



Carnegie Wave Energy Limited

(ASX:CWE)

Annual General Meeting

6th November 2015

Dr. Michael Ottaviano

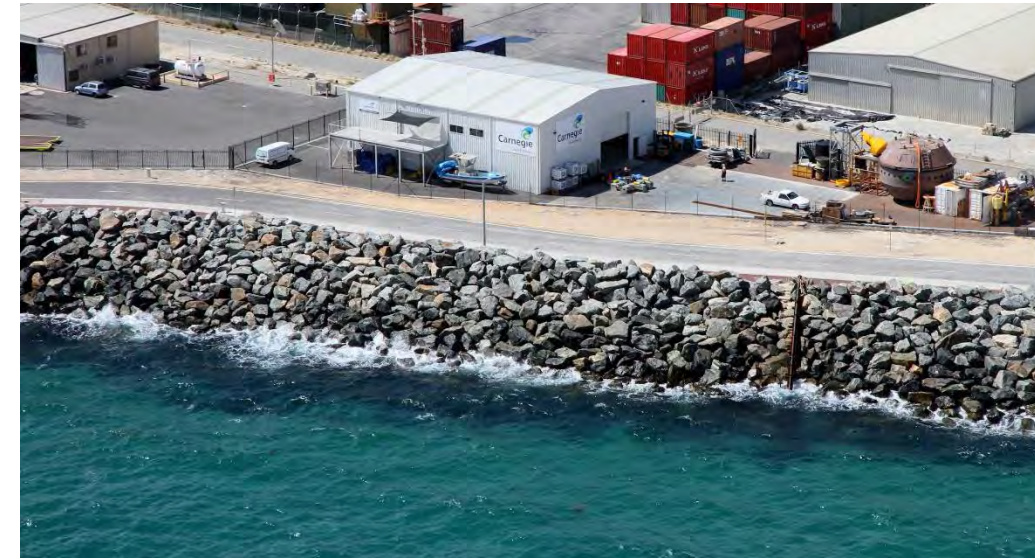
Managing Director & CEO

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Investment Highlights

- Owner and developer of world leading “CETO” wave energy technology
- Tens of thousands of in-ocean operating hours.
- \$118m spent to date on CETO over 6 prototype cycles
- Team of 40+ focused on wave technology and project development
- Dual market focus
 1. Europe/UK:
 - Dedicated wave sites, grants, tariffs, wave resource, EDF licence and supply chain
 2. Islands:
 - High diesel tariffs, lack of energy security, wave resource, funding support

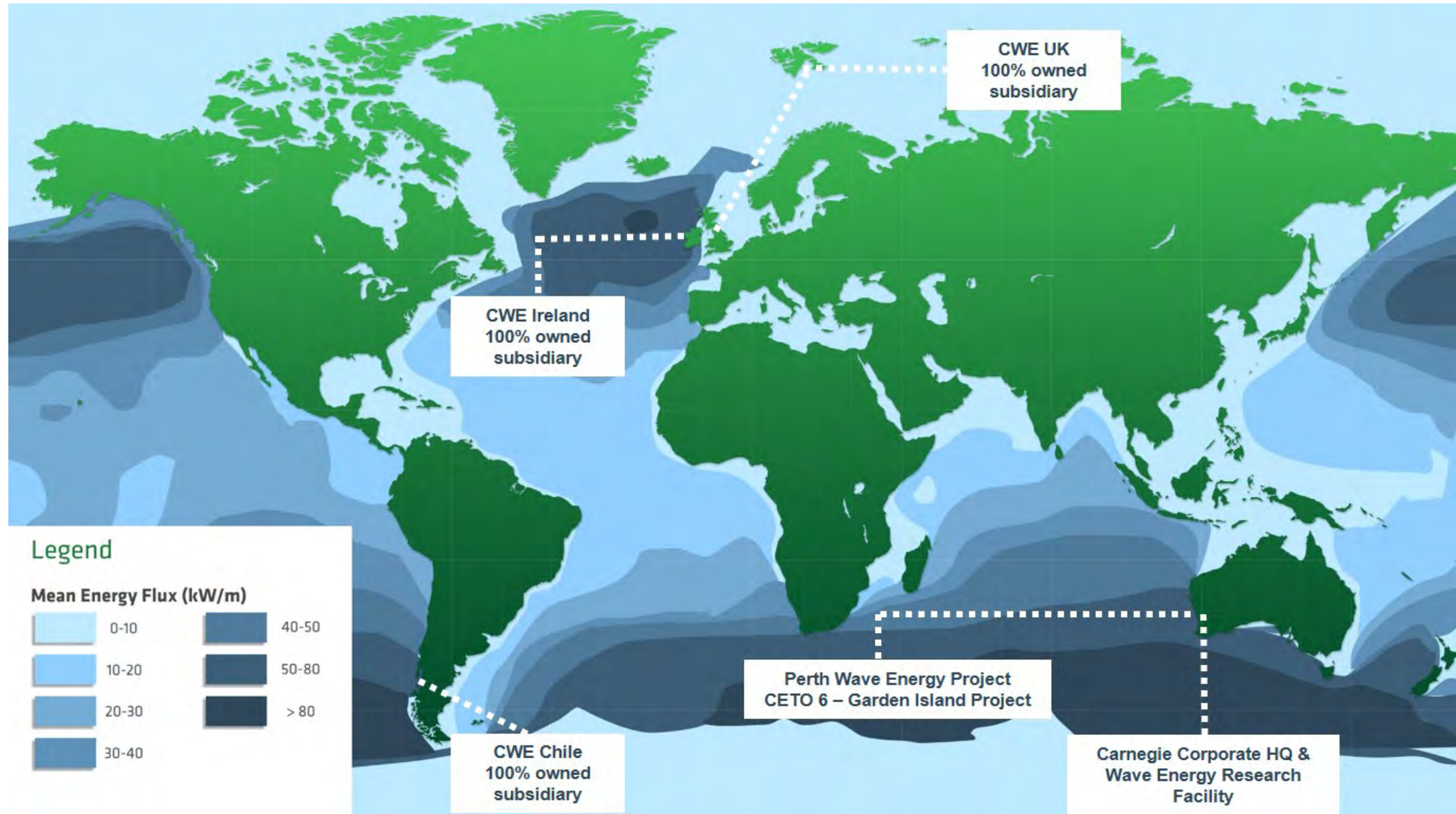


Carnegie Board of Directors



L-R: Kieran O'Brien (ex ESB), Mike Fitzpatrick (ex Hastings), John Leggate (ex BP), Jeffrey Harding (Chairman, ex Pacific Hydro), Michael Ottaviano (MD & CEO), Grant Mooney (NED, Joint Company Secretary)

Carnegie's Global Reach



Carnegie Trading Snapshot

- \$85m market capitalization
- \$13m net cash
- \$14m undrawn Government grants
- \$20m undrawn debt facility
- 1.77 billion shares on issue



Increasing Industry Recognition



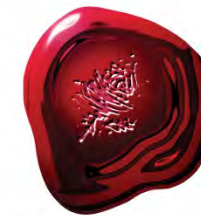
Innovation Excellence Winner,
2014



Top 100 Global Sustainable
Solutions, 2015



Top 50 Most Innovative
Companies in Australia, 2015



BANKSIA
SUSTAINABILITY
AWARDS 2015
CATEGORY FINALIST

Banksia Sustainability Awards,
Innovation Category Finalist,
2015



Program Innovation Winner,
2014



Clean Energy Council

Innovation Award Winner, 2015



The Australian Innovation Challenge, Finalist,
Minerals & Energy, 2015

ENERGY & ENVIRONMENT

By AMY YEE APRIL 22, 2015

BloombergView

ENVIRONMENT

Sea Power Can Eclipse Solar



THESE SUBMARINE TOWERS REPRESENT THE WORLD'S FIRST FULLY operational wave plant. Designed by the Italian company Carnegie Wave Energy, three of these structures will rise from the ocean floor just off Perth, where they connect to a 100-metre-long, 11-metre-wide platform that makes use of the power of the ocean's waves. The towers are designed to harness the energy of the waves, which are pushed up by a pump at its base. The pump sends a stream of pressurised water shooting through pipes that run along the ocean floor. Those generate electricity at a land-based hydroelectric plant, where the force

of the water to the turbines. The pumping action can also be used to drive desalination plants and make fresh, drinkable water. Now Carnegie is upgrading to CETO 6, which will produce power completely offshore by using the pumping action to drive a generator within the buoy, making electricity on site. Subsea cables will then wire the power back to land. With its 20-metre diameter, CETO 6 can produce 1Mw of energy; by 2017 Carnegie wants to tether three units off Perth.

Compared to wind and solar power, wave energy is denser: by area, Carnegie's wave farms can generate four times more energy than solar farms, Ottaviano says. Next, Carnegie plans to bring its innovation to WaveHub, a wave-energy testing site in Cornwall, where it wants to roll out ten CETO 6 units that will generate 10MW of power. **Emma Bryce** carnegiwave.com

Surf's up

These wave farms help to power an Australian naval base – and they're coming to Cornwall



The Economist



Renewable energy

Looks swell

MELBOURNE
A new project off the coast of Australia may make wave power a reality

NO LAND stands between Antarctica and Australia's west coast—just a vast ocean, rippled and rocked by the Roaring Forties. For centuries these westerlies, which blow between latitudes 40° S and 60° S, powered ships sailing from Europe to

Credible Alliances

ARENA



Australian Government
**Australian Renewable
Energy Agency**

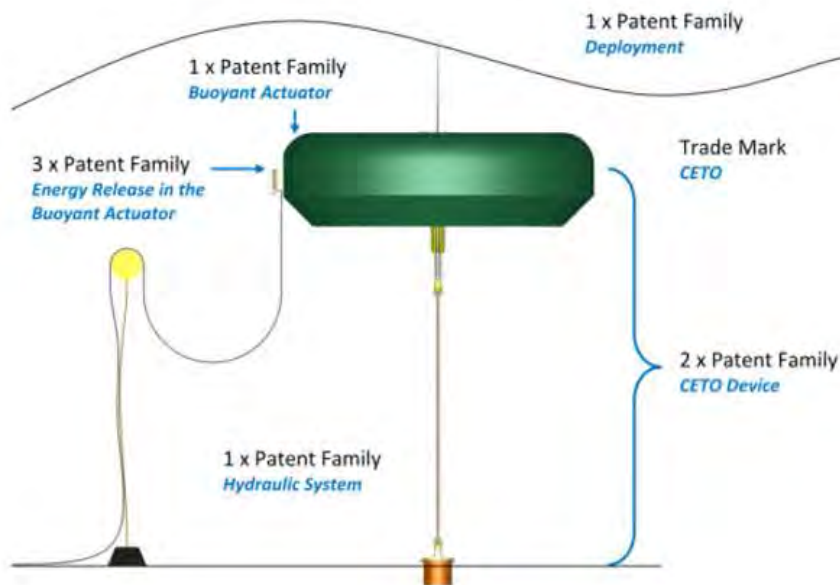


**GOVERNMENT OF
WESTERN AUSTRALIA**



CETO Intellectual Property Portfolio

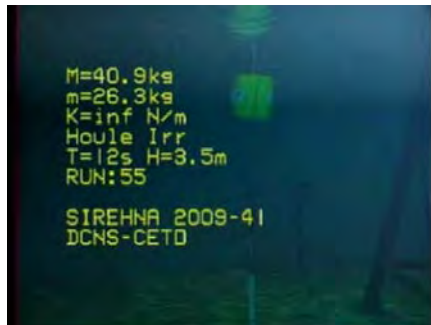
- Carnegie's patent portfolio consists of eight patent families covering the strategic elements of the CETO technology and more than 100 patents and patents pending globally
- An Independent Expert's Report described the investment in CETO as having "...created significant IP barriers to entry..."
- Carnegie's 100% ownership of the CETO technology provides significant flexibility in business models including build own operate projects, JVs, OEM arrangements, technology licensing arrangements, and provision of O&M services
- Carnegie has also developed significant "soft" IP e.g. know-how, modelling, process design, control algorithms etc that is essential to successful technology design and operation






Unprecedented Progress

Track Record - 10,000s hours of ocean testing & years of technology development



An aerial photograph of the Perth Wave Energy Project, showing three CETO units in the ocean. Each unit consists of a large, circular, greenish-yellow floating platform with a small structure on top. The units are spaced out in a diagonal line across the frame. The water is a deep blue with visible ripples and small waves.

