Hydroelectric Conference

Micro-hydroelectric generation for Galway
19 October 2018 | NUIG Campus

I. Summary of Presentations – The Morning Session

1. River System Overview
Phil, The Galway Waterways Foundation

There is huge power in the Corrib as it drains the entire Corrib/Mask/Carragh catchment through the short distance it travels through Galway City. As well as the volume of water that it carries, it is reportedly the second fastest flowing river in Europe. There is a drop of approximately 15 feet from the regulating weir next to Fisheries Field to the exit of the river into the Bay, a distance of approximately 2/3 mile. This drop takes place through several smaller rivers and canals in the system.

There were approximately 30 businesses within the City that were powered by water between the 16th and 19th centuries. Many of these locations are evident because of the remaining waterfalls, sluice gates, and drops that can be seen along the rivers and canals. Ownership and responsibility for the waterways is divided across a number of bodies, agencies, and interest groups making it difficult to make changes or implement projects.

2. The University as Energy User
Noel O'Connor, Asst. Director Buildings and Estates, NUIG

NUIG is the second biggest energy consumer in the City. The University has increased in size by 50% in the last 10 years. Energy efficiency has improved by 33%. Total spending has increased because of the increase in campus size. Current energy spending is €4.5Mio. The University has undertaken a number of programmes to improve energy efficiency including installation of CHP's, biomass boilers, SolarPV, building regulations, behaviours, etc. Further goals have been established for exceeding energy efficiency improvement percentages; 50%

improvement by 2040.

3. The Galway Energy Coop
Kieran Cunnane

A community-based cooperative is currently in formation in the Companies Office (Register of Friendly Societies). The purpose is to democratise the provision of energy; to innovate in the use of, production, and distribution of energy; to provide benefits to the community; to share the benefits among its members; and to be open, transparent, and ethical. Membership will be available by purchase of shares. Share price and any additional fees are yet to be decided. Individuals, companies, and institutions can become members. Multiple shares can be purchased by members but voting is based on one vote per member irrespective of share ownership. Members elect the company directors in an AGM. Directors must step down in rotation.

4. State of the Art of Mini Hydro-Electric Installations
Jonathan Cox

Mini hydro-electric generation is a proven technology installed and working in thousands of locations outputting anywhere between 10 – 5000kw. The advantages of hydro over wind and solar are its consistency, reliability, and correspondence to demand profiles.

Both cross-flow and screw type turbines are available for mini-hydro installations. Cross-flow turbines require a head of between 5 – 200 meters. Screw turbines are suitable for lower heads of between 1 – 7 meters. A control system and trash rack cleaning mechanism must be part of the installation. Each hydro installation is unique. Fit the turbine to the site not the site to the turbine. Available evidence indicates that these installations if done correctly do not adversely affect fish life and may even improve it because of the civil works done in conjunction with the project. Be aware of ownership issues of the water & weirs and also of conservation protections, etc.

5. Flow-based Systems
Bart Bonsal, G-Kinetics

G-Kinetics develops flow-based turbines that are suspended in water courses and based on the acceleration of the flow of water through the turbine using similar lift characteristics to sailboat hulls. Development and testing is currently taking place in

Limerick; an implementation is currently taking place in Bordeaux. Turbines operate in the range 1.5 to 2.25 meters per second. Systems producing 25–60kw are now in implementation. Further development is planned to reach outputs up to 250kw. No civils required. Slow rotation speeds don't adversely affect fish life. The company would like to do further trials and testing in Galway's waterways.

6. Hydro-Electric to Hydrogen Systems
Dr Pau Faras, NUIG

Systems are currently being tested in an EU Inter-Regulatory project to use hydro-turbines to produce electricity to release hydrogen from water. Hydrogen can be stored to later burn in automotive engines or to supply district heating systems. Hydrogen can be thought of as a "battery" for storing the power generated by the hydro-electric system.

7. The Business View of Mini-Hydro Electric Installations
John Fingleton, Fingleton White Engineering

Hydro installations cannot be standardised and have to be fitted to the situation, usually involving significant civil engineering investment. There can also be complications regarding ownership of the site, water extraction, regulations, etc. Output is constrained by canal/river size and layout. The turbine, power house, grid connection all have to be considered and possibly designed individually. Ongoing maintenance must take place for trash removal, lubrication, parts, etc. Installations may require daily inspection. In Fingleton White's experience, small installations producing below 50kw do not produce enough cash flow to justify repair if damaged or to pay for a caretaker to mind them. Installations with larger outputs, say over 100kw continue to operate successfully. Wind turbines can be standardised and produce more electricity for the investment required.

8. The Government Policy View
Micheal O'Cinneide

The Government's Energy White Paper 2015 targets 100% of all energy from renewable sources by 2050. The Climate Action and Low Carbon Development Act 2015 sets out a target of 20% renewables by 2020 and more aggressive targets for 2030. The River Basin Management Plan 2018 – 2021 sets out a series of measures for water quality improvement and public participation. This Act resulted from the EU Water Framework Directive. The LAWCO office for Galway/South Roscommon is a manifestation of the Directive and the Act. These targets must be supplemented by

public education at all levels. Galway could become the living laboratory for sustainable communities.

9. The Campaigner's View
Duncan Stewart

Ireland not meeting its renewables and reduced carbon emission commitment would lead to fines having to be paid. There has been 60% reduction in wildlife in the last 50 years. Global warming will lead to sea-level rise that will threaten low lying, coastal regions. Micro-plastics are endangering marine life and are entering the food chain.

II. Summary of Discussion and Ideas – The Afternoon Session

1. Galway could be a model for how the University and the community can work together to produce more renewable and sustainable forms of energy. It could provide a test bed for further development and refinement of hydro-based power generation. And it could become an educational resource for students at all levels to learn about energy creation and conservation.

2. There is room for improvement in the proven technologies, such as turbines which depend on head; need for further research, testing, and refinement of new technologies, such as flow-based turbines; and opportunities to refine emerging technologies, such as wind- or hydro-electric combined with hydrogen production. With cross-flow and screw-type turbines there are questions regarding vibration, noise, aesthetics, and effect on aquatic life particularly in an urban environment. Flow systems though proven to work haven't yet gained commercial acceptance. Systems show promise that combine the production of electricity with the production of hydrogen but are only now being tested.

3. The University, the Ryan Institute, or both are in a unique position to deal with some of these challenges, solve the associated problems, access research funding for the work, and establish a leadership position in the country in micro-hydro-energy generation and community engagement.

4. As a first step in a community/University hydro project, the existing installations in the city should be put back into service to demonstrate feasibility, interest and quick wins. The most straightforward case is in the

University-owned McLaughlin Building on Nun's Island where two turbines are located. Other possibilities include the water wheel next to the Mill St. car park and the mill wheel located in the basement of the Bridge Mills.

5. Aberdeen provides an interesting example of energy innovation. City buses are powered by hydrogen fuel cells. The hydrogen is produced by electrolysers using electricity generated by wind. Galway could do something similar but with water power - place two screw turbines on either side of the regulating weir. Use the electricity to drive an electrolysis process to release hydrogen which could be used for transport or for district heating.

6. See https://www.rescoop.eu/ for examples of the democratisation of energy, how an energy co-op can work, examples of projects, and much else. Invite the founder of ResCoops, Dirk Vansintjan, to give a talk in Galway on renewable energy cooperatives.