CPPP/S6/25/13/4

Citizen Participation and Public Petitions Committee
Wednesday 10 September
13th Meeting, 2025 (Session 6)

PE2109: Halt any further pump storage hydro schemes on Scottish lochs holding wild Atlantic salmon

Introduction

Petitioner	Brian Shaw on behalf of the Ness District Salmon Fishery Board
Petition summary	Calling on the Scottish Parliament to urge the Scottish Government to create a moratorium on any further development of pump storage hydro operations on Scottish lochs holding wild Atlantic salmon until the impact of such developments on wild Atlantic salmon migrations is understood.
Webpage	https://petitions.parliament.scot/petitions/PE2109

1. The Committee last considered this petition at its meeting on 27 November 2024. At that meeting, the Committee agreed to write to the Scottish Government, major developers of pumped storage schemes including Scottish and Southern Electricity Networks, and the UNESCO Centre for Water Law, Policy and Science.

2. The petition summary is included in **Annexe A** and the Official Report of the Committee's last consideration of this petition is at **Annexe B**.

3. The Committee has received new written submissions from Glen Earrach Energy, SSE Renewables, Statkraft, the Scottish Government, UNESCO Centre for Water Law, Policy and Science, the Petitioner and Edward Mountain MSP which are set out in **Annexe C**.

4. Written submissions received prior to the Committee's last consideration can be found on the petition's webpage.

5. Further background information about this petition can be found in the SPICe briefing for this petition.

6. The Scottish Government gave its initial response to the petition on 27 September 2024.

7. Every petition collects signatures while it remains under consideration. At the time of writing, 532 signatures have been received on this petition.

Action

8. The Committee is invited to consider what action it wishes to take.

Clerks to the Committee
September 2025

Annexe A: Summary of petition

PE2109: Halt any further pump storage hydro schemes on Scottish lochs holding wild Atlantic salmon

Petitioner

Brian Shaw on behalf of the Ness District Salmon Fishery Board

Date Lodged

19 June 2024

Petition summary

Calling on the Scottish Parliament to urge the Scottish Government to create a moratorium on any further development of pump storage hydro operations on Scottish lochs holding wild Atlantic salmon until the impact of such developments on wild Atlantic salmon migrations is understood.

Background information

There has been a recent tsunami of interest in pump storage hydro (PSH) in Scotland. The economic case for PSH has been made by the sector but the environmental impacts have been glossed over, denied or ignored.

PSH operations move huge volumes of water and create large variations in loch levels sterilising shoreline ecology. In the case of Loch Ness, if all existing, consented or proposed PSH schemes were approved, the level of Loch Ness will vary by up to 1m daily. Loch Ness would effectively become an inland tidal loch, which would have serious ecological impacts including on the River Ness.

The impact of PSH on salmon smolt migration is not understood but is acknowledged by PSH developers as harmful. Wild salmon in Loch Ness sustain an ecosystem including the famous dolphins at Chanonry Point.

Please note that we are not against PSH per se, but schemes need to be located in the least environmentally damaging locations.

Annexe B: Extract from Official Report of last consideration of PE2089 on 27 November 2024

The Convener: PE2109, which was lodged by Brian Shaw on behalf of the Ness District Salmon Fishery Board, calls on the Scottish Parliament to urge the Scottish Government to create a moratorium on any further development of pump storage hydro operations on Scottish lochs that hold wild Atlantic salmon until the impact of such developments on wild Atlantic salmon migrations is understood.

We have been joined for consideration of the petition by our colleague Edward Mountain. Good morning, Edward.

The petitioner feels that the economic case has been made for pump storage hydro but that the environmental impacts have been glossed over, denied or ignored. The SPICe briefing explains that operating a pump storage project requires planning permission or a section 36 energy consent from, respectively, the local authority or Scottish ministers. The Scottish Environment Protection Agency and NatureScot, as statutory consultees, would also be expected to comment on any planning or energy consent application in respect of impacts on hydrology, the water environment and nature conservation. The briefing states that the Scottish wild salmon strategy notes pressures on wild Atlantic salmon, including obstacles to fish passage that can be created by infrastructure or changes to the water.

The Scottish Government's response states:

"The legal position of the Scottish Government is that processes under planning would examine the relevant environmental impacts and reach a conclusion, on the basis of evidence and facts relating to the particular development."

Edward Mountain, do you wish to address the committee?