The Perth Wave Energy Project

Offshore CETO units

An aerial photograph of the Perth Wave Energy Project's onshore infrastructure. The site is a fenced-in area on a sandy, hilly landscape. The central feature is a large, white, gabled building with a corrugated metal roof and two large doors. To its right is a long, white, rectangular container or trailer. Further right are several smaller, white, rectangular buildings. A large, green, cylindrical water tank is visible near the long container. A white car is parked near the smaller buildings, and a blue car is parked near the large building. A small, blue, rectangular building is located to the left of the large building. A small, blue, rectangular building is also visible near the bottom left. The site is surrounded by a fence, and there are some trees and shrubs on the surrounding hills. The text "The Perth Wave Energy Project Onshore infrastructure" is overlaid in the bottom left corner.

The Perth Wave Energy Project

Onshore infrastructure

Perth Wave Energy Project – major industry milestone



- Demonstrated CETO 5 technology including:
 - Three Wave Energy Converters (WECs)
 - Power delivery to grid
 - Wave powered, reverse osmosis desalination
 - <1 day CETO WEC installation
- >14,000 operational hours across 3 units, since November 2014, across 4 seasons
- Only operational wave power plant in the world
- Designed and delivered by Carnegie
- Measured CETO 5 results confirmed modelled forecasts
- Measured results confirm CETO 6 forecasts

Perth Wave Energy Project – desalination pilot plant

- Integrates off-the-shelf reverse osmosis desalination technology with the CETO infrastructure.
- The Perth Project is the first wave project to produce clean power and fresh water anywhere in the world.
- Cooperation agreement with Western Australian Government owned Water Corporation
- The Desalination Pilot Plant is supported by a \$1.27m AusIndustry grant, under the Clean Technology Innovation Program
- Water supply agreement with the Department of Defence
- Desalination plant capable of 150m³/day potable water production off CETO project or off grid

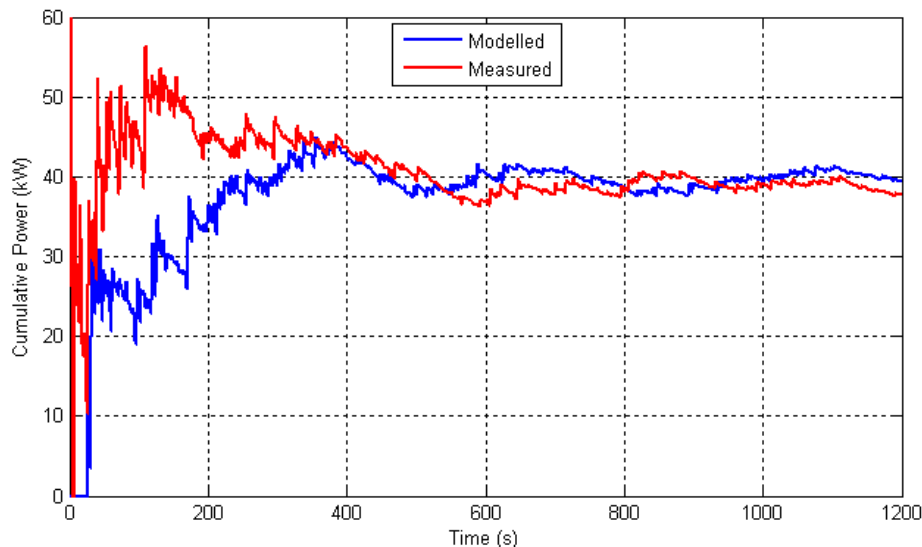
“Carnegie’s wave powered seawater desalination technology offers a novel and promising approach to achieving desalinated freshwater with zero greenhouse gas emissions”

Sue Murphy, CEO, Water Corporation



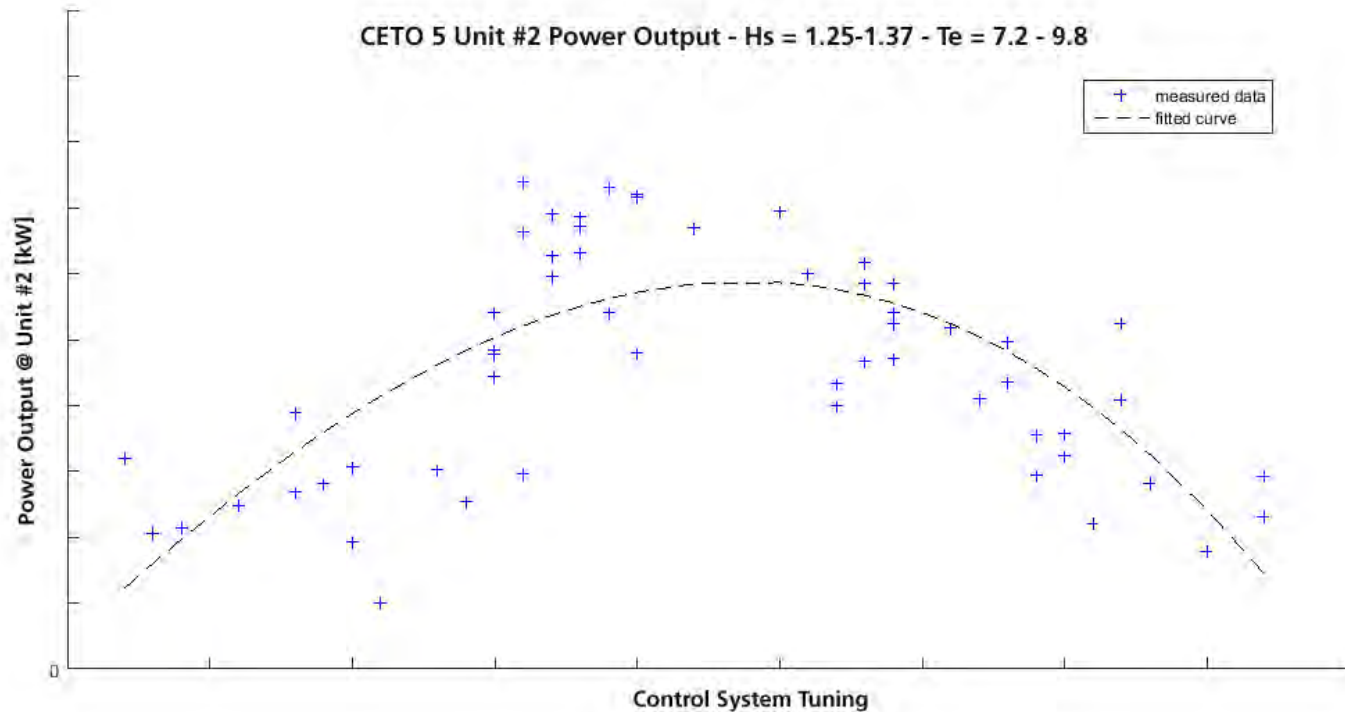
Perth Wave Energy Project – operation, maintenance and performance

- Range of sea states experienced, including waves up to 5.8m
- 3 unit array, over 14,000 hours of cumulative operation
- Exporting power and water to DoD
- Regular offshore inspections conducted
- CETO Unit retrieved for onshore inspection and maintenance then reinstalled (“hot swap verified”)
- CETO unit and system performance in line with expectations



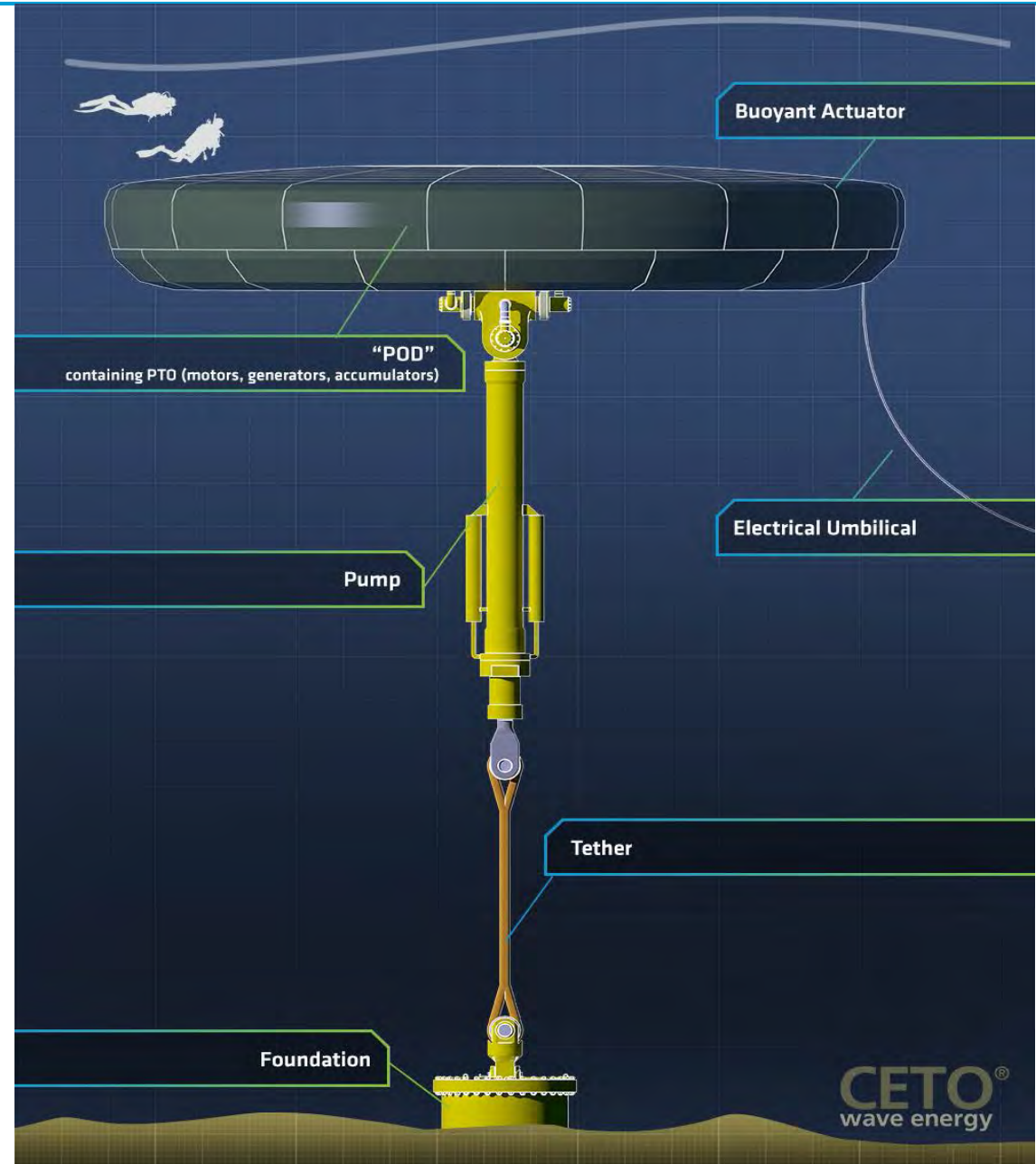
Perth Wave Energy Project – effectiveness of control strategy

