

ASX ANNOUNCEMENT

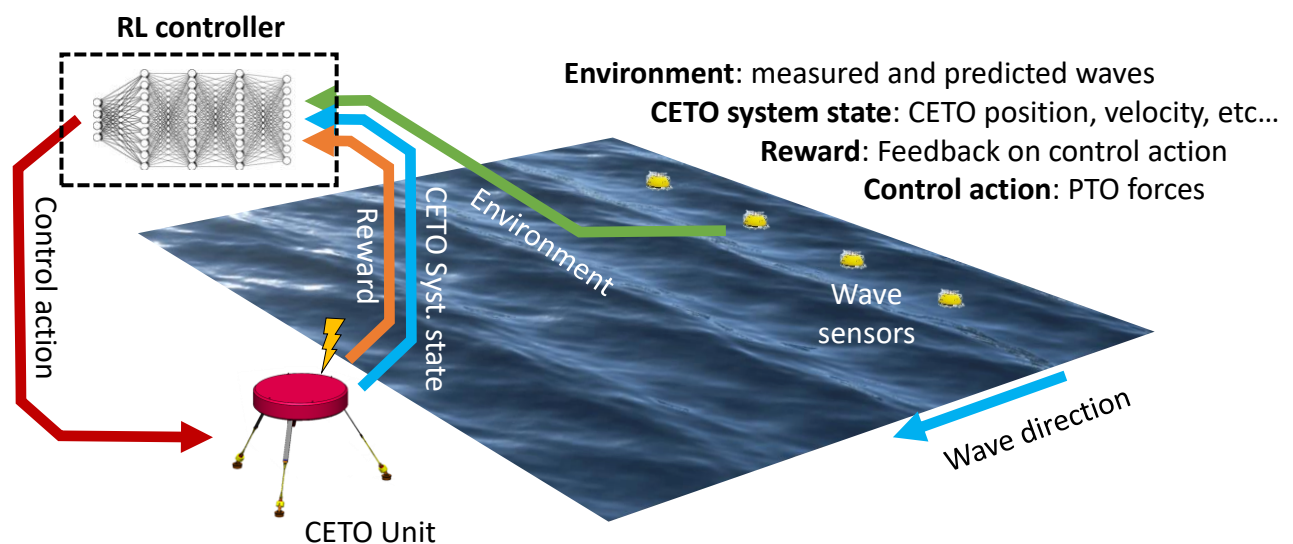
30 November 2020

Carnegie signs Collaboration Agreement with Hewlett Packard Enterprise Company (HPE) to develop a reinforcement learning based controller for CETO

Carnegie Clean Energy Limited (Carnegie or the Company) is excited to announce that it has signed a Collaboration Agreement with Hewlett Packard Enterprise Company (HPE) in which the parties will work collaboratively on a project to develop a reinforcement learning based controller for the CETO wave energy technology. The work will extend the artificial intelligence development already underway at Carnegie.

Hewlett Packard Labs will contribute their reinforcement learning (RL) expertise and computational resources to the project, working alongside Carnegie's team, which is already developing an intelligent controller for the CETO technology. The RL based controller development in this project will occur in parallel with, and provide an opportunity to enhance, the Carnegie team's ongoing work on a machine learning (ML) based intelligent controller.

Reinforcement learning is an area of artificial intelligence in which a machine learning model is built with the ability to self-learn. While the intelligent controller currently under development has to optimise the device's response for every wave (using ML models within the optimisation), the RL controller has the ability to directly learn and apply the optimum response to predicted waves, during operation. The RL controller, which comes pre-loaded with a simple control scheme, explores away from this reference using the concept of reward to identify and learn good control actions.



Reinforcement Learning control applied to CETO

The RL controller uses input from the environment (predicted waves), the state of the CETO system (how it responds to the environment), and rewards from previous actions, to determine how to optimally control the system

What this means for wave energy is that a RL based controller can move beyond optimising CETO's response using an ML model of the system trained on simulated data. A RL based controller can actively adjust, experiment, learn and optimise by utilising what actually happens during operations.

Initially, Carnegie envisions that a RL based controller would likely use a power-output-based reward to learn optimum operation. Over time, the controller could become more advanced and could ultimately use a reward based on Levelised Cost of Energy (LCOE), thereby incorporating a range of variables into its operation (including not only energy production but also elements of operations and maintenance costs such as fatigue, avoiding large damaging waves, and even commercial considerations.)

The teams at Carnegie and HPE look forward to working together to pursue this exciting innovation which has the potential to improve the performance and reduce the cost of the CETO technology and revolutionise control of wave energy converters.

– ENDS –

Approved for release by the Chairman and Company Secretary

About Hewlett Packard Enterprise Company (HPE) and Hewlett Packard Labs

HPE is a global, edge-to-cloud Platform-as-a-Service company built to transform your business. How? By helping you connect, protect, analyse and act on all your data and applications wherever they live, from edge to cloud, so you can turn insights into outcomes at the speed required to thrive in today's complex world. Our purpose is to advance the way people live and work.

Hewlett Packard Labs is the exploratory and advanced research group for Hewlett Packard Enterprise and its businesses.

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