

# Development and commercialisation of the CETO wave technology

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PECC Ocean Energy Seminar

29<sup>th</sup> March 2012



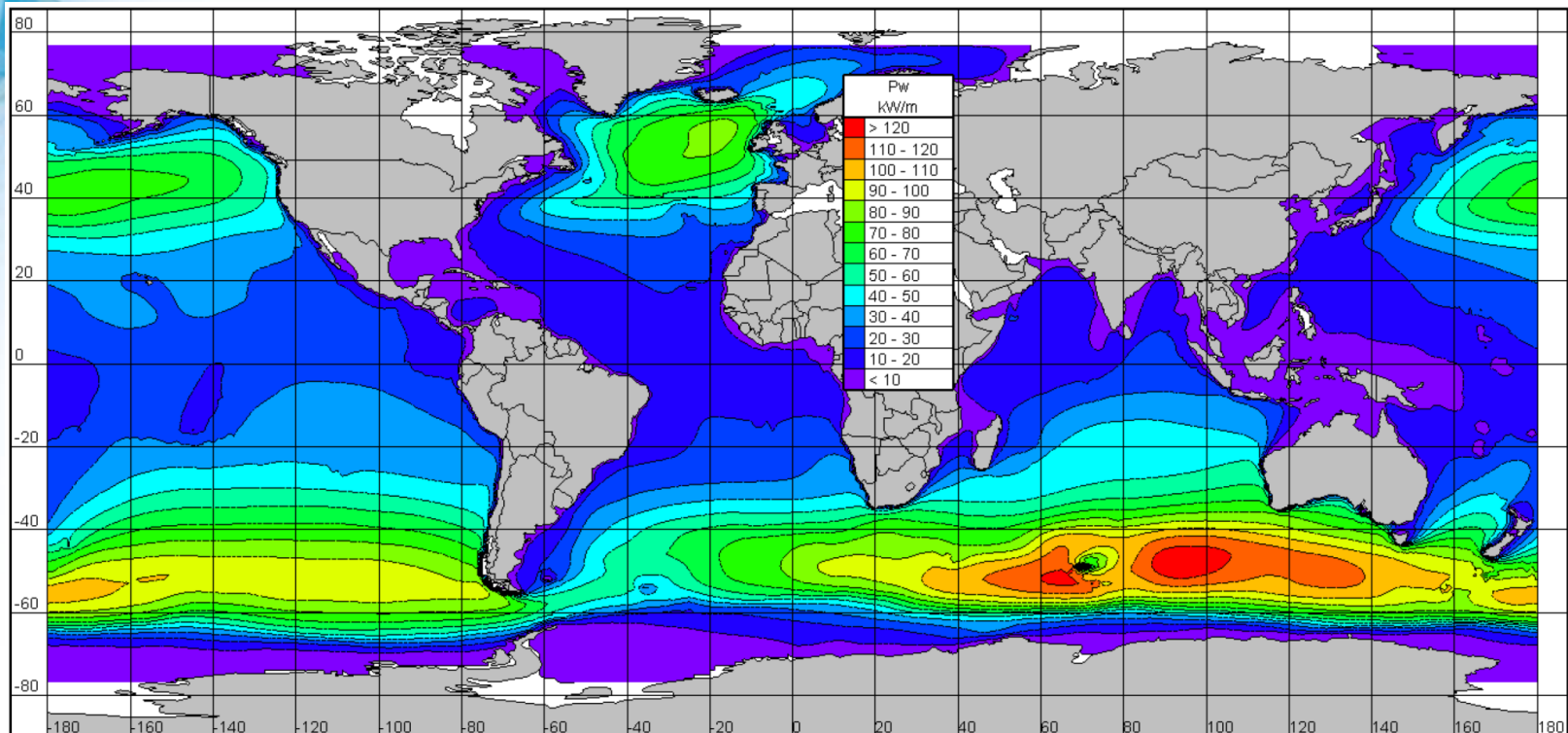
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# Global Wave Energy Market Size

- Global marine energy sector worth US\$760 Billion by 2050<sup>A</sup>
- Nearly \$100 billion in estimated annual revenue by 2025<sup>B</sup>
- Equates to 2.5% of current global electricity production



# Carnegie Wave Energy (CWE) – snapshot

## Australian Stock Exchange (ASX) - CWE

Market capitalization	\$52m
Average daily volume	\$50,000
Debt	Nil
Cash	\$7.5m



- Inventor, owner and developer of **proprietary wave energy technology** ("CETO")
- CETO produces **zero-emission power** and **desalinated freshwater directly** from the ocean's waves
- 84 patents or patent applications
- 20 engineering, commercial, and administration staff
- Over AU\$50m development capital raised since 2006
- Business model is focused on OEM but other revenue sources applicable – site development, licencing, D&C, BOO etc