Edward Mountain (Highlands and Islands) (Con): I would like to, convener, if there is time.

The Convener: Please do.

Edward Mountain: Thank you, convener. I remind members of my entry in the register of members' interests, which shows that I own part of a wild salmon fishery. I should also point out that I managed fisheries on the Ness and Loch Ness until 2006. My family has a strong connection with Loch Ness, having funded various expeditions to try to find the monster in the 1950s.

The petition has come about because of the work that is being proposed for pump storage in Loch Ness. I accept the importance of pump storage to our net zero demands in Scotland. It provides us with green energy and the ability to have a black start, should there be a complete failure in the national grid.

However, the pump storage at Loch Ness has proven that there are real threats to the environment that we do not yet fully understand. Pump storage will increase the temperature of the water that goes back into the loch. It will invariably require the feeder loch to have its height increased, which is what is being suggested for Loch

Ness. That will damage the edge of the loch and cause problems for flora and fauna. The very edge of the loch is probably the most oxygenated area. NatureScot has objected to the proposal.

I know that it would be difficult for the committee to make a recommendation to stop everything when it comes to pump storage, because it is important to Scotland. However, we need to understand what we are doing when it comes to generating electricity.

As a member of the Net Zero, Energy and Transport Committee, I say this with a bit of trepidation, because other members might not thank me for it, but this committee might think it appropriate to refer the petition to the Net Zero, Energy and Transport Committee so that it can undertake work to ascertain whether there is a problem. I am not volunteering that committee's services, because I might be killed when I return to it, but it might be an idea.

The Convener: It is generous of you to spoil all our fun. I am sure that we might want to consider some of the issues raised in the petition in the first instance while you go on your next trip to area 51 and your various monster quests.

Are there any suggestions on how we might proceed?

David Torrance: I wonder whether the committee would consider writing to the Scottish Government to seek a further response to the petition, particularly on whether it is sure that a pump storage hydro scheme would not have a significant impact on wild Atlantic salmon, and on how its policy on pump storage hydro schemes is informed by the Scottish wild salmon strategy, which recognise the impact of infrastructure and changes to water on the fish.

Fergus Ewing: I second David Torrance's suggestion and support further examination of the consequences of pump storage, as Edward Mountain has eloquently set out, not least because of the potential for disturbance of the habitat of my most famous, albeit elusive, constituent, Nessie.

There is a great deal of support for pump storage schemes in principle, and I am among the most enthusiastic of supporters. I should say for transparency that I am due to speak to Mr Shaw later and have been in correspondence with him about the issue.

11:00

The concern about the impact of pump storage schemes is an enduring one, and the right time to bottom out the issues is now, not when it is too late. I do not know what the answers are. Mr Mountain has expertise in this area, and so do many other people. I have had many discussions, over many years, with the Ness District Salmon Fishery Board and others who are interested in the success of our wild salmon sector. The petition addresses an enduring concern that will not go away. We must bottom things out. This is the time for the Government to get to grips with the issue.

I have a supplementary suggestion to make. I would like to find out what work has been done by the developers. Plainly, all the developers will have commissioned their own research. In the interests of openness and transparency, I suggest that we write to the developers, including the developers of the project in question, and to SSE. I suspect that they will have already commissioned reports on the impacts on wild salmon. In order that we can have a proper debate, we should ask them to make those reports public, to avoid any suggestion that any unwelcome or inconvenient truths that might have emerged from those reports are being kept secret. We need to get to grips with the issue. If we do not, others in decades to come might well question what we were doing.

Maurice Golden: I agree with Mr Torrance and Mr Ewing. I am concerned about the cumulative effect of such schemes, of which there are a number. In that regard, I have two suggestions to make. One is that we need to understand the context. Globally—whether in relation to the Hoover dam in the USA, the three gorges dam in China or the Gabcíkovo-Nagymaros dam between Hungary and Slovakia—there is a massive body of evidence on the environmental impact of dam building. If a particular pump storage scheme is looked at in isolation, that might lead to unintended consequences in the long term. Academia—I am thinking, in particular, of the UNESCO centre for water law, policy and science, which is based at the University of Dundee—might be where we should go to look at the wider context.

Secondly, we need to get an understanding from the Scottish Government of whether the planning system can adequately cope with and assess the cumulative impact of a number of such schemes.

The Convener: A considerable number of suggestions have been made. If Mr Golden is ever on “Pointless”, I think that he might win the money if his question involves naming dams. [Laughter.]