- Strong correlation between modelled and measured results
- Results supported Carnegie's control strategy effectiveness
- Optimum system settings against a variety of sea states
- Learnings from Perth Wave Energy Project to feed into CETO 6 detailed design



CETO 6 Design – commercial product platform

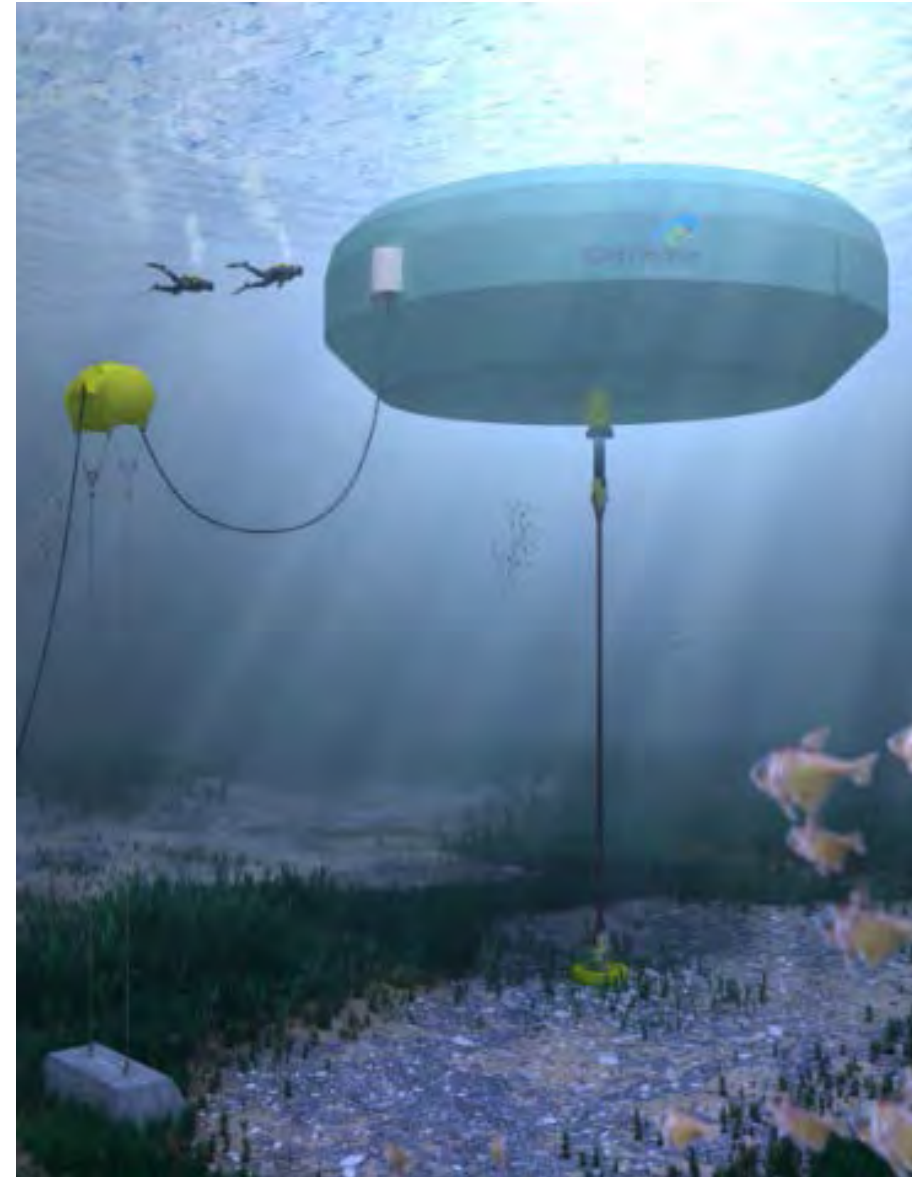
- Development based on:
 - 14,000 CETO 5 in-ocean operational hours and data analysis
 - CETO 6 wave tank testing at FloWave, Edinburgh using scale model
 - Internal modelling and design development
 - Engagement with UK/EU and Australian supply chain
- Approximately 4 times the rated capacity of CETO 5 generation (nominal 1MW)
- Power generation inside the buoyant actuator allows more advanced control capability
- Rapid installation and retrieval (no offshore heavy lifts)
- Electrical export cable delivers power onshore avoids hydraulic transmission losses
- Tidal range compensation
- Nearshore and more distant to shore wave sites suitable



CETO 6 – commercial product platform

First CETO 6 Project:

- Garden Island, Western Australia
- Concept design complete
- Project construction start 2016
- Project commissioning 2017