# Carnegie's World Class Relationships



- \$12.5 million grant for the Perth Wave Energy Project



- MoU for Perth project collaboration and offtake
- Feasibility study for U.S. Naval Communications base



- MoU to negotiate power purchase from Perth project



- Collaboration agreement & concept funding for a 5MW Irish CETO project



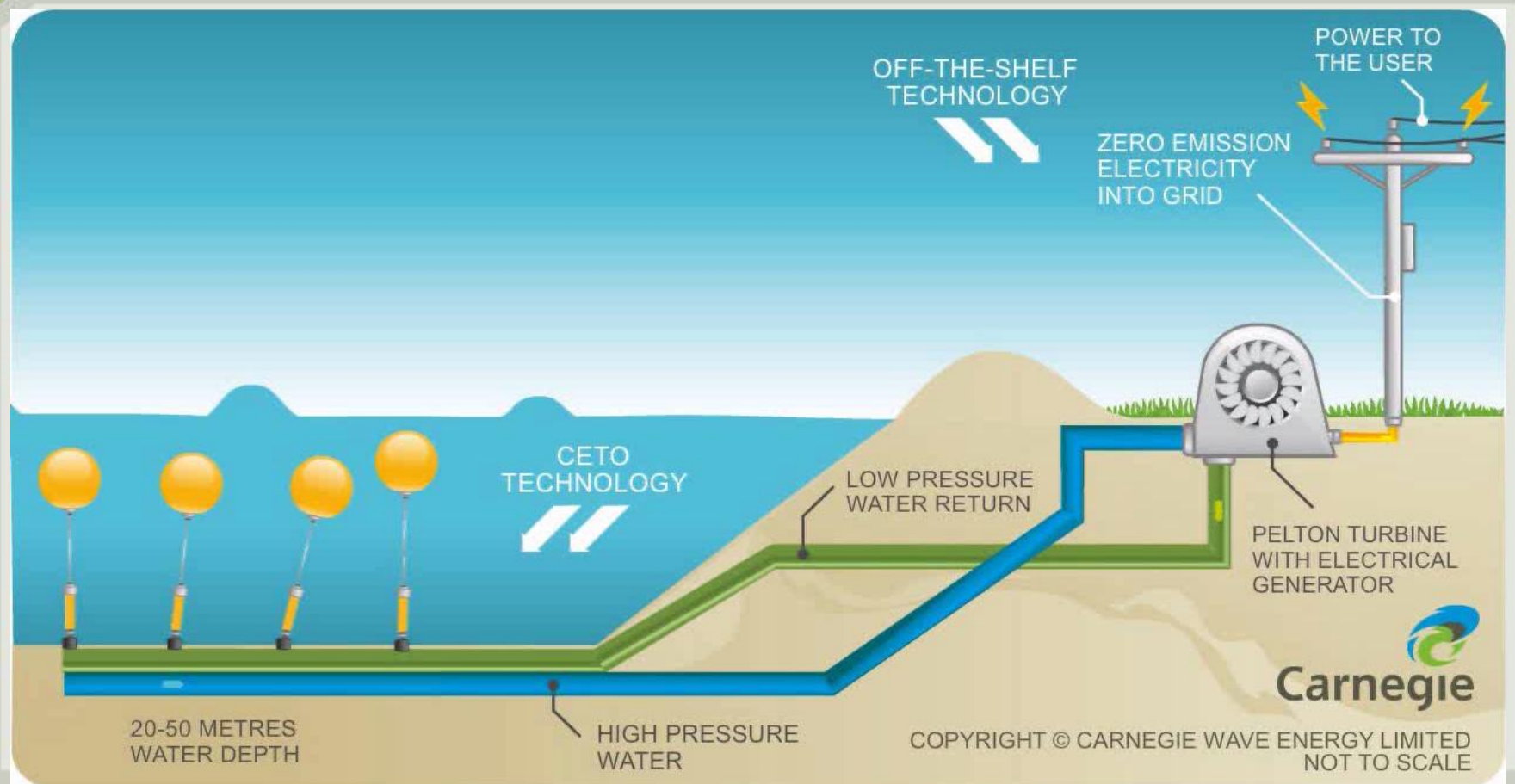
- Northern Hemisphere licensee & JV development partner
- \$5m French Govt. funding for Stage 1 Reunion Island project