Are colleagues content for the committee to keep the petition open and to take up those suggestions?

Members *indicated agreement.*

Fergus Ewing: I am glad to hear that you watch daytime television.

The Convener: Well, I am a pensioner.

We will have a brief suspension, because a veritable galaxy of parliamentary collegial talent is about to join us for the next petition.

Annexe C: Written submissions

Glen Earrach Energy written submission, 9 January 2025

PE2109/B: Halt any further pumped storage hydro schemes on Scottish lochs holding wild Atlantic salmon

Thank you for your letter (6 December 2024) asking for information from Glen Earrach Energy Ltd (GEE) about work that has been undertaken to understand the impact of pumped storage hydro schemes on wild Atlantic salmon.

GEE is a wholly owned subsidiary of Balmac Forest Ltd, the owner of the Balmacaan Estate in Scotland. We are developing a 30 GWh pumped storage hydro (PSH) project on the estate that is set to become the UK's largest, most water-efficient and sustainable PSH scheme. We anticipate delivering first power in 2030 and achieving full commissioning in 2032. It is estimated GEE's PSH scheme will cut post-2030 grid carbon emissions by over 10% and reduce grid running costs by over £3bn (NPV 2025-2050) over its first 20 years of operation (estimates provided by LCP Delta, Alpiq & AECOM).

Our project leverages a high hydraulic head (approximately 500 metres) – the vertical distance between the upper and lower reservoirs. That means we will be able to store more energy and generate more power than all other PSH projects on Loch Ness combined. This brings the greatest economic and strategic benefits to the UK for each cubic metre of Loch Ness water moved. It also means less water is required to be stored in the upper reservoir for the same amount of energy, reducing our environmental impact.

Community Engagement and Collaboration

As the landowner, we are committed to ensuring that our project benefits our local community and environment.

We initiated early engagement activities in April 2024, shortly after submitting our scoping report to the Scottish Government's Energy Consents Unit (ECU), to gather initial community feedback. We conducted four in-person early engagement sessions, reaching over 300 individuals. We also gathered initial community feedback through email and online channels. We then held four pre-application consultation events to gather further feedback on the emerging proposals.

By actively listening to community concerns and ideas, we have refined the project design. This includes minimising visual impact through reduced above-ground infrastructure, relocating the temporary construction compounds and providing temporary on-site accommodation to reduce traffic to and from site.

Environmental Assessment and Mitigation

In answer to the request raised in your letter around Atlantic salmon, our team of environmental experts are conducting a comprehensive range of studies to assess potential environmental effects, including on Atlantic salmon, as part of the aquatic ecology chapter. These studies will inform the development of avoidance and

mitigation measures to minimise and manage any potential impacts. This information will be documented in our Environmental Impact Assessment Report (EIAR), which we plan to submit as part of our application to the ECU in March 2025.

We have proactively addressed environmental concerns raised by stakeholders and continue to work with them on issues raised.

Since May 2024, we have been actively engaging with the Ness District Salmon Fisheries Board (NDSFB), NatureScot, The Scottish Environment Protection Agency (SEPA) and The Highland Council. This collaboration includes commissioning a smolt tracking study by academic experts to enhance our understanding of smolt behaviour in Loch Ness which will be used to inform the operation of the scheme. This study, initiated in December 2024, is due to complete the surveying phase in the 2025 smolt season (April-June), with data being analysed in the summer of 2025. This smolt tracking data will be used to evaluate the EIAR assessment (which will have been informed by a study consisting of a detailed literature review and existing data on salmon smolt).

Further to conducting rigorous environmental impact assessments, it is important to note that GEE's 30GWh project is exceptionally water-efficient: as an example, for every 1,000 MWh (1 GWh) of energy stored, GEE’s project would only change Loch Ness’s water level by around 1.5 cm.

GEE's approach prioritises minimising environmental impacts, while maximising the project's benefits. We look forward to continued collaboration with stakeholders, including NSDFB, the authors of the original petition, to ensure the project delivers positive outcomes for all. We will demonstrate all relevant impacts and mitigations in our EIAR, which SPICe rightly highlight will be necessary to gain planning consent. We will share our EIAR with the committee once finalised and welcome any further questions you might have.

