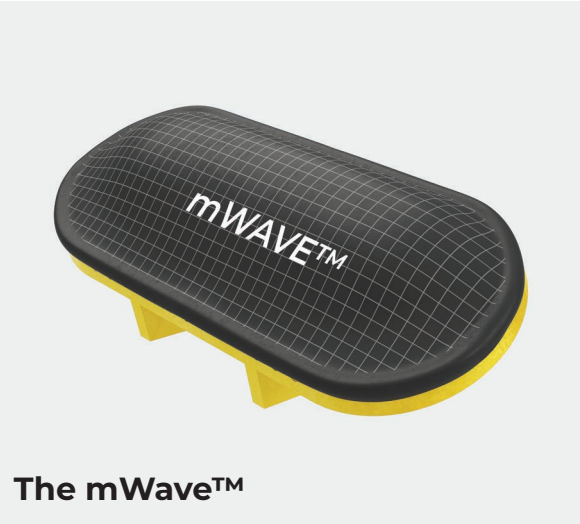
MADE
CYMRU
CASE
STUDY #4

MANUFACTURE
ADVANCED
DESIGN
ENGINEERING

Making waves with Bombora

A company that's working hard to put Wales on the map for marine energy is Bombora.



The mWave™

A company that's working hard to put Wales on the map for marine energy is Bombora, whose innovative mWave™ product produces environmentally friendly, consistent and cost-competitive energy for commercial power generation in coastal locations throughout the world. Bombora is currently focusing on a €20 million project to design, fabricate and test the first 1.5 MW mWave™ prototype in Wales. The project is part funded by the European Regional Development Fund through Welsh Government.

Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

bombora

UNDEB EWROPEAIDD
EUROPEAN UNION

Llywodraeth Cymru
Welsh Government

Cronfa Datblygu
Rhanbarthol Ewrop
European Regional
Development Fund

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Sam Leighton,
Managing Director at Bombora

> Our research project with MADE Cymru is an excellent example of how sectors are collaborating to achieve net zero. By bringing innovative technology developers together with academia, the research not only supports Wales' transition to a low carbon future; it also strengthens the country's position as a global frontrunner in wave energy generation.

Research Officers from the MADE Cymru project at University of Wales Trinity Saint David are working collaboratively with Bombora to develop and test a key component for the device, rationalising the manufacturing method and reducing the manufacturing costs. The team are also committed to identifying opportunities to manufacture the improved component here in Wales. The combined industry and technological knowledge of the team at Bombora, coupled with the research ability and advanced technology available to those working within the Advanced Design Engineering (ADE) team at MADE Cymru, will undoubtedly deliver positive product development for future component manufacturing.

The Challenge:

The mWave device is made up of multiple air-filled cell modules. Each module is enclosed by a flexible membrane aligned for optimum performance to the incoming waves. The pressure differential produced from a wave(s) crest and trough causes the alternating compression and decompression of the membrane, forcing air from inside the cell into a duct to drive a turbine, thus generating electricity. The cell then refills with air, inflating the membrane in a continuous sequence.

The novelty of the mWave system lies in the flexible membrane. The current material used for the membrane requires large specialist tooling and equipment, which narrows the pool of suitable suppliers.

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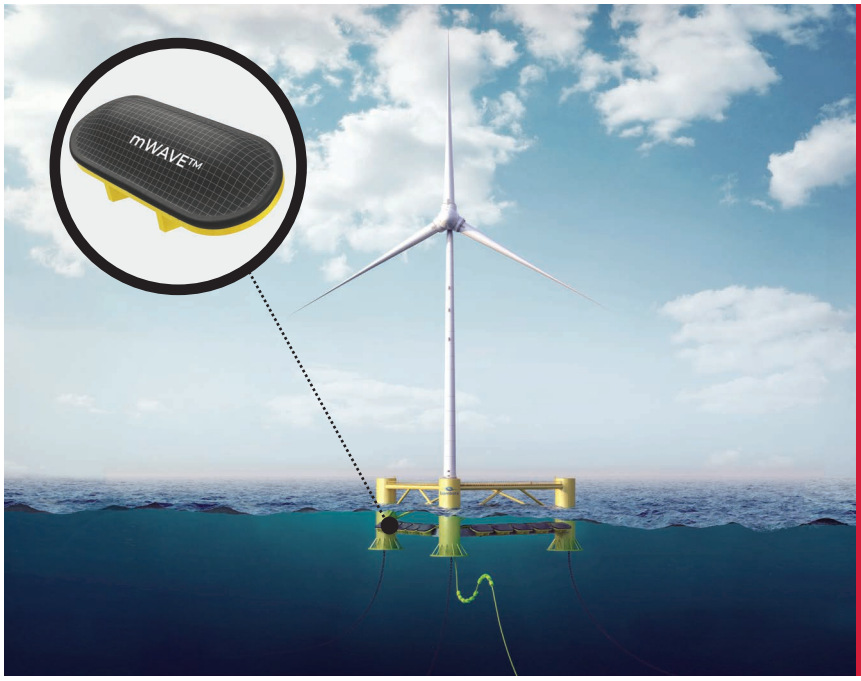

