

# Making Waves in Clean Energy

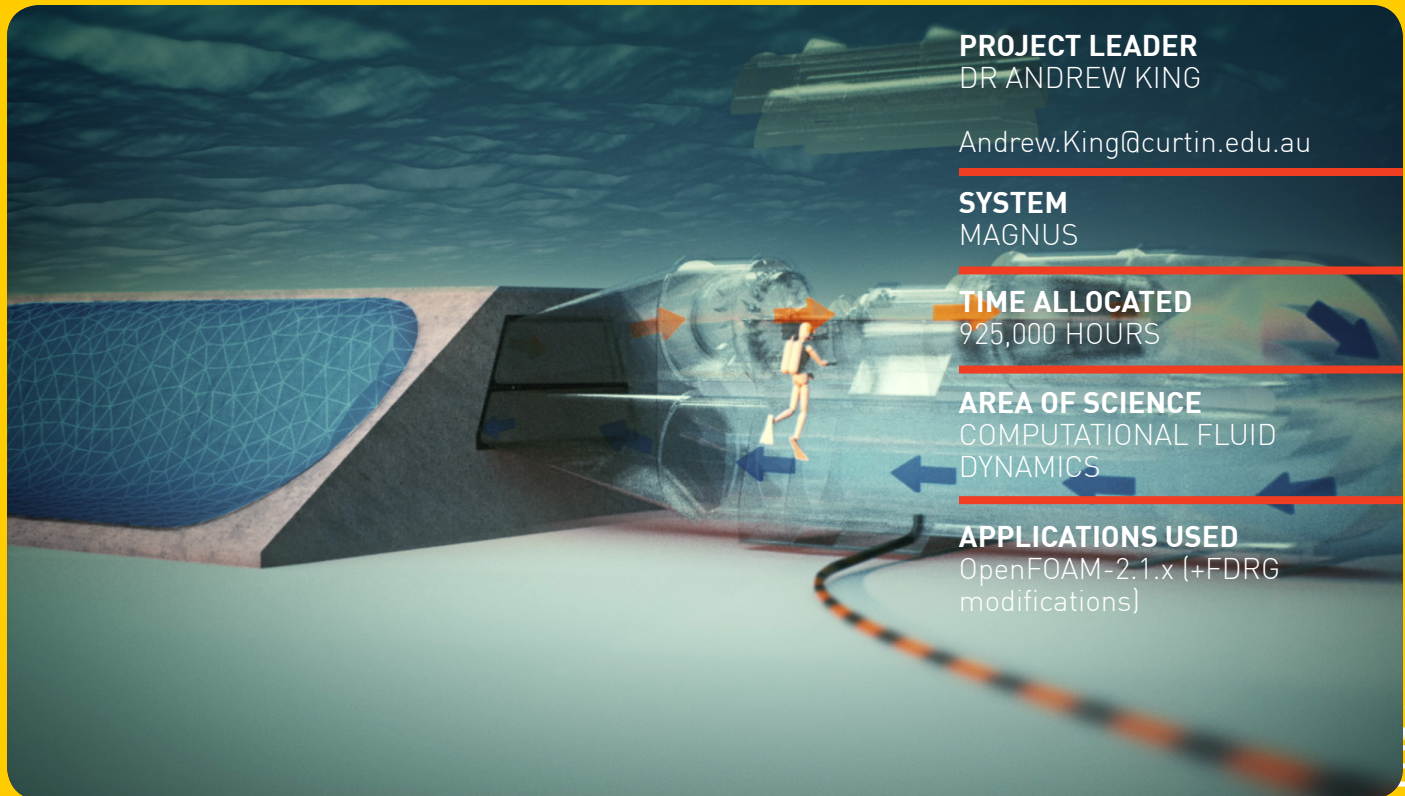
*PAWSEY Supercomputing Centre*  
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**Press Media**

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# MAKING WAVES IN CLEAN ENERGY



**PROJECT LEADER**  
DR ANDREW KING

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**SYSTEM**  
MAGNUS

**TIME ALLOCATED**  
925,000 HOURS

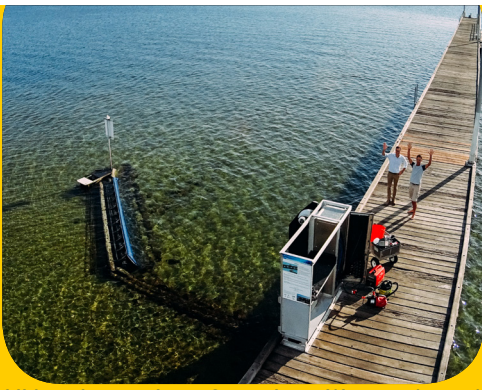
**AREA OF SCIENCE**  
COMPUTATIONAL FLUID  
DYNAMICS

