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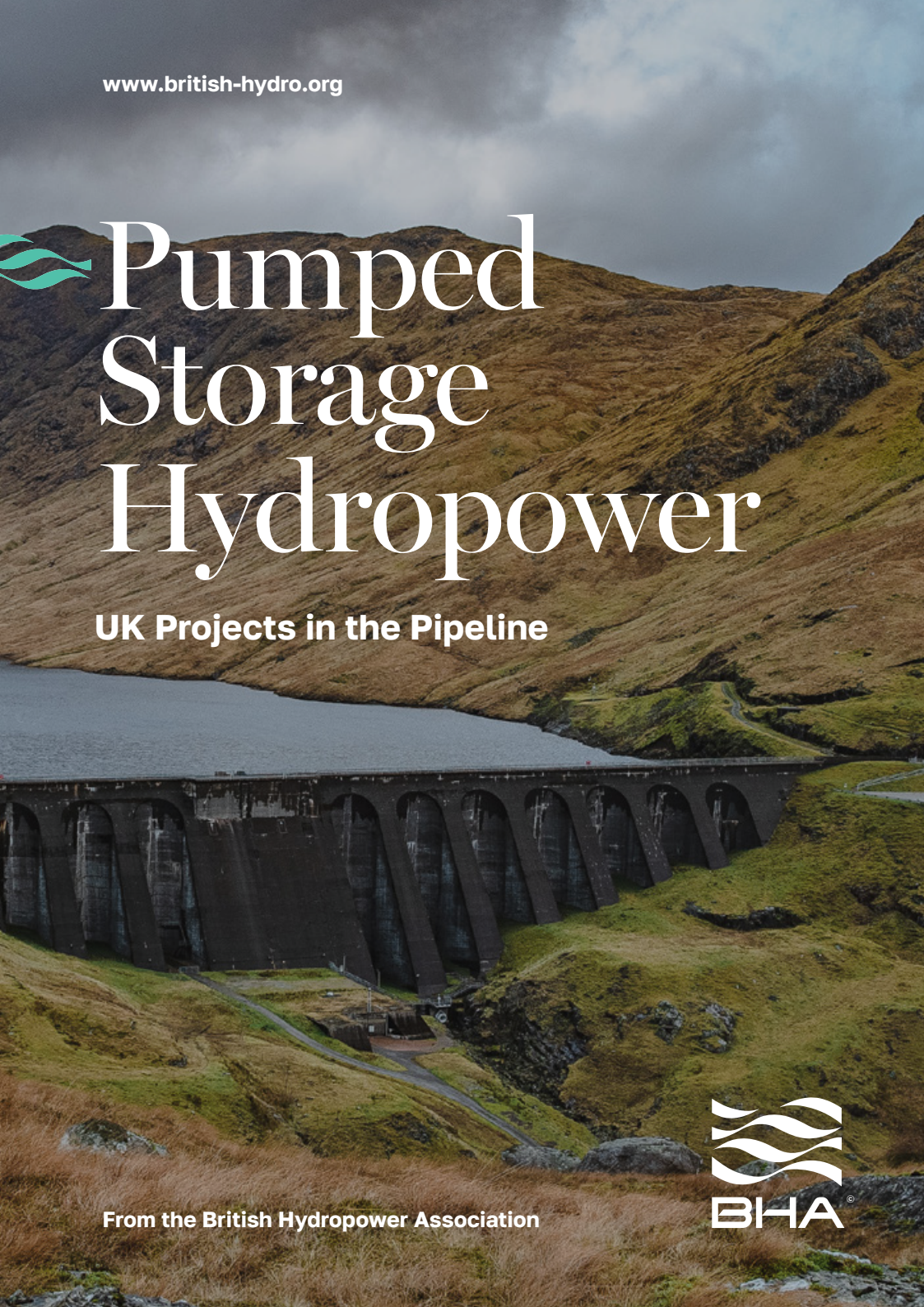
Pumped Storage Hydropower

UK Projects in the Pipeline



From the British Hydropower Association

BHA

Pumped Storage Hydropower

There has been no new pumped storage hydropower capacity in UK for over 40 years but there is over 10GW and 200GWh of storage capacity in new projects awaiting regulatory support.