- Northern Hemisphere EPCM partner

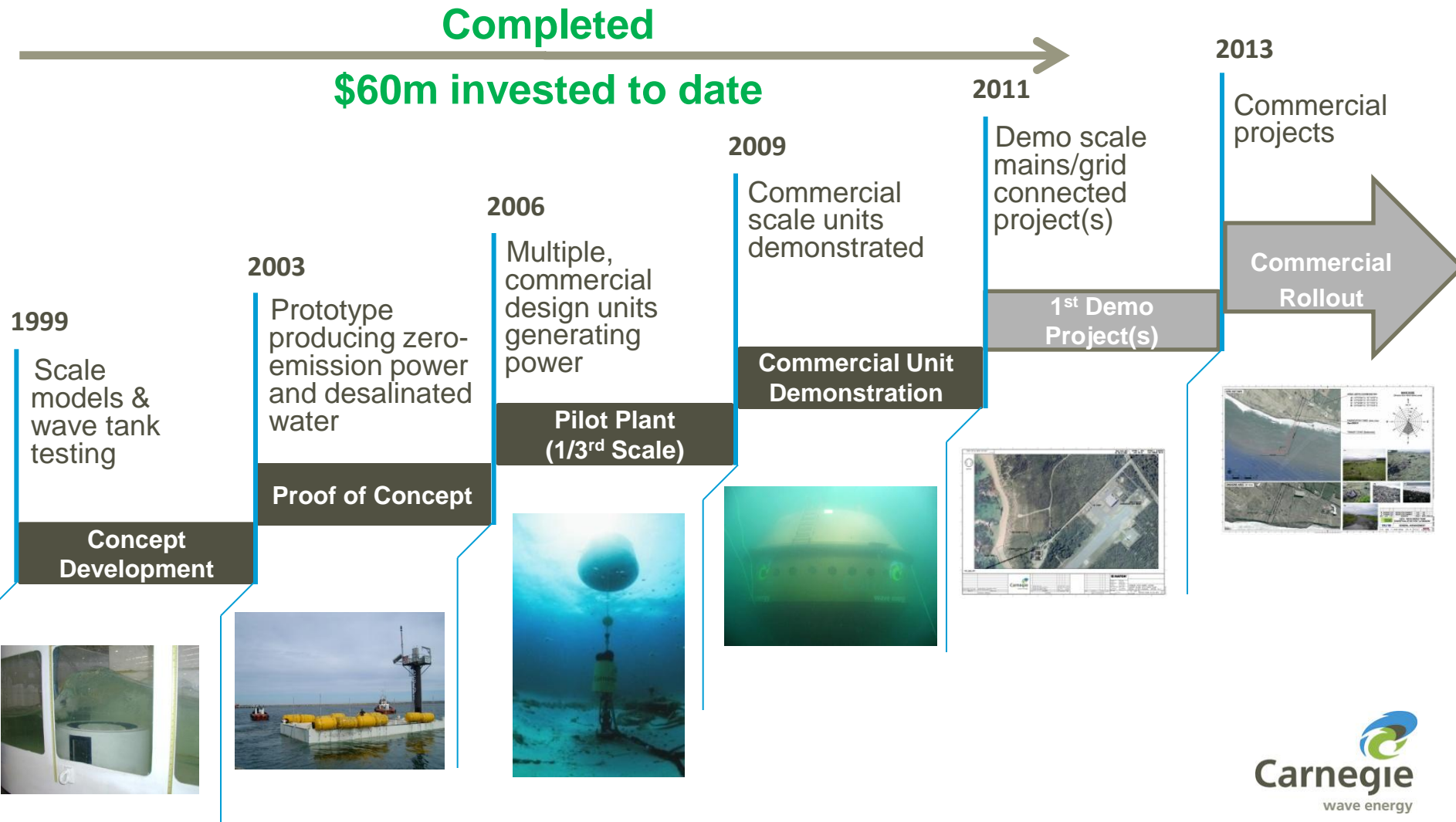
# CETO Concept

CONCEPT



Wave-driven pumps → Pipelines deliver high pressure water ashore → Driving proven hydroelectric generators

