Glenmuckloch Pumped Storage Hydro Scheme
Non-Technical Summary
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Introduction

Glenmuckloch Pumped Storage Hydro Ltd. is proposing to develop a pumped storage hydro scheme on land at Glenmuckloch Surface Coal Mine (Figure 1) approximately 3.5 kilometres north-west of Kirkconnel in Dumfries and Galloway. The proposal, known as the Glenmuckloch Pumped Storage Hydro scheme, will be capable of generating up to 400 megawatts of electricity.

The development has been subject to a thorough environmental assessment and design iteration process to ensure that it represents the optimal development for the site.

The Pumped Storage Hydro scheme complements other proposals at the site to restore the surface coal mine and develop it as an Energy Park accommodating a range of energy technologies.
The Applicant

The applicant “Glenmuckloch Pumped Storage Hydro Ltd” represents a joint venture between Buccleuch Estates Ltd and 2020 Renewables. The partners in the project bring together a wide range of experience and knowledge of both the site itself and development of large scale energy projects. Buccleuch is the site landowner and responsible for overseeing all future developments. Their experience of major earthworks and excavation activities is invaluable in the planning of the project. 2020 Renewables is a developer and operator of renewable projects employing staff with a proven track record of developing, financing and constructing both renewable and large scale conventional power projects.

Purpose of the Non-Technical Summary

The aim of this Non-Technical Summary is to summarise the content and main findings of the Environmental Statement in a clear and concise manner to assist the public in understanding the potential environmental effects of the proposed development. The full ES (Volume 1: Main Report; Volume 2: Chapter Appendices; and Volume 3: Landscape and Visual Impact Assessment (LVIA) Figures) provide a more detailed description of the proposed development and the findings of the Environmental Impact Assessment process.

Further Information

Copies of the ES and further information on the proposed development may be obtained from the applicant by email: info@2020renewables.com or by post, Glenmuckloch Pumped Storage Limited, c/o 2020 Renewables Ltd, Clyde View (Suite F3), Riverside Business Park, 22 Pottery Street, Greenock, PA15 2UZ.

The NTS is available free of charge; a CD containing copies of all documents is available at a cost of £10 and a printed copy of the ES costs £500. An electronic version of the reports supporting the application, including the ES, will be available to download from http://www.energyconsents.scot (Case Reference EC00005236)
Project Benefits

Objectives & Need for Development

The Glenmuckloch Pumped Storage Hydro scheme:

- Represents the next stage of the development of the Glenmuckloch Energy Park;
- Supports both the current coaling and restoration activities at Glenmuckloch Surface Coal Mine site;
- Aims to maintain and support the workforce currently employed at the Glenmuckloch Surface Coal Mine site;
- Will cost over £150 million to build;
- Provides a long term economically sustainable use for the brown field site at Glenmuckloch;
- Supports the development of pumped storage facilities as part of the Scottish energy mix;
- Will help in securing electricity supplies by balancing electricity demand with intermittency of some types of generation;
- Increases the availability of renewable electricity at times of peak demand, thereby supporting the security of renewable energy supply, increasing the diversity of energy supplies and reducing carbon emissions;

- Supports a vision of highlighting Dumfries and Galloway as a progressive area for meeting and solving the challenges that come from the Scottish Government’s target of generating the equivalent of 100% of demand from renewable sources.

The proposed development, is designed to meet the demand for energy storage created by the UK energy system. Pumped Storage Hydro schemes fulfil a different role within the UK energy system (national grid) than other types of electricity generators (e.g. coal fired power stations, nuclear or wind) and can be more accurately described as energy “storage” rather than “generation”. Pumped Storage Hydro schemes are used by the electricity network operator in a number of ways but in simple terms they provide the operator with both an instant source of electricity as well as a mechanism for balancing the network for example generating electricity during times of high demand.
Economic Benefits

Biggar Economics conducted an economic impact assessment of the project and considered how the scheme might be expected to affect the local, regional and Scottish economies. The Glenmuckloch Pumped Storage Hydro scheme:

- Would generate economic activity and create and safeguard jobs and has the potential to have a significant beneficial impact;
- Represents, over its 100 year operational lifespan, a major investment in the economies of the local area, Dumfries and Galloway and Scotland, providing employment for several generations;
- During the development and construction phase, the proposed development could generate £54.1 million and support 336 job years of employment in the local area, £79.3 million and 513 job years in Dumfries and Galloway and £100.1 million and 712 job years in Scotland (including 600 direct job years plus wider economic multiplier effects);
- During each year of the operational phase the proposed development could generate £0.3 million (£26.5 million over 100 years) and support 8 jobs in the Local Area, £1.6 million (£155.5 million over 100 years) and support 16 jobs in Dumfries and Galloway and £2.5 million (£252.8 million over 100 years) and 22 jobs in Scotland;

In addition to the above, further steps will be taken to maximise opportunities for the local community and ensuring a positive lasting legacy for the local area. A number of proposals are being considered with Dumfries and Galloway Council, such as committing to the use of local suppliers, proactive engagement with the local supply chain and a local employment initiative, which would focus on employing, training and reskilling local people so that they could benefit from the employment opportunities presented by the scheme.
How Pumped Storage Hydro works

Pumped storage hydro works by releasing water from a higher waterbody to a lower one and passing it through a turbine or several turbines to generate electricity. At times of low electricity demand water is pumped back up the hill and stored in the upper reservoir until further electricity is required. Figure 2 shows the main components of a pumped storage hydro scheme.
Opening the gate at the upper reservoir allows water to be released and passed through a series of water pipes, then through the turbines and into the lower reservoir. The times and duration of this electricity generation will be determined through the contractual arrangements with the electricity grid operator – National Grid. In simple terms this will be when there is a requirement for electricity e.g. during periods of high demand.

Water is then pumped back up the hill at times when excess electricity is being produced for example on windy days or when there is little demand.

This cycle may occur several times a day, should it be needed. The exact times of pumping and generating is dependent on the supply and demand of the electricity grid.
The site is currently operated as a surface coal mine where coal is being excavated, using large diggers and vehicles. As coal has been dug from the site, a void has been created with water naturally collecting within it.
The Glenmuckloch site

Glenmuckloch Surface Coal Mine

The proposed site is located approximately 3.5 kilometres north-west of Kirkconnel and accessed from the A76 across an existing rail bridge via the Lagrae Road as shown on Figure 5.

Coaling operations at Glenmuckloch commenced in 2006. In May 2013 following the liquidation of the previous operators ATH the site was transferred to Glenmuckloch Restoration Ltd., part of Buccleuch Estates Ltd. with Hargreaves contracted to restore the site.

The restoration of the 733 hectare site includes continuing production of coal from the eastern extension with around 25,000 tonnes of coal being produced between November 2013 and July 2014. This includes 62 people, 75% living in the local area, that are currently employed at the site undertaking restoration and mining activities. The western part of the site has been restored with mining operations taking place in the eastern part. The coaling operations in the eastern part have resulted in a large hole which will be used to form the lower reservoir.

Site Features

St. Conals Cross: (also known as St Connel’s Cross) is located about 30 meters below the upper reservoir but will be protected throughout the construction period. Public access to the monument from St Conals Church, would be provided once the Glenmuckloch Pumped Storage Hydro scheme has been constructed (Figure 5).

Public Rights of Way and Access: Prior to opencast coaling operations a public Right of Way allowed access to walkers from Lagrae Road to the east of the site to Ellergoffe Knowe and the hills to the west of the site. Once construction activities at the site have ceased this right of way will be reinstated. The public rights of way in and around the site are shown on Figure 5.

Lagrea Burn Site of Special Scientific Interest: As a condition of the planning consent for the Eastern Extension of the Glenmuckloch SCM consent was given for the excavation of part of the Lagrea Burn Site of Special Scientific Interest. This geological SSSI provides exposures of strata from the productive Middle Coal Measures to the sandstones of the barren Upper Coal Measures. This includes a good exposure of Skipseys Marine Band the band of marine invertebrate fossils forming the boundary between the Middle and Upper Coal Measures. The design of the PSH will leave a publically accessible designed exposure of the same geological sequence in the eastern wall of the lower reservoir.