What is Pumped Storage Hydropower?

Serving as a dynamic energy storage solution, pumped storage hydro (PSH) involves two reservoirs at different elevations. During periods of low energy demand, surplus electricity is used to pump water to the higher reservoir. When demand peaks stored water is released, generating electricity.

Why do we need it now?

On cold, overcast and windless days, gas often generates 70% of UK power. To meet the Government's target of 95% clean power by 2030, the UK must transition to a renewables-dominated, low-carbon electricity system. Within this system, energy storage, including long-duration energy storage (LDES), is essential for balancing the grid and maintaining security of supply. Pumped hydro is one of the oldest forms of LDES, capable of generating significant capacity within minutes.

The four existing PSH schemes in the UK were state-funded over 40 years ago to store overnight nuclear and coal power generation.

As most electricity came from fossil fuels in the 20th Century, stored energy was inherent in the system. Today the original four schemes have a combined output of 2.8GW/24GWh representing around 8% of average UK electricity generation and 5% of the energy storage the UK will need to achieve net-zero by 2050.

Grid Services: Inertia and Black Start

Pumped hydro provides over 90% of utility-scale energy storage worldwide and offers crucial stability or inertia to a power network. Physical inertia is the effect of large rotating machinery to resist sudden changes in frequency but is a 'difficult to value' benefit in the UK market. A lack of system resilience was seen as a contributor to the Iberian Peninsula blackout in April 2025.

PSH also provides rapid response, short-term operating reserve and black start services to grid operators. Hydropower is one of the few technologies capable of restarting the grid and in the US provides 40% of black start capability despite only providing 9% of US power generation.

The upper reservoir of Ffestiniog power station, Wales

The Economic Benefits of Pumped Hydro

This booklet provides a summary of 14 new PSH schemes across the UK in various stages of development, with a combined storage capacity of over 10GW and 200GWh. According to Imperial College London, just 4.5GW of new PSH could save up to £690m per year in energy system costs by 2050.

Analysis by LCP Delta shows that higher duration storage technologies, notably PSH at over 16 hours, provide the greatest system cost savings and carbon reduction by displacing peaking gas generation.

The UK has some of the highest power prices in the world, mostly through exposure to volatile gas markets as demonstrated in 2022 on the outbreak of the Ukraine War. Reducing dependency on gas and making more efficient use of our large wind turbine fleet is critical in the years ahead. Grid constraints and a lack of energy storage mean that the UK's wind fleet is often curtailed when wind is plentiful. In 2024 this inability of the grid to use low-cost wind energy cost the UK £1.2 billion, a milestone passed in early November for 2025.

The main inlet valve at Dinorwig, Wales

By adding 12GW of long duration energy storage (LDES), 2035 carbon emissions could be reduced by up to 28%

The Sloy power station on Loch Lomond. SSE have applied to convert Sloy from conventional to pumped hydro at a capacity of 160MW / 16GWh.

UK Government support for Energy Storage

In October 2024, the UK Government's Department for Energy Security and Net Zero confirmed a cap and floor scheme to stimulate investment into LDES technologies. This revenue support mechanism aims to limit developers' exposure to market risk and has been successfully used for over 10 years for UK interconnector investment. Top up payments are made to a developer if generated revenues are lower than a floor price to allow recovery of invested capital, whilst the cap will reflect equity returns for assets with a similar risk profile with excesses repaid to the regulator, Ofgem.

The scheme's final design focuses on technologies that can last the 25-year regime period at 'continuous rated power' for a minimum of 8 hours at over 100MW. This is typically supportive for pumped storage projects, and the BHA recommends that a later application window should increase the minimum storage duration and value a project's location and the grid services it provides.

In June 2026, Ofgem published its 'minded-to' decision for Window 1 of the long duration electricity storage (LDES) cap and floor scheme. It provisionally selected 16 projects, with a combined capacity of 7.645 GW, for support. Three were Pumped Storage Hydropower projects, together accounting for approximately 3.9 GW, more than half of the capacity provisionally selected. Other successful technologies included lithium-ion batteries, compressed air energy storage and vanadium redox flow batteries. Ofgem expects to publish its final determinations later in 2026 and to consult on the design of future selection windows before the end of the year.