# Significant De-risking Over Last 4 Years & Major Milestones in Next 18 Months





# In-Ocean Prototype Testing

- Carnegie's Wave Energy Test Facility, Western Australia

Perth City



**CETO  
offshore test  
area**



**Private wave energy research facility**



**CETO subsea  
pipeline**





# CETO3 Commercial Scale Unit



Connectors



Buoyant Actuator



Tether



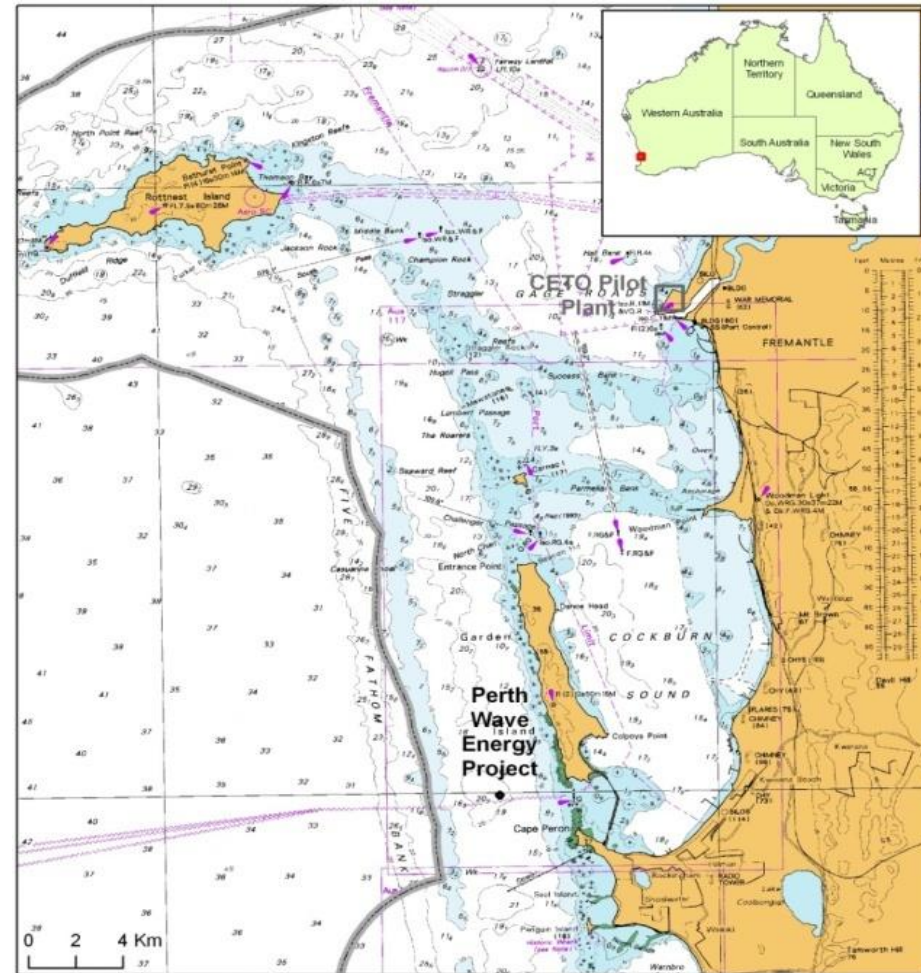
Pump



Attachment



Foundation



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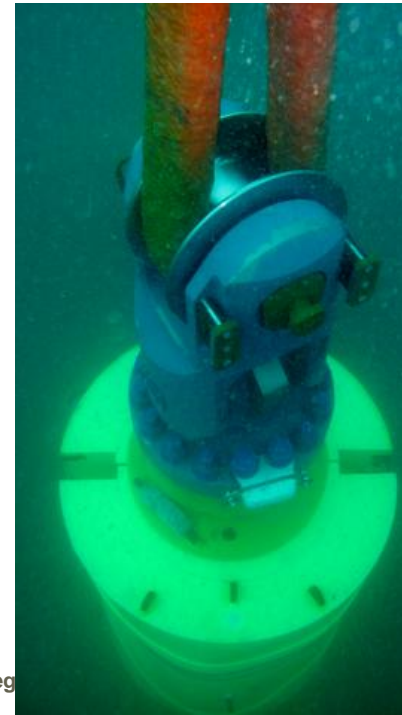
# CETO3 Manufacture to Deployment



