NORTH YORKSHIRE COUNTY COUNCIL

Transport Economy and Environment Overview and Scrutiny

21 October 2021

Small scale electricity generation from hydro-electric schemes in rural areas

1.0 PURPOSE OF REPORT

1.1 To provide a briefing on some of the issues and practical considerations associated with the adoption of small scale hydro-electric schemes in rural areas of the county.

2.0 BACKGROUND

2.1 The publication of the North Yorkshire Rural Commission report and recommendations on 5 July 2021 provided a fresh perspective on some of the issues faced in rural communities. In reviewing the recommendations, the committee noted that potential role of small scale hydro-electric power plants for electricity generation in rural communities had not been actively considered.

2.2 This report provides an overview of some of the issues and practical considerations associated with the use of small scale hydro-electric plants.

3.0 SMALL SCALE HYDRO-ELECTRIC PLANTS

3.1 Small scale hydro-electric plants can be used to generate electricity for a number of adjacent properties in rural parts of the county. Small scale hydro-electric systems in England range from less than 20kW unit systems up to 100-200kW units. Usually, the turbines in the plant turn a mechanical shaft that in turn is used to generate electricity. When assessing the viability of a hydro-electric scheme, the following are important considerations:

- The vertical drop of the water, known as the 'head'. As the vertical drop increases the size of equipment needed to generate power reduces
- Potential sites need to be assessed to ensure that the potential electricity output is enough for the investment into the site to be viable
- There are a number of ways of managing the flow of a river or stream through a hydro-electric plant. All require an element of excavation and building work to be undertaken to enable the diversion of the necessary flow from the existing watercourse. This then means that there are planning and environmental implications to consider
- Early engagement with the Environment Agency and the Canal and River Trust is advisable
- A site must also be protected from flooding and also not make any existing flooding worse
- A site may have good potential for electricity generation but be inaccessible for contractors to put in the necessary infrastructure
- Electricity generated may be used at the point at which it is generated or sold to the national grid. The latter may be complex and require greater investment in physical infrastructure. It will also necessitate engagement with the national grid

- Where electricity is used at the site at which it is generated then another consideration is battery storage capacity
- A preliminary site assessment by a specialist can cost around £1,000
- Consideration must be given to the potential impact upon fisheries and other wildlife
- Local grants may be available for the development of small-scale renewable energy projects
- There are three main types of turbine in use: an impulse turbine; a reaction turbine; and a gravity turbine
- A hydro-electric plant will need screening for water borne rubbish and to protect fish.

Source – the British Hydropower Association - British Hydro Association Protecting the environment & rural communities (british-hydro.org)

3.2 The majority of community owned hydro-electric power plants are in Wales, Scotland and the North West. Local examples of small scale hydro-electric community energy schemes include Howsham Mill Hydropower, Bainbridge River Basin Hydro and Whitby Esk. The Whitby Esk 50kW hydro-electric power plant in Ruswarp North Yorkshire is based upon an Archimedes screw turbine. There is a film on YouTube that provides an overview of how it works - https://www.youtube.com/watch?v=Y7-6gOI8hAw

3.3 North Yorkshire has a large number of rivers and tributaries that could be used for the generation of small scale hydro-electric power. The rivers that would be best suited to this are the Wharfe, Nidd and Ure. Ideally, any units installed would be linked to existing infrastructure on rivers, principally weirs. There may also be opportunities to regenerate old infrastructure that was historically used to drive mechanical equipment, such as water mills, although much of this infrastructure has fallen into disrepair and may be owned by a wide variety of different people and organisations.

3.4 To help ensure that there is sufficient head and flow in a river, it is important to maintain existing weirs. The majority of weirs are maintained by the Environment Agency. Well maintained weirs also help with flood management.

3.5 Hydro-electric power generation can be scaled from a small turbulent hydro-electric turbine generating 3kW per hour (enough for 3 or 4 houses) at a cost of approximately £30,000 to a scheme using multiple Archimedes screws that can supply a large industrial or agricultural site at a cost of up to £5,000,000.