Kind regards,

Roderick MacLeod

Director

SSE Renewables written submission, 10 January 2025

PE2109/C: Halt any further pump storage hydro schemes on Scottish lochs holding wild Atlantic salmon

Following your letter dated 6 December 2024 in relation to PE2109, I am pleased to respond on behalf of SSE Renewables, the owner and operator of the largest fleet of hydro-electric power assets in Scotland.

The importance of pumped storage hydro in the net zero transition

As members of the Committee may be aware, pumped storage hydro is the world’s largest, most proven, and cost-effective long-duration electricity storage technology. Its deployment will help reduce the UK’s reliance on imported gas and provide vital

energy balancing services to the grid, not just for instant response but also for longer periods when renewable energy may not be available. As a result, pumped storage hydro is a critical enabling technology for the wider deployment of the renewable energy the country needs.

Decades of experience at Foyers Power Station

While we have not commissioned any new research into the impact of pumped storage hydro operations on wild Atlantic salmon, we have decades of experience in this proven technology, with 300MW of pumped storage hydro in operation at Foyers Power Station at Loch Ness since 1974.

As far back as the 1943 Act of Parliament which established the North of Scotland Hydro Electric Board (NoSHEB), there was a requirement to avoid, “as far as possible, injury to fisheries and the stock of fish in any waters”. This environmental consideration was built into original hydro scheme agreements and continues to be licensed by the regulator, the Scottish Environment Protection Agency (SEPA), today.

Our understanding is that there is a lack of presence of Atlantic salmon in watercourses in the immediate vicinity of Foyers Power Station, and no natural inclination for salmon to be attracted to the water from Loch Mhor or the Rivers Fechlin and Foyers due to no natural spawning populations originating from them.

However, as a responsible owner and operator of hydro infrastructure, laboratory testing was undertaken in 1971 through the development process to ensure a suitable smolt screen design velocity for the operation of Foyers on Loch Ness. The velocities of flows through intake screens were tested on rainbow trout and salmon smolts to determine the speed and duration that smolts could continuously swim against without becoming entrained on the screens. This robust research, alongside regular operational monitoring of the intake screens, has resulted in no observed impact on smolts at Foyers, with SEPA’s current guidance on flow rates aligning to the results of this research.

Robust planning processes for pumped storage hydro development

At SSE Renewables, we are progressing a development pipeline of pumped storage hydro projects in the UK. This includes our consented flagship project, Coire Glas, which could deliver up to 30GWh of storage capacity if built, doubling the total electricity storage capacity in Great Britain today.

In addition to Coire Glas, we are co-developing a new pumped storage hydro project at Loch Fearna in Scotland’s Great Glen and also have plans to convert the largest conventional hydro power station in our existing hydro power fleet, the 152.5MW Sloy Power Station on the banks of Loch Lomond, into a pumped storage hydro scheme.

It is critical to note that all proposed pumped storage developments go through a robust Environmental Impact Assessment through the statutory planning process,

including significant Ecological Impact Assessments of the impacts of developments on various factors, including on aquatic ecology and fish.

In relation to the proposed conversion of Sloy Power Station into a pumped storage hydro facility, our understanding is that based on recent research, smolts can maintain a higher indefinite swimming speed than the results of the 1971 research, demonstrating SSE Renewables' leading position in utilising the latest research and data to inform our development proposals, while protecting, restoring and, where possible, enhancing the natural environment.

Simultaneously tackling the climate and biodiversity crises

While playing our part in the delivery of a cleaner, more secure power system by developing and operating the largest fleet of hydro-electric infrastructure across Scotland, we are acutely aware of the responsibility on us to meet our legal and regulatory requirements to protect the environment through all phases, from development through to operation.

We have been monitoring salmon and their interactions with conventional hydro infrastructure for over 80 years, contributing to academic research on the downstream migration of salmon smolts, and leading mitigation and restoration projects across our hydro catchment areas to ensure any impacts are minimised.