Other Developments

Other developments located or proposed within the site include:

Glenmuckloch Community Energy Park Ltd - in July 2015 two 100 kilowatts community turbines were erected at the site. The revenue from these turbines is being provided to the community and applications can be made through the funding arm ‘PROPEL’ comprising pupils at Sanquhar Academy.

Glenmuckloch Wind Farm – A planning application for a further eight wind turbines at the site was submitted to Dumfries and Galloway Council in June 2015.

Site with no PSH

If the Glenmuckloch Pumped Storage Hydro scheme does not go ahead for any reason the site will be restored as per the restoration plans attached to the Glenmuckloch Surface Coal Mine planning consent and agreed with Dumfries and Galloway Council.
Project Description

The proposal is for the development of the Glenmuckloch Pumped Storage Hydro scheme making use of the exiting 18.2 million cubic metre open cast void on the site to create a storage reservoir (lower reservoir).

A second reservoir (upper reservoir) would be created on Halfmerk Hill on the ridge above the open cast site.

For the purposes of the environmental impact assessment and initial project development, a maximum design envelope has been identified for a scheme capable of output of up to 400 megawatts. The final size of the scheme will be determined following further design work and consultation with the grid operators.

The development will be designed to operate for over 100 years and will comprise the following main components:

**Upper Reservoir and Dam** – a new water body and dam will be created on the ridge, Halfmerk Hill, above the surface coal mine. Construction will involve excavation of the reservoir and re-use of the excavated rock to create the dam which will also incorporate a geo-membrane liner. The dam surface will be covered in soil and turved/vegetated to ensure it fits in with the existing vegetation at the site and minimise its visibility.
**Lower Reservoir** – the lower reservoir will be created within the existing void excavated during mining operations. The final void will be re-shaped to ensure the walls are the correct gradient and the reservoir will be lined using mudstone from the site or a geo-membrane line.

**Waterways** – a series of underground pipes (known as penstock) will transport water between the two reservoirs. The pipes will be constructed by excavation of ground and re-burial of the pipes between the upper and lower reservoirs.

**Underground Powerhouse** – water will pass through a series of underground turbines located within the power house. The underground structure will be located largely within the existing surface coal mine void however there may require to be additional excavation works carried out.

**Substation** – above ground switchyard and substation will connect the proposed development to National Grid electrical infrastructure.

**Administration Buildings** – above ground control building and parking spaces provided for day-to-day operation and maintenance of the development.

**Transformers** – located above ground directly above the powerhouse.

**Crane** – mobile Goliath Crane will be provided to service the underground power station and transformer bays.

**Access Tracks** – the site will be accessed from the A76 via the Lagrae Road with an on-site track connecting both the upper and lower reservoirs. The access tracks will be built first to allow plant and machinery to get onto the site and will then support ongoing operations.

**Temporary Site Compound and Workers Camp** – for use during construction.
The project will also require the following:

- **Water**: 3.3 million cubic metres of water will be stored and used within the system.
- **Water Abstraction** – options being considered include sinking a borehole into flooded mineworkings and/or using abstracting water from the Nith during times of high flow. A separate application to Scottish Environmental Protection Agency under the Water Environment Controlled Activities (Scotland) Regulations 2011 will be made. This application will include a full assessment of the associated environmental impact and will be publically advertised.
- **Grid Connection** – will be on an overhead line details of which are not yet known. This will be dealt with under a separate consent process.
- **Construction Staff** – approximately 327 construction workers on site.

Following the completion of construction any areas of disturbed ground will be revegetated and restored. The Glenmuckloch Pumped Storage Hydro scheme is expected to take 5-6 years to construct and is likely to be operational in 2022. This would happen in conjunction with the construction of the proposed Glenmuckloch Wind Farm, the ongoing coal excavations and the following restoration of the site.

