The stored energy can be then be exported during periods of low renewables generation, or at times of peak demand, to keep the system in balance and ensure the security of the UK's energy supply all year round.

Pumped Hydro

The History of Hydro in Scotland

Hydro schemes have a long history in Scotland, the first commercial scale hydro scheme was built at Foyers on Loch Ness in the late 1800s – a scheme designed to power an aluminium smelter – and it still exists today, albeit with some improvements over the years .The vast hydro schemes built in the 1940s, 50s and 60s were not just an astonishing feat of engineering which employed thousands of workers. They also brought electricity to the more remote parts of Scotland for the first time, transforming the lives of many Scots.

And all by making use of the Scottish landscape with its mountains and lochs, shaped by the wind and the air over the centuries.



The Concept

The idea behind pumped storage is simple. It works by using large elevated natural features to store energy as raised water. At times of peak demand, water in the upper reservoir is released to a lower reservoir, flowing through a turbine, generating electricity. When demand is low, excess energy on the grid is used to pump water back up to the upper reservoir. In simple terms, a Pumped Storage Hydro project is effectively a fully controllable big battery, connected to the electricity grid.

The Future of Hydro in Scotland

These hydro schemes will continue to play an essential role in the UK electricity system for decades. Loch Kemp beside Loch Ness is part of a new generation of pumped hydro schemes being developed in the highlands. The requirement for new pumped hydro will grow as more weather dependent renewables particularly - offshore wind and solar are deployed and balancing this intermittent generation on the grid becomes ever more challenging. The role of pumped hydro in the UK will therefore play a critical part in the UK's move to Net Zero.