We have worked proactively and collaboratively with stakeholders to design and deliver improvement projects, using the best available knowledge and data, including:

- The Upper Garry Salmon Restoration Project, in partnership with the Ness District Salmon Fishery Board, University of the Highlands and Islands (UHI), Mowi, SEPA and Garry Fishings, kickstarting the revival of wild salmon in the River Garry.
- Re-watering the River Garry, alongside the Tay District Salmon Fisheries Board, SEPA and UHI, to provide major benefits for adult salmon spawning and juvenile production.
- The award-winning Artificial Intelligence partnership with Microsoft, Avenade and NatureScot to monitor puffin and salmon numbers across SSE Renewables' sites.
- Recognised at the 2023 Nature of Scotland Awards, the transformational Trap and Transport project on the River Tirry (https://www.youtube.com/watch?v=oZ8ZKentSE4&list=PLt8-QCjOTko_17i3hlhl2xVfuvbNUP8N4&index=9) utilises pioneering methods to improve smolt survival rates. Working in partnership with the Kyle of Sutherland District Salmon Fishery Board, SEPA and specialist contractors, the project has delivered a near four-fold increase in smolt numbers and trap efficiency, with returning adult salmon numbers at record levels in 2024.

Through over 50 years of operation, experience and expertise of pumped storage hydro at Foyers Power Station, we are not aware of an adverse impact on wild Atlantic salmon in Loch Ness. We remain committed to continued engagement with

local fishery boards, elected representatives and interested parties to ensure future pumped storage developments work in tandem with the natural environment as we collectively tackle the climate crisis.

Yours sincerely,

Director of Hydro Asset Management

SSE Renewables

Statkraft written submission, 10 January 2025

PE2109/D: Halt any further pump storage hydro schemes on Scottish lochs holding wild Atlantic salmon

In response to the Citizen Participation and Public Petitions Committee letter (dated 06 December) requesting pumped storage hydro (PSH) developers to share available research studies regarding cohabitation between PSH projects and wild salmon populations in the Loch Ness region, please find relevant information pertaining to this request at Points 1 and 2 below.

For background, Statkraft is a responsible and well-established renewable energy developer in Scotland with an acute focus on ensuring that our projects protect the natural environment and enhance biodiversity. Alongside our multi-technology footprint and development pipeline across wind, grid stability, pumped storage hydropower and green hydrogen in Scotland, Statkraft has been developing and operating large-scale hydro schemes in Norway and across the world since 1895. We currently operate 363 hydropower plants globally with a total installed capacity of 15,541MW.

As the largest producer of hydropower in Europe, we are proud to be leveraging our expertise and experience to ensure that the consented Loch na Cathrach PSH project is developed in a sensitive and environmentally conscious manner. We are committed to sharing all available information and partnering with local and national stakeholders to ensure wild Scottish salmon populations are carefully protected and nurtured during the construction and operation of Loch na Cathrach.

This commitment is underpinned by the terms of the Loch na Cathrach Scottish Government project planning consent issued in June 2021 *(Energy Consents Unit letter Ref: ECU00000728, dated 07 June 2021)*. Statkraft is on course to discharge the relevant environmental condition set out in the overall 2021 project consent in close working partnership with Scotland's nature agency NatureScot to ensure the protection of wild salmon populations in the Highlands (detail at Point 1). To discharge this planning condition, Statkraft is currently working with Brian Shaw, River Director of the Ness District Salmon Fishery Board, and are due to collaborate on a smolt tracking study to provide further data on PSH impacts. See more information at Point 2 on this study.

We hope the below detail is informative as you assess the impact of pumped storage hydro developments on wild Atlantic salmon population and migrations in the Highlands region.

1. Overall Environmental Impact Assessment (EIA) as part of Loch na Cathrach consent

As noted above, please find at this **weblink**[1] Loch na Cathrach's full EIA documents which form a core part of the project's consent from the Scottish Government in June 2021. Specifically see Vol 2 - Chapter 7, Vol 5 - Appendix 7.1 and Vol 5 - Appendix 17.1 for more information on how the Loch na Cathrach project complies with requirements around wild salmon cohabitation. Due to Statkraft acquiring the Loch na Cathrach project in 2023 from Intelligent Land Investments Group (ILI), the EIA consent documents are in PDF format only. Please do let us know if this is an issue.

2. Fish passage assessment survey partnership with Ness District Salmon Fishery Board

During the Loch na Cathrach planning approval process, the Section 36 consent letter included an agreement that a "Fish Passage Assessment including a smolt tracking survey" be carried out. Statkraft and Ness District Salmon Fishery Board (NDSFB) have been in discussions to design, fund, run and publish the findings of the above study. See more information below with a caveat that the specific terms and parameters of the study are yet to be confirmed.