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Figure 8 ▲ Timeline for Developments on the Glenmuckloch site
Consultation and Design Evolution

Consultation

A detailed scoping and consultation process was followed in order to:

- Ensure that consultees are informed of the proposal and provided with an opportunity to comment at an early stage in the Environmental Impact Assessment process;
- Obtain baseline information regarding existing environmental site conditions;
- Establish key environmental issues and identify potential impacts to be considered during the Environmental Impact Assessment;
- Identify those issues which are likely to require more detailed study and those which can be justifiably scoped out of further assessment;
- Provide a means of confirming the most appropriate methods of assessment.

A scoping response from the Scottish Government providing input from statutory and other key consultees was received in September 2015. Further consultation meetings have been held with Dumfries and Galloway Council, Scottish National Heritage, Scottish Environmental Protection Agency and the Scottish Governments Energy Consents and Development Unit during which specific site related issues were discussed in greater detail.

In parallel with the statutory consultation process, a comprehensive programme of community engagement in relation to the proposed development has been conducted to inform local stakeholders and engage with local communities. Meetings have been held with both the Kirkconnel and Kelloholm Community Council and Sanquhar Community Council (Royal Burgh of Sanquhar) to introduce the scheme, outline the proposals to the members and answer any questions.

A “drop in” style public exhibition was held in the Kirkconnel Miners Welfare Hall on 2nd November 2015 with around 25 people attending. The purpose of this event was to inform members of the local community about the proposed development, allow them the opportunity to meet the members of the Joint Venture – Buccleuch Estates Ltd and 2020 Renewables, to provide them with an opportunity to answer any questions and to provide comments on the proposed development.
Design Evolution

Several factors have influenced the design of the Glenmuckloch Pumped Storage Hydro scheme. These include achieving a best fit between maximising the amount of water stored in the system, integrating coaling operations and other site proposals.

The scheme will be further refined during the detailed design stage following approval of the application. This will take into account developments at the site and feedback from the ongoing consultations.

The initial design phases are described in the following table.

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<th>Stage</th>
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<td><strong>Phase 1</strong></td>
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<td>Pre-feasibility January 2015</td>
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<td><strong>Phase 2</strong></td>
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<td>2</td>
<td>Initial design May 2015</td>
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| 3              | Full Design July 2015         | Full initial design produced and following changes made:  
Upper reservoir – moved northwards to avoid St. Connel’s Cross  
Upper reservoir – changes made to accommodate wind turbines  
Substation – substation reduced in size for technical reasons |
| 4              | Final Design October 2015     | Final design produced for public exhibition and s36 application.  
Further analysis of the electricity market and potential commercial trading arrangements within that market is being undertaken with the potential that the s36 application may be for a pumped storage scheme up to 400 megawatts. |
Environmental Impact Assessment findings

Environmental Impact Assessment process

The Environmental Impact Assessment process involves collation and analysis of information regarding the likely significant environmental effects of a development and provides an opportunity to ‘design out’ adverse effects wherever possible. Where adverse effects cannot be designed out, mitigation measures can be proposed to avoid, compensate, or reduce significant environmental effects to an acceptable level. As such, Environmental Impact Assessment is an iterative process, rather than a one-off appraisal, which allows feedback from stakeholder consultation and the results from baseline studies to be fed into the design process of the wind farm. A team of independent, environmental specialists undertook each of the technical assessments.

Hydrology and Hydrogeology

The key surface and ground water issues considered in the assessment include: potential impacts on the water environment (including wetland habitats, watercourses and aquatic species such as fish); potential increases in flood risk to people and property; and potential impacts on water supplies. In general, the proposals are anticipated to result in a clear improvement in the water environment locally relative to the existing situation.

A minor new water abstraction is required to help fill the reservoirs and keep them topped up when they are in operation. The options currently being investigated are either abstraction from groundwater within abandoned coal workings beneath the site or from the River Nith. The abstraction rates and volumes proposed would have a negligible impact on the water environment and would be strictly regulated by the Scottish Environment Protection Agency.

There are no public water supplies affected by the scheme. Private water supplies have been identified and inspected. Because of their location relative to the proposed works, these supplies would also be unaffected.

The scheme designs would ensure that there is a negligible impact on flood risk to infrastructure, people or property downstream. Creation of the two large reservoirs does have potential safety implications, but the related risks have been carefully considered and accounted for by the scheme designers, in line with reservoir safety legislation.
Ecology

The likely significant effects of the proposed Glenmuckloch Pumped Storage Hydro scheme on the habitats and species that are of ecological value have been assessed.