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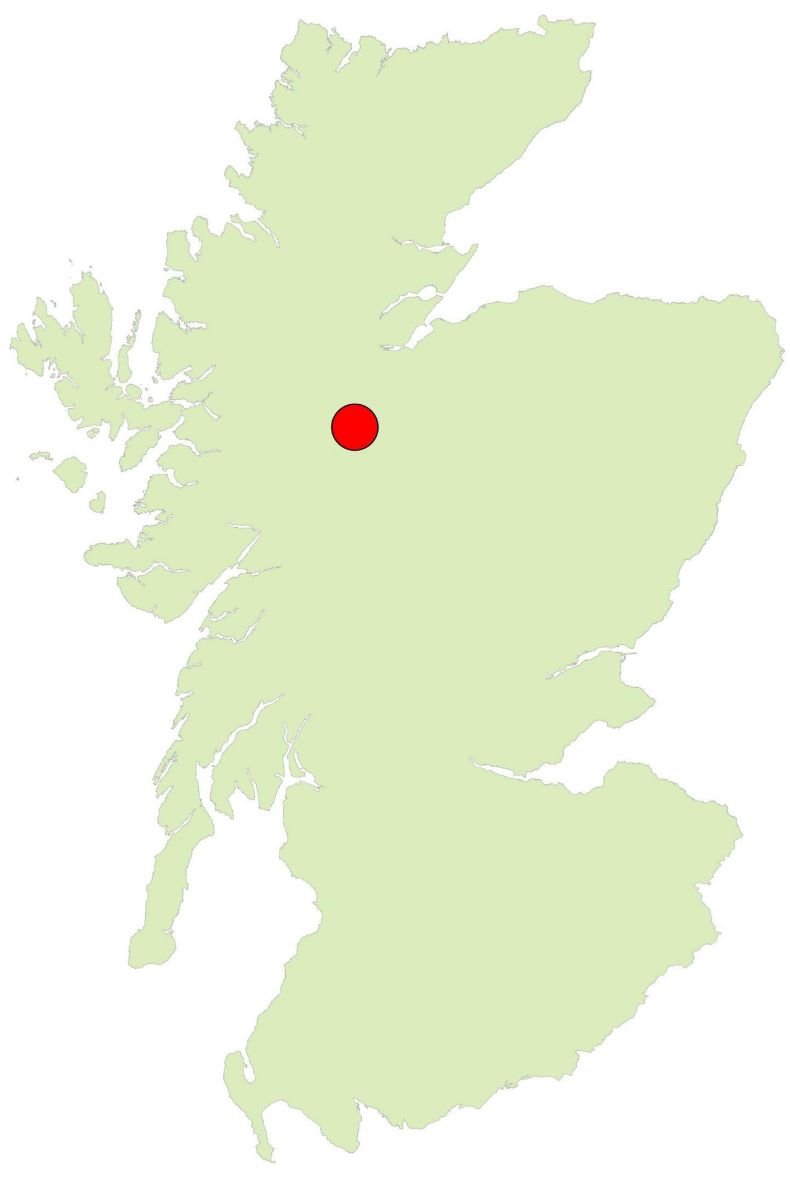
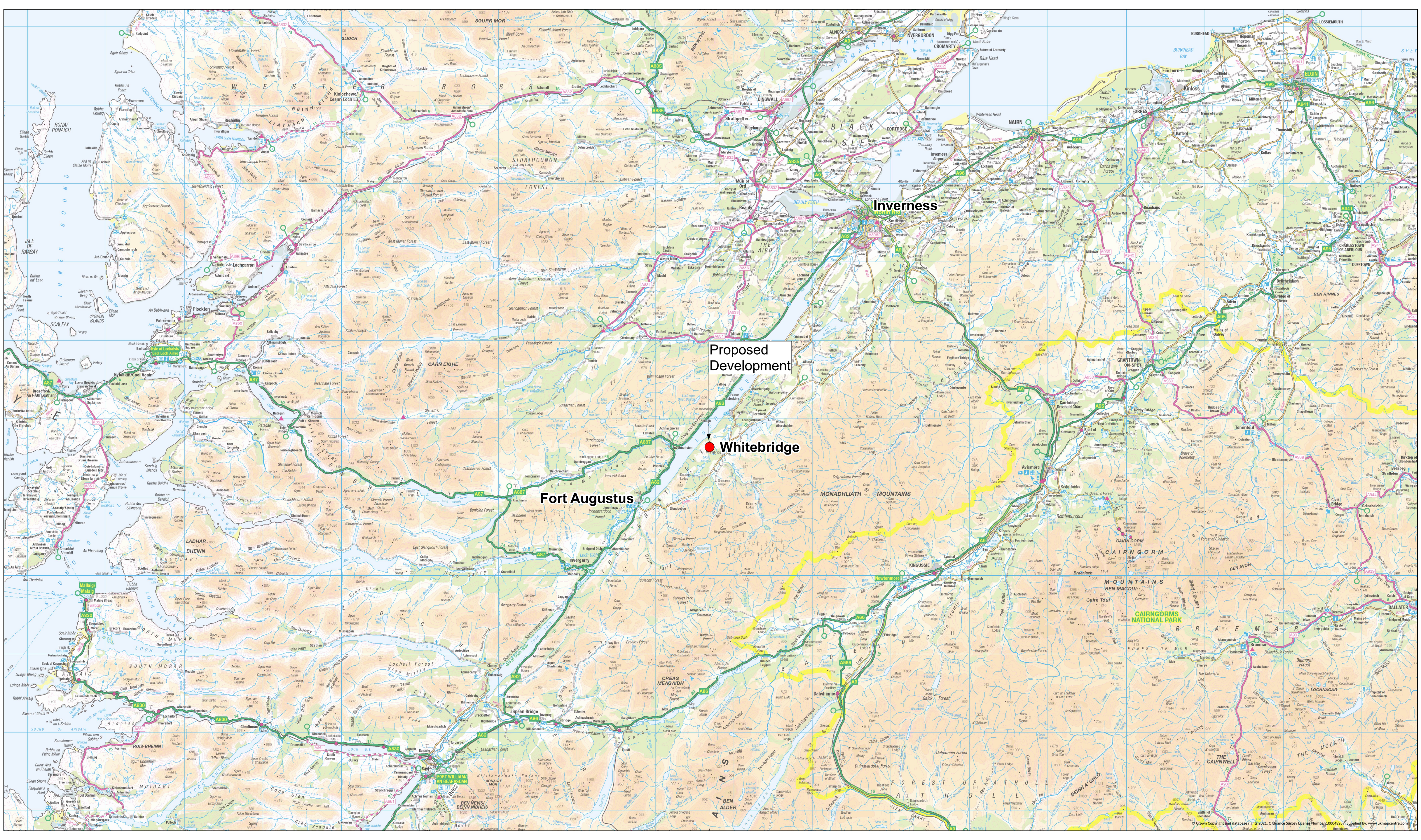
Location of Loch Kemp Storage



Loch Kemp is a natural lochan situated within the Dell Estate to the south of Loch Ness, approximately 13 km to the north-east of Fort Augustus. Access into the site would be via the B862 at Whitebridge, using existing estate and forestry tracks (to be upgraded and extended). A widened access track would be required to the power house site on the shore of Loch Ness.



Aerial view of Loch kemp and Loch Ness

Loch Kemp sits in a natural bowl

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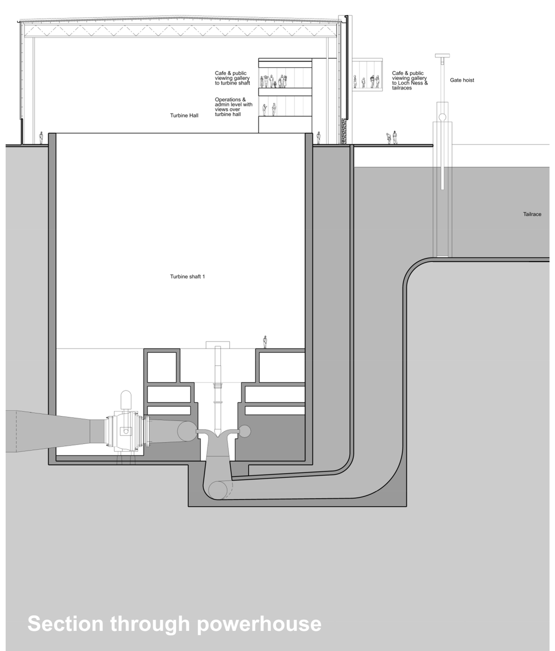
The Project

