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Where are we going? Phase 2 activities

Seed capital raised

Phase 2 activities

- Final Engineering and Design (FED) Feasibility Study
- Phase 2 Development (P2D)
- Company Production & O&M
- Construction
- Installation
- Operation & Maintenance
- Energy Production
- Export

Control Tank Testing (ACC - ACC-1000)

Expert Opinion - work to date

Tom Bruce, Chief Executive, E.ON Energy

"Much lower than the average generating costs for a range of wave energy devices"

"Selection and coupling of systems gives specificity, demonstrating an innovative solution."

BLACK & VEATCH

"An appropriate turbine can be designed using mature technologies and materials"

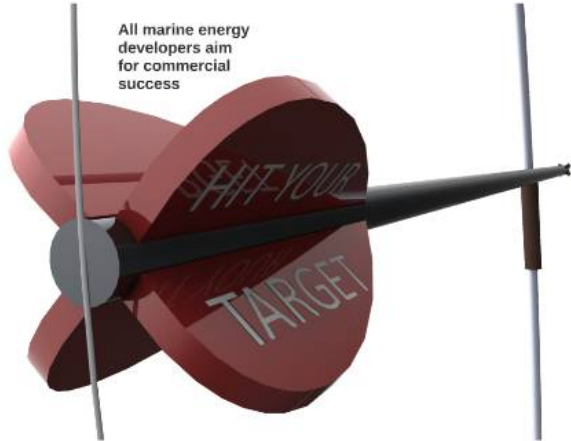
ARGASCO

Award Winning Wave Energy



Green Island, QLD, Commonwealth Bank Tower

2014-2015 Australian Energy Innovation Awards



All marine energy developers aim for commercial success

Where have we come from? Phase 1 activities

Founder funded

Phase 1 activities

- Independent 2nd party validation
- Tank testing

2014 Australian Energy Innovation Awards

System taxonomy



Wave Energy Converter (WEC)

WEC Array

WEC System

WEC Farm

Leapfrog Development

(think big, start small & get paid to develop)



TRL 1-3 PHASE 1

TRL 4-5 PHASE 2

TRL 6-8 PHASE 3

TRL 9 PHASE 4

Small scale (Phase 2)

- first edge generation (Como foreshore)
- local wave in marinas (local manufacturer)

Larger scale (Phase 2/3)

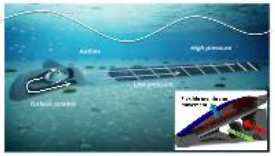
- casual shoreline protection (Gold Coast, Portsea, Quirra Beach)

Commercial scale (Phase 3/4)

- Demonstrator and farm (Electricity sales, Garden Island, Carribbin Port Authority)



How Does it Work ?



Wave Energy Converter (WEC)

Wave Energy Converter (WEC)

Wave Energy Converter (WEC)

Now in practice

Bombora Wave Power Tank Testing Program

Vision - Wave Farm Arrays



Look Familiar?

Award Winning Wave Energy



Garden Island WA
Demonstration farm
7.5MW

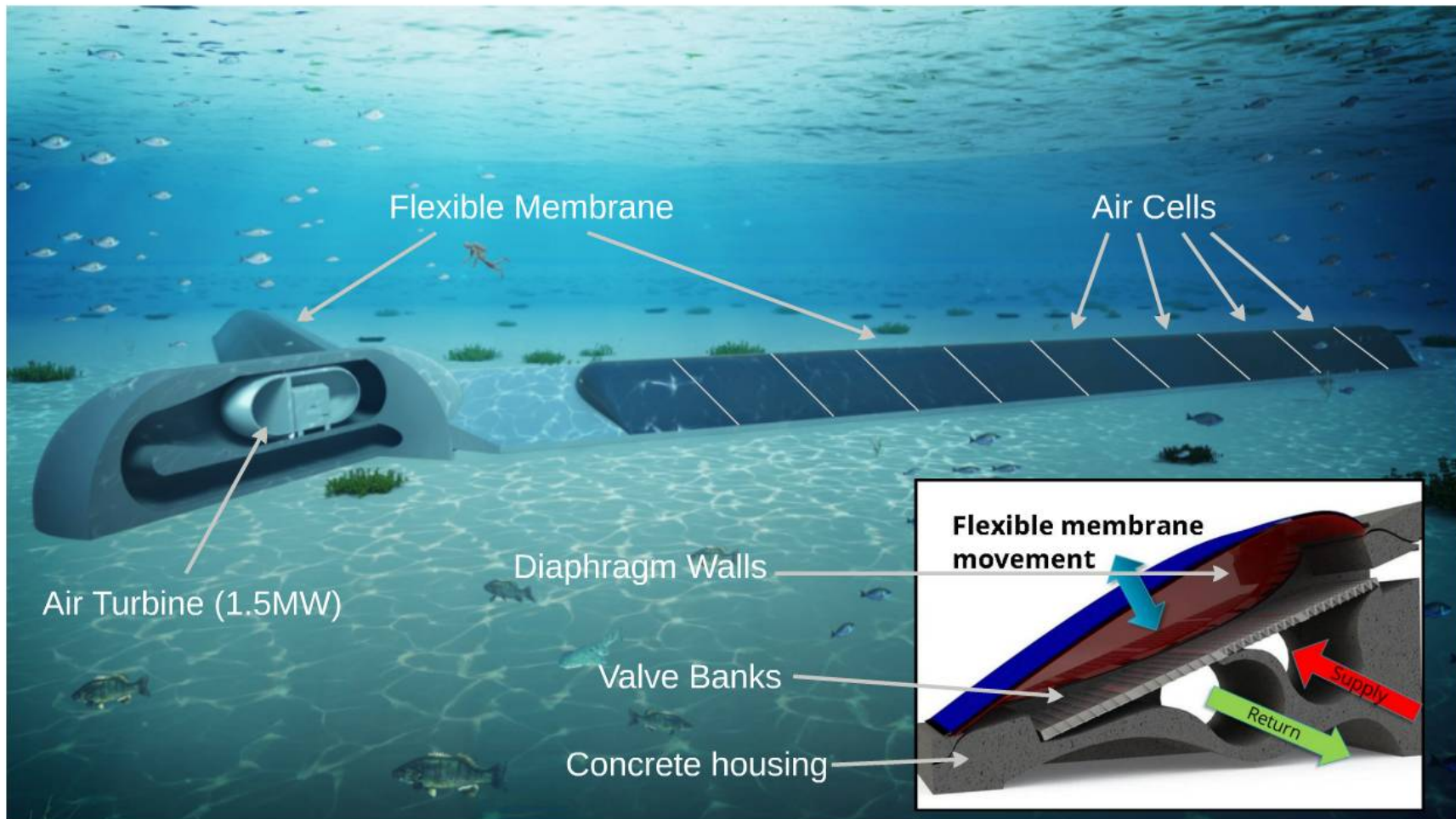


Zero CO2 emissions
Low embodied CO2
Higher energy density, more
predictable & persistent resource