## CETO 3: Manufacture to Installation

## CETO 3 – Results & Verification

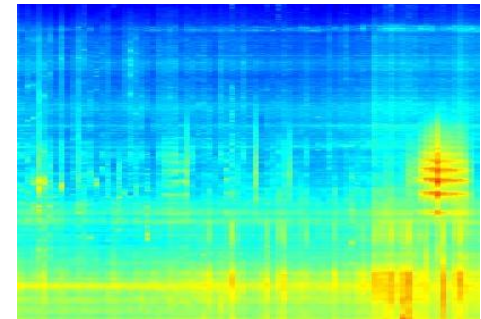
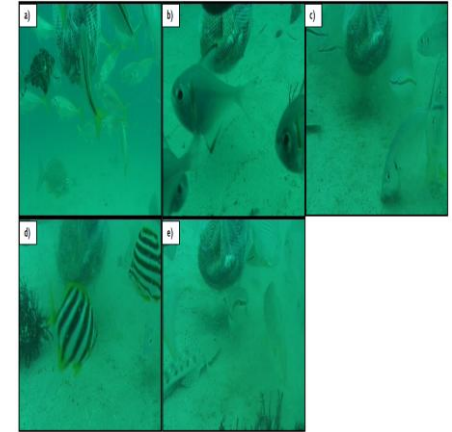
- Proof of function at commercial scale
- Verification of the modelled motions
- Environmental monitoring data under analysis
- Independent Verification of the following:
  - Measured CETO 3 Capacity of 78kW
  - Sustained pressures of 77bar (relevant to desalination)
  - Time domain model
  - Peak CETO 3 Capacity of 200kW (+25% and -40%)





# PWEP – environmental monitoring

- Environmental management plan & extensive stakeholder consultation
- Underwater video & noise monitoring surveys before, during and after single unit deployment
- Analysis undertaken by Curtin University Centre for Marine Science and Technology and consultants RPS Environment
  - No significant environmental impacts identified
  - 27 fauna species found including one shark, one ray, 24 teleost and one crustacean species
  - Potential for a CETO array to increase the biodiversity of a habitat otherwise poor in marine fauna