Key Details of the Proposed Development

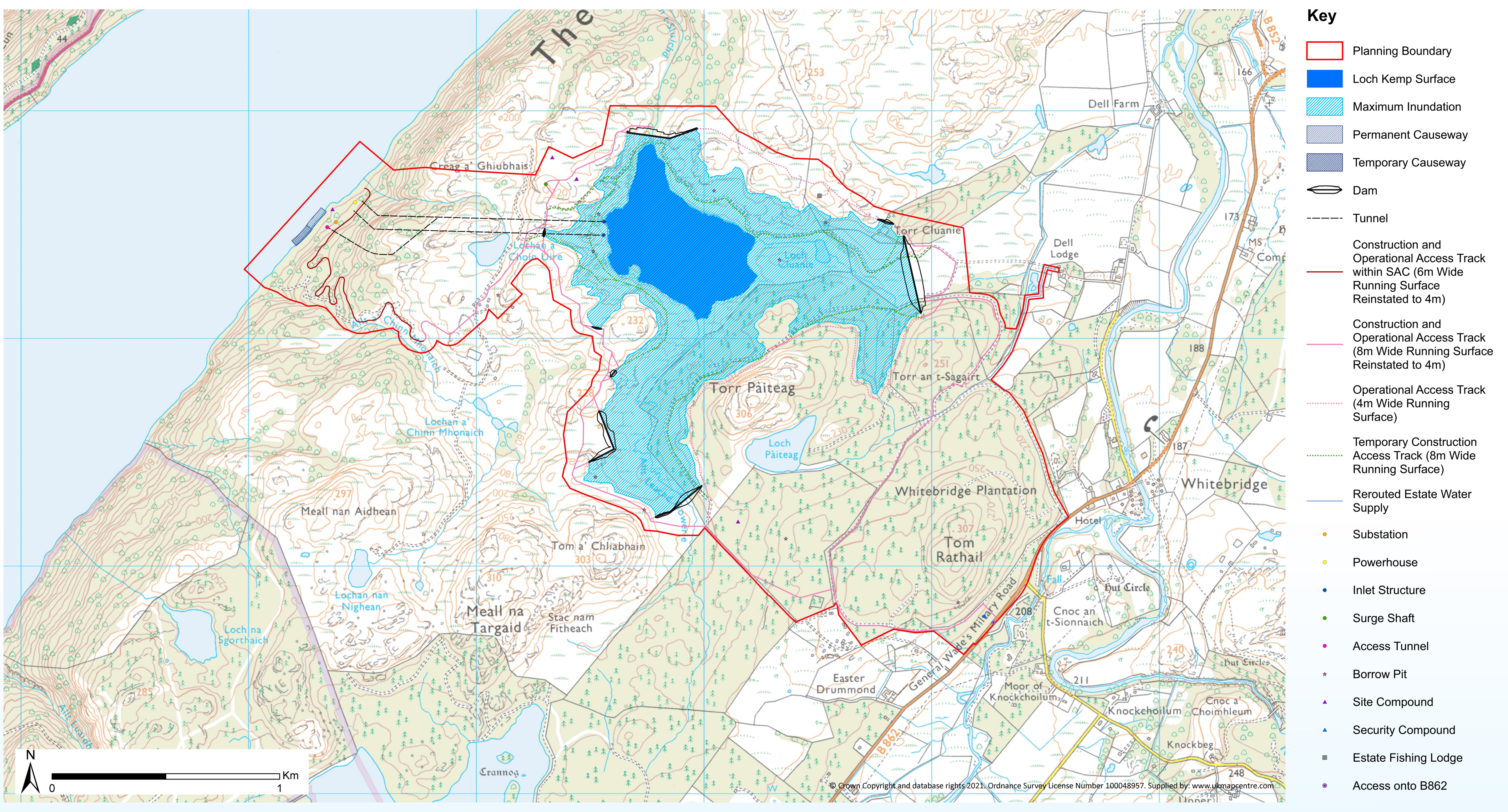
- Pumps water in both directions between Loch Ness and Loch Kemp,
- The vertical distance is approx. 175m
- Uses an underground tunnel approximately 1km long.
- Has a generating capacity of up to 600MW.
- Has an energy storage capacity of 9,000MWh 15hrs storage).

The primary function of Loch Kemp Storage would be to extract, store and release energy to or from the electricity transmission system as required to help balance supply and demand for power at a national scale. It would operate by transferring water between Loch Ness and the enlarged Loch Kemp through the tailrace tunnel, powerhouse, high pressure tunnel and headrace tunnel. The Proposed Development would either be operated in the 'generating' mode, when electricity would be generated by releasing water from the upper reservoir at Loch Kemp through the pump-turbines and into Loch Ness, or in the 'pumping' mode, when electricity is used to drive water through the pump– turbines in the other direction from Loch Ness to the upper reservoir.