**APPLICATIONS USED**  
OpenFOAM-2.1.x (+FDRG  
modifications)

mWave air flow

Low-cost, sustainable energy is currently at the forefront of global market demand. One leading edge concept that is beginning to generate international interest is wave power. Wave power involves harnessing the power of the ocean's waves and converting it to electricity through a wave energy converter. Dr. Andrew King, from Curtin University's School of Civil and Mechanical Engineering, is working with Perth company Bombora Wave Power to examine and optimise the performance of Bombora's mWave™ wave energy converter. Using the world-class supercomputing infrastructure at Pawsey, Dr. King and his team can develop a series of mathematical models on water, air, and membrane fluid mechanics to predict the volume of electricity that can be generated. Through the use of the supercomputers, the feasibility of mWave™ production can be made into accurate predictions to ultimately succeed as a cutting-edge renewable energy solution for Australia.

2016



Mid-scale test site at Como Jetty, Western Australia

## CHARACTERISATION AND POWER PREDICTION FOR A NOVEL WAVE ENERGY CONVERTER

### THE CHALLENGE

In collaboration with award-winning company Bombora Wave Power, Dr. King has developed optimal design features for the mWave™ wave energy converter suitable for the ocean environment. The mWave™ technology needs to endure storm conditions at sea yet remain cost-effective for global market electricity production. The complexity of ocean wave interaction with Bombora's wave energy converter, and the lengthy timeframes that parametric studies require, presented a significant challenge for the research team. "The mathematical models are nonlinear, tightly coupled and extremely challenging to solve," said Mr.

Shawn Ryan, Executive Director of Bombora Wave Power.

Access to high-performance computing resources allowed Computational Fluid Dynamics (CFD) to lay the foundation for the accurate and complete understanding of the power capture process of the mWave™. The project called for computing infrastructure that was beyond the capability of standard computing facilities.

### THE SOLUTION

Using Magnus, the most powerful supercomputer in the Southern Hemisphere, Dr. Andrew King, and his team have been able to refine the designs of Bombora's wave energy converter. Using fully coupled CFD models to understand and optimise the full potential of the innovative technology, the timeframe and cost of developing the mWave™ has been significantly reduced.

"Computer simulations enable us to build confidence in our mWave™ wave energy converter design by getting the design closer to the final technical solution," said Mr. Ryan.

"Developing wave energy technology is very complex and expensive, so testing design proposals with the assistance of the supercomputer, prior to building the full-scale device, is essential in order to minimise development costs and commercialisation time."

### OUTCOME

Following the mWave™ designs created through CFD techniques on Pawsey's state-of-the-art supercomputers, the wave energy converter prototype was constructed. The mid-scale prototype had a series of air-inflated rubber membranes covering a structure mounted to the seafloor and arranged at an angle to capture the power from the incoming waves.

In 2015, the mWave™ prototype was tested in the Swan River in Western Australia, with the tests confirming the energy capture process. Each full scale mWave™ is rated at 1.5 Megawatts with the potential to supply sustainable electricity to 350 homes.

"The models and simulations have built real confidence in how our mWave™ will perform when installed at full scale. Running multiple simulations simultaneously is a great way to compare different design iterations and configurations," said Mr. Ryan.

"Bombora is continuously researching and developing ways to optimise and refine the design and configuration of an mWave™ farm, which consists of multiple mWave™ devices, to get the maximum possible conversion of wave energy into electricity, at the lowest possible price."

Bombora Wave Power is working towards commercialising the low-cost mWave™ technology and in doing so, positioning Australia at the forefront of sustainable energy technology.

"Without access to a supercomputer, Bombora's confidence in the mWave's™ ability to generate competitively priced, high volumes of energy, would be considerably less," said Mr. Ryan.

Ongoing research into wave energy will continue to facilitate the design and improvement of cutting edge wave energy converter technology. The Pawsey Supercomputing infrastructure will be an integral part of this process.