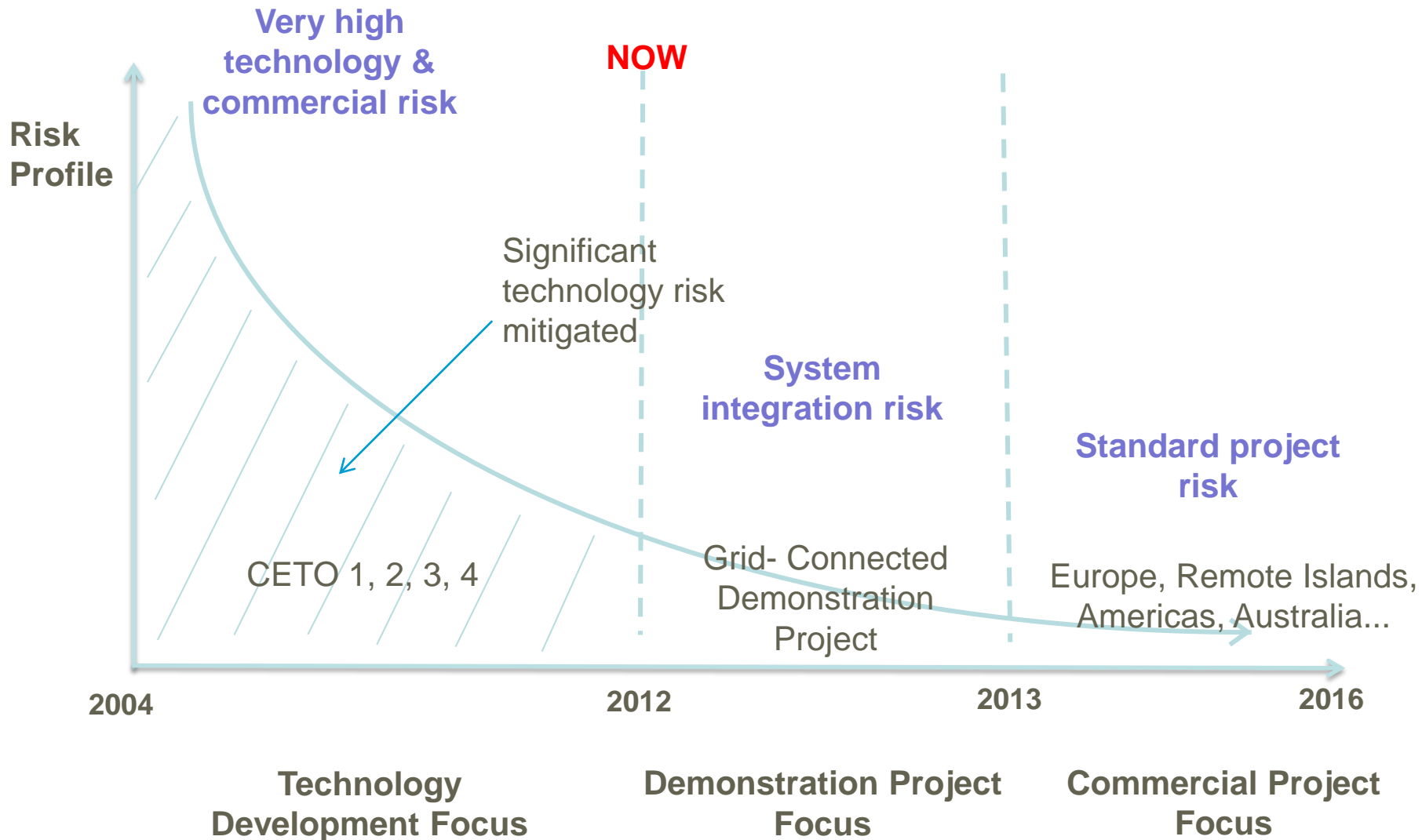


# CETO 4 Unit – Reunion Island with EDF

- Licence & JV with EDF EN
- DCNS providing EPCM
- \$10m spent by EDF & French Govt.
- 150kW unit to be installed Q1-2012
- EU22c/kWh tariff (AU30c/kWh)
- CWE option to buy 49% of local SPV



# Developing & De-risking CETO – significant technology risk now mitigated





# Australian Demonstration Project Example

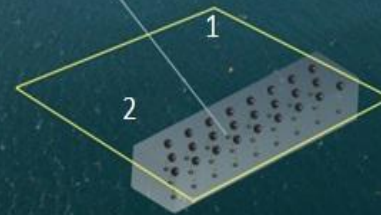
- Garden Island, WA

Perth – 30km

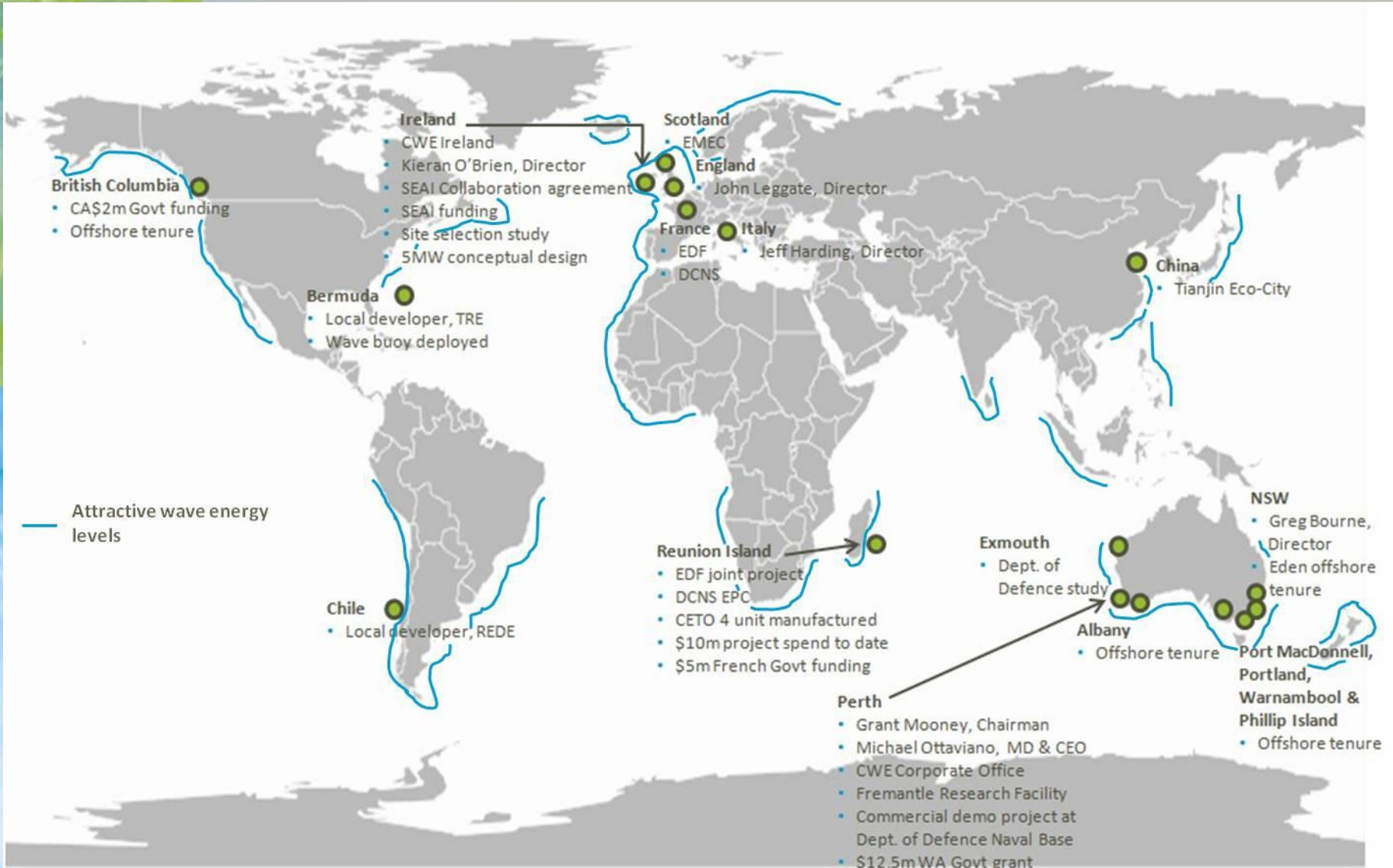
HMAS Stirling – Australia's  
largest naval base