Section through powerhouse

Loch Kemp Pumped Hydro alone could save up to one million tonnes of CO_2 a year as well as helping the UK to become more energy secure and less reliant on gas and oil. Scotland is also about two and a half million tonnes short of its CO_2 emission reduction target so this project would represent a significant step towards helping Scotland meet its targets.



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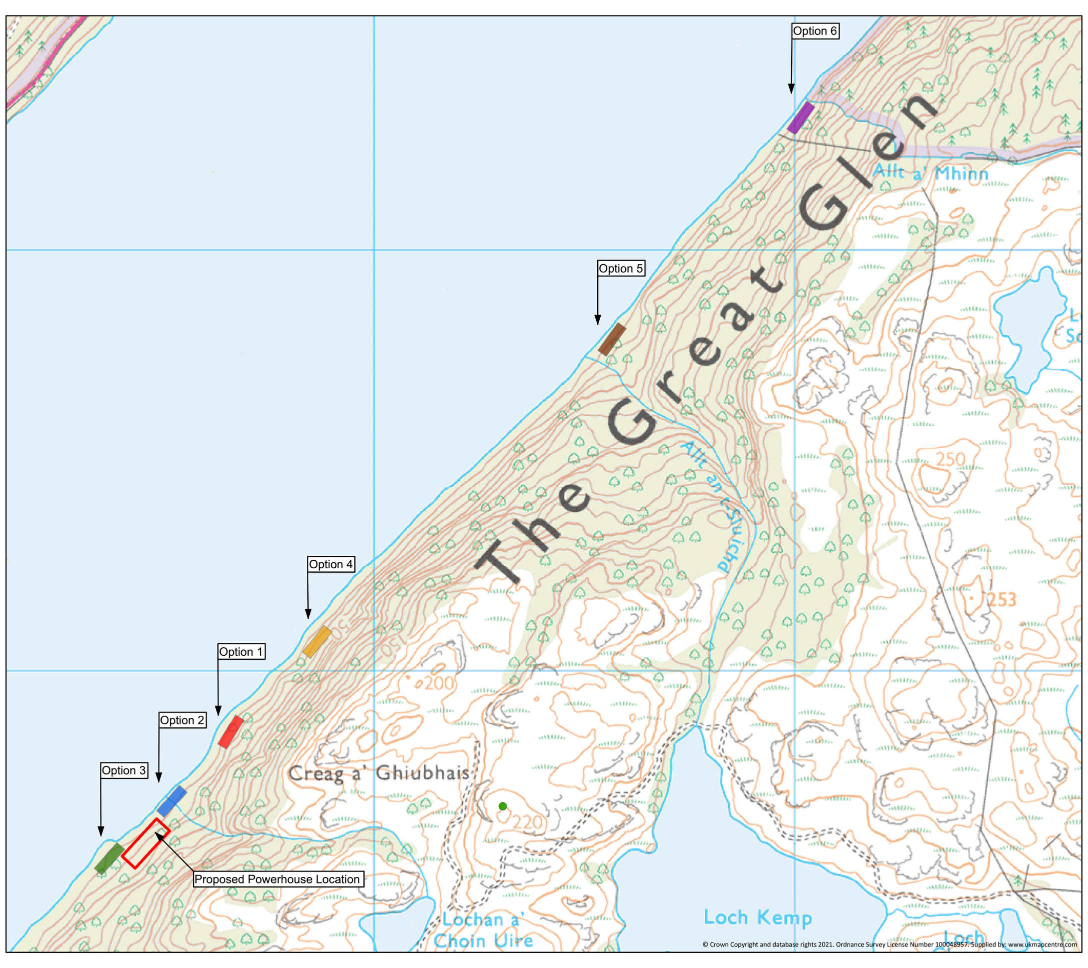
Design Development

The design of the Proposed Development has evolved through an iterative process in conjunction with environmental survey work and through ongoing liaison with key consultees. The current layout has been informed by technical and environmental considerations to ensure that all elements of the Proposed Development are sensitively designed.

