Introduction to OpenHydro

The following is the summary of my research based travel in Ireland that was made possible by the OERA Student Research Travel program. In the month of November, 2014, I was awarded funding to aid in sending me the OpenHydro technical centre in Greenore, County Louth, Ireland. This travel is meant to coincide and complement an Engage grant, funded through NSERC, with OpenHydro.

Figure 1: OpenHydro turbine at the European Marine Energy Centre (Photo by OpenHydro)

As a subsidiary of DCNS, a world leader in naval defense, OpenHydro exhibit their expertise in marine technology be designing, manufacturing and installing their tidal energy systems. Their open-centre turbine combines technological simplicity and reliability with minimal environmental and ecological impact. The slow moving, single piece, rotor minimizes the potential failure methods and harm to marine life that are associated with exposed blades. The open-centre design, in addition to the shaped inlet duct, increases turbine efficiency and allows for an exit route for marine life. The design also avoids the use of oils and greases for lubrication that could have potential for leaking pollutants.

Currently OpenHydro have seven project opportunities underway in the UK, France, The United States and Canada. In 2006 the company installed a research platform at the European Marine Energy Centre (EMEC – See Fig. 1) that can be raised and lowered for testing and inspection. In 2008, from their EMEC location, OpenHydro became the first company in the UK to successfully generate electricity onto the Scottish grid with tidal technology. Other successful installs occurred for the EDF project in France in the following years. Five more projects have been approved and are underway,

including the connection with the Fundy Ocean Research Centre for Energy (FORCE). In March 2014 the Nova Scotia Department of Energy awarded OpenHydro one of four berths at FORCE, a project than plans to install an array of two 16 m, 2 MW turbines in 2015. In November, 2014, it was announced at the 5th International Conference on Ocean Energy (ICOE) that OpenHydro and their Canadian partner Emera Inc. have formed a joint venture business called Cape Sharp Tidal to oversee this project. This continues their connection with Nova Scotia after the partnership with Nova Scotia Power in 2009. Together they developed North America's first 1 MW in-stream tidal turbine in the Minas Passage. Though tidal forces exceeded modelling expectations and popped the blades from the turbine, this achievement remains as an important milestone for tidal energy development.

Objective of Travel

The primary objective of the time spent at OpenHydro's technical facility was to meet the R&D leads, gain knowledge on their methodologies, and further define the Engage project. The intention of the project is to characterise and quantify the impact of design changes to the subsea base structure (see Fig. 2).

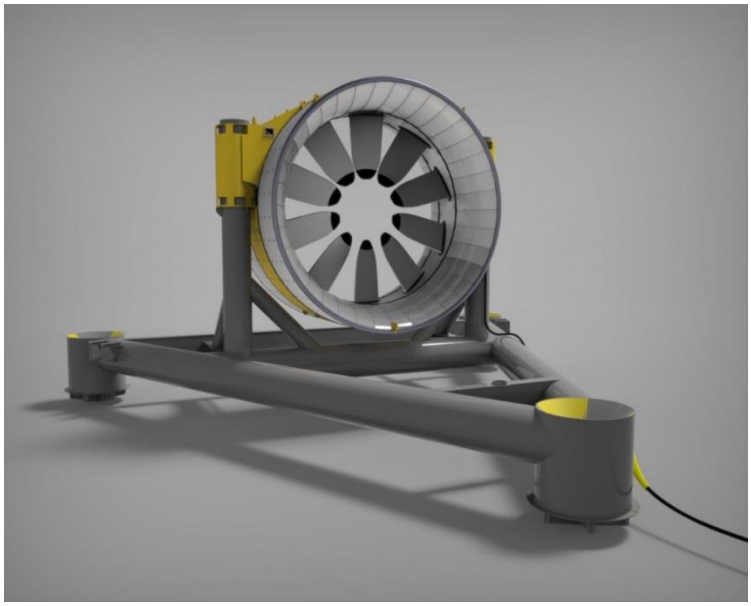

Figure 2: OpenHydro turbine and subsea base (Photo by OpenHydro)

The approach taken will utilise my experience with computational fluid dynamics (CFD), a method which is shared with the OpenHydro R&D team. To that end, the opportunity to include the R&D leads in the initial phase is helpful to ensure that the project moves ahead seamlessly and in a direction

that is beneficial to the group and the tidal industry. During the two weeks the following tasks were completed:

- I met with the lead engineers from OpenHydro and was given introductions regarding their technical history and numerical modelling methodology.
- A brainstorming process determined the subsea base design changes that would be most valuable to investigate during the six months. The most applicable numerical approach was also chosen.
- I was given access to relevant files and modified them for application to this project. A first-stage model was created that will act as the foundation of future models throughout the project's lifespan.

Time spent at OpenHydro also had a networking benefit, forming relationships that will last through this project and beyond. My supervisor, Dr. Dominic Groulx, joined me at OpenHydro during the final days to strengthen collaborative relations through networking and observation.

Aside from time spent at the OpenHydro technical centre, Dr. Groulx and I were given a tour of the Queen's University Marine Laboratory in Portaferry, on Strangford Lough. This facility's research includes investigations in wave energy, algae biofuels, evolutionary ecology and biodiversity functioning. Furthermore, the centre facilitates mid to full scale experimentation in the lough itself. We were also given a tour of their research facilities at their main campus in Belfast. Here we expanded our marine energy network by meeting fellow researchers who discussed the experimental capabilities of their wave and flume tanks and their real world experimentation and analysis approaches.

Benefits of Research Based Travel

My time spent in Ireland was invaluable for the seamless start-up of the Engage project discussed above. It is this experience that will allow me to quickly get the project underway with design change priorities and deliverable deadlines. Working with technical experts for two weeks also provided first hand insight into the inner workings of a research and development facility which is at the leading edge of its industry.

In addition to the benefits for the project, this research travel helped solidify a collaborative relationship between Dalhousie University and OpenHydro. The travel also proved to be an excellent networking opportunity for both myself and Dr. Groulx, at OpenHydro and Queen's University, creating fast relationships to continue into the future. Dalhousie strives to improve ocean energy technology to better the viability of the industry. Collaborative relationships of this sort will help expedite the advancement of this industry, as well as strengthen the role Nova Scotia will play.

Final thanks go out to OERA for their financial support through the Student Research Travel program to make this travel possible. Additionally, thanks go to Bjoern Elsaesser at Queen's University for his warm welcome and Andrew Carlisle, Oliver Warlow, Tom Doyle, Sébastien Digard, and countless others at OpenHydro for their hospitality and helpful contribution to the project.