Kwinana Desalination Plant

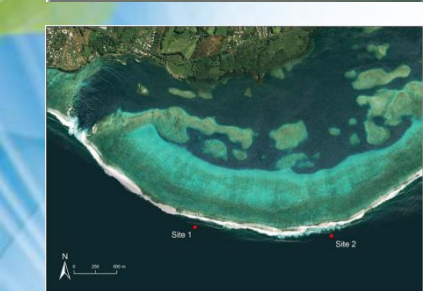
- 1 - Offshore lease area and maritime safety marks
- 2 - CETO offshore array
- 3 - Subsea Pipelines
- 4 - Onshore Powerhouse location
- 5 - Grid connection point
- 6 - HMAS Stirling, Australia's largest naval base



# Targeted Global Project Pipeline



# CETO island markets



- CETO System
  - Simple, submerged, scaleable
  - electrical generation & desalination onshore
  - simplified installation and maintenance
- Island markets
  - high energy prices driven by cost of imported diesel
  - low potable water reserves, high water price
  - energetic wave environments
- CETO Projects underway:
  - Reunion Island. 2-15MW Project, REFIT \$300/MWh, \$5M Government funding, JV with EDF EN, DCNS providing EPCM
  - Bermuda. Project with Triton Renewable Energy for power and desalinated water
  - French Polynesia. Discussions with local developer for power project