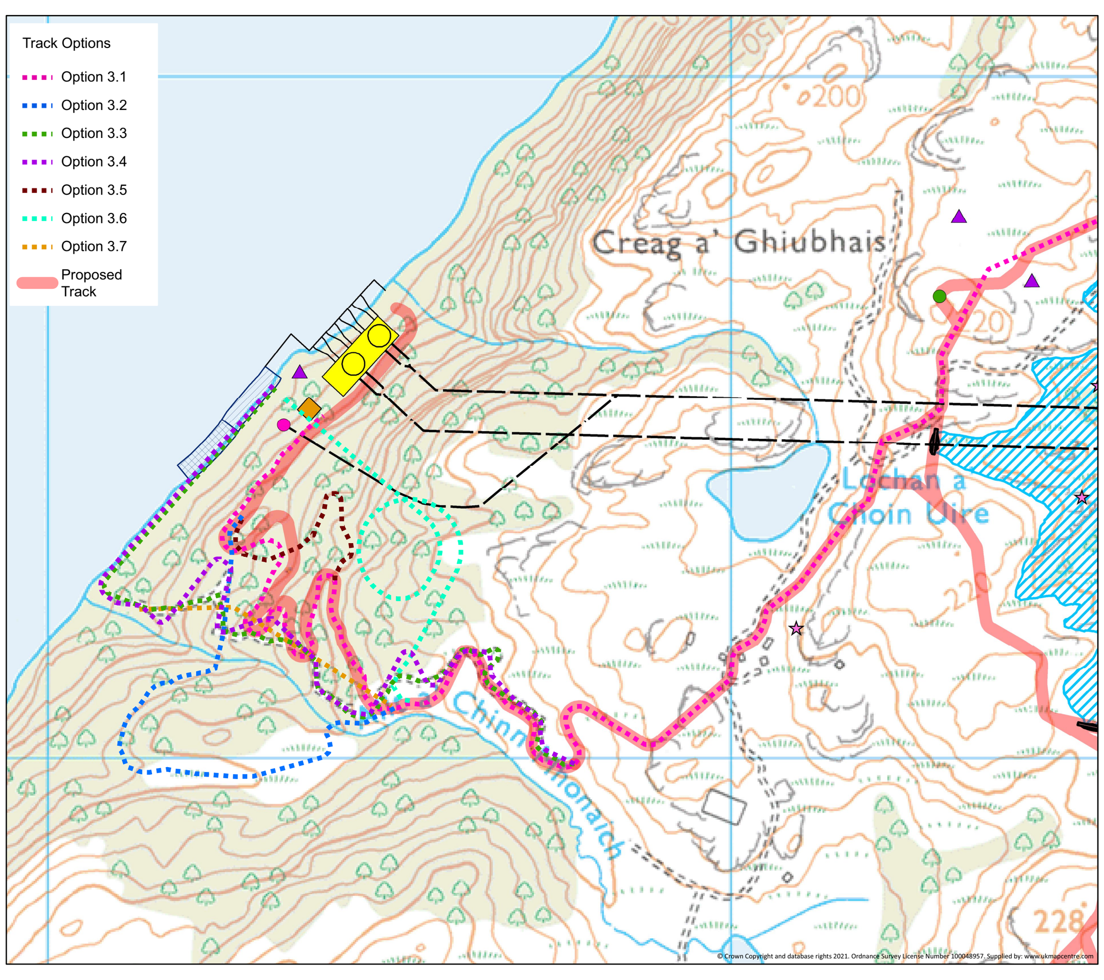


Powerhouse Site Options

An optioneering study was undertaken to establish the preferred location for the powerhouse. The proposed powerhouse location has been informed by topographical, geological, ecological and technical considerations.

Track Options

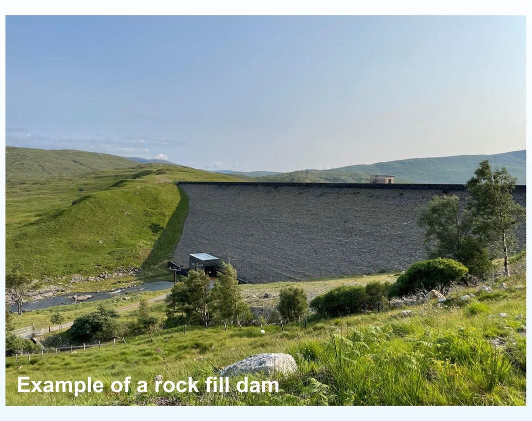
A similar exercise was undertaken to establish the preferred route for the construction track to the powerhouse. Due to the steep terrain, topography was a key consideration, along with minimising impact on the Ness Woods Special Area of Conservation (SAC).



Dam Design

The Proposed Development consists of eight dams, comprising a combination of rock fill, earth embankment and concrete type, to minimise environmental effects.


Example of a concrete dam


Example of a rock fill dam

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The Proposed Development

The principal components of the Proposed Development would comprise:

Dams and Upper Reservoir – Four new saddle dams between 15 – 30 m high and four, minor cut-off dams would be constructed around Loch Kemp to enable the storage of water by increasing the size of the existing Loch Kemp to form the upper reservoir. The loch would be raised by approximately 28 m from its existing 177 m AOD elevation to approximately 205 m AOD.

Underground Waterway System – Screened intakes would feed a tunnel carrying water between the upper and lower reservoirs, through the powerhouse.

Shaft Type Powerhouse – A series of powerhouse shafts with a surface building located on the shore of Loch Ness would contain reversible pump turbines and motor generators together with associated equipment such as transformers and switchgear.

Outlet Area - A tailrace structure would be located on the shore of Loch Ness and integrated with the powerhouse. A jetty and administration building would also be located adjacent to the powerhouse.

Access Tunnels - Tunnels would be provided for accessing the waterway system.

Access Roads - Access roads would be provided for the construction of the Proposed Development and for operational and emergency access; and

Rock Disposal - Most of the rock from the excavated tunnels and shafts would be removed via the shafts and tunnel portals near the powerhouse on the shore at Loch Ness. The excavated rock from the underground works would be reused in a positive manner in the dams and localised area of construction works wherever feasible.