The location of the proposed scheme is approximately 1 kilometre from the designated sites, North Lowther and Muirkirk Special Protection Area and North Lowther Site of Special Scientific Interest, and so would not directly impact them or their designated features.

The main issue of ecological importance is the presence of Peregrine Falcon which were recorded on the site. These birds may be disturbed by further coaling activities or construction of the Pumped Storage Hydro scheme. To mitigate this it is proposed, following discussion and agreement with Scottish Natural Heritage, to create a suitable replacement nest site elsewhere within the site boundary.

Site habitats include wet heath, marshy grassland, modified bog, semi-improved grassland, conifer plantation and bracken. Areas of these would be removed in advance of construction works, although the lower reservoir would largely be in the area of the existing surface coal mine. Mitigation would be put in place in the form of a site specific habitat management plan, which would restore areas disturbed during construction and would seek to enhance the ecological value of the habitats on site after construction.

Protected mammal activity (badger and otter) was recorded in low levels across the site. Habitat that would be suitable for water vole was also present on site. However the site is not a key area for any of these species.

Salmonid, grayling and lamprey species of fish were recorded in the River Nith, and the fisheries habitat is of good quality. In the event that any water is abstracted from the River Nith any intake point will be designed to include screening to ensure the protection of all fish species.

If all mitigation measures are implemented, then it is not expected that there would be any significant impacts upon any of the ecological receptors on site.
**Viewpoint 1 - A76 Nether Cairn**

*Existing View* from Viewpoint 1 - A76 Nether Cairn.

*Computer Model Visualisation* of the Glenmuckloch Pumped Storage Hydro Scheme.

*Photomontage View* of the Glenmuckloch Pumped Storage Hydro Scheme.
Landscape and Visual

The existing character of the landscape within the site is continually changing due to the ongoing mining and restoration operations within the Glenmuckloch Surface Coal Mine. These mining operations already influence the character of the landscape and have an influence on people’s views. The Glenmuckloch Pumped Storage Hydro scheme is likely to result in some changes to the character of the landscape and to people’s views.

The landscape within the site is partially of low quality and in relatively poor condition as a result of the surface coal mining excavations. The site includes a steep slope, with the upper reservoir proposed to be on the side of a ridgeline.

The visual effects of the proposed development have been assessed using zone of visibility modelling. These show the areas of land within which the proposed development may be visible. Photomontages, which illustrate the predicted appearance of the proposed Glenmuckloch Pumped Storage Hydro scheme have also been created.

Views of the pumped storage hydro scheme are relatively contained, due to the low height of the different parts. Moreover, natural screening is provided by the landform and surrounding woodland. The lower reservoir would therefore rarely be visible, due to its low-lying position, which would be well screened by the restored surface coal mine. The water surface is likely to only be visible from very close proximity.

The upper reservoir would be the main visible part of the proposed development, due to its position on the skyline. The upper reservoir would be visible by receptors within the local area of Upper Nithsdale. The upper reservoir dam embankment would be restored with rough grassland to match the surrounding hill slopes to reduce the visual effect.

The landscape and visual effects from these closest areas of Upper Nithsdale are likely to be adverse during construction, due to the increased construction influences present, but these would be temporary in nature. However, during the operational period there would be a beneficial change from the current coal site.

The assessment identifies localised significant visual effects during the construction period on several nearby viewpoints. Some significant impact is also seen on the landscape character of the immediate areas of the NW Lowthers and Upper Nithsdale landscapes in which the proposed development is located. During the operational phase, the assessment only identifies significant visual effects from St Connel’s Church.
Viewpoint 7 - Kelloholm

Existing View from Viewpoint 7 - Kelloholm.

Computer Model Visualisation of the Glenmuckloch Pumped Storage Hydro Scheme.

Photomontage View of the Glenmuckloch Pumped Storage Hydro Scheme.
Transport and Access

The receptors of the proposed development on issues relating to traffic and access, includes the local communities of Kirkconnel and New Cumnock. Any effects would largely be related to construction.