Window 1 PSH projects Provisionally Selected for Cap and Floor Support

Planned operation in 2030:
Loch Kemp, 660 MW

Planned operation in 2033:
Coire Glas, 1,450 MW
Earba, 1,800 MW

The BHA continues to advocate for the remaining PSH projects under development across the UK to be eligible for a future LDES application window. Ofgem intends to consult on the design of future selection windows before the end of 2026, with a potential second window expected to follow in 2027. While the UK needs a mix of energy storage technologies, we believe all forms of hydropower, including tidal range, are essential to achieving clean power and net-zero goals.

Enabling successful project delivery

Subject to final Window 1 cap and floor awards, PSH developers will need to progress final investment decisions and construction programmes on demanding timescales. This will require coordination between industry, local authorities, regulators and central government.

The BHA supports the delivery of large-scale hydropower in the UK by convening the sector at dedicated events. These events bring together developers, major contractors, equipment manufacturers and policymakers, demonstrating strong confidence in the sector and identifying the action needed to turn the project pipeline into investment, jobs and industrial growth.

The following sections summarise the challenges identified and the areas where collaboration can support successful project delivery:

scottish renewables
areg Aberdeen Renewable Energy Group
Scottish Canals
prosper
HIE Highlands and Islands Enterprise
Iomairt na Gàidhealtachd 's nan Eilean

Supply Chain

Each industry specialism will have several UK and international firms keen to bid for work, and with multiple PSH projects a step closer to construction, firms now have a signal of confidence in the UK market. The BHA has written to the Secretary of State for Energy, outlining the global competition for turbines and generators. Voith, Andritz and GE Vernova are three major OEM suppliers who can 'pick their markets' in a global PSH pipeline of 600 GW under development. Ministers and industry leaders should foster the scale up of British firms to service this major export opportunity.

Workforce and Skills

A report published in January 2025 by the University of Highlands and Islands with support from Statkraft, showed that Scotland already has a tight labour market in the construction and energy sectors. With a scale up of offshore wind, major road and house building projects, national-level initiatives will be needed to serve demand. The BHA is working with industry partners to advocate for a Centre of Excellence for Skills, Safety and Innovation to be based at Torvean Quarry near Inverness, able to support several energy and construction sub-sectors. The project would cost £30m and deliver modular training including; plant & crane operations, civils and formwork, fabrication, welding, electrical systems and scaffolding.

Transport

Getting equipment, steel and concrete to each site will be a major undertaking which could have a detrimental impact on an already busy road network. Projects plan to use the ports of Inverness and Fort William and nearby railheads where possible. The Caledonian Canal was built in the early 19th Century and has supported safe navigation, defence, forestry and aluminium smelting. Its role in the energy transition, moving equipment through the Great Glen to minimise road use, is the next obvious chapter in its history. Upgrades are estimated at £20-38m to ensure consistent availability of heritage infrastructure through the construction phase, notably for Coire Glas, Loch na Cathrach and Loch Kemp, that all passed Ofgem's eligibility assessment.

Housing and Welfare

Each PSH project is likely to have over 500 workers on site at peak construction. This requires careful management in terms of welfare, transport and temporary accommodation, but also in terms of how workers might interact with local communities. There is an opportunity for new local housing to be built for first use by workers before a hand over to the local authority. Developers support this concept which has precedent from 1930's hydropower projects like Sloy, Tummel Garry and Glen Affic.

Grid Connections

Grid connection is a major barrier to the roll out of new energy infrastructure across the UK. Delays due to the queue for connection, the availability of parts or suitably qualified personnel and a slow planning and consents process cause uncertainty and cost escalation.
Under current rules, all works at 400 kV are classed as 'non-contestable' and can only be carried out by Transmission Operators (TOs), even where developers or accredited contractors can deliver it quicker and at lower cost. The BHA is lobbying for a 'build-transfer' model, a joint venture partnership or reform to licence permissions for independent transmission connection providers (ITCPs) to work on the grid.