In addition to above, there will be ancillary infrastructure including site compound, substation and visitor centre.

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Why this site

The Kemp site is a good location for a Pumped Storage development for a number of reasons:

- The large body of water provided by Loch Ness means good availability of water all year round
- The natural ‘bowl’ provided by the ground around Loch Kemp means some storage is provided by nature, and increasing this storage requires the addition of a small number of modest dam structures with minimal visual impact.
- The horizontal distance between Loch Ness and Loch Kemp means a relative short (1km) tunnel.
- The point of connection (POC) to the grid is nearby at Foyers substation.
- The general location in Scotland close to wind generation means the site can provide ‘locational balancing services’ to National Grid, which helps alleviate constraints from the capacity in the transmission network.

Community Benefits

The project would represent a substantial investment in the local area and would deliver economic benefits for the lifetime of the project, including:

- Apprenticeship schemes;
- Potential for the creation of jobs in construction and once operational;
- Potential business opportunities for local suppliers particularly during the construction phase;
- New visitor attraction on the shore of Loch Ness at the Powerhouse;
- Business rates; and
- Local IT network improvements

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The Environmental Impact Assessment

The Environmental Impact Assessment (EIA) is being undertaken to understand the potential impacts the Proposed Development could have on the environment and to identify appropriate mitigation measures to avoid, reduce or offset any adverse effects identified.

Early **ecological and bird survey work** commenced in 2021 and surveys have also been undertaken in Spring – Winter 2022 in a number of specialist topics including cultural heritage, geology, protected species, habitats, birds, fish and aquatic ecology.

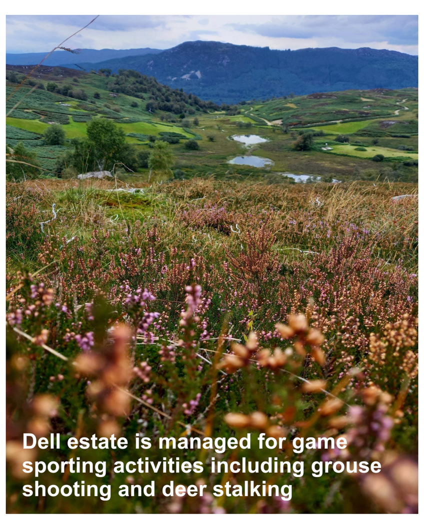
A **landscape and visual assessment** will be undertaken to establish the potential effects of the Proposed Development on landscape character and visual amenity. This will include an assessment of visual receptors located at residential properties and workplaces, and route-based receptors including roads, core paths and other recreational routes and waymarked hiking trails.

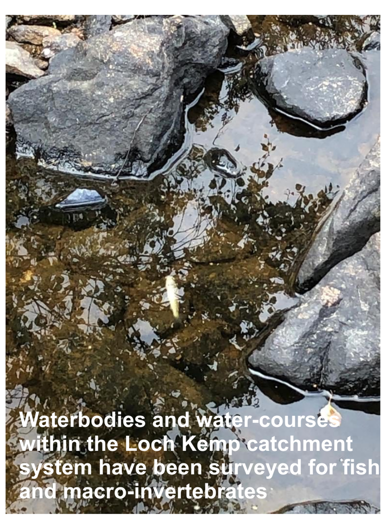
A qualified Forestry Consultant has been engaged to develop and oversee the implementation of a **Woodland Management Plan**, to integrate the Proposed Development into the existing woodland environment and to minimise the loss of woodland and to prevent fragmentation of existing woodlands.

A **Transport Assessment** will be included within the EIA Report. Furthermore, the rock excavated during construction will be reused on-site to build the dam structures and the Caledonian Canal system will be used for the delivery of some larger pieces of equipment and materials, leading to a reduction in the amount of construction traffic travelling to and from the site via public roads.

Topics included within the EIA

- Water Management and Hydrological Considerations
- Landscape and Visual
- Land Use and Recreation
- Terrestrial Ecology
- Ornithology
- Aquatic Ecology
- Fish
- Geology, Soils and Water
- Cultural Heritage
- Traffic, Access and Transport
- Noise and Vibration
- Air Quality
- Forestry


Dell estate is managed for game sporting activities including grouse shooting and deer stalking


Waterbodies and water-courses within the Loch Kemp catchment system have been surveyed for fish and macro-invertebrates


Noise monitoring surveys have been undertaken from nearby properties


A forestry consultant has been engaged to develop a Woodland Management Plan

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The Environmental Impact Assessment

SAC Restoration Works and Compensatory Measures

A range of potential restoration and compensation measures have been considered within Ness Woods SAC. The SAC is currently assessed as being in unfavourable condition, largely due to grazing pressures and limited woodland regeneration measures. Options to improve the condition of the SAC within Dell Estate, including tree planting, methods for managing grazing and improving woodland management, are currently being explored. With the help of specialists, potential areas of woodland outside of the current SAC boundary, that could be brought up to SAC standard through management, have been identified to help compensate for the direct loss of SAC woodland. Other non-woodland areas on Dell Estate, where SAC species could be planted with SAC woodland species, have also been identified through soil sampling work. The Applicant is also engaging with Forestry and Land Scotland (FLS) about potentially providing funding to restore areas of Plantations of Ancient Woodland Sites (PAWS) adjacent to the SAC, following the harvesting of commercial species.