> The prospective Loch Ness/Loch Dochfour smolt tracking study will focus on investigating smolt migration downstream from Loch Dochfour. Potential partners – which may be expanded – are Ness District Salmon Fishery Board (NDSFB), Scottish Centre for Ecology and the Natural Environment (SCENE), Scottish Canals and Statkraft. The study (pending confirmation) will identify a baseline for salmon smolt passage in the Dochfour Weir area, pre-construction of the Loch na Cathrach PSH. This is aimed to provide high resolution data on smolt movements in the vicinity of the River Ness/Caledonian Canal bifurcation.
>
> Smolt movements will be established using acoustic tracking of tagged salmon smolts during the downstream migration, with smolts captured from one of the main Loch Ness spawning tributaries, fitted with acoustic tags, recuperated, then trucked and released into the upstream end of Loch Dochfour.

Once finalised and to provide further substantive evidence on the impact of PSH on salmon populations, we would be delighted to share the results of this study with the Committee, as well as wider stakeholders including the Scottish Government, once it is complete.

The above is the current extent of research Statkraft holds on impact of PSH on wild salmon populations.

[1] Planning application documents | Loch na Cathrach Pumped Storage Hydro - Statkraft UK

I hope this information is helpful and we would be pleased to answer any questions you may have as you continue your inquiries into this important topic.

Scottish Government written submission, 23 May 2025

PE2109/E: Halt any further pump storage hydro schemes on Scottish lochs holding wild Atlantic salmon

Additional questions from the Public Petitions Committee

The Committee is keen to understand whether the Scottish Government is assured that PSH schemes are not having a significant impact on wild Atlantic salmon; and also, to understand how the Scottish Government's policy on PSH schemes is informed by the Scottish Wild Salmon Strategy.

The Committee would also like to know whether the Scottish Government is confident that the planning system can adequately assess the cumulative impact, if there were to be a number of approved PSH schemes.

Scottish Government Response to the further questions raised by the Committee

Consent under section 36 of the Electricity Act 1989 ('the Act') is required to construct and operate generating stations including PSH generating stations where the installed capacity when constructed will be in excess of 50MW. Applications for consent are assessed and determined on a case-by-case basis, taking into account the provisions of the Act, all applicable legislation, and all other material considerations.

The Scottish Government considers that the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (the EIA regulations) provide a robust framework for assessing the likely significant impacts of PSH proposals on wild Atlantic salmon, and for ensuring that the Scottish Ministers are capable of reaching a reasoned conclusion on the likely significant effects of the development before a decision on a section 36 application is made.

The EIA regulations provide that EIA reports submitted by applicants for section 36 consent to construct or operate generating stations, including PSH generating stations, must be prepared by competent experts. EIA reports must identify, describe and assess the likely significant effects of any proposed PSH development on all relevant factors of the environment, including on any such effects on wild Atlantic salmon. EIA reports must contain a description of any likely significant cumulative effects of a PSH with other existing or approved development. The EIA regulations therefore require that an application under section 36 for construction and operation of a PSH generating station, at a given location, must consider the operational, or consented, PSHs with which it may have combined effects. Such combined effects would include any ecological effects or effects on wild Atlantic salmon, if such effects are relevant to the application. EIA reports are consulted upon widely, with statutory and other bodies with environmental competencies. The Scottish Ministers may not

conclude the EIA process until a reasoned conclusion may be reached as to the likely significant effects, including the cumulative effects, of the proposed development on the environment. This conclusion may rely on the imposition of conditions to secure environmental mitigation measures.

A decision to give consent under section 36 is not wholly dependent on there being a conclusion at the end of an EIA process that there are no significant adverse environmental effects. The EIA regulations, and the EU directive from which they originate, envisage that for large infrastructure projects significant environmental effects are more likely to occur. The EIA regulations require however that Ministers must determine the application in the knowledge of what significant effects are likely to occur, in consideration of any mitigation measures forming part of the development or to be secured by conditions of any consent. Consideration of any likely significant effects, at the conclusion of the EIA process, then forms part of the planning balance.

National Planning Framework 4 (NPF4) is a key policy consideration in the determination of applications under section 36. NPF4 places climate and nature at the centre of our planning system and makes clear our support for all forms of renewable, low-carbon and zero emission technologies, including pumped storage hydro schemes. Potential impacts on communities and nature, including the cumulative effects of developments, are important considerations in the decision-making process. All applications are subject to site-specific assessments, including environmental impact assessment (EIA) where applicable. NPF4 sets out the Scottish Government's support for all forms of renewable, low-carbon and zero emissions technologies, including energy storage, such as pumped storage hydro. NPF4 also designates PSH which meet relevant and applicable criteria as a national development.