TMO4+ is a grid connection reform approved by Ofgem in April 2025 that overturns the queue with a 'first ready and needed, first connected' framework. TMO4+ has a 2-gate process; demonstrating 'readiness' in terms of land rights and planning, and then proving a project is 'needed' by aligning with national strategic plans. Whilst developers have long build times, the BHA is pressing for Gate 2 approvals to be earlier than Q3-26 to assist projects to reach FID swiftly, once a cap and floor is awarded.

Neptune's Staircase: A flight of eight locks on the Caledonian Canal at Fort William which can enable access to the Great Glen for construction works and the delivery of large equipment.

Locations

1. Coire Glas
2. Earba
3. Glenmuckloch
4. Loch Kemp
5. Loch na Cathrach
6. Balliemeanoch
7. Cruachan Expansion
8. Fearna
9. Glen Earrach
10. Sloy
11. Dorothea
12. Glyn Rhonwy
13. Moel Tryfan
14. RheEnergise

Coire Glas

Location of Project:

Loch Lochy, Scotland

Project Capacity:

1.3GW, 30GWh

Name of Developer:

SSE Renewables

Overview:

Coire Glas on Loch Lochy in the Great Glen is one of the UK's most advanced pumped hydro schemes receiving planning consent in 2020. In early 2023, SSE announced a £100-million investment boost to further develop Coire Glas including the construction of a 1.2km, 5m high exploratory tunnel as part of a comprehensive package of site investigation works led by Strabag UK, Stantec and COWI.

Coire Glas will have a 90m high, 685 wide dam wall at the upper reservoir, and at 529m the highest hydraulic head of all UK projects. Overall, the project has favourable ground conditions, design maturity, and good access close to the A82 and Caledonian canal for the movement of materials and workforce. The project passed eligibility for Ofgem's cap and floor award with a planned commissioning date in 2033.

Earba

Location of Project:

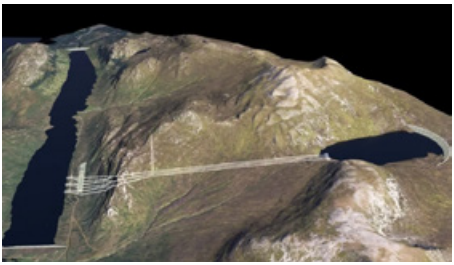
Kinloch Laggan, Scotland

Project Capacity:

1.8GW, 40GWh

Name of Developer:

Gilkes Energy



Overview:

The Earba project will store up to 40GWh of energy making it one of the largest schemes in the UK capable of powering 1.4m households per year. To put this into perspective, it would require the construction of 200 typical lithium-ion battery storage systems each at 200 MWh, to match the equivalent storage capacity of Earba. The project has recently been granted Section 36 planning consent by the Scottish Government and passed eligibility for Ofgem's LDES scheme aiming for commissioning in 2033.

The project has a hydraulic head of 355m and 3km tunnels between Loch Earba and the upper reservoir at Loch Leamhain. The ground conditions and buildability are all supportive with easy access to the national grid and existing road access. The scheme will take seven years to build employing over 500 people on site, with hundreds more in the supply chain.

Glenmuckloch

Location of Project:

Kirkconnel, Dumfries & Galloway, Scotland

Project Capacity:

210MW, 1.6GWh

Name of Developer:

Foresight Group

Overview:

The site is on a partially restored open cast coal mine which forms the lower reservoir achieving 200m of head. The project has gathered significant support through the section 36 energy consent planning process without objection. The project will connect to the grid via a new 132kV collector substation to be built at the site, connecting via 7km of overhead line to the existing substation at Glenglass.

The project is near several operational wind turbines with more in development, therefore making it an ideal site to provide grid balancing and energy storage. The project is located on the Buccleuch Estate, that undertook the initial development and permitting work. It is now led by Foresight Group, a London-based investment manager, focused on energy transition and sustainability.