Other Compensatory Measures

Compensatory planting and biodiversity enhancement measures are also proposed outside of the Ness Woods SAC. Approximately 14.5 ha of new native woodland planting is proposed around the margins of Loch Kemp to compensate for trees that would be lost within the inundation area of the upper reservoir. Additional planting will also be undertaken elsewhere on Dell Estate to compensate for the loss of any commercial forestry. Peatland restoration works will be undertaken within the estate to compensate for the loss of peatland within the inundation area.

As part of the Proposed Development falls within the Ness Woods Special Area of Conservation (SAC) and Easter Ness Forest SSSI, there has been a particular focus on understanding the extent and condition of the habitats (and species) that exist within the designated area. Specialist surveys have been undertaken including:

- Habitat Surveys
- Protected Species Surveys
- Tree Tagging
- Lichen Survey
- Bryophyte Survey
- Peat Probing

Ongoing liaison with NatureScot during the design development stage has been key to ensure that the scope of the ecological survey fully cover all that is required and that the design and any mitigation measures minimise any adverse effects and maximise the opportunities to benefit this designated site.

A Habitat Regulations Appraisal (HRA) is being undertaken parallel to the EIA in order to assess potential impacts on the Ness Woods SAC.


Tree tagging within the SAC


Water Gauge at Outflow to the Alt an t-Sluichd


All watercourses within the Ness Woods SAC (within Dell Estate) have been surveyed for freshwater bryophyte and lichen species


Typical woodland within the Ness Woods SAC (on Dell Estate), with the understorey dominated by bracken

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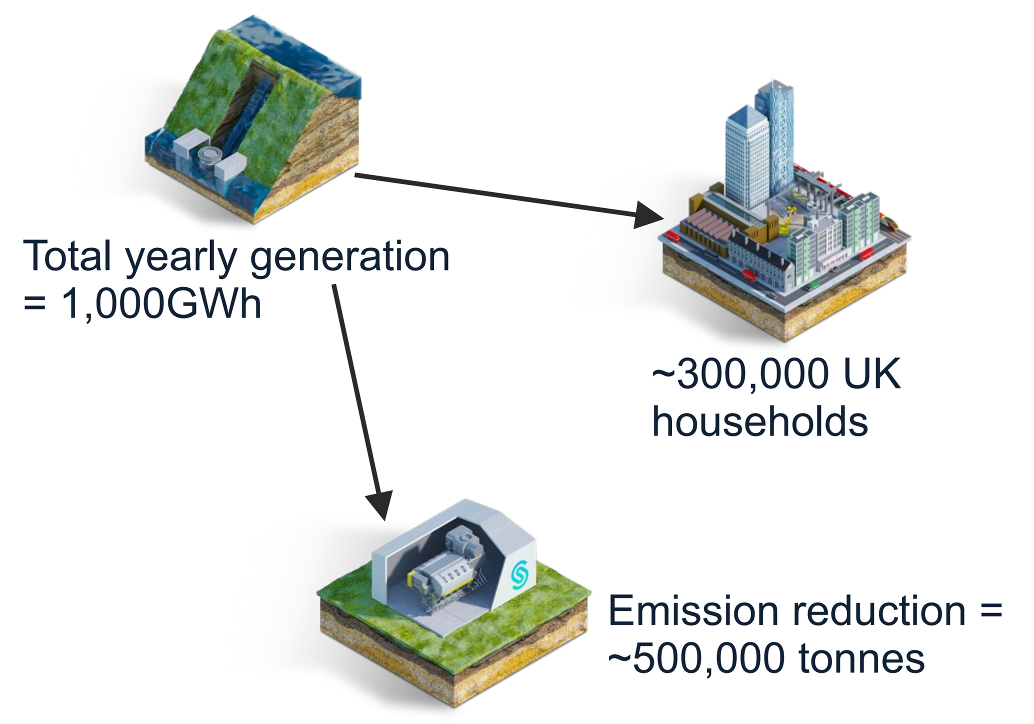
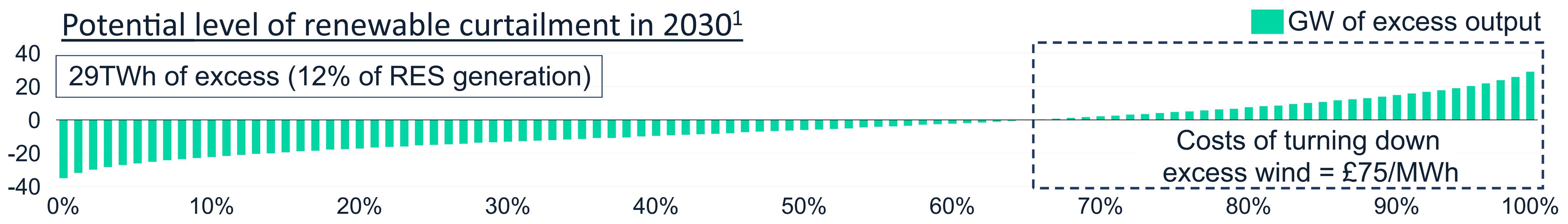
The Bigger Picture