Directorate for Energy and Climate Change

UNESCO Centre for Water Law written submission, 30 May 2025

PE2109/F: Halt any further pump storage hydro schemes on Scottish lochs holding wild Atlantic salmon

The need for caution in the rush for pumped storage hydro in Scotland's mountains.

Dr Andrew Black, UNESCO Centre for Water Law, Policy & Science, University of Dundee.

Important questions are facing decision-makers in Scotland as regards plans for several pumped storage hydro (PSH) mega-projects, largely in the North-West Highlands. While there are some very good reasons to support each of them, there are also grounds to pause and consider alternatives.

In favour:

Pumped storage is a proven technology which can undoubtedly assist in the journey to net zero. Two schemes in Scotland (Cruachan, Foyers) and two more in Wales

(Dinorwig, Ffestiniog) have already been contributing to grid balancing for several decades; proposals for more are now timely or overdue as the installed capacity of wind and solar schemes increases. Pumped storage capacity reduces the need for carbon emissions[i].

Pumped storage assists with energy security[ii]. By allowing storage of potential energy in times of net surplus, the need for imported hydrocarbons is reduced, at a time of rising geopolitical tensions.

The construction jobs and economic benefit of expanding the existing pumped storage base will be considerable, with much of it in Scotland[iii].

Significant sums have already been invested in developing proposals, Environmental Impact Assessments, community outreach and more[iv] [v] [vi] [vii] [viii].

Against:

Protected species and habitats will inevitably be adversely impacted by the various PSH proposals under consideration. Terrestrial habitats will be inundated, existing freshwaters will be subject to substantial changes e.g. in water depths, and bodies such as the Ness District Salmon Fishery Board have raised objections owing to the already precarious state of the Atlantic salmon in particular[ix].

Lasting impact: the proposals for PSH schemes represent huge interventions in our landscapes and riverscapes, which must be expected to become permanent features. If any or all of these threaten the dwindling populations of e.g. Atlantic salmon, the impacts will be cumulative year by year, and could ultimately lead to species losses.

Tourism may be affected negatively: while onshore and offshore wind is already flagged as a concern for international tourism, exposure of loch shorelines would be expected to increase in extent and frequency, adding to the pressures on a sector presently worth more than £5 billion annually[x].

Alternative technologies for energy storage are falling in price – and avoid the scale of damage to iconic landscapes and species which are necessary in forming new reservoirs or raising water levels in existing lochs. An international survey found that battery storage system costs fell by 40% between 2023 and 2024[xi]. While not explicitly stated as a concern, the diminishing cost of alternative storage may have been one factor behind the decision of Drax Group, owners of the Cruachan PSH, to pause the development of their Cruachan 2 PSH, a scheme which has been in gestation for more than a decade[xii] [xiii].

Alternatives

Progress with demand management (e.g. with smart meters[xiv]) and smart use of domestic battery installations (e.g. Powervault[xv]) and electric vehicle batteries could reduce the demand for pumped hydro. In marginal situations, in which a PSH may be proposed for infrequent need, questions would need to be asked about the extent of need and the nature of alternatives.

A proposed new generation of small modular (nuclear) reactors[xvi] may help diversify generation and provide baseload power which could help pump water for peaking generation in existing PSHs – in periods of low renewables availability, e.g. a blocking high pressure system in winter.

Given that the energy grid will always be in some form of continuing evolution, in a context of continuing technological innovation, it is worth considering whether existing or even new combined-cycle gas generation have some residual value for occasional use, if the alternative is to build more PSH schemes with lasting adverse environmental impact. A report to UK government[xvii] has investigated the issue, assessing possibilities and also some technical and financial barriers.

Infrastructure decisions are rarely straightforward and typically require trade-offs to be made. The Glenmuckloch proposal for pumped hydro in a former open-cast coal mine is a rare example of a contribution to meeting peaking electricity demand without severely affecting natural habitats. Choices may often be seen as being between global impact vs local. Demand management is the ultimate key to reducing adverse environmental impacts in both domains. In the absence of dramatic reductions in Scotland's total energy demand, decision-makers will have to choose between adverse impact within Scotland vs adverse impact globally.