Loch Kemp Storage

Location of Project:

Whitebridge, Scotland

Project Capacity:

660MW, 14.5GWh

Name of Developer:

Statera

Overview:

Loch Kemp is a pumped storage project near Fort Augustus in the Scottish Highlands being developed by Statera Energy. Using Loch Ness as the lower reservoir, the project is currently envisaged to generate up to 22 hours at 660MW, a total storage capacity of approximately 14.5GWh.

The scheme involves building several new dams around Loch Kemp to raise the current water level, enabling an upper reservoir of 34 million m3. The project will have relatively short, 1.2km headrace tunnels with the powerhouse incorporated into buildings and marine access on the shores of Loch Ness. The scheme would be connected to the National Grid substation used for the Foyers pumped hydro scheme via an underground 275kV cable.

Statera Energy have submitted a section 36 planning application and have a grid connection agreement. The project has passed the eligibility assessment for a cap and floor award and aims to begin construction in 2026 with commissioning in 2030.

Loch na Cathrach

Location of Project:

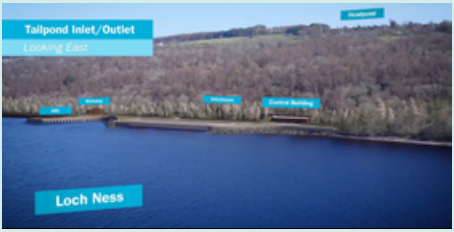
Dores, Scotland

Project Capacity:

500MW, 4GWh

Name of Developer:

Statkraft



Overview:

Loch na Cathrach PSH project formerly known as Red John, is a 500 MW / 8 hour energy storage facility under development by Statkraft in the Scottish Highlands, approximately 14km southwest of Inverness. Approved by the Scottish Government in June 2021, the scheme uses Loch Ness as the lower reservoir and a newly constructed upper reservoir at 250m of head near Loch Duntelchaig. The system will employ three reversible pump turbines housed in an underground powerhouse, facilitating energy storage and generation. Grid integration involves a 275kV connection to the Knocknagael substation via approximately 9 km of underground cables. The project is eligible for Ofgem's cap and floor mechanism and plans for commissioning in 2030.

In January 2025, Statkraft published a report with the University of Highlands and Islands identifying a competitive labour market in the Scottish energy and construction sector. Workforce planning and early investment in training will be key to all projects in finding suitably qualified personnel.

Balliemeanoch

Location of Project:

Argyll & Bute, Scotland

Project Capacity:

1.5GW, 45GWh

Name of Developer:

ILI Group & AECOM

Overview:

Balliemeanoch will be one of the largest Pumped Storage projects in the UK with a storage duration of 30 hours if fully operated. The developer is currently seeking section 36 energy consent from the Scottish Government. The project will feature a 110m high dam and a 2.8km, 9m wide headrace tunnel, a large catchment area and an upper reservoir storing 58 million m^3 of water at a hydraulic head of 385m.

The tail race (outlet) will be into Loch Awe which is also used for the Cruachan project.
To support logistics, 14km of new road access and a temporary jetty on Loch Fyne will be constructed for the delivery of materials and heavy machinery. This is a major advantage vs sole access by road, and the project is actively engaged with the local community to address concerns for peatland habitat loss.

Cruachan Expansion

Location of Project:

Argyll and Bute, Scotland

Project Capacity:

600MW, 8.6GWh

Name of Developer:

Drax

Overview:

The Cruachan expansion project is the development of a new powerhouse, transformer cavern, penstocks and tailrace tunnel adjacent to the existing power station to provide a further 600MW of generating capacity, optimising the existing Cruachan reservoir and dam. The project has an approved grid connection and development consent with an Owners Engineer and M&E FEED contractors appointed in recent years. The existing Cruachan power station generates 440MW, which is due to increase to 480MW in next two years as part of a refurbishment programme.

Cruachan typically generates around 15% of power from rainfall into the upper reservoir catchment and the four reversible Francis turbines can move 200m^3 of water / second. The developer placed the project on hold in May 2025 and did not bid into the initial window for Ofgem's cap and floor mechanism due to increasing project costs while the recoverability of capital remains unclear. The project remains competitive due to good ground conditions, short tunnels and existing infrastructure.