Pumped storage is essential to help GB progress through its journey towards a net zero economy. Loch Kemp Storage could potentially save up to 512,409 tonnes of CO2 by displacing fossil fuel generation

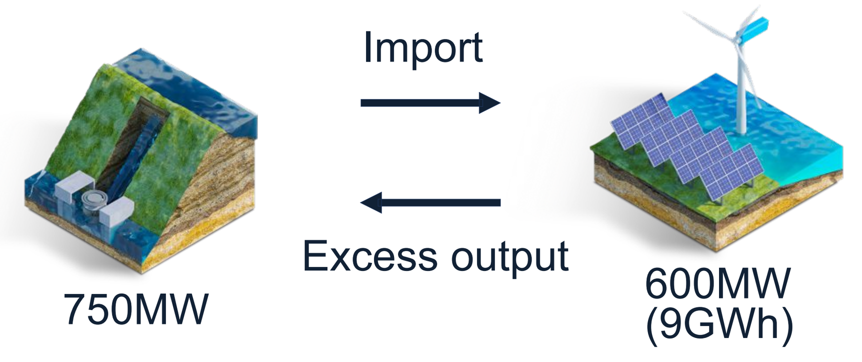
- The 600MW (9GWh) Loch Kemp project cycling ~125 times per year would produce yearly generation of over 1,000 GWh. This would cover the annual needs of 308,219 UK households, assuming an average electricity usage of 10 kWh/day.
- The project would displace some marginal fossil fuel plants[2] and therefore reduce system emissions by ~512,409 tonnes of CO2.



Pumped storage reduces wind curtailment in the GB electricity system. Loch Kemp Storage could reduce curtailment costs by ~£3million/year by storing excess wind output



- By 2030, with >40 GW of offshore wind on the system, renewable generation is expected to exceeds demand >33% of hours, leading to significant level of curtailment.
- Situated close to 750MW of wind capacity, Loch Kemp Storage would be able to import from these sites during periods of high wind output to reduce curtailment.

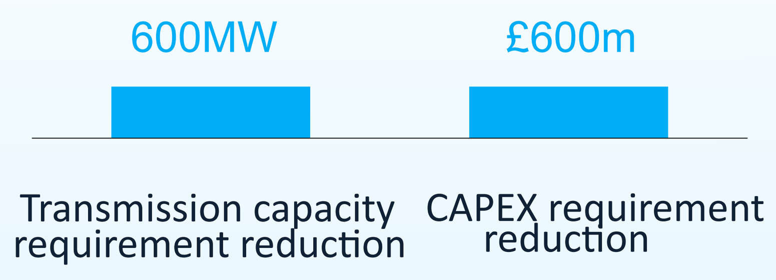


2200 hours of curtailment /year
>£3m/year cost reduction

Pumped storage helps with network constraints management. Loch Kemp Storage could help reduce the need for up to 2GW of transmission between England and Scotland

- The system will require a total interconnection capacity of ~11GW between Scotland and England by 2050 due to increasing renewable penetration.
- Up to 4.5GW of new-build PSH would be needed to reduce the transmission requirement by 2GW, saving up to £2bn avoided CAPEX[3].

Impact of new-build PSH on Transmission capability between Scotland & England



1) Capacity assumption based on National Grid FES 2020 CT Scenario, source: LCP 2) assumes 40% efficiency, 3,500 annual run hours and standard gas carbon intensity of 0.18219 tCO2/MWh therm 3) Research published by Imperial College London Consultants

The Proposed Timeline

Throughout the process, Statera will continuously engage with the local community and stakeholders about the emerging proposals.

Site Selection and Feasibility
(12 months)
Extensive research has been carried out to identify a well located and viable site for the development of a pumped storage scheme.

Pre-Planning
(12 to 18 months)
Public Exhibitions & Community Engagement / Scoping / Environmental Surveys / Design Freeze / Environmental Impact Assessment (EIA).

We are here

December 2022
Public Exhibitions and community engagement

January 2023
Gate Check Report Submission/Gate Check Meeting

March 2022
Gate Check 2

April 2023
Section 36 Application

Submit application and await decision
(12 months)
An application is submitted to the Scottish Government accompanied by a comprehensive EIA Report showing the results of studies undertaken. This is publicly available information. Interested parties and statutory consultees such as the Local Authority and residents can formally comment on the application.

Construction
(36-48 months)
If approved, construction would typically take three to four years.

Operation
Whilst it is anticipated that the consented life of the scheme would be 80 years, with proper maintenance, the scheme could run indefinitely, like other pumped storage schemes in the UK.