All Party Parliamentary Group for the Waterways

General Meeting

"Uses of Inland Waterways other than Leisure and Boating: Sustainable Power and Heating"

Wednesday September 13th 2023
from 9.30 am to 11.00 am in Room P, Portcullis House and by video meeting

Present

Michael Fabricant MP (Chair), Simon Baynes MP, Jim Shannon MP, James Morris MP, Baroness Golding, Duncan Baker MP(online)

Apologies had been received from Ben Wallace MP, Sir Roger Gale MP, Chi Onwurah MP

Also in attendance by video were officials from Defra and representatives of navigation authorities and waterway organisations.

Welcome and Introductions

Michael Fabricant MP, Chair of the Group, welcomed parliamentarians and representatives of waterway organisations to the hybrid meeting. Presentations from the Energy Saving Trust and the British Hydropower Association were followed by a general question and answer session.

Amy Tillson explained how attendees could raise questions using the Zoom Q&A function which would be answered later on.

Michael Fabricant MP then introduced the first speakers, Ben Whittle of the Energy Saving Trust, who presented on "Opportunities and barriers for heat pumps and the waterways". After introducing himself he gave some background on UK emissions figures. The UK produces about bout 100 million tons of CO_2 as a result of heating buildings and about 77 million tons of that is from heating homes. He then explained about the successful changes that are being made to decarbonise electricity generation, with moves way from coal and towards renewable energy. Countries like Norway are ahead because they have so much hydro power available. Heat pumps are powered by electricity so that if decarbonsation targets are met then a heat pump will produce 90% less emissions than a gas boiler by 2030. He added that there are even bigger gains to be made by combining heat pumps with other renewable energy like hydropower and PV panels.

He explained the difference between open and closed loop water and ground source heat pump systems.
Closed loop systems

- Use a chemical that is pumped around the pipes.
- Slinkies buried in ground or dropped in lakes or rivers
- Boreholes typically <150m deep

Open Loop systems

- Boreholes may be much deeper for accessing mine workings or even deep geothermal
- Temperatures up to 200 degrees

Water Source heat pumps can be open loop, taking water from underground, or from a river and returning it in a different hole somewhere else or back into a river. These systems can be installed on jetties. Coils of closed loop systems can also be sunk to the bottom of water courses but these would not be suitable for navigable waterways if they were in shallow water as the can get damaged.

Open loop systems are more complex in engineering terms and both abstraction and discharge permits may be needed, and they have very high installation and high maintenance costs but can potentially be very high performance.

Closed Loop systems don't need abstraction licences, but they do need permits. Maintenance and installation costs are lower than open loop systems but still relatively high. They can also be high performance.

He explained that air Source heat pumps are much cheaper to install and maintain, but their performance is lower. However, he noted that the very high initial costs of a ground or open or closed loop groundwater system is never really recovered over the lifespan of the equipment so even though air source heat pumps won't perform as well as ground or water source heat pumps the fact that they're so much cheaper to put in probably means there are more sensible choice in in many cases. This can be mitigated with much bigger district heating schemes in in cities using rivers.

Typically canals are not useful for water source heat pumps because of the low flow of water, and there's a risk that the canal might freeze.

In the absence of financial incentives, opportunities for financially successful schemes are likely to be large commercial buildings, or where heat pumps are part of district heating schemes (which may be multi technology, including industrial or sewage waste heat recovery, data centre cooling etc.)

The high associated costs for feasibility and environmental reports, scoping studies and design, civil engineering and permitting costs may be outweighed by the levelised cost of energy at scale. Installations can be part of a mixed technology system which can operate in the flexibility markets (i.e. receive payments for turning on and off at advantageous times for National Grid), and could even be powered by co-located hydro-electricity in the right circumstances. Heat pumps can cool at the same time as providing heat – this can be utilised to add extra value (potentially double)

He explained that well installed water source systems can run more efficiently than air source heat pumps, there is a risk of damage to infrastructure where installed in navigable waterways. However a question remains on economic benefits when compared to air source heat pumps in a domestic setting. In large commercial projects the economic risks can be reduced through various means.

He then went on to explain the environmental risks associated with water source heat pumps. In the winter, heat pumps used for heating chill the river, in the summer, heat pumps used for cooling buildings heat the river. Warming the rivers in summer increases the risk of negative impacts such as algal blooms or animal reproduction levels. Combining heating and cooling loads can reduce the impact on water rejected into rivers or aquifers at city scale. The International Hydrogeologists Association are already discussing potential impact of cooling dominant clusters of open loop systems on waterways like the Thames in London

There is no obligation at this time for a developer to consider the cumulative impact of their proposal alongside other installed or planned projects when permitting or applying for licenses – though the planning authority should do. Cumulative impact could create excessive warming of aquifers, rivers and lakes.
It could also include reducing the efficiency of open loop cooling systems over time. This is in contrast to the Netherlands, where heating and cooling loads are required to be balanced where water is discharged with a permitting license, on a 5 year rolling average. Continuous monitoring is required, and licenses may be removed.