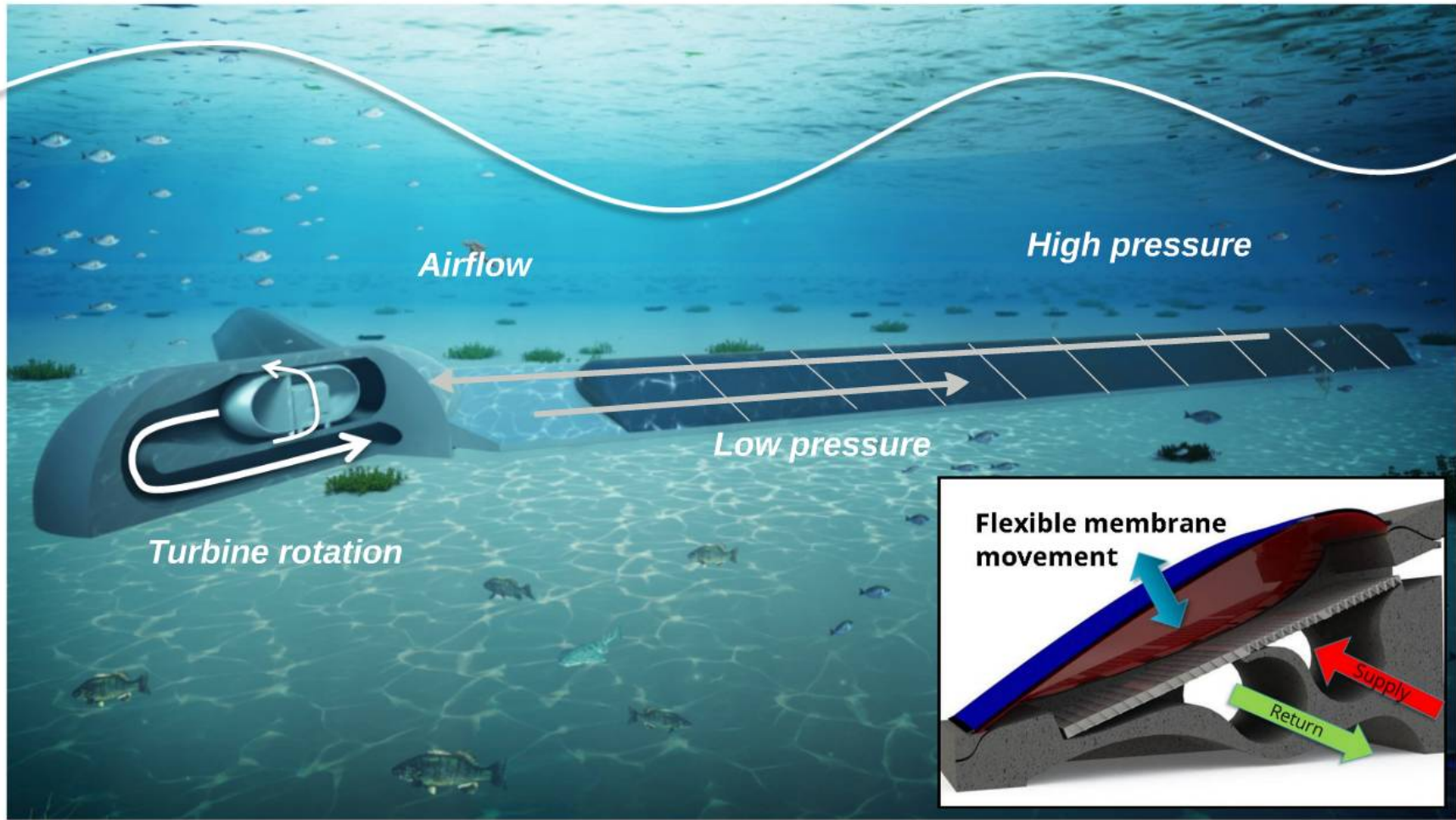
Shawn Ryan Executive Director



System taxonomy



How Does it Work ?



Now in practice

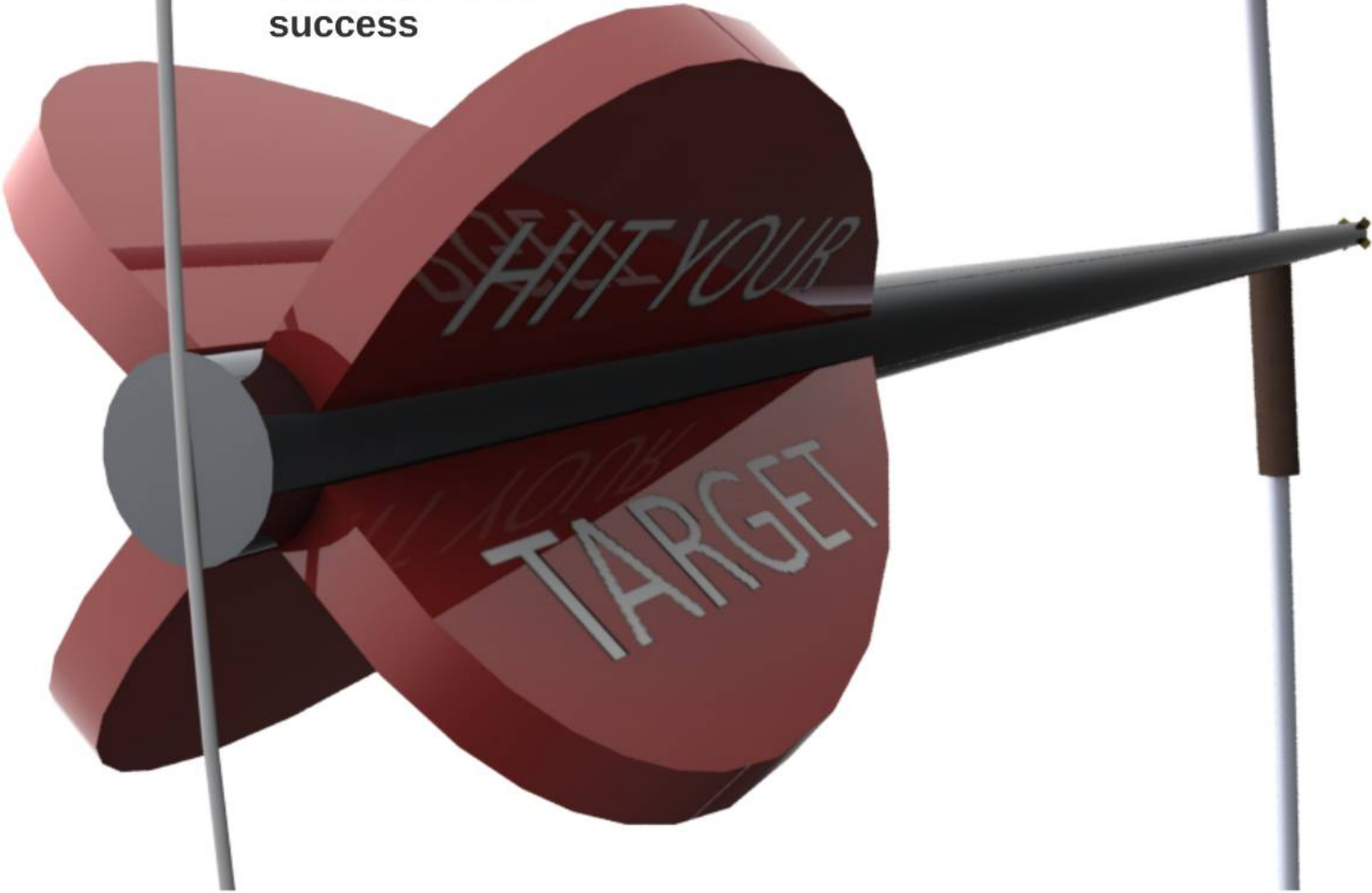
*Bombora Wave Power
Tank Testing
Program*

Vision - Wave Farm Arrays



Look Familiar?