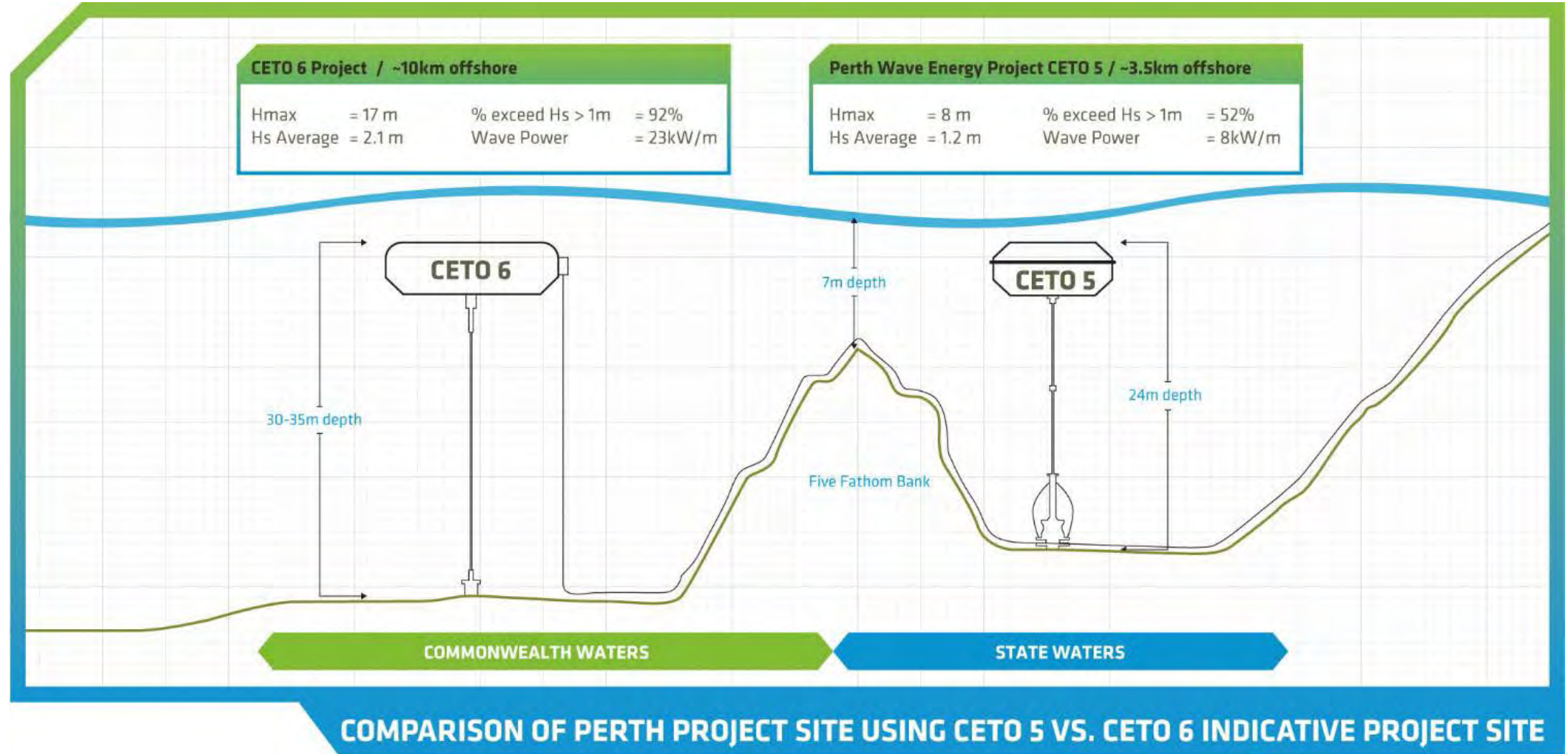


CETO 6 Design Development





Garden Island CETO 6 Project – CETO 6 site versus CETO 5 site



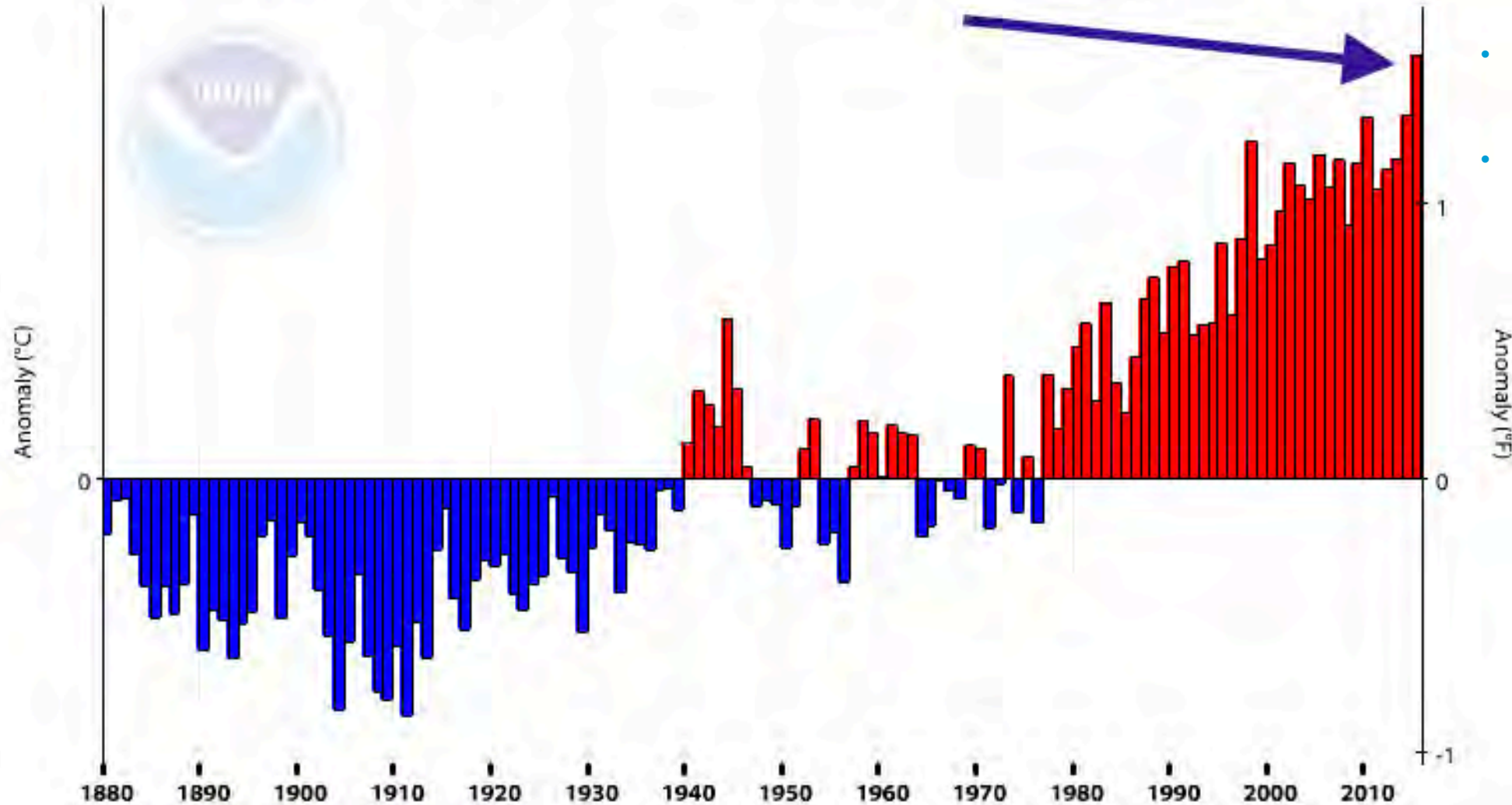
- CETO 6 located in deeper water off Garden Island, past Five Fathom Bank
- CETO 6 site has higher average energy (23kW/m versus 8kW/m)
- CETO 6 site has more consistent waves (>1m 92% of the time versus 52%)



Market

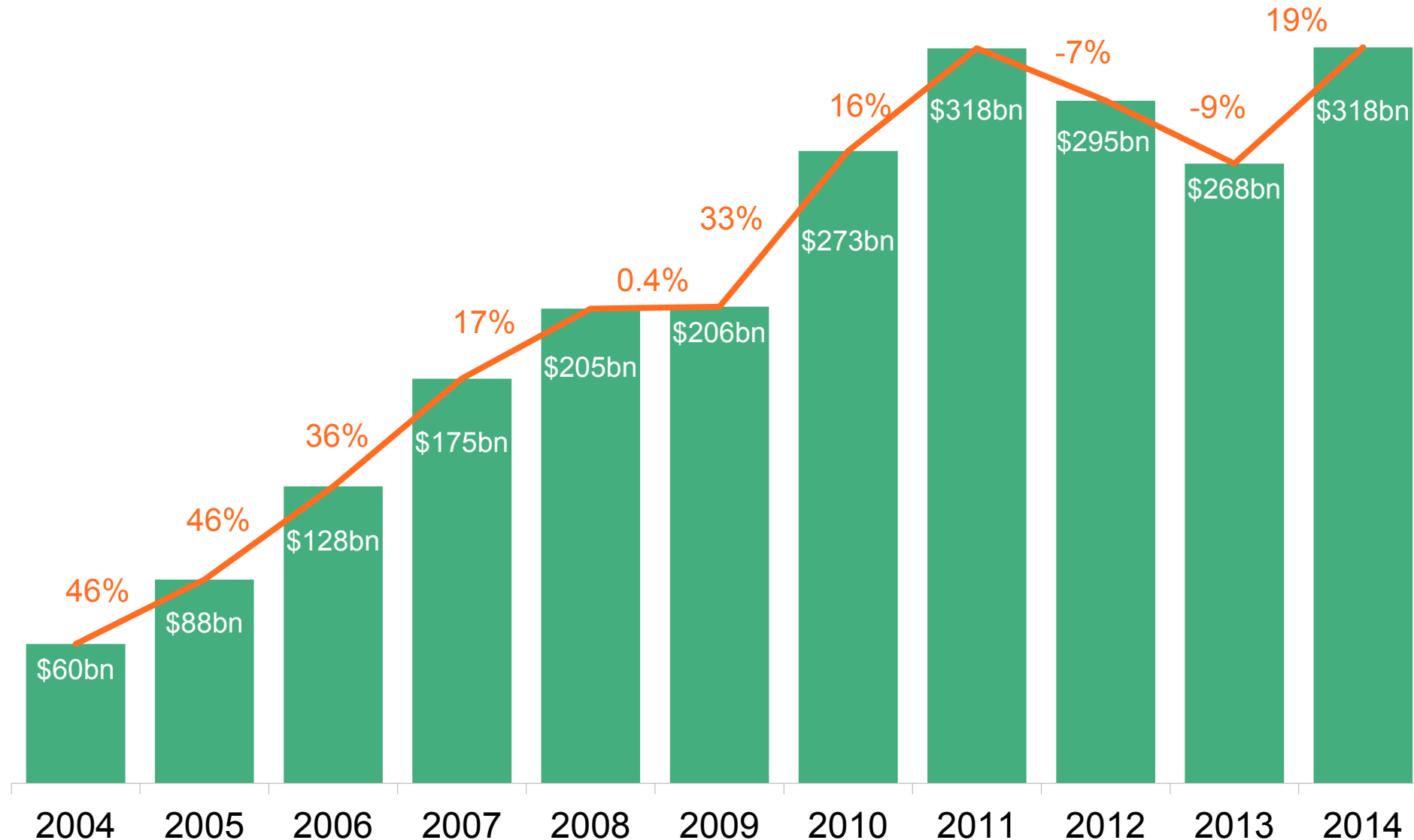
Climate Change Investment Drivers Continue To Grow

Global Land and Ocean Temperature Anomalies, January-September



- September 2015 hottest ever recorded month since 1880
- 2015 likely to be hottest ever year on record

Global Renewable Investment – massive growth over last decade



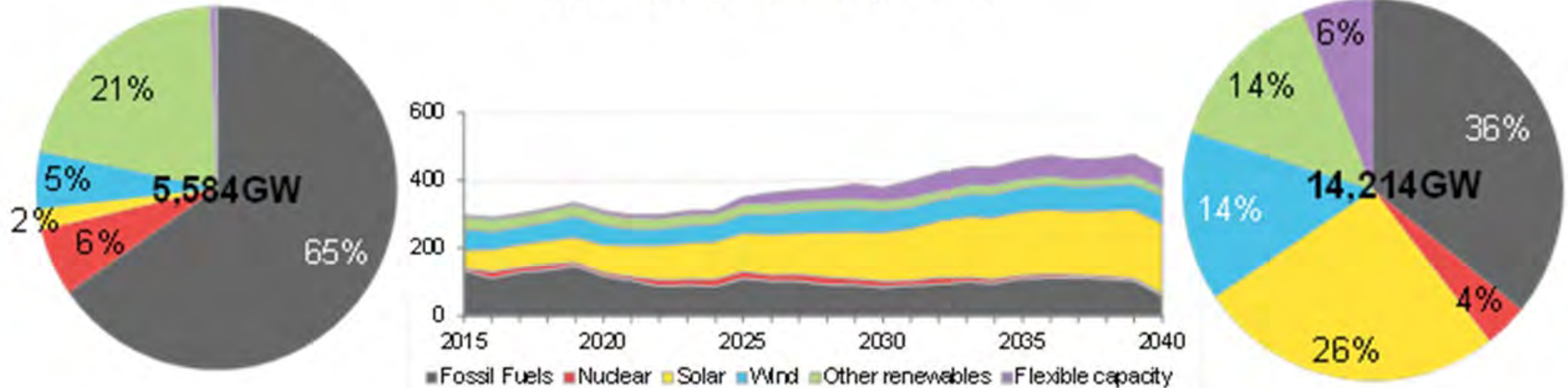
Excludes the effect of declining costs of renewables meaning that more MWs are built for the same investment.

Note: Total values include estimates for undisclosed deals. Includes corporate and government R&D, and spending for digital energy and energy storage projects (not reported in quarterly statistics).