Fearna

Location of Project:

Glen Garry, Scotland

Project Capacity:

1.8GW, 37GWh

Name of Developer:

Gilkes Energy & SSE Renewables

Overview:

The Fearna project is a proposed large-scale energy storage scheme in the Scottish Highlands, developed through a 50:50 joint venture between SSE Renewables and Gilkes Energy. Situated approximately 25km west of Invergarry, the project will connect the existing Loch Quoich reservoir with a newly developed upper reservoir at Loch Fearna. The scheme benefits from short, 1km tunnels, a hydraulic head of 376m and 20 hours of storage making it one of the four largest in the UK.

Fearna has secured a grid connection at 1.8GW and has applied to the Scottish Government for section 36 planning consent. The project requires 2 dams and 20km of upgrades to roads but reduces ground risk by citing the powerhouse at the lower reservoir instead of deep underground. Whilst slightly behind other projects in terms of planning, this project is a strong contender for a second application window for Ofgem's LDES scheme.

Glen Earrach

Location of Project:

Balmacaan Estate, Scotland

Project Capacity:

2GW, 34GWh

Name of Developer:

Glen Earrach Energy

Overview:

The Glen Earrach Energy (GEE) project with a generating capacity of 2GW is the largest, most water-efficient and arguably the best situated pumped storage scheme in the UK. Located on the Balmacaan Estate above the vast waters of Loch Ness, the project has a hydraulic head of 480m, favourable geology and good access for construction both by road and water using the Caledonian Canal for the delivery of large equipment.

The project remains competitive for Ofgem support due to its scale and location, able to absorb excess energy from Scotland's large offshore wind fleet. Pumped hydro in the Loch Ness catchment area can also alleviate flood risk and support salmon migration by improving the design of the Ness Weir.

The Glen Earrach project has a strong community engagement ethos ensuring a legacy in the region for decades to come. Glen Earrach alone has been estimated to reduce the UK electricity grid's post-2030 carbon footprint by around 10%, and lower grid running costs by over around £3bn in the first 20 years of operation.

Sloy

Location of Project:

Inverglas, Loch Lomond, Scotland

Project Capacity:

160MW, 16GWh

Name of Developer:

SSE Renewables

Overview:

Sloy Power Station is Britain's largest conventional hydropower plant and has been in operation since 1950. It currently generates around 130 GWh of electricity in a year of average rainfall. The current scheme makes use of the water of Loch Sloy, carried over 3km by a tunnel through Ben Vorlich before descending four high pressure pipelines to the Sloy Power Station on Loch Lomond. Four Francis turbines drive vertical shaft generating sets with a combined capacity of 152.5MW.

SSE Renewables now propose to convert Sloy to pumped hydro by using three of the existing high-pressure pipelines enabling the scheme to generate for longer periods. The existing 32.5MW G4 turbine will be upgraded to match its sister units, increasing the station's generating output by 7.5MW to 160MW. Subject to planning consent, SSE Renewables aim for a final investment decision in late 2027 and to commission the new pumped storage scheme by the end of 2030.

Dorothea

Location of Project:

Nantlle Valley, Gwynedd, North Wales

Project Capacity:

365MW, 2.95GWh

Name of Developer:

Dorothea Pumped Hydro

Overview:

The Dorothea project aims to form a lower reservoir from three of five water-filled voids of the former Dorothea Quarry giving a combined water volume in excess of 4 million m^3. Cwym Silyn lake at a distance of 2.5km would form the upper reservoir at a hydraulic head of 320m. With a nearby 400kV grid connection, the scheme aims to generate 365MW for a minimum of eight hours with scope to be increased.

Dorothea Quarry is a place of exceptional industrial heritage and the project team is working with Bangor University to document, preserve and interpret the site as a long-term commitment to the UNESCO World Heritage Slate Landscape of North-West Wales. The project would take four years to build, sustain 600 jobs and bring substantial economic, social and cultural benefits to the Nantlle Valley. Over its lifetime, Dorothea is estimated to avoid around 30 million tonnes of CO2e - equal to roughly five years' of all road-vehicle emissions in Wales.