3.6 Investment in and funding for hydro-electric schemes is limited. Depending upon the scale and nature of the scheme, the financial burden can be significant. It is often the case that schemes that are feasible do not progress due to lack of funding. Those schemes that progress tend to be those taken forward by large, private landowners.

3.7 In May, June and July each year the water level in rivers tends to drop as rainfall decreases. This reduces both the head and the flow and so limits the capacity for energy generation from hydro-electric units. Over the winter months, rivers tend to flood and hydro-electric units cannot safely be operated during a flood. As such, for roughly four months of the year, alternative power sources will be needed. This is why it is often recommended that hydro-electric power generation is used in conjunction with one or more other renewable sources, such as solar and/or wind.

3.8 The Environmental Audit Committee of MPs recently undertook an inquiry into community energy generation and recommended that government do more to remove administrative and legislative barriers to the development of community energy; and provide practical support for the development and implementation of community energy schemes.

Community energy schemes are those which are wholly owned and/or controlled by communities or through a partnership with commercial or public sector partners.

3.9 The York and North Yorkshire Carbon Abatement Pathways study evidences the need to increase renewable energy generation by 174MW per annum to meet the target to be a carbon negative region by 2040. A 'Routemap to Carbon Negative' is being developed to define the range of actions that could be taken and the impact that they will have upon carbon dioxide emissions.

3.10 Local Area Energy Planning has begun. This is intended to provide granular spatial data on Energy Assets (supply and demand) including critical factors for renewable energy generation of grid network capacity.

3.11 There may be opportunities for the feasibility of some hydro-electric power schemes at community-based sites to be investigated under the Community Renewal Fund, should a recent bid submission by the York and North Yorkshire LEP be successful. The outcome should be known in November 2021.

4.0 CONCLUSION

4.1 Whilst it is clear that there are opportunities for the use of small scale hydro-electric plants in the county, there remains some significant barriers to its adoption. Schemes can be costly and involve complicated and protracted negotiations to secure the necessary permissions to proceed. Hydro-electric power, as part of a basket of renewable energy, could provide the majority of electrical power for some communities, businesses and community facilities, helping with progress to carbon neutrality.

5.0 FINANCIAL IMPLICATIONS

5.1 There are no financial implications as this is a briefing report.

6.0 LEGAL IMPLICATIONS

6.1 There are no legal implications as this is a briefing report.

7.0 CLIMATE CHANGE IMPLICATIONS

7.1 The development of small scale hydro-electric power generation in North Yorkshire would help increase the amount of electricity generated from renewable sources, which will in turn help towards the achievement of carbon neutrality.

8.0 REASONS FOR RECOMMENDATIONS

8.1 There is potential for hydro-electric power generation to be used as part of a basket of renewables to expand the supply of sustainable electricity to small communities and community facilities. This will accelerate the move away from a reliance upon fossil fuel generated electricity and so help the Council achieve its target of net carbon neutrality by 2030.

9.0 RECOMMENDATIONS

9.1 That the committee consider the briefing and determine what course of action to take. This could be one or more of the following:

1) Identify a specific line of enquiry to pursue at the meeting of the committee on 20

January 2022, possibly how the barriers to the expansion of small scale hydro-electric power generation could be overcome

2) Recommend to the Director of Business and Environmental Services and/or Cllr Greg White, as Executive Member with climate change in his portfolio, that officer time is dedicated to the development of a feasibility study for the development of hydro-electric power generation in the county by the Council in partnership with interested community groups. This could be linked to the recent Community Renewal Fund bid submission.

3) Write to the Secretary of State for Energy and Climate Change, the Rt Hon Kwasi Kwarteng MP, highlighting the need to remove barriers to the expansion of small scale hydro-electric power schemes and to promote support for communities interested in adopting such schemes.

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