The MADE Cymru team worked with Bombora to research potential alternative materials as part of the company's on-going product design development. The project is focused on finding new materials with equivalent design criteria but reducing the costs associated with handling and fitment.

What we did:

MADE Cymru encapsulated a suite of Industry 4.0 advanced design and manufacturing capabilities, in conjunction with several in-house software applications for preliminary research and development. Amongst this comprehensive list was GRANTA, a software package for intelligent material selection. The material dataset covers thousands of individual material standards, specifications, suppliers and grades. This process supports the right material choices during early product development stage.

Based on the pre-requisite design criteria, the search enabled complete confidence in the findings - rapidly generating new ideas through systematic and chronological search. An additional benefit of this tool, that companies have now started becoming compliant on, is the carbon footprint or impact factor on the environment. Incorporating this in future projects helps SMEs demonstrate the sustainability of their project(s) and can help when applying for grants and funding. The shortlisted material can then be exported directly to a variety of third-party CAD/CAE software for FEA/CFD analysis.

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The Result:

The research tools and methodology employed to date have been incredibly beneficial in identifying simulation and CAE results for preliminary material. MADE Cymru's powerful method of searching for materials is greatly assisting Bombora to identify solutions that meet mWave's rigorous technical criteria, at the same time as enhancing the commercial competitiveness of this groundbreaking renewable wave energy product.

Figure 1 demonstrates material performance alongside factors such as cost, energy used in production, substance risk and several other metrics that can be employed consecutively or simultaneously – such as the limits as specified under the design criteria - to observe performance of different grades of material.