All marine energy developers aim for commercial success



Success = Low cost of electricity

How to achieve?

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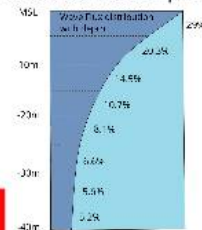
Loc

Survival - 1:100 year wave



Near shore vs Offshore

Grounded foundation vs complicated mooring



Associated infrastructure



Maintenance transit times

Average to peak wave (Capacity Factor)



Success = Low cost of electricity

How to achieve?

Resource

Location



Ho

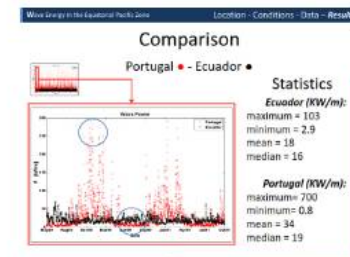
Resource

Surviva



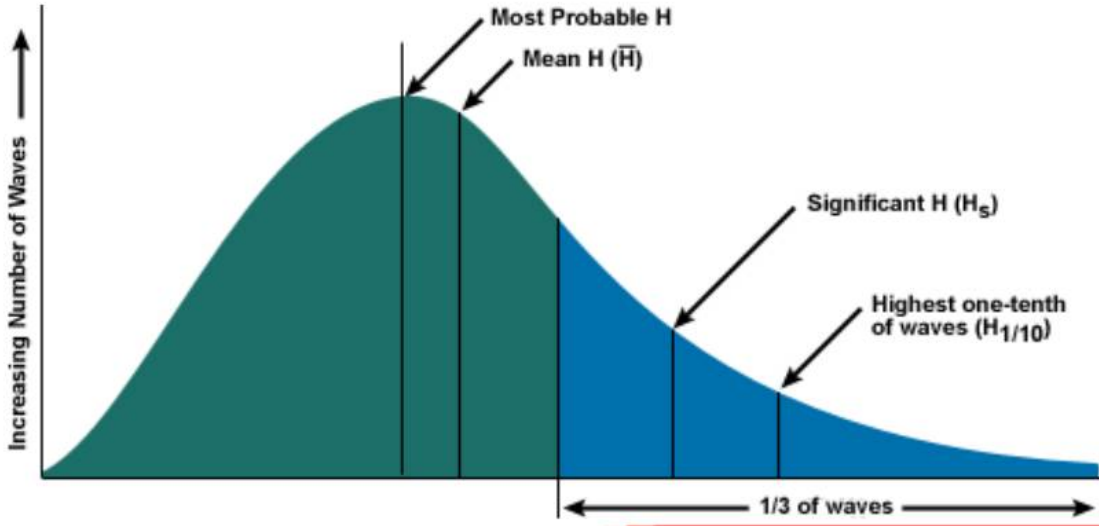
Near sh

Average to peak wave
(Capacity Factor)



Rogue wave size
(Control system implications)

Survival - 1:100 year wave



Near shore vs Offshore

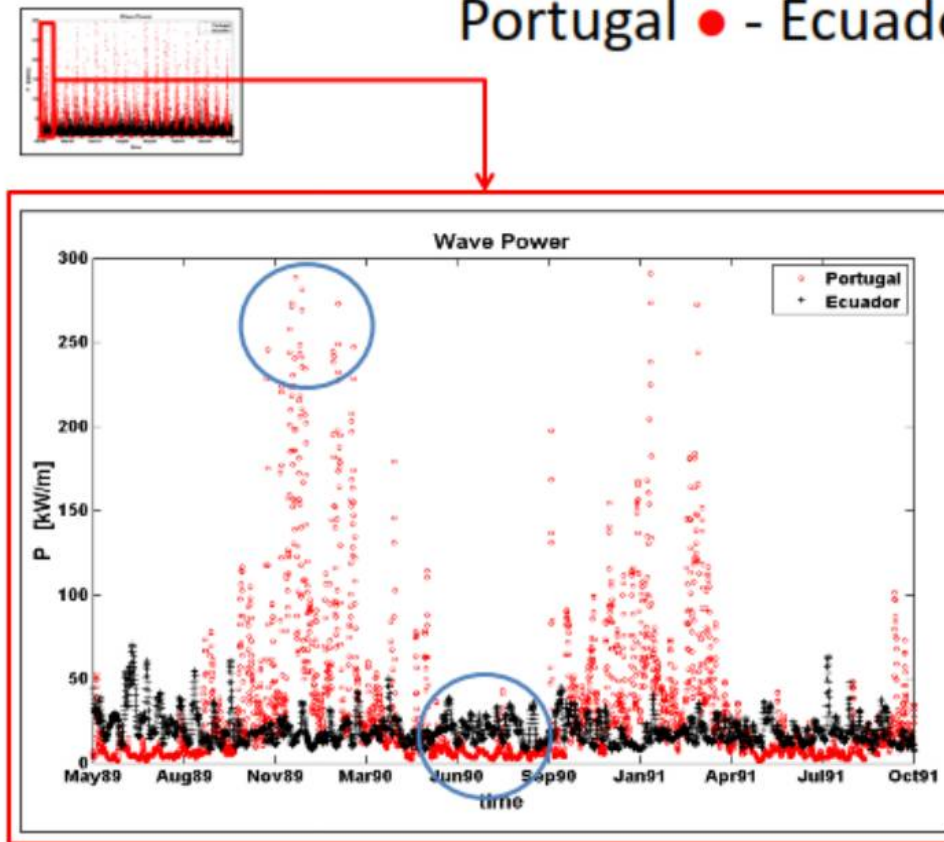
Average to peak wave (Capacity Factor)