Glyn Rhonwy

Location of Project:

Llanberis, North Wales

Project Capacity:

100MW, 800MWh

Name of Developer:

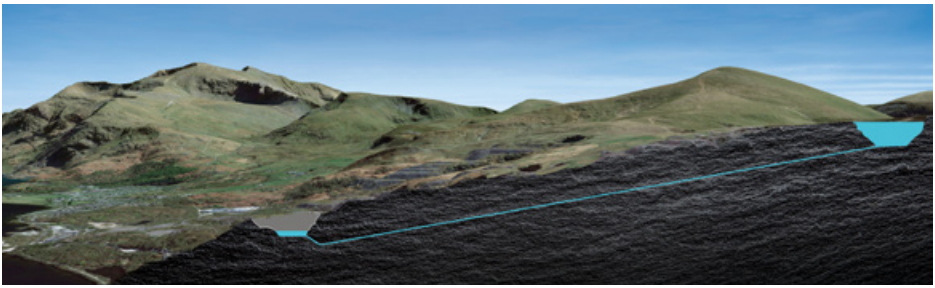
Quarry Battery Company

Overview:

Also known as Snowdonia Pumped Hydro, this 100MW project near Lanberis, North Wales plans to form a new 1.3 million m^3 reservoir in a former slate quarry. It would have 250m of hydraulic head and be designed with the landscape in mind, restoring local heritage and avoiding the use of pylons for transmission to the grid.

Planning consent, grid connection and an abstraction licence were achieved in 2017. The project has support from Octopus Energy but awaits eligibility for Ofgem's cap and floor mechanism.

Whilst the pumped hydro schemes in North Wales are relatively small and expensive on a CapEx/MW basis, their economic assessment is greatly strengthened when wider attributes are considered. Duration, lifespan, heritage restoration, rural employment, water storage and the proximity to offshore wind and major cities are all key attributes that make their construction a 'no regrets' decision.



Moel Tryfan

Location of Project:

Nantlle Valley, Gwynedd, North Wales

Project Capacity:

100MW, 600MWh

Name of Developer:

Caernarvonshire Crown Slate Quarries

Overview:

The twin quarries of Moel Tryfan and Alexandra are owned by Caernarfonshire Crown Slate Quarries, occupying the high ground to the north of the Nantlle Valley sharing an ownership boundary with Pen-yr-Orsedd quarry.

Quarrying of the slate around the Moel Tryfan – Alexandra complex continues on a relatively small scale, but early-stage discussions continue with local planning authorities on plans for a pumped storage scheme. The site would use Alexandra Quarry as the upper reservoir with a capacity of 1.2 million m^3, with a hydraulic head of 250m and a headrace tunnel of around 1.3km.

The scheme is rated at 100MW for ease of planning but could be marginally increased to better meet regional energy storage needs. At this scale, build times could be relatively quick, helping to balance the grid, storing excess power from offshore wind arrays in the Irish Sea.

RheEnergise HD Hydro

Location of Project:

Ivybridge, Devon

Project Capacity:

500kW (test scale)

Name of Developer:

RheEnergise

Overview:

The RheEnergise Demonstrator Site is a High-Density Hydro (HD Hydro) energy storage project located near Plymouth in Devon. The project uses the company's proprietary high-density fluid, R-19, which is 2.5x denser than water, enabling significant energy storage using modest elevation differences.

RheEnergise at the test scale of 500kW generating capacity consists of upper and lower buried storage tanks connected by a pipeline. A specially patented (pending) Francis turbine, modular pump, and power conversion equipment are housed efficiently adjacent to the lower tank.

Construction began in the Summer of 2024, with commissioning in Winter 2025. The first full scale project will be 10MW and 80MWh, with the second aimed at 20MW and 120MWh. The site forms a key part of RheEnergise's pathway toward delivering HD Hydro installations across the UK, Europe and internationally.

The British Hydropower Association is the leading trade membership association solely representing the interests of the UK hydropower industry.

Our mission is to drive growth in the sector by engaging, influencing and promoting hydropower, tidal range and pumped storage hydro, making these technologies relevant within the Government's ambition to enable a decarbonised, secure grid by 2030.

For more information, please contact the BHA:
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