He outlined two case studies:

River Clyde, Glasgow

A river such as the Clyde has enough low cost, low carbon heat for half a million homes. The chilled river water can then be used for cooling data centres, further improving the cost and carbon footprint. Thermally connecting the parts of society that want to reject heat with those that need it is another viable option. In addition to delivering renewable heat at 80 degrees centigrade for an expected, 1500 houses and 1.4 million square feet of industrial space with half the carbon footprint of burning gas, the heat pump will also contribute to creating 6,500 jobs on the industrial estate.

Drammen, River Drammenselva in Norway

This system is owned by a private utility company who bought the concession from the local authority. 3 heat pumps give a combined capacity of 14 MW (about 2000 homes)

The heat pump uses the natural refrigerant ammonia that has a zero global warming potential and is not a greenhouse gas. The heat source is seawater that is taken in around 8 or 9 °C from a depth of 18 m . The system heats district water from 65 °C to 90 °C for use in building heating and hot water systems. The system has an average coefficient of performance (COP) of 3.0 which means 1 unit of electricity is combined with 2 units of heat from the seawater to provide 3 units of heat to the district heating circuit. With the low cost of hydro-based electricity, it is cheaper to run a heat pump than a gas or electric boiler. The heat is extracted from a local fjord whose water temperature is around 8 °C. The water is heated from recovered energy at a temperature of 120 °C. A city ordinance requires most new buildings to exploit this form of heating.

He summarised the key points as follows:

- Heat pumps are key to UK heat decarbonisation and offer enormous potential to reduce emissions, especially when paired with renewable electricity sources and smart tariffs.
- In domestic scenarios, water source heat pumps are very expensive and unlikely to be applicable to many homes.
- Canals are unlikely to be significant sources because of freezing risk, (as well as damage from boats) in many parts of the system.
- Bigger projects are perfectly viable for district heating schemes, but careful consideration needs to be given to the environmental impact of open loop systems on the aquifers, river and marine environments and wildlife – especially where cooling loads are present.
- Specialist advice should be sought from hydrogeologists to assess the risk of cumulative impacts on the environment.
- Detailed monitoring should be carried out at installation locations.

Michael Fabricant MP then introduced the second speaker, Kate Gilmartin, of the British Hydropower Association who spoke about "Utilising assets for long term energy resilience and security"

Kate Gilmartin began by introducing herself as the CEO of the British Hydropower Association, which is the leading trade membership association solely representing the interests of the UK hydropower industry. She explained that the BHA's 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 2035.

She explained that hydroelectric power is generated using flowing water to spin a turbine and that the technology has existed since 1856). The turbine's shaft is connected to an electric generator, and the water is controlled through a sluice gate.
The amount of power generated depends on water available to flow through the turbine and the 'head' or drop that the water falls through. Low head hydropower units are defined as having a small "head" or drop, and a large volume of water. They are often sited next to a weir.

The potential to generate electricity from rivers and other water conveyance systems is well understood and there are multiple examples of small-scale hydropower projects on English rivers.She explained that the key considerations are always economics (site specific conditions), and environmental impact.

She said that there are around 15,000 weirs that could offer the potential for hydropower, as well as pumping stations, water transfers and outfalls. Developing long term energy generation assets as part of a wider portfolio of renewable energy generation makes good business sense, as hydropower can operate for 80+years when well maintained.

She explained why now is a good time to develop hydropower systems, as they provide a predictable and renewable energy source, with the potential to significantly reduce the need to purchase energy via the grid and/or to operate diesel generators (where accompanied by some form of battery storage). They're resilient against future energy price

increases, and creating a renewable energy portfolio will help organisations reach Net Zero targets. Fish friendlier turbines have now been developed as well as understanding and monitoring of turbine impact on fish and eels and relevant screening and creating engineering solutions in line with evidence. If a weir can't be removed for river restoration, then it can be utilised for generation alongside a fish pass. Very low head turbines also mean accessing sites previously deemed non-viable.

A decentralised, decarbonised grid will look very different and with intermittent solar and wind, we need generation that will be there continuously over the winter months when we need to heat our homes with electric heat pumps. Hydropower fulfils this need.

She outlined the economics of hydro power, explaining that it has been developed for the following reasons:

- Availability i.e. when there was a need for electricity in North Scotland)
- Value i.e. a good business case, social value, or environmental value

Hydropower has peaked and troughed according to Government policy, availability of subsidy (or price stabilisation mechanism) and the cost of electricity. Long term PPA (power purchase agreements) are key for the business case of hydropower as the energy market is volatile and distorted by cheap fossil fuels.

She then outlined a case study on the river Irwell catchment. Groundwork (in partnership with Hallidays Hydropower) received a grant from the Rural Community Energy Fund, to review the hydropower potential across the Irwell Catchment, which is a large blue-green natural capital asset within Greater Manchester.