Wave Energy in the Equatorial Pacific Zone

Location - Conditions - Data – *Results*

Comparison

Portugal ● - Ecuador ●



Statistics

Ecuador (KW/m):

maximum = 103

minimum = 2.9

mean = 18

median = 16

Portugal (KW/m):

maximum = 700

minimum = 0.8

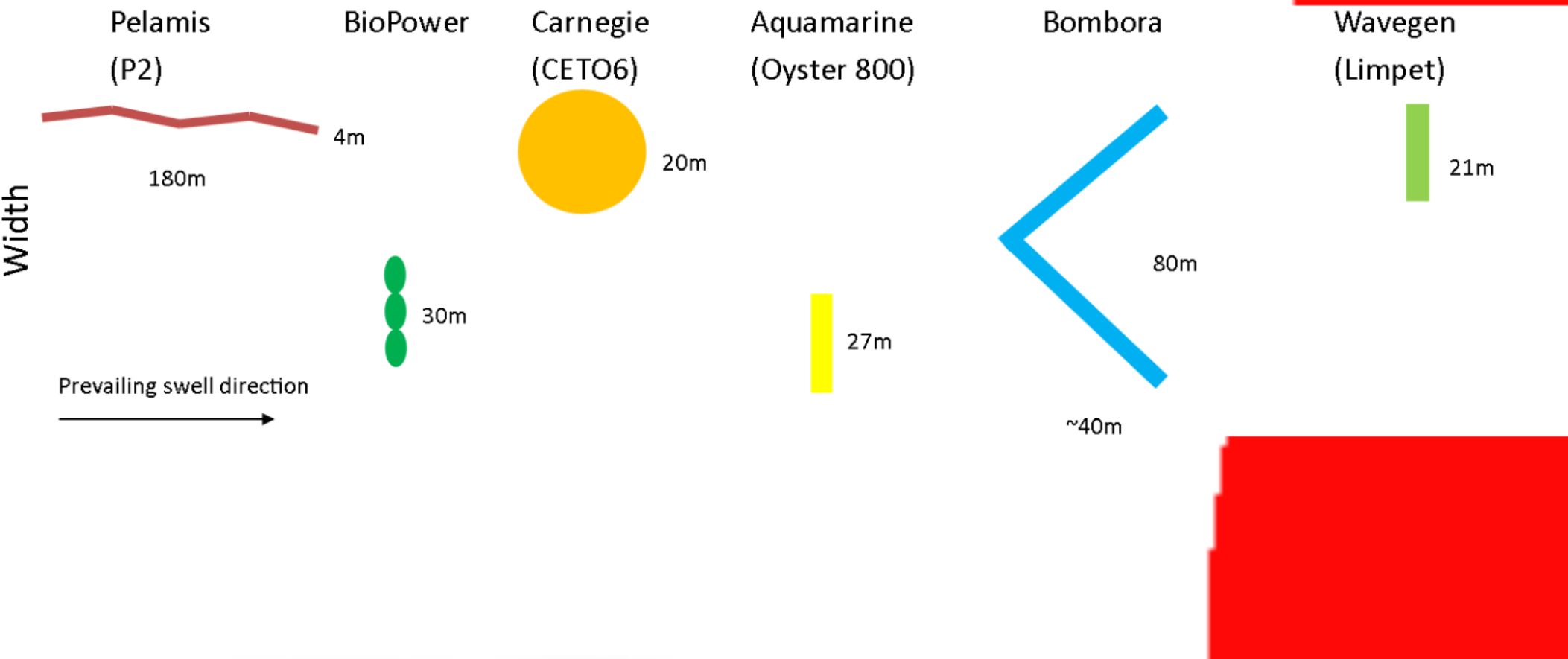
mean = 34

median = 19

Rogue wave size (Control system implications)

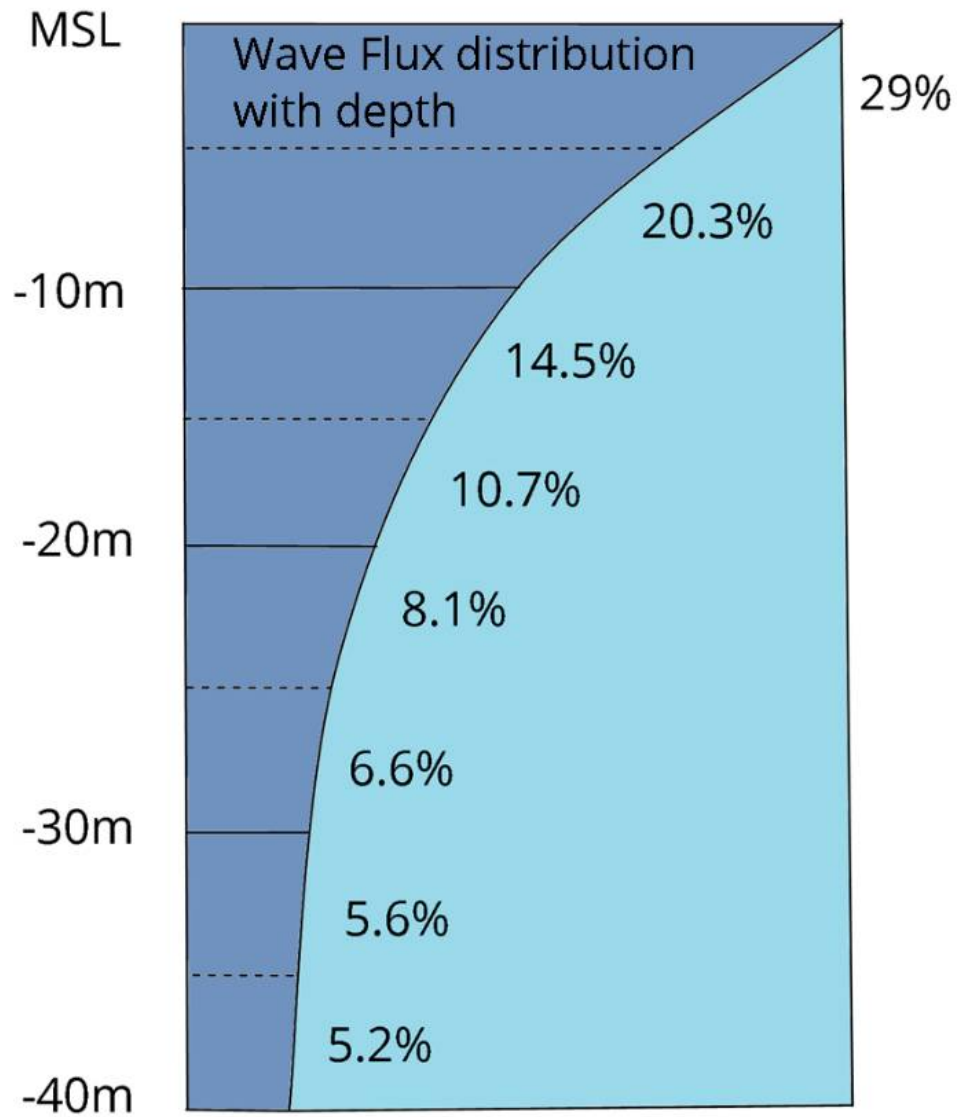


Scale (kW/m wave width)