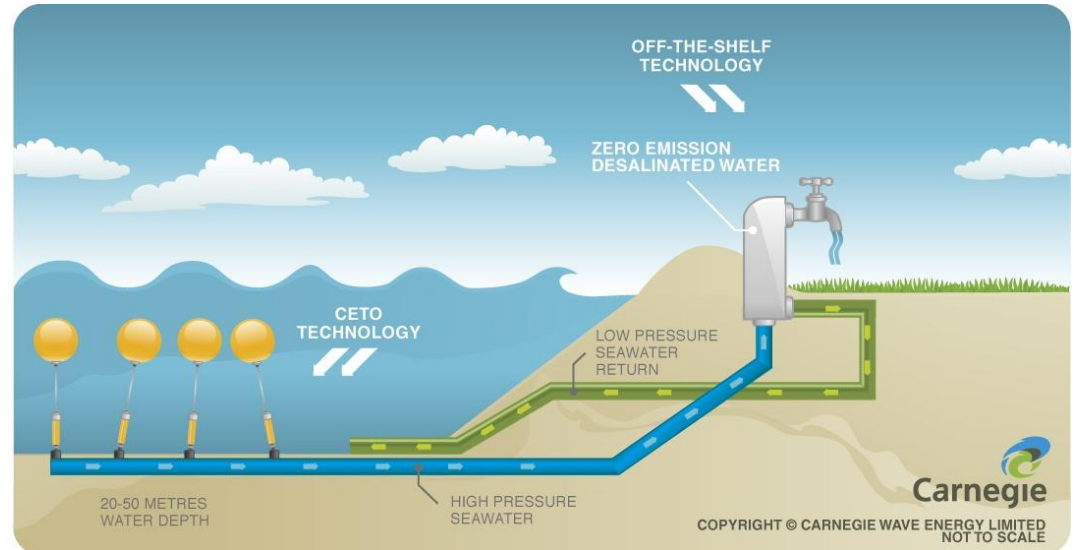


# CETO Direct Desalination

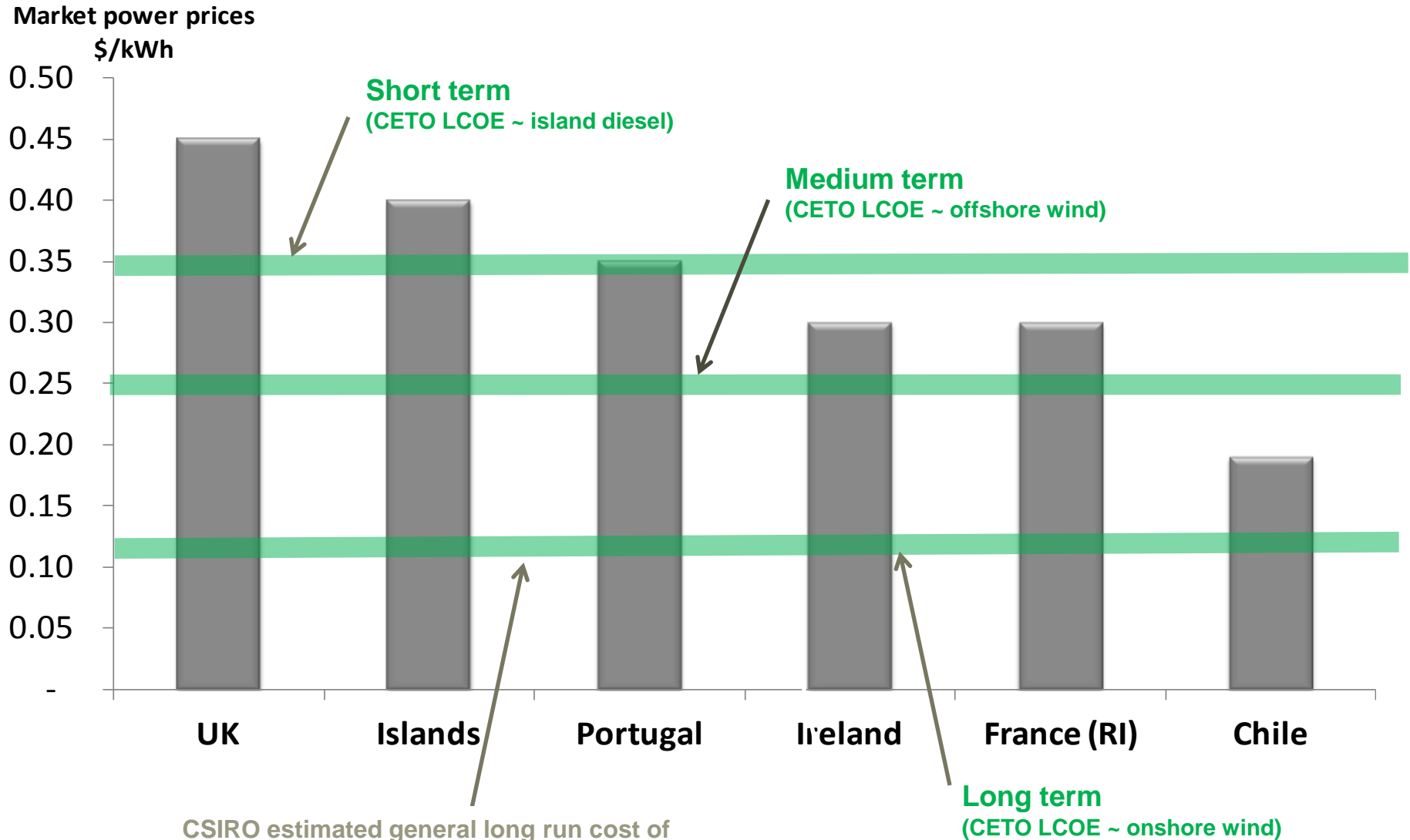
- Only wave energy company in the world to have produced desalinated water from wave energy technology
- Proof of concept only, no regard for membrane life, efficiency etc



Former Australian Prime Minister John Howard, Fremantle Wave Energy Facility



# CETO – cost competitive in an increasing number of markets over the next 10 years



CSIRO estimated general long run cost of wave energy (report March 2011)

# Upcoming Milestones

## 2012


- CETO 4 deployment at Reunion Island by EDF
- Government grant decisions
- Demonstration project site selection
- Demonstration project construction commence

## 2013

- Demonstration project commission







You can't see wave energy.  
But you can power a city on it, day and night.