They took a low-carbon, community-centric, multi-benefit approach delivering value for people and the planet.

The Irwell Catchment has the potential to be a valuable carbon sink and a community-based, holistic approach should consider water quality and improving the river status under the Water Framework Directive, climate change mitigation through carbon sequestration, barriers, fish passage and improved fish migration, hydroelectric power, flood mitigation, blue/green amenity space and industrial heritage.

The intended outcome of this work is to look at how hydropower development can reconnect people with the river by improving access and amenity to the riverscape and creating a new 'green industrial heritage' attraction, built from the 'old industrial heritage' of the River Irwell. She explained how they used a process of filtering to identify which river barriers would be the most suitable, with 10 identified.

She also outlined another case study at Sandford, a 450kW community owned hydropower scheme developed by the Low Carbon Hub in Oxford, commissioned in 2018 alongside a 120m fish pass. Their ambition is for the whole of Oxfordshire to be powered by an interconnected series of smart micro-grids centred around multiple small scale, community controlled renewable energy schemes.

She summarised with the key reasons why hydropower is important:

- They remove the need for diesel generators.

- They complement other renewable energy generation by providing overnight electricity, complementing solar and enabling grid stability. They smooth the grid profile and generates energy when we need it, i.e. at peak tea time energy use.

- Turbines have a very long life (80+ years) and provide highly skilled rural jobs carrying out operation and maintenance.

- They can support restoration of industrial architecture and heritage and link communities to blue/ green amenity space. Community ownership models improve access and relationship with waterways and help grid issues at local level – especially as we need to electrify heat.

Questions and Answers/Discussion

Michael Fabricant MP thanked the speakers for their presentations and invited questions.

The question and answer session included questions and discussion with MPs and peers as well as representatives from navigation authorities and waterway organisations.

James Morris MP asked a question about the planning and legislation controlling the installation of heat pumps, in terms of cumulative impacts if many schemes were granted permission to be built in one area. Ben Whittle responded saying that this is something that is being legislated against in the Netherlands and also mentioned the name of a member of the International Association of Hydrogeologists who is working on this issue in UK projects. Ben Whittle offered to put him in touch. He explained that systems are in place to monitor schemes to ensure they don't take or dump more heat than pre-defined parameters. James Morris MP also asked about the hydropower price stabilisation mechanisms. Kate Gilmartin explained that a system of upper and lower prices had taken over from the Feed-In-Tarriffs.

Terry Cavender from the Buckingham Canal Society asked how Canal Restoration charities can engage with Energy Saving Trust to explore mixed technology solutions? Both Ben Whittle and Kate Gilmartin said they were very happy to discuss possibilities with anyone interested.

Bernie asked if the National Grid could accommodate all these extra inputs of electricity, or does it require upgrading? Kate Gilmartin responded that it is a problem currently, with transmission constraints and people queuing to connect but with smaller schemes it should be less of a problem. There's lots of work going on between network operators and developers, so many of the problems are site-specific. Network operators do have heat maps online to show whether there are constraints in the area. She also said that the way we consume energy needs to be smarter in the future. At the moment it is a "just in-time" model and storage is the key factor. It's unlikely that the grid itself will need to be updated.

Rupert Smedley from the IWA Sustainable Boating Group asked a question of Ben Whittle: If individual narrowboats start using water source heat pumps for heating (possibly using some sort of skin tank), does he think that there is a risk of localised freezing of the canal?

He responded that this would probably be quite impractical, but if you got over the engineering issues it's not unusual to see poorly designed heat pump systems with ice on the outside, so yes it would be possible.

Chris Nash from the Manchester Bolton Bury (MBB) Canal Society said the Society took part in the Irwell Catchment Hydro study and ask if there is scope to involve the restored MBB Canal with the river Irwell hydropower schemes to achieve wider community benefits. Kate Gilmartin responded that she would be very happy to discuss this with the Society.

Skip (no organisation given) asked about the viability of charging electrically powered boats at each weir/lock, rather than pumping small amounts into the National Grid. Kate Gilmartin responded saying that while in principle it is a good idea, she's not sure there would be enough useful work to convert to electricity from one lock emptying or filling.

Jim (no organisation given) asked what has the hydropower unit installed last year on the river Weaver at Dutton locks achieved in useful power output? Kate Gilmartin said she would find out for him if he got in touch.

Les Etheridge of the Inland Waterways Association asked how important is it that our waterways are well maintained in order for the UK to get the maximum benefit from the approaches you have described? Kate Gilmartin suggested that using rivers to generate power could offset some of the costs of maintaining them.

Summary, actions, and closing remarks

Michael Fabricant MP thanked the speakers on behalf of the All Party Group and closed the meeting.

The presentations from this meeting are available on request from Amy Tillson, APPGW Secretariat by emailing amy.tillson@waterways.org.uk.