Location

Grounded foundation vs complicated mooring



Associated



Associated infrastructure



Maintenance transit times





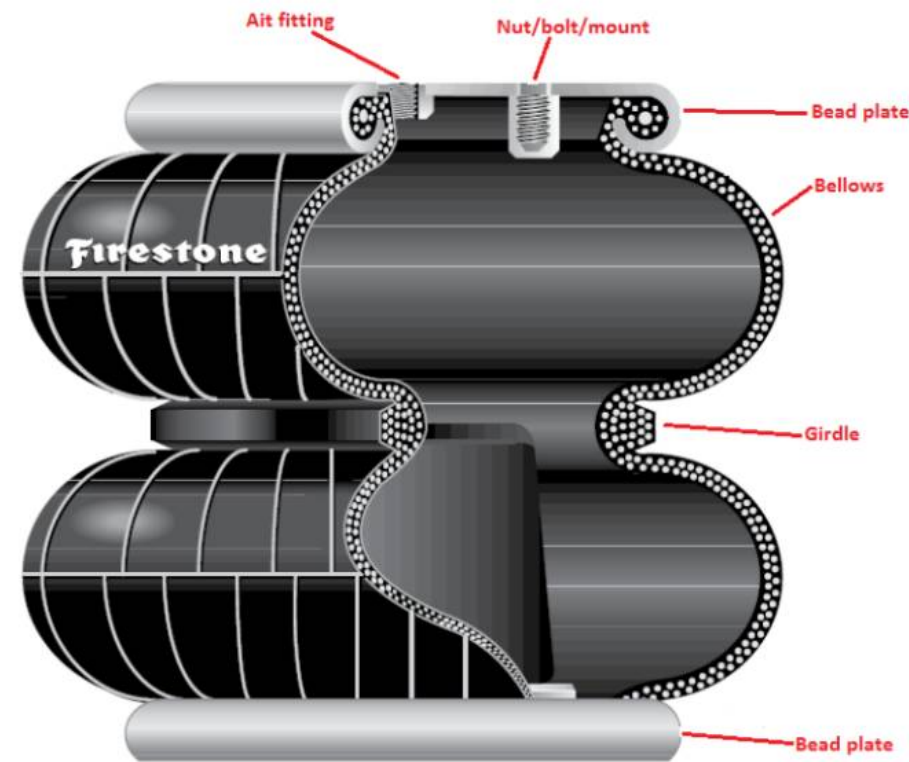
Operational access requirements

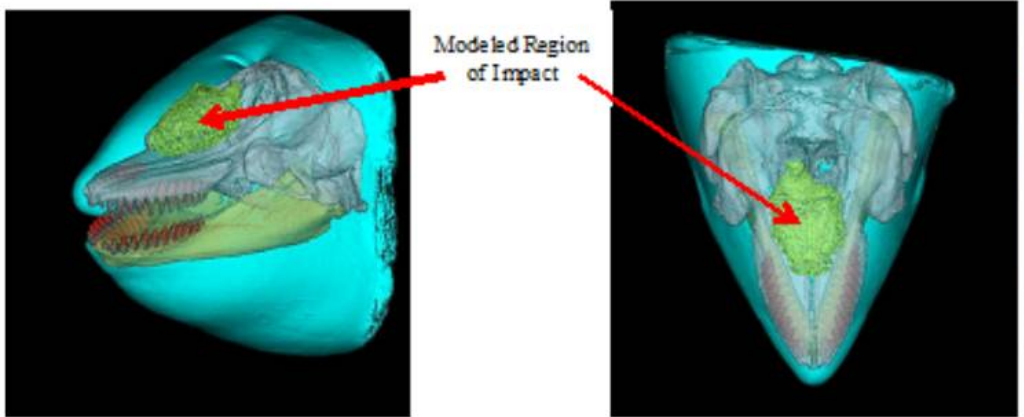
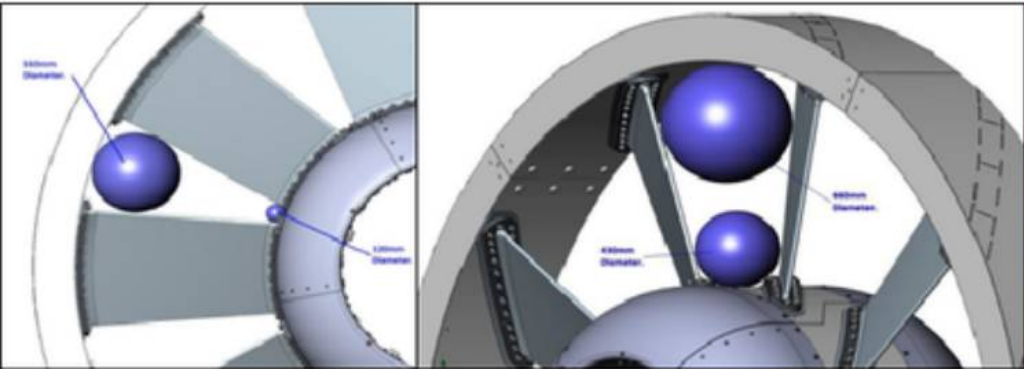


Recreation Surfing

Design

Power take off "end stop condition"



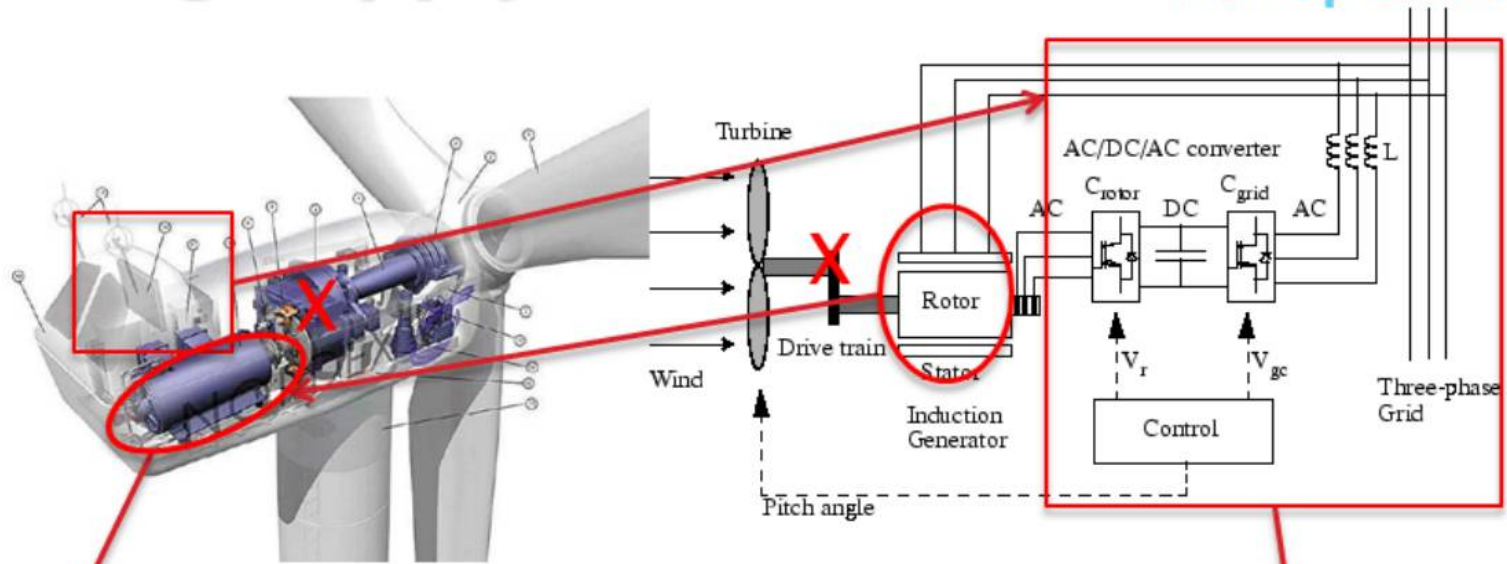


Machine & human/critter interface



Materials of construction

Existing Supply Channels



= Reduced time to market + faster market uptake

Resilient Ocean Energy

Original vs off the shelf



nt

Serviceable Markets



Renewable electricity



Tourism (Diving/snorkeling)



Marine habitat and biodiversity enhancement



g)

Recreation - Surfing



©2008 bretwalker.com

Marina and harbor wave and wake attenuation





Shoreline protection

Success = Low cost of electricity

How to achieve?