Source: Bloomberg New Energy Finance

Forecast Energy Growth – renewables the dominant energy player globally

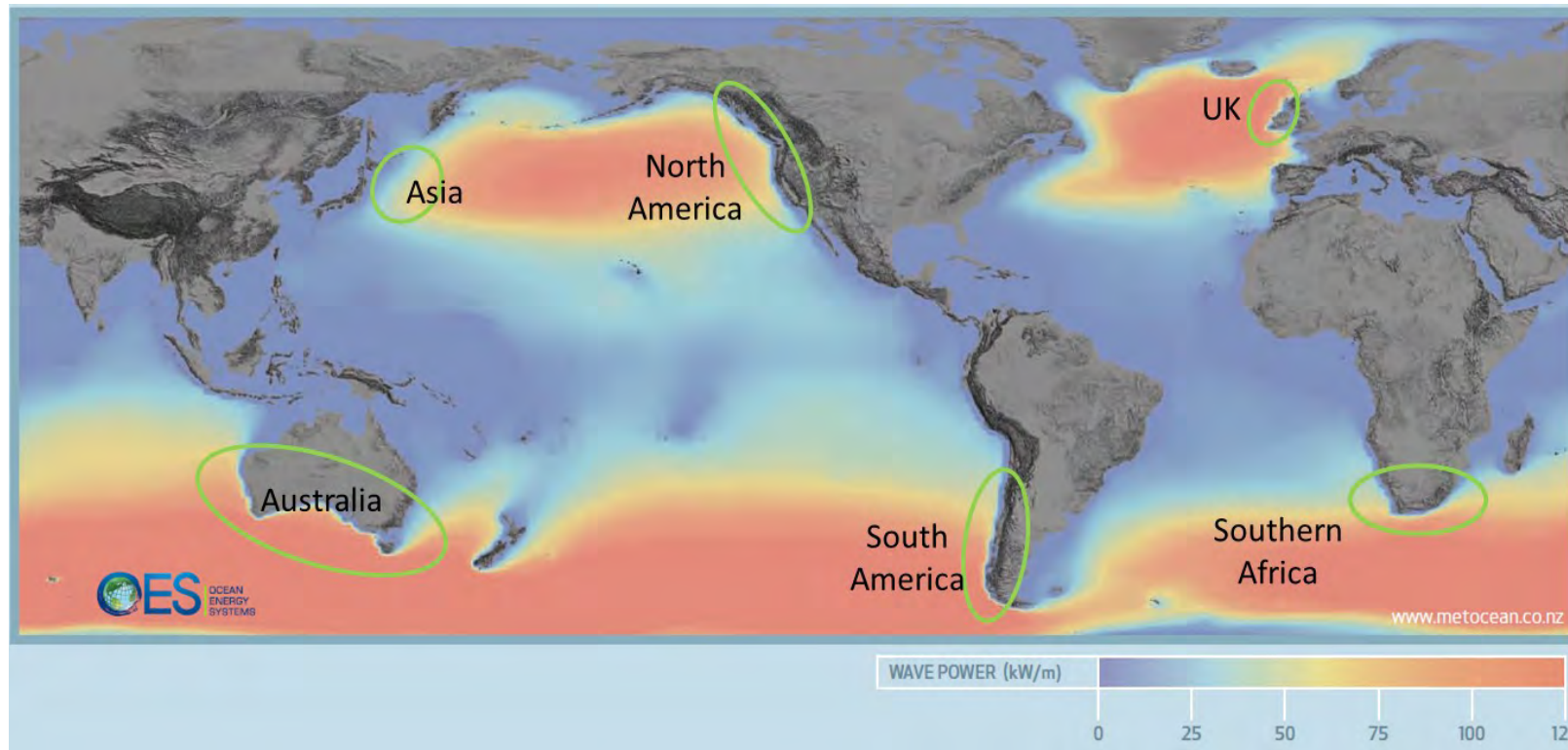
Annual capacity additions, 2015-40



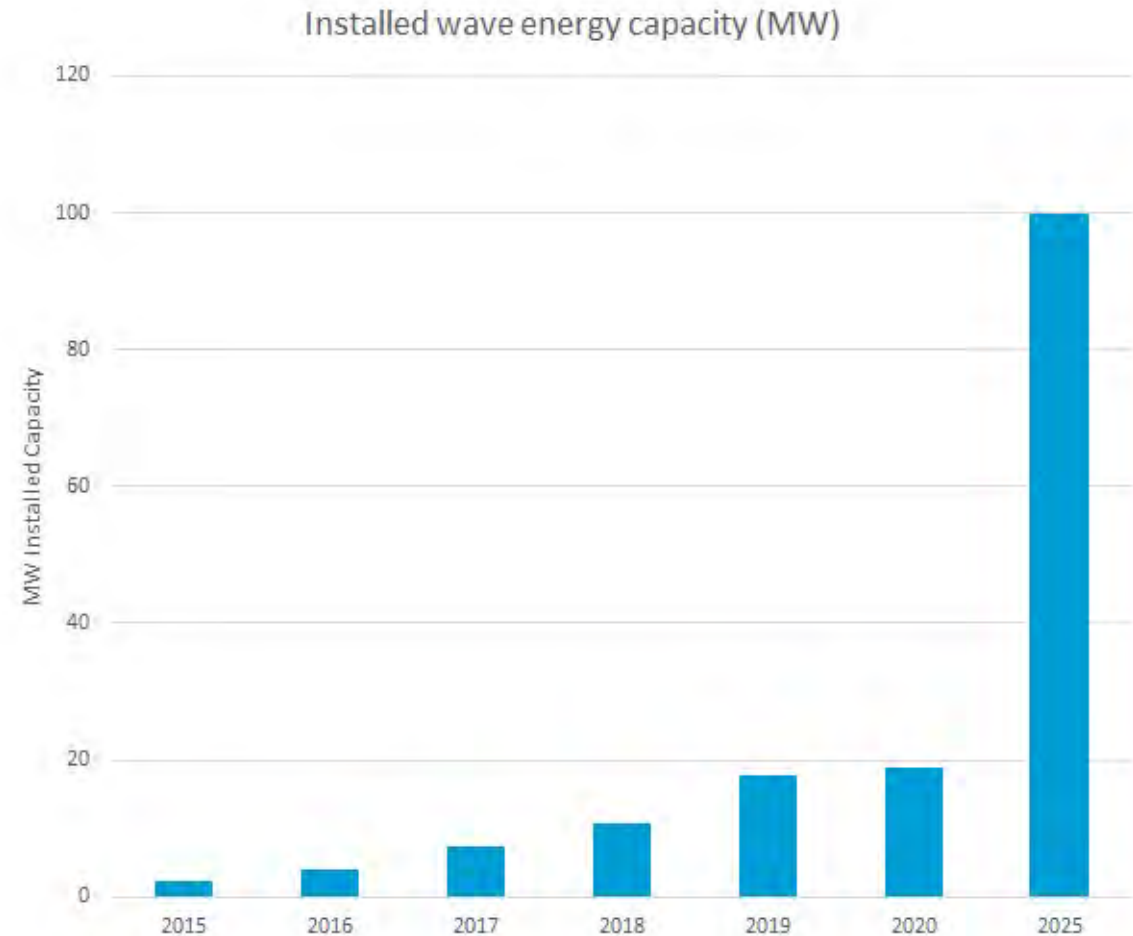
- Some \$12 trillion to be invested in power generation worldwide in 2015-40.
- Just over \$8 trillion of that will be invested in renewables.
- Fossil fuels shrink from 65% to 36% of world's capacity over next 25 years.

Wave Energy Resource & Market Potential

- Two percent of the world's coastal waters have wave power densities that are large enough to extract wave energy (480GW of power output or 4,200 TWh/year)
- The IEA estimates global wave energy installed capacity to be **188 GW** by 2050
- Market is global, large and co-located with demand centres
- Resource is more predictable, consistent and available than wind or solar and therefore complementary



Forecast Wave Energy Growth – start of the growth curve








Source: Bloomberg New Energy Finance





- Forecast installed wave energy capacity is anticipated to reach ~100MW by 2025

Trend to Fewer Large Scale, Ocean-tested Wave Technologies Continues

2012

Device Type	Description	Image	Examples
Attenuator	Usually long, floating structures placed parallel to the direction of waves in order to absorb them. The device's motion can be selectively damped to produce energy.		Pelamis,
Overtopping	Overtopping devices are a wave surge/focusing system, and contains a ramp over which waves travel into a raised storage reservoir.		Wave Dragon
Oscillating Water Column (OWC)	In an OWC, a column of water moves up and down with the wave motion, acting as a piston, compressing and decompressing the air. This air is ducted through an air turbine and the device typically is located onshore		
Point Absorber	A point absorber is a floating structure absorbing energy from all directions of wave action due to its small size compared to the wave length.		
Surge Converter (SC)	A surge converter extracts energy from the surge motion in the waves. They are generally seabed-mounted devices located in nearshore sites.		

2015

Device Type	Image	Small scale tested	Large scale, ocean tested	Large scale, ocean tested & still active
Attenuator		Pelamis,	Pelamis,	-
Overtopping		Wave Dragon	-	-
Oscillating Water Column (OWC)		WaveGen, Pico Plant, Oceanlinx, Ocean Energy	WaveGen, Pico Plant,	-
Point Absorber (deep water)		CETO Wave Energy Technology , Ocean Power Technologies, Wavestar, Seatricity, SeaRaser, Wello Oy, AlbaTERN	CETO Wave Energy Technology , Ocean Power Technologies, Wavestar, Seatricity, SeaRaser, Wello Oy, AlbaTERN	CETO, Wello
Surge Converter (SC) (near shore)		Aquamarine Power, Waveroller, Langlee Wave Power	Aquamarine Power, Waveroller, Langlee Wave Power	Waveroller

- Company failures typical of an emerging technology market continue to occur
- New ideas/start ups continue emerge but typically don't progress due to inability to access capital
- Well funded, later stage, ocean tested technologies have significant competitive advantage



Commercialisation Strategy

Dual Market Focus for Early Commercial Projects

Technology
Development

Early commercial markets /
projects

Later commercial
markets / projects



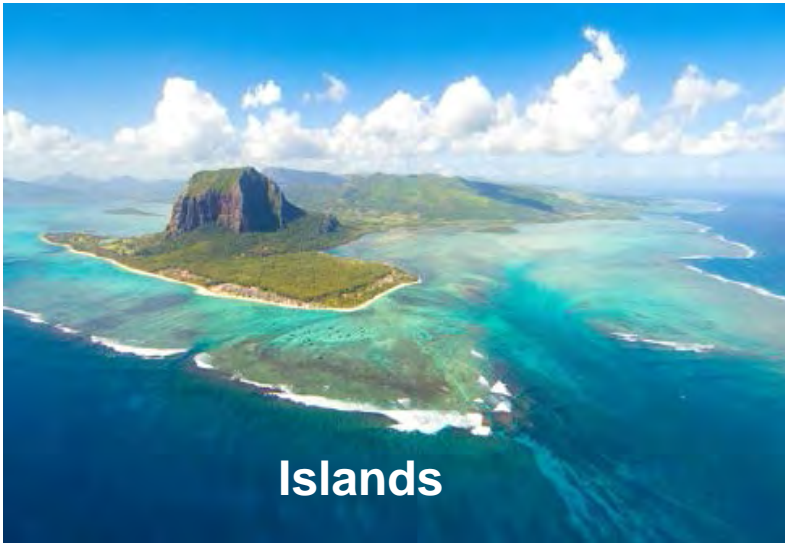
- **UK/Europe** – multiple grid-connected, pre-consented wave energy sites either operating or in development seeking a viable wave energy technology.
- **Islands** – Existing CWE relationships with a number of islands aimed at making islands “CETO ready” while CWE makes CETO “Island ready”

Carnegie's Market Focus – Europe/UK & Islands



Europe/UK

- 5 wave energy dedicated sites in Europe and UK either in operation (and empty) or in development with a total potential capacity approaching 100MW
- Dedicated wave energy feed in tariffs, grants, debt available
- Experienced supply chain for manufacturing, assembly, installation and maintenance
- CWE UK base and CEO, Wave Hub site secured, R&D and site grants won



Islands

- Island and off-grid markets reliant on electricity generated using imported fossil fuel, which is expensive, with high emissions, non-secure, with environmental spill risk etc.
- Climate change / emissions considerations – many islands and remote communities on the front line of climate change and introducing aggressive renewable energy targets
- Increasing government and political support from EU, DFATS, regional development funds, and nation state appetite for increasing renewable energy penetration
- Suitable wave market but CETO not yet “island-ready” and islands not yet “CETO-ready”