Petitioner written submission, 29 July 2025

PE2109/G: Halt any further pump storage hydro schemes on Scottish lochs holding wild Atlantic salmon

Ness District Salmon Fishery Board commissioned a Computational Fluid Dynamics (CFD) study on Loch Ness to examine the cumulative impact of pump storage (PSH) on the hydrology and temperature regime. The report can be downloaded here. Graphics showing the water flow changes arising from the cumulative operation of these schemes were also produced. This link shows the Graphic for Invermoriston to Urquhart Castle area of the loch, and this Graphic for Dores Bay area. As an alternative to reading the report we asked AI to generate a podcast based on the report. This podcast it is quite extraordinary and well worth a listen. It can be listened by clicking on the link at the top of this page https://ndsfb.org/pump-storage-hydro/ .

For the CFD Study a mid-May scenario was set up in the model with an appropriate temperature profile in Loch Ness, with all the pump storage hydro headponds full, and with synchronous generation at the start. Each scheme has different duration, and water volumes, so they soon become out of sync. The wind speed was set at 20kmph and the air temperature was 15oC. The model was then run over a 48hour period. It was assumed that the headpond temperatures were the same as the Loch Ness surface water (10oC) and no allowance was made for any thermal gain from the operation of the turbines. A multitude of different scenarios can be envisaged, but each model run is expensive.

The effect on Loch Ness is profound with cold water currents crossing the loch, changes to the temperature profile, including at depth, and the formation of a vortex

in Dores Bay. The model was not run under calm conditions but it is quite likely that a cross-current between Glen Earrach and Foyers will become established. All of this occurring over a single 48hr period.

Ness DSFB were concerned that disruption of the natural hydrology Loch Ness would occur, but we were surprised by the scale of the changes shown in this model. A salmon smolt emanating from the Moriston, or any other tributary, is going to be exposed to conflicting currents, temperature changes, and if they end up in Dores Bay, enter into a vortex, which could become a food trap and a predation hotspot. All of which will make Loch Ness an even more hostile place for salmon smolts, with increased losses during the smolt migration. Dores Bay is also a designated bathing water and the potential formation of a vortex there is significant.

Ness DSFB are of the opinion that this report highlights one of the many unknown threats posed to Loch Ness by pump storage hydro, hence why we think it is essential that there is a public local inquiry. Our concern is primarily related to the ecology, but Loch Ness is such an important asset, not only to the Highlands, but nationally, that the issues need to be understood and debated so that a properly informed decision can be reached.

Edward Mountain MSP written submission, 2 September 2025

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I remind members of my entry in the register of members' interests, which shows that I own part of a wild salmon fishery. For clarity, I want to put on record that I managed fisheries on the Ness and Loch Ness until 2006.

Wild Atlantic salmon in Scotland are in serious decline, due to a combination of global warming and fish farming on the west coast. My view is that pump storage at Loch Ness has proven that there are real threats to the environment that have not yet been fully evaluated. The damage which could be caused to the eco-system could be immense. In freshwater lochs the pump storage hydro schemes will increase the temperature of the water that goes back into the loch. My view is that as a precaution, hydro pumped schemes should not be allowed unless it can be proved that the overall temperature of the loch and indeed the surface temperature does not increase, or affect migratory fish.

[i] Pumped Storage Hydro - British Hydropower Association
[ii] New scheme to attract investment in renewable energy storage - GOV.UK
[iii] Six pumped storage hydro projects to create up to 14,800 UK jobs, new report finds

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[iv] Britain’s biggest pumped hydro storage scheme in 40 years gets £100m investment boost | SSE
[v] ILI
[vi] SSE submits planning to Scottish Government for Sloy pumped storage hydro scheme | SSE Renewables
[vii] Cruachan-July-30-2024-Final-1.pdf
[viii] UK Government must invest in hydropower, industry tells Secretary of State for Energy Security and Net Zero
[ix] Pump Storage Hydro | Ness District Salmon Fishery Board
[x] Tourism Performance | VisitScotland.org
[xi] BNEF finds 40% year-on-year drop in BESS costs- Energy-Storage.News
[xii] Drax will not bid for LDES cap and floor scheme - Solar Power Portal
[xiii] Cruachan hydro power station output 'could double' - BBC News
[xiv] Smart meters explained - Energy Saving Trust
[xv] On a Mission to Transform UK Energy Use | Powervault • Powervault
[xvi] What are small modular reactors and why does UK want to build them? | Nuclear power | The Guardian
[xvii] Assessing the deployment potential of flexible capacity in Great Britain – an interim report