Uses a flexible membrane and simple valves to squeeze air through a circuit, extracting electricity by an air turbine



Lowest Cost Of Electricity

Leapfrog Development

(think big, start small & get paid to develop)



Small scale (Phase 2)

- river edge preservation (Como foreshore)
- boat wake in marinas (local manufacturer)

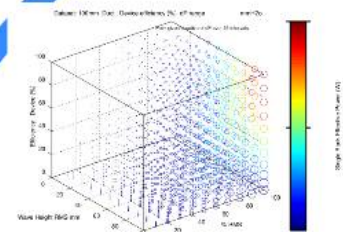
Larger scale (Phase 2/3)

- coastal shoreline protection (Gold Coast, Portsea, Quinns Beach)

Commercial scale (Phase 3/4)

- Demonstrator and farm (Electricity sales, Garden Island, Geraldton Port Authority)





Founder funded
Where have we come from?
 Phase 1 activities

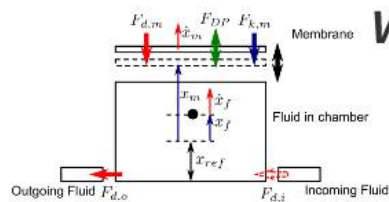
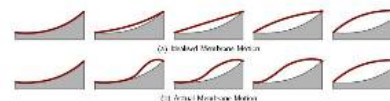
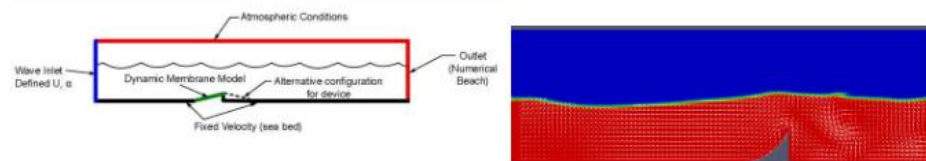
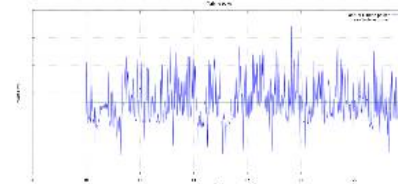


Figure 1: One-dimensional model of the Bombara WECD
 Preliminary Feasibility, characterisation Curtin Uni. (Dr Andrew King)