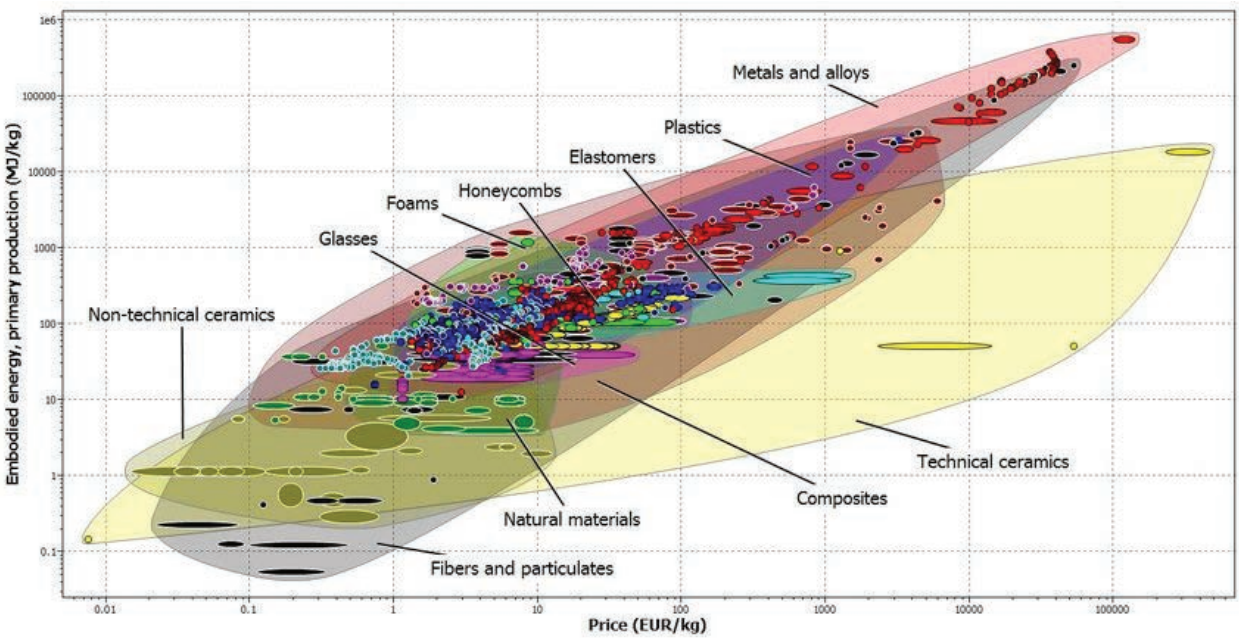

Figure 1: Embodied energy vs. price graph, produced in GRANTA for demonstration only (Dimitrijevic, 2014)

MADE Cymru's ADE initiative is working on several other projects where the aim is to convert existing factories into smart factories through automation, additive-manufacturing, advanced designing techniques and through employment of cutting-edge research.

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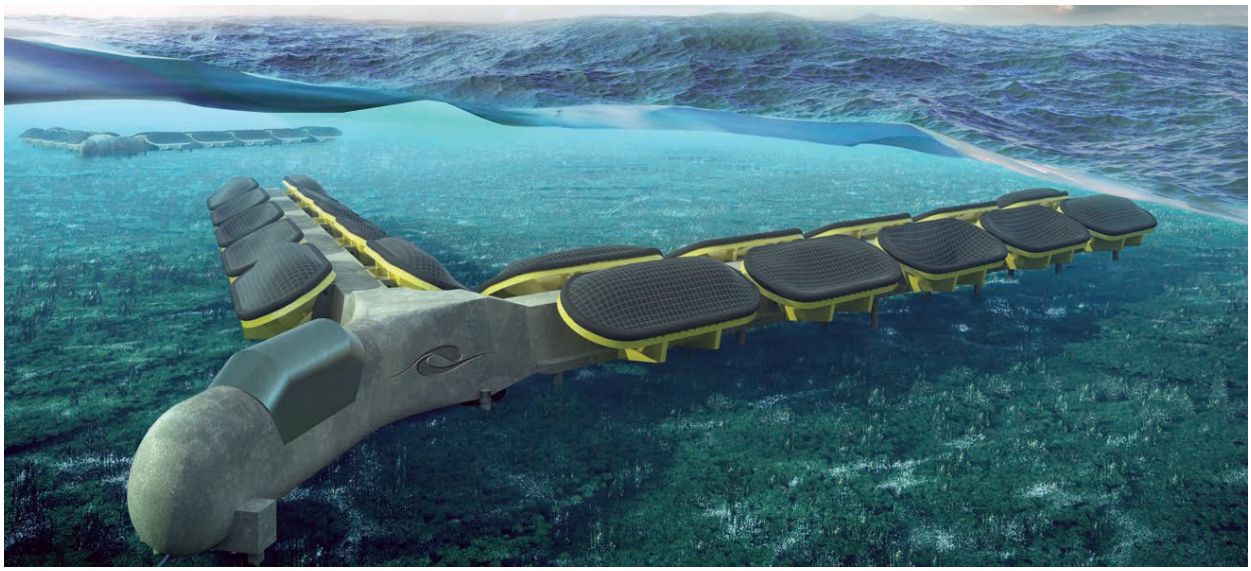
The team aims to scope businesses so that manufacturability can be brought in-house or within Wales and join together with the existing chain of commands of the company. This improves and enhances current processes and products through the logistics of Industry 4.0; this not only has positive economic benefits, but also educates industries about niche technologies to future-proof for the future.

For more information on Bombora visit: **www.bomborawave.com**



To find out more about our Advanced Design Engineering (ADE) R&D support or the MADE Cymru upskilling programmes, please visit **www.madecymru.co.uk**

Tel: 01792 481199
Email: MADE@UWTSD.ac.uk

MADE Cymru is a suite of programmes designed to navigate organisations through Industry 4.0 via collaborative research & development and upskilling. Part/Fully Funded by the European Social Fund/European Regional Development Fund through the Welsh Government. Delivered by University of Wales Trinity Saint David.