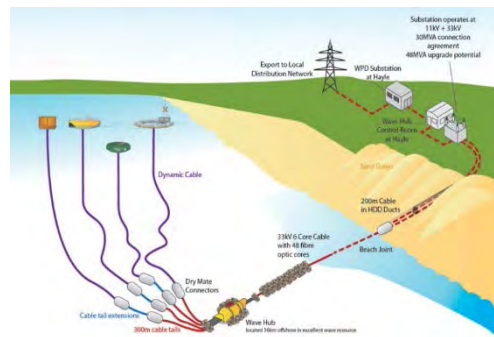
European & UK Wave Energy Sites



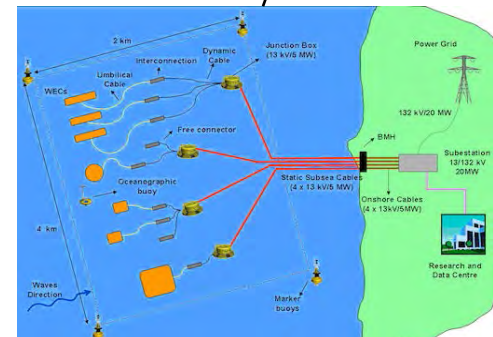
EMEC, Scotland



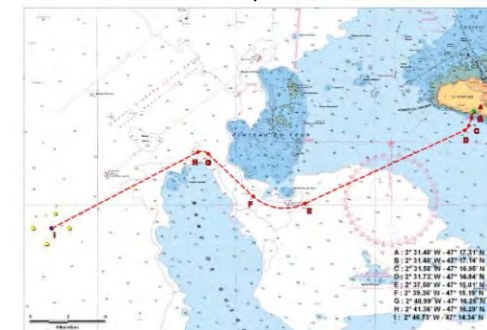
Westwave, Ireland



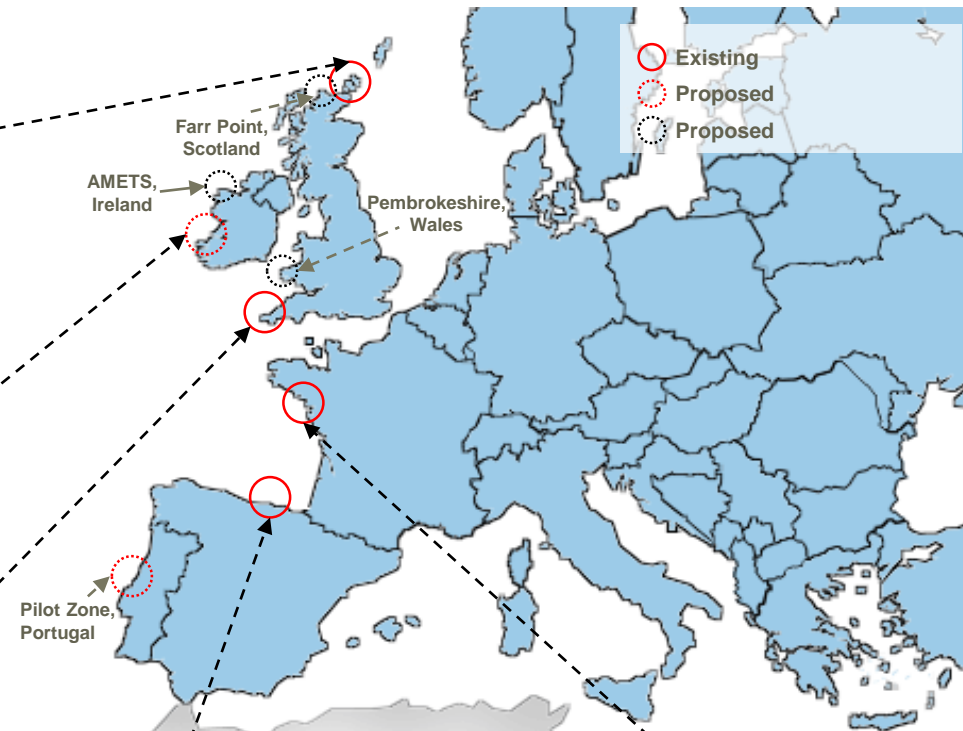
Wave Hub, Cornwall, UK



BiMEP, Spain

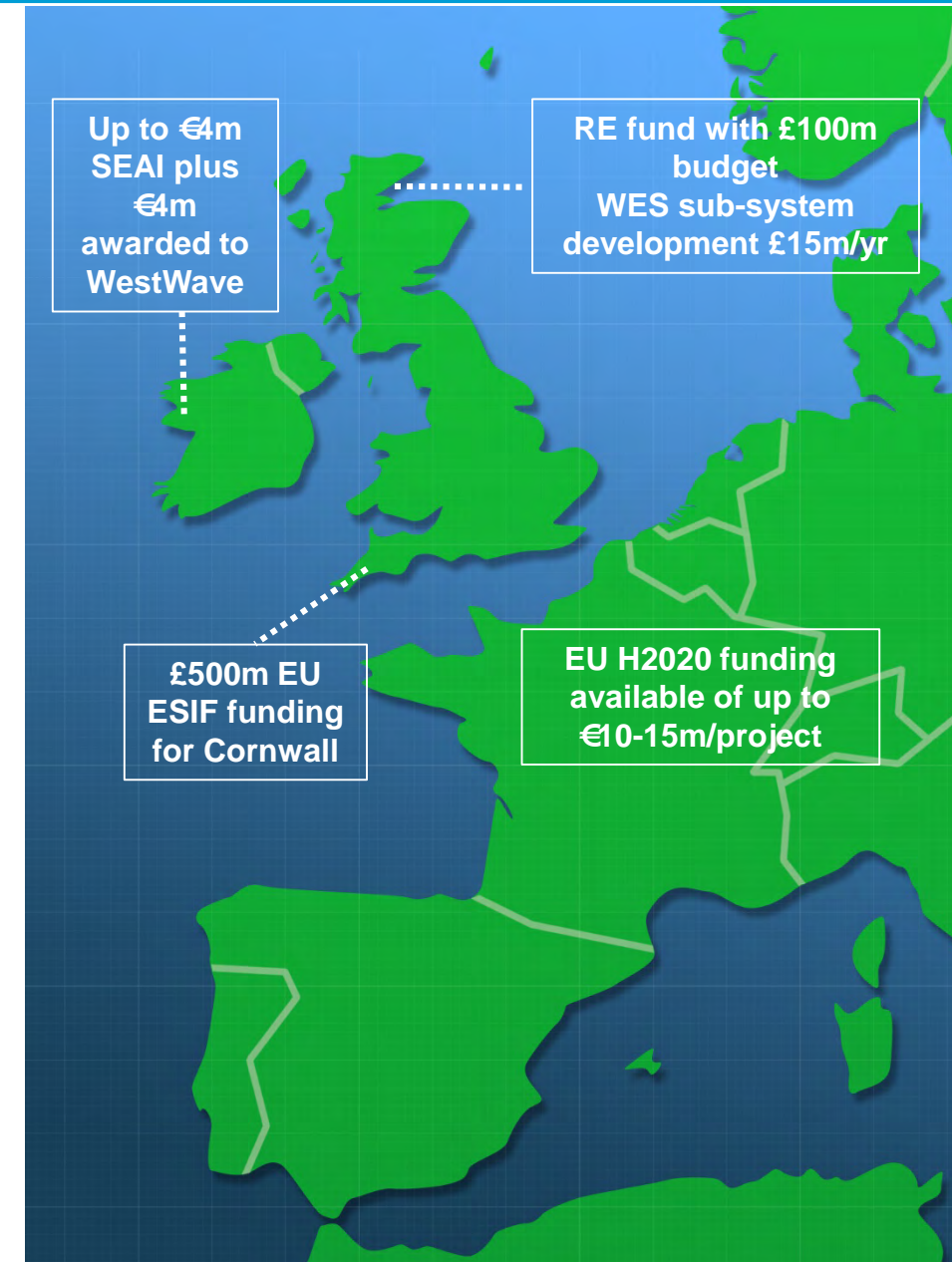


SEM-REV, France



Examples of UK & European Funding

- A number of regional development, renewable energy and technology grants available in the UK and Europe
- Potential grants of up to €15 million for small scale wave arrays
- Possibility of larger grants and debt for larger arrays – not yet tested for wave projects, but seen with tidal projects such as MeyGen



CWE UK & European Activities to Date



CETO 6 testing at FloWave, Edinburgh



First CETO technology licensee



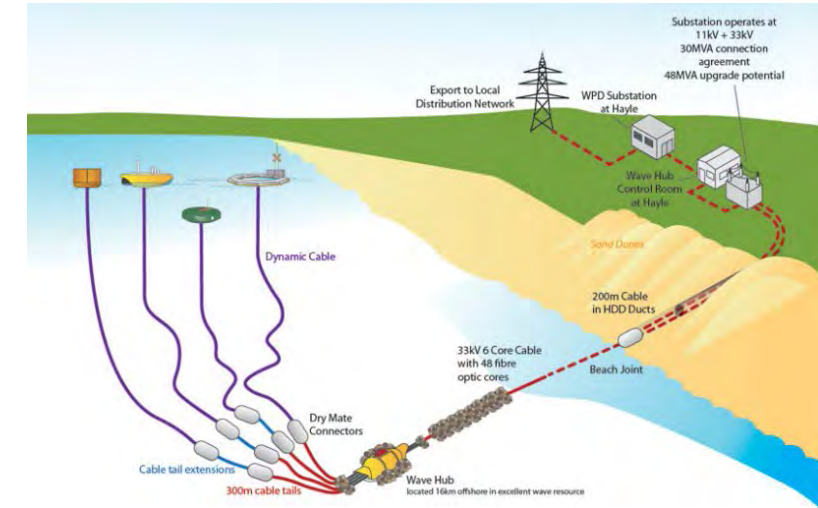
50% funding for conceptual design and site project study with CWE Ireland

Wave Energy Scotland
Government funded WavePOD
(with Bosch and Aquamarine)