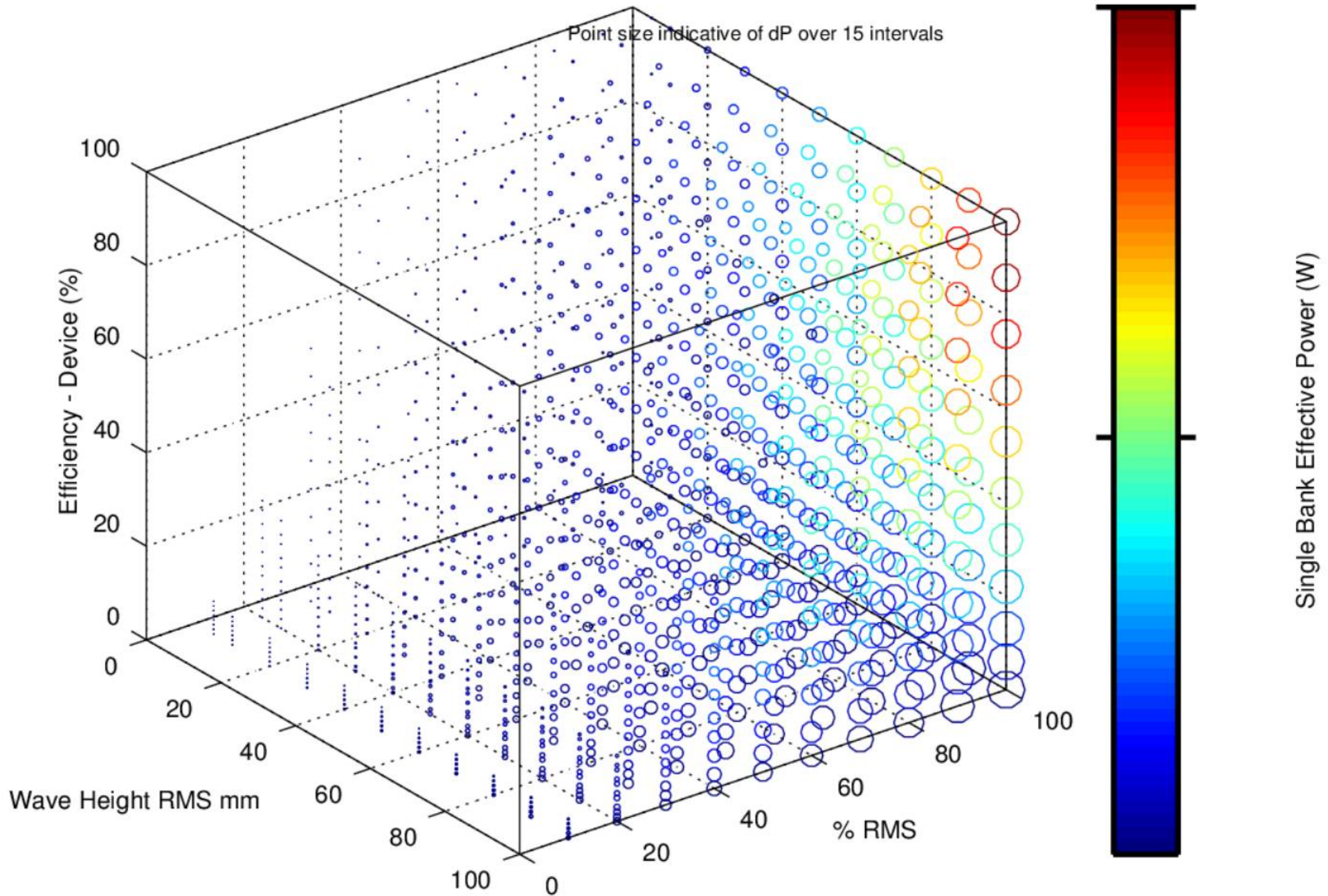


Independent 3rd party validation

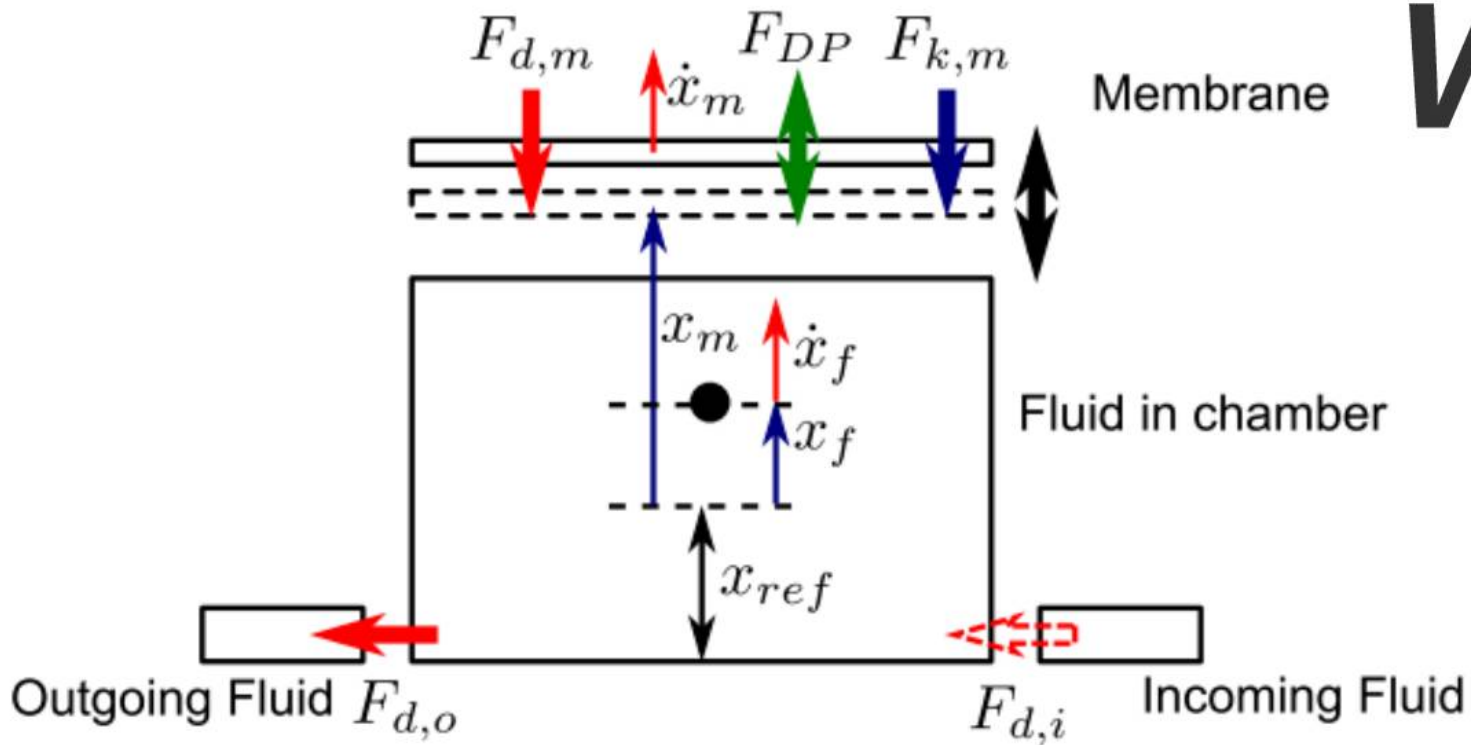


Dataset: 100mm_Duct_Device efficiency (%) dP range

mmH2o



Internal first principle analysis

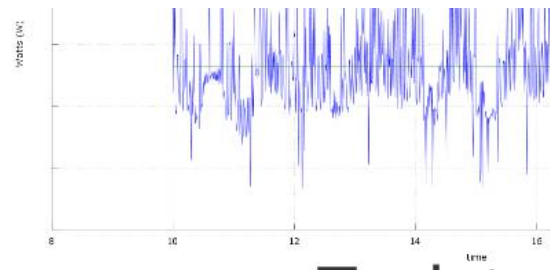


Where

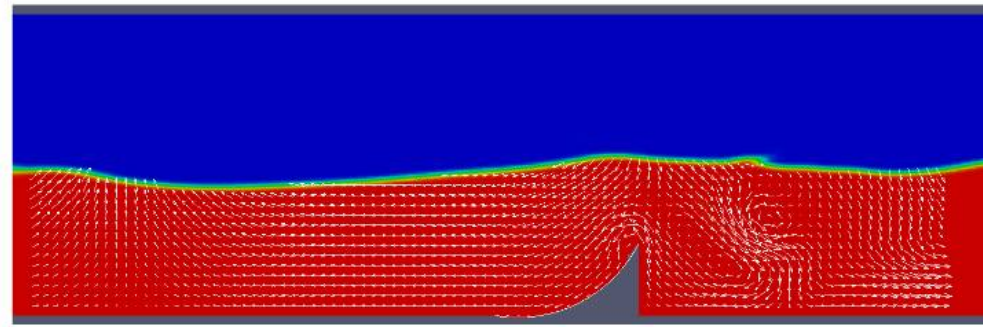
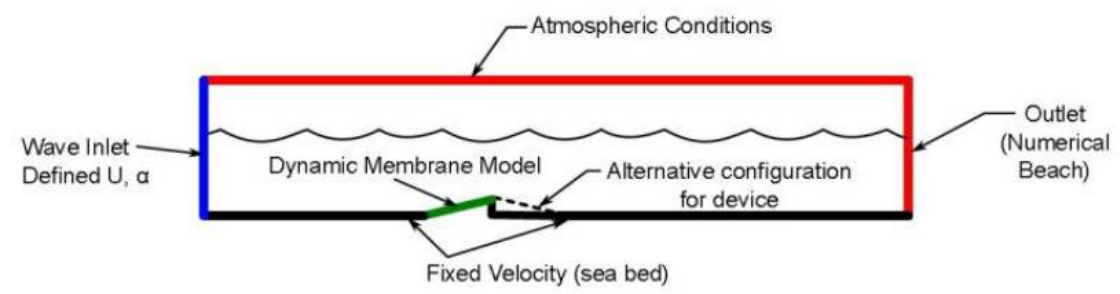
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Figure 1: One-dimensional model of the Bombora WECD

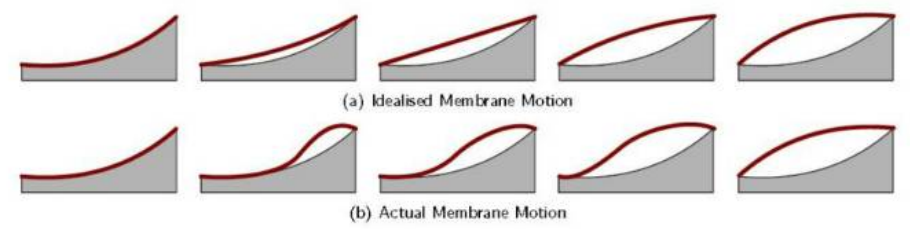
Preliminary Feasibility, characterisation Curtin Uni. (Dr Andrew King)