Construction vehicles would consist of heavy goods vehicles, but would also include special ‘heavy load’ transport vehicles which are used to transport over-sized items such as electricity transformers. Construction traffic is likely to access the site via the A76(T), crossing the railway to the west of Kirkconnel, then travelling west along a private roads towards the site.

Based on up-to-date traffic flow information, it was found that no significant or long-lasting effects resulting from the construction phase are anticipated. During construction the number of heavy goods vehicles using the A76(T) is likely to increase traffic flows in the area by a maximum of 14%.

No significant problems are expected on any of the roads within the study area during the operation of the proposed development. The impact of operational traffic is likely to increase traffic flows in the study area by less than 1%.

The findings of this assessment show that there would be no major issues relating to traffic and access as a result of the proposed development. While construction traffic is likely to increase heavy goods vehicles movements in the local area, these impacts would be temporary and short-term.

Noise

Potential effects of noise and vibration during construction and operation as a result of the following activities have been assessed including:

- Temporary effects from excavation, construction and construction traffic
- Permanent operational effects from plant facilities, transformers and vehicles
- Permanent operational effects from changes on the nearby road network

Noise significance thresholds for the temporal and permanent effects and evaluative criteria have been established consistent with guidelines, standards and current practice. Dumfries and Galloway Council and local policies have been considered, together with professional judgment.

Construction noise during the day, evening and night time, have been assessed as not giving rise to any temporary significant effects. Likewise, vibration effects from excavation and construction have been identified as negligible.

For operational noise from transformers, building services and onsite vehicles, the noise emissions would be controlled, to ensure compliance with local criteria and international guidance. During operation, there would be no likely significant adverse noise effects due to increase of road traffic flows.

Site specific construction noise and vibration controls would be included within a Environmental Management Plan for construction including site working hour restrictions and measures to reduce noise and vibration through best practicable means.

Noise emissions during operation would be controlled through careful design and would not require complex mitigation measures to ensure that there would be no significant residual adverse noise or vibration effects from the proposed scheme.
Cultural Heritage

The cultural heritage assessment considered 55 designated and undesignated sites within 5 kilometres of the proposed development. Overall, the range of cultural heritage located within the vicinity of the proposed development reflects the post-medieval history of Kirkconnel and the rural, upland agriculture of the area. It is judged that no direct effects would occur to known cultural heritage receptors. The assessment identified some potential for encountering unrecorded archaeology within the footprint of the development during construction; dating from prehistory to the post-medieval periods.

The effects from the operation of the development are primarily based on the consideration of indirect impacts to the setting of selected cultural heritage receptors. The assessment has judged that changes to the setting of cultural heritage receptors from the development, on the whole, would be limited and create effects of either minor or no adverse significance.

Known features such as the cross on the Penachrig Burn St Conals (or Connel's) Cross, erected by the Duke of Buccleuch in the late 19th Century, are located close to the main construction area of the upper reservoir. Steps will be taken to ensure that direct physical effects are not incurred on known cultural heritage receptors within close proximity of construction areas. Measures may include detailed survey and digital recording of the cross prior to temporary removal and safe storage. Conservation works may then be undertaken on the cross and base prior to reinstatement enhanced by interpretation boards incorporating the survey and recording results. Access may be enhanced via a new footpath from the south or east within the wider scope of works associated with reinstating and introducing new Rights of Way.

While the design of the Glenmuckloch Pumped Storage Hydro scheme is such that known cultural heritage assets have been avoided, potential direct physical impacts to potential buried archaeology during construction would be mitigated through an appropriate programme of archaeological works. This would be approved by the Dumfries and Galloway Local Authority Archaeologist. No additional mitigation is proposed for setting effects. With the application of the mitigation strategy, it is judged there would be no residual effects after mitigation.

Based upon the assessment of impacts likely to occur as a consequence of the proposed development, it is judged there may be significant direct physical effects to unknown, potential cultural heritage assets during the construction phase. However, with additional mitigation measures it is assessed residual physical effects will not be significant. It is therefore expected that no significant effects to the setting of cultural heritage assets will occur.