CWE Ireland

CWE Ireland established



WaveHub berth site

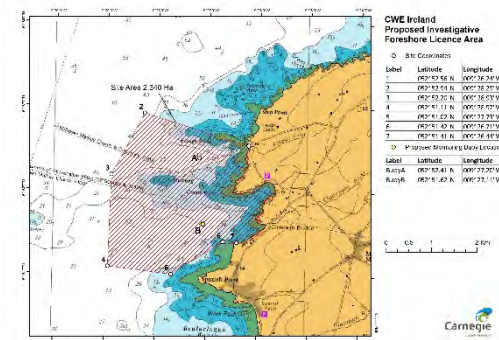


Collaboration agreement with Atlantis



CWE UK

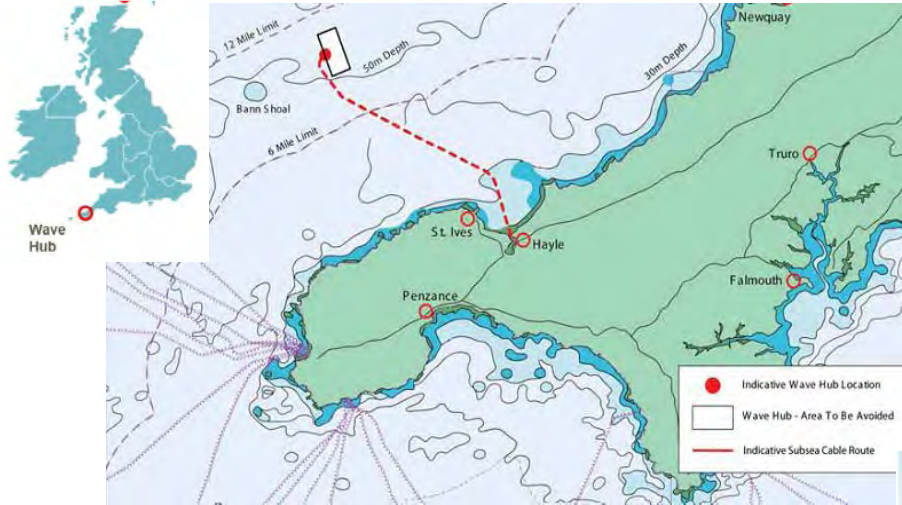
CWE UK established
CEO appointed



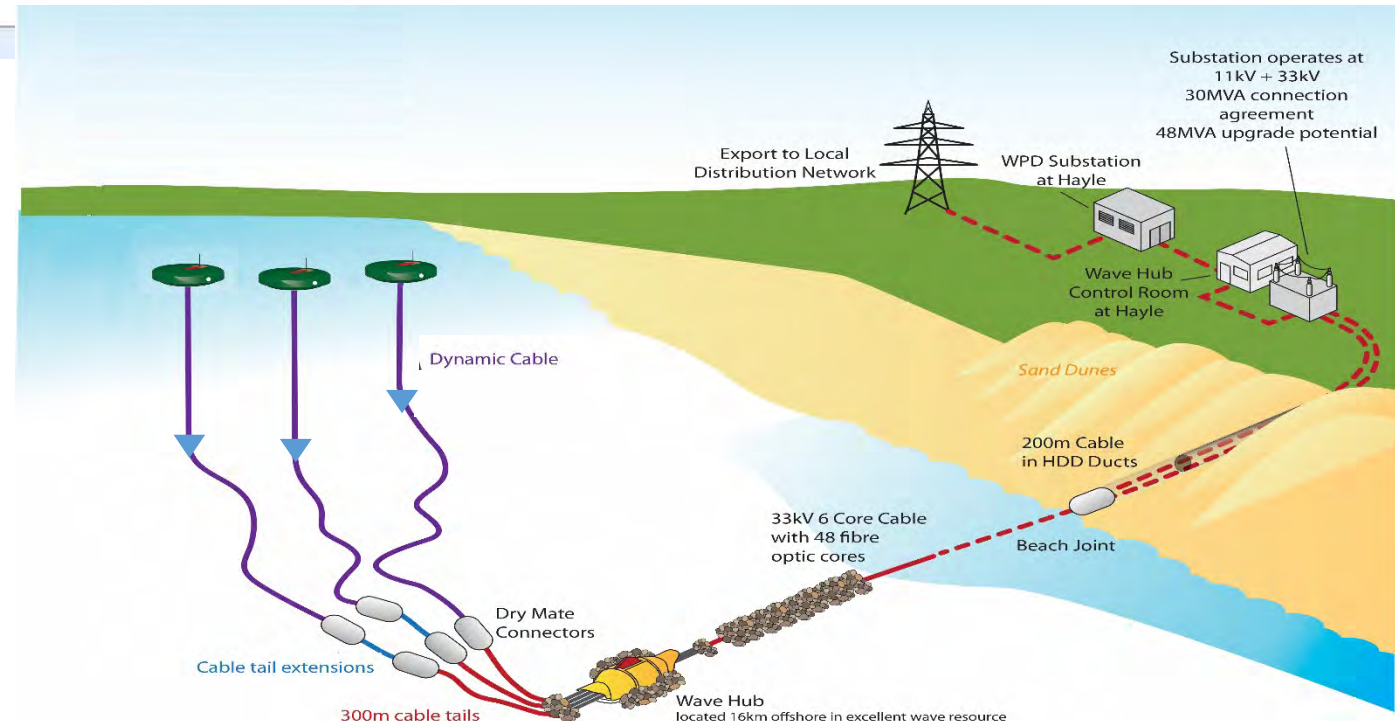
Irish site licence approved



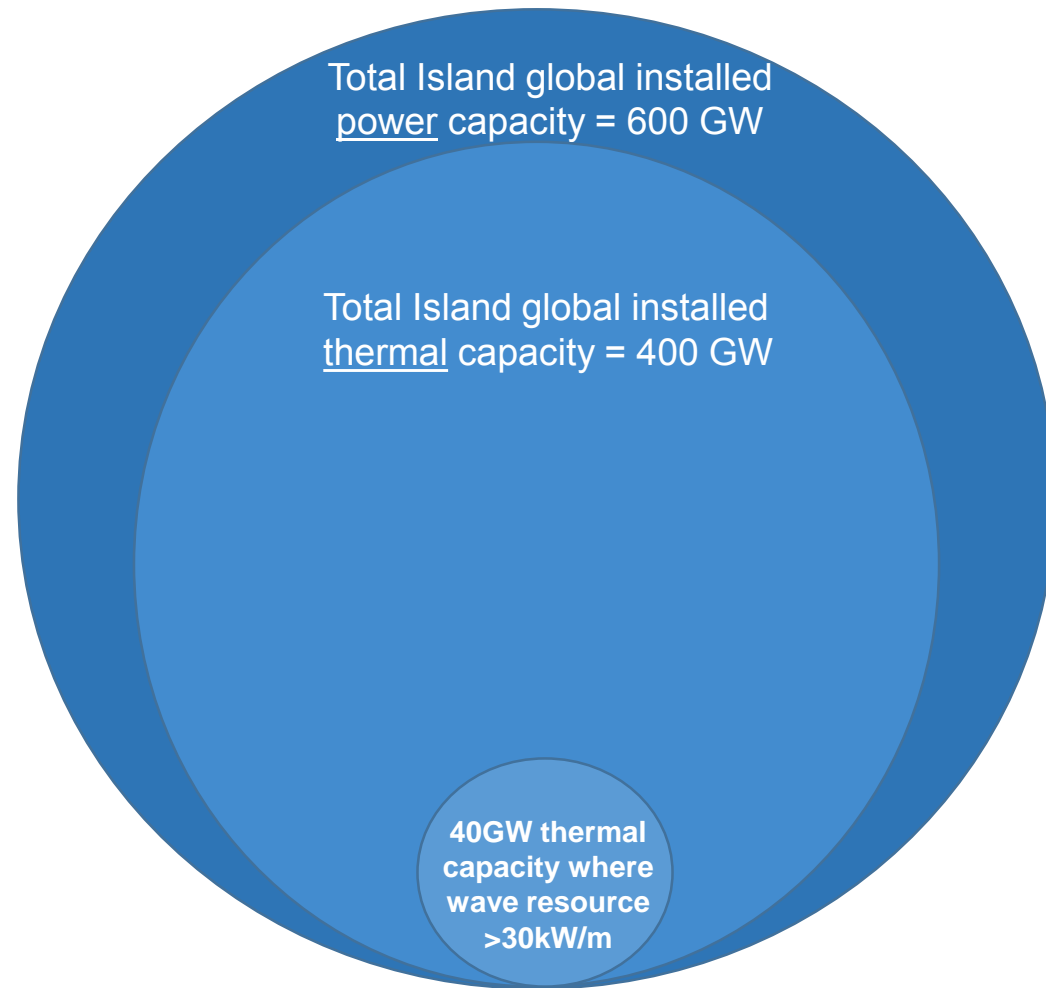
OEE Board Member,
DECC MEPB, ReUK
& MSG member



- \$70m+ spent by UK Govt. on existing offshore and onshore power infrastructure and grid connection.
- Existing infrastructure capable of hosting 50MW project
- Supported by \$500/MWh feed in tariff and Govt. grants
- CWE UK berth secured up ~10MW project
- Grant application submitted



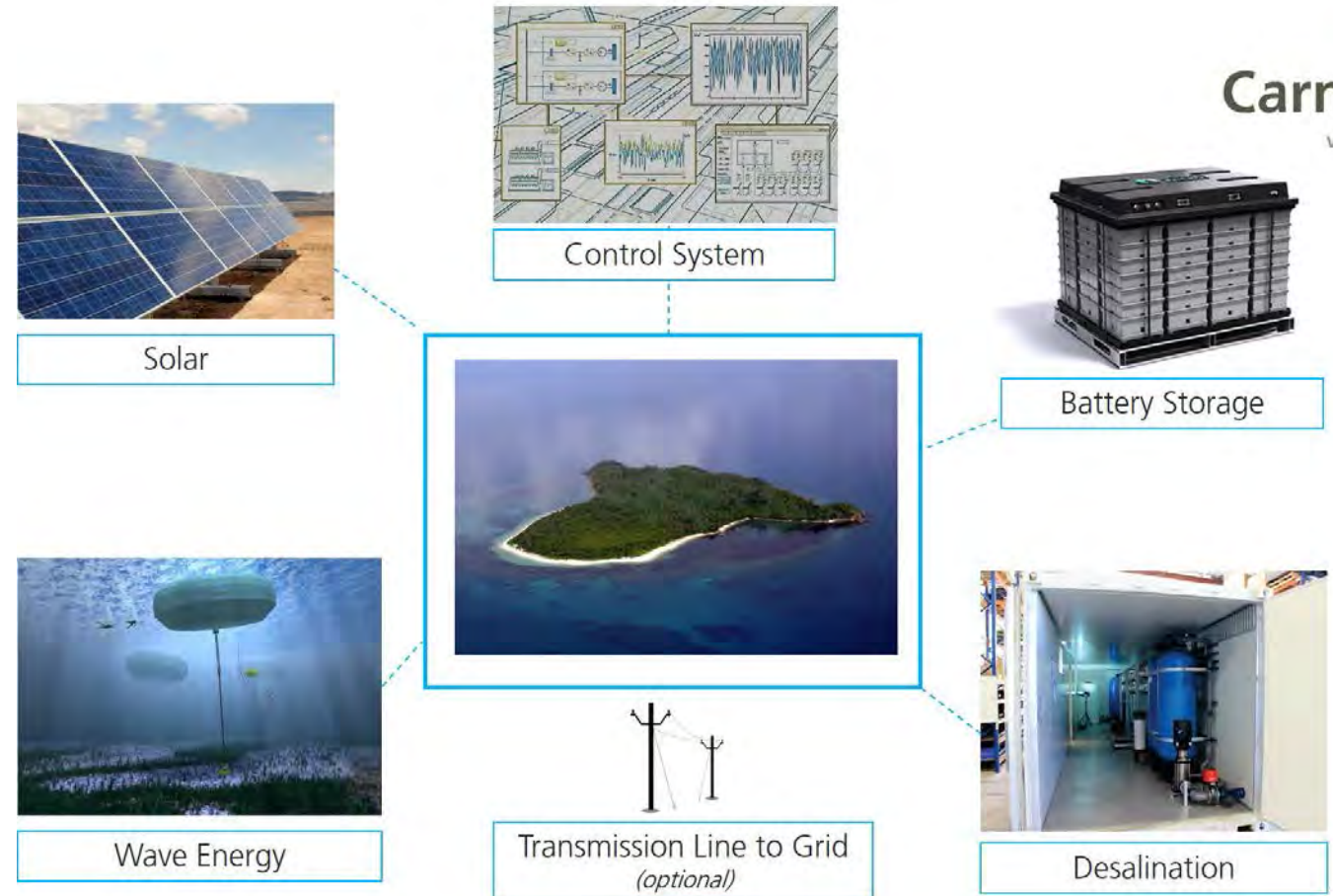
Size of the Addressable Island Market



1. At least **400,000 MW** of existing thermal installed capacity that could be replaced with renewable energy. And with energy consumption growing in developing nations growing at ~ 8% p.a.
2. About 10% of this or **40,000 MW** has a wave resource in excess of **30kW/m**.
3. These islands are not yet ready for a wave system – require an *integrated & demonstrated* RE solution.
4. Microgrid solutions can be delivered now and made “CETO compatible” so CETO can be “retrofitted” once ready into the 40,000 MW market place.
5. And an effective non-wave, microgrid solution would open up the remaining **360,000 MW** (non-wave) market not currently available to CWE
6. Many islands, e.g. Mauritius and Seychelles, have RE targets ranging from 15% to 100% and need technical and commercial solutions to now deliver on targets.

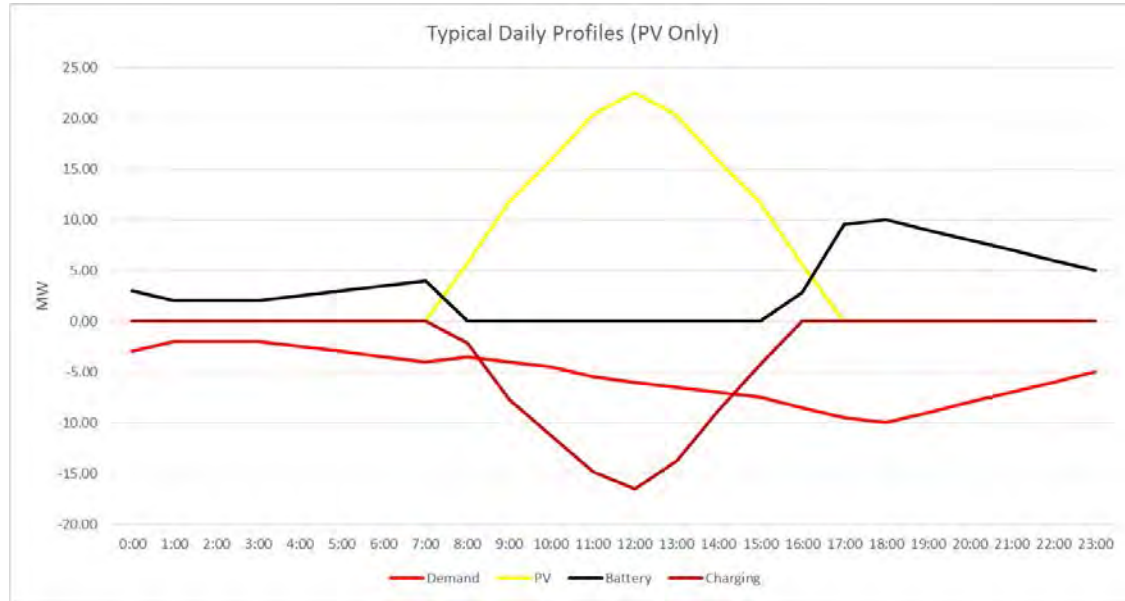
Microgrids – islands, off-grid and fringe of grid benefits

- Combine multiple energy generation sources with sophisticated control systems and energy storage to allow high penetration of renewable energy often into small capacity or islanded systems
- A mix of renewable generation technologies e.g. solar, wind and wave, takes advantage of different time of day or seasonal variation, reducing the amount of energy storage and diesel generation required
- Desalination increases the options to integrate higher levels of renewables by using water as a form of energy storage
- Can be used to avoid cost of upgrading and maintaining long, expensive transmission lines to “fringe of grid” communities
- Global microgrid market estimated at US\$4.3 billion in 2013 and expected to grow to US\$19.9 billion by 2020 (Navigant Research, 2015)

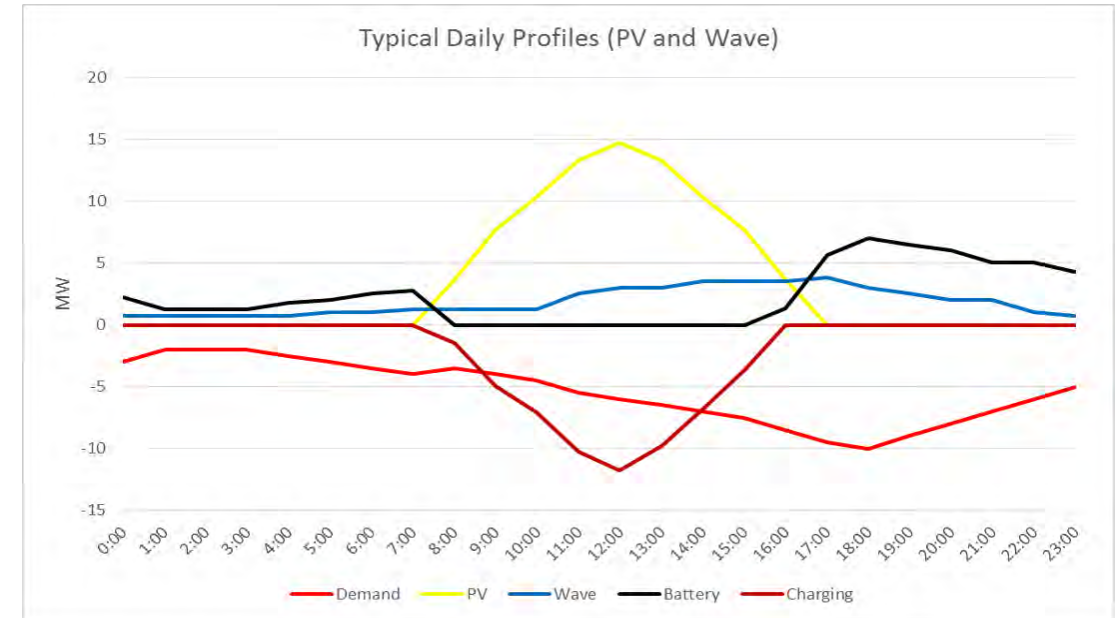


Wave-Integrated Microgrids – benefit of wave consistency

- An example of an island microgrid with and without wave power shows that the amount of solar PV & storage can each be reduced by around a third due to the consistency of the wave resource.



Peak Demand (MW)	10
Daily Demand (MWh)	130
PV Capacity (MW)	23
Wave Capacity (MW)	0
Storage Capacity (MWh)	80

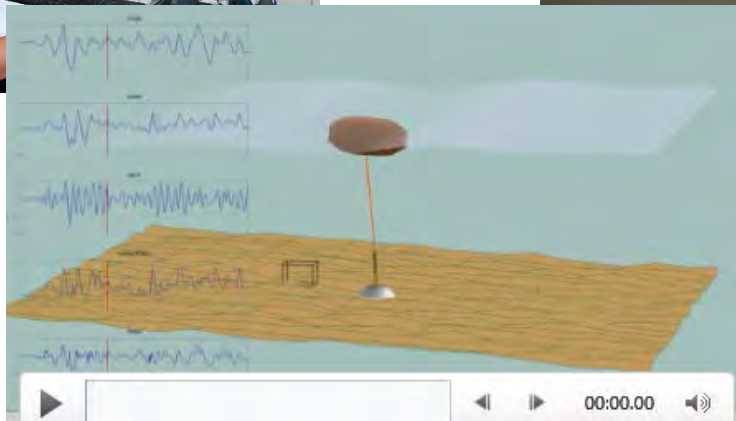
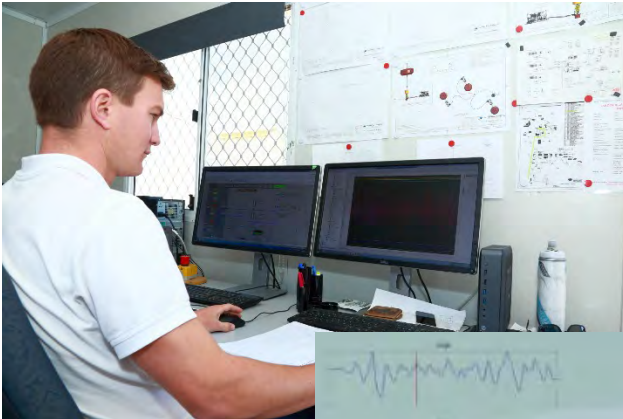


Peak Demand (MW)	10
Daily Demand (MWh)	130
PV Capacity (MW)	15
Wave Capacity (MW)	5
Storage Capacity (MWh)	56

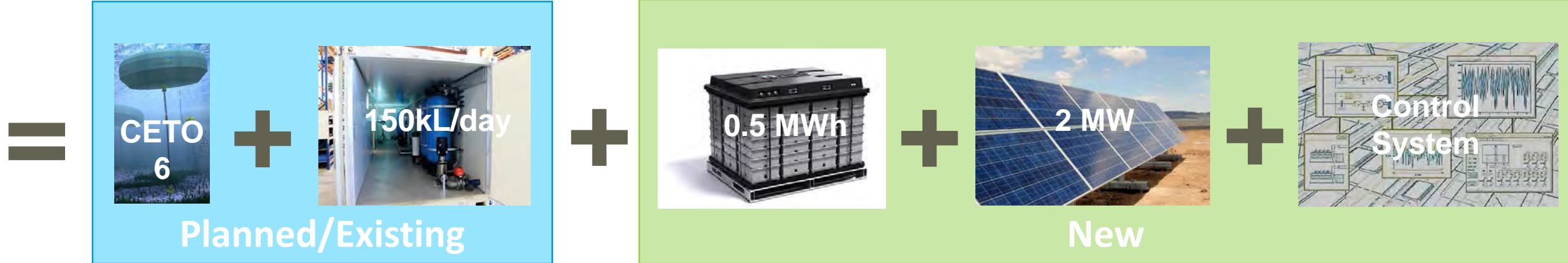
Reduction in PV & Solar
by about 1/3rd each due to
introduction in wave

The Carnegie Island Advantage

- Leverages Carnegie's existing technical capabilities in power & water project design, resource assessment, construction, operation and maintenance, complex control systems, grid connection and protection
- Leverage our existing island relationships – Mauritius, Rodrigues, Seychelles, Bermuda
- Leverages our existing industrial relationships e.g. MAK Water, Western Power
- Allows us to create pull through for CETO into this market when CETO is “island ready”
- Allows us to generate earlier revenues



First CETO 6 Microgrid Project - Garden Island



- Garden Island Microgrid (GIMG) will be the world's first wave integrated renewable microgrid project
- CETO 6 project at Garden Island (GI) will integrate:
 - planned CETO 6 units
 - existing infrastructure - CWE desalination plant & DoD infrastructure including diesel generation
 - with a large scale solar PV farm and
 - battery storage and control systems.
- Project partner is Western Australian energy utility, Western Power, who provide grid and network expertise and support.
- Project power and water purchaser is the Australian Department of Defence
- GIMG will demonstrate Carnegie's Island Power capability to island customers globally.

CETO Remote Island Project Pipeline



Seychelles



- MoU signed with the Government of Seychelles
- Collaboration and investigation of wave energy & microgrid opportunities on the island



Bermuda



- Continued collaboration with Triton Renewable Energy Limited
- Support from local power utility Bermuda Electric Light Company Limited
- Wave buoy deployed to analyse available wave resource

Current and Upcoming Developments

- CETO 6 development - 1MW capacity target
- Garden Island microgrid project - solar/battery system in 2016
- First multi-unit CETO 6 array @ Garden Island in 2017
- Second multi-unit CETO 6 array in UK starting 2018
- European and Island project pipeline development
- Continued R&D activities in Australia & UK.