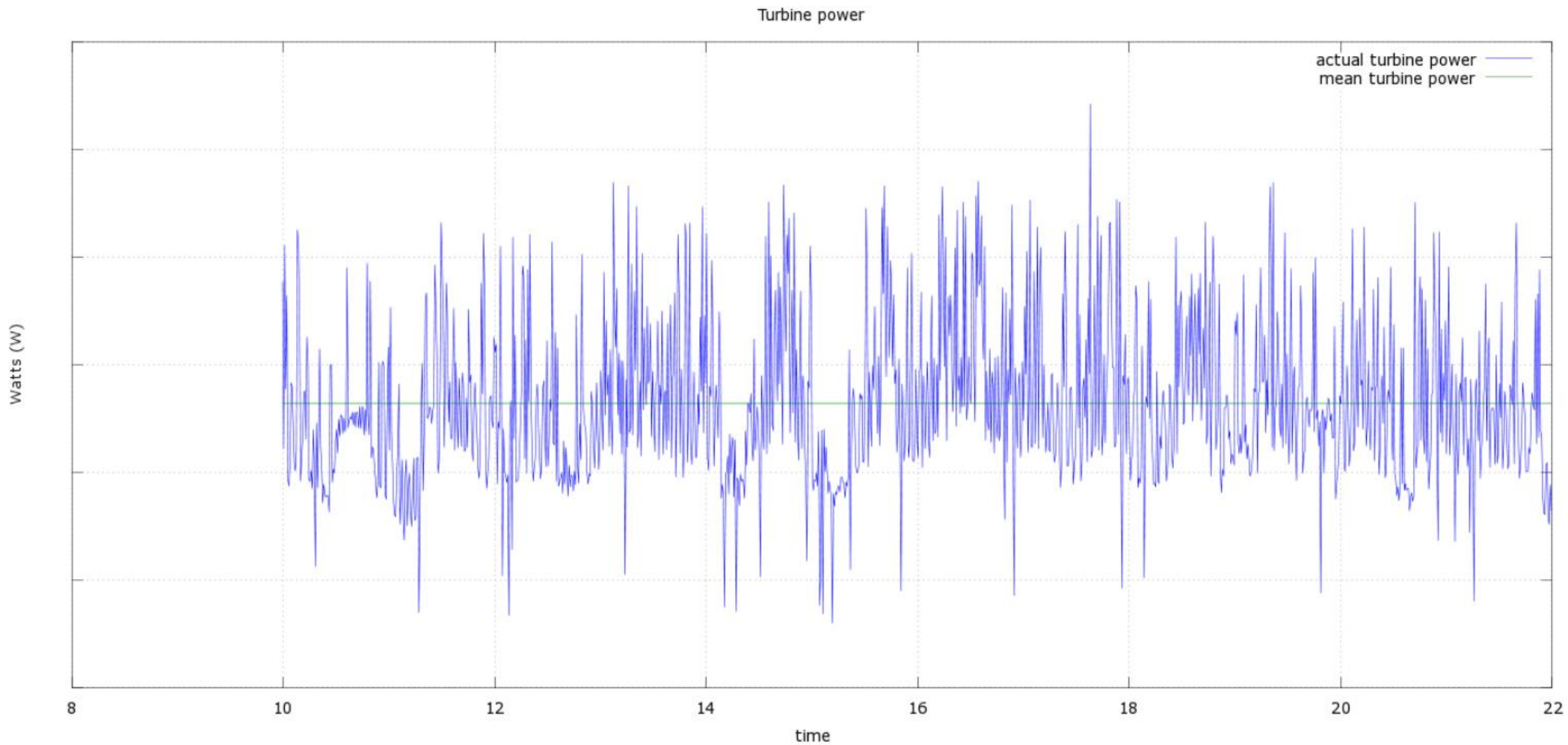
Tank test



2D characterization model: Curtin Uni. & Ivec (Dr Andrew King)



Independent 3



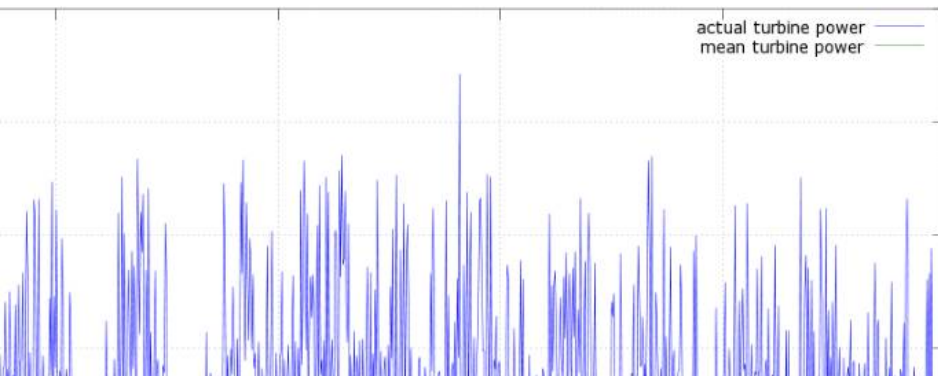
Tank testing



WESTERN AUSTRALIA
**Innovator
of the
2013 Year**
FINALIST

Independent 3rd party validation

Turbine power



Report

WAVE ENERGY CONVERSION DEVICE (WECD)
Prefeasibility study

Document No: 10-70-810-REP-0002



Pre-feasibility report & external review

Expert Opinion – work to date



Tom Thorpe
Oxford Oceanics, ETSU / Harwell

“Much lower than the average generating costs for a range of wave energy devices”

“Selection and coupling of features gives specificity... demonstrating an innovative solution. “



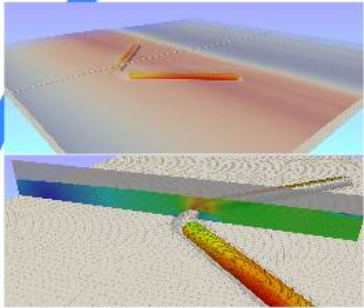
BLACK & VEATCH

“An appropriate turbine can be designed using mature technologies and materials”

AIRGASCO PTY LTD 



First product
Walcon pontoon
with integrated
Bombora system

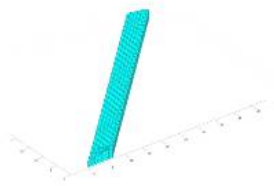


3D CFD (FSI) Modeling
Curtin University mechanical
engineering department and IVEC

Front End Engineering and Design (FEED)
Feasibility Study

IP Protection (International – PCT)

Seed capital raised
Where are we going?
Phase 2 activities

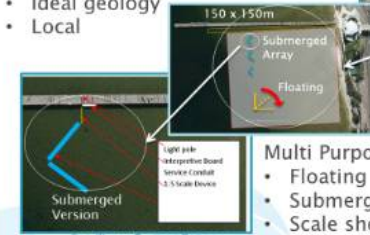


Spectral and temporal modeling ARR, CMST

Como Jetty Prototyping Site



- Good scaled wave climate
- Ideal bathymetry
- Ideal geology
- Local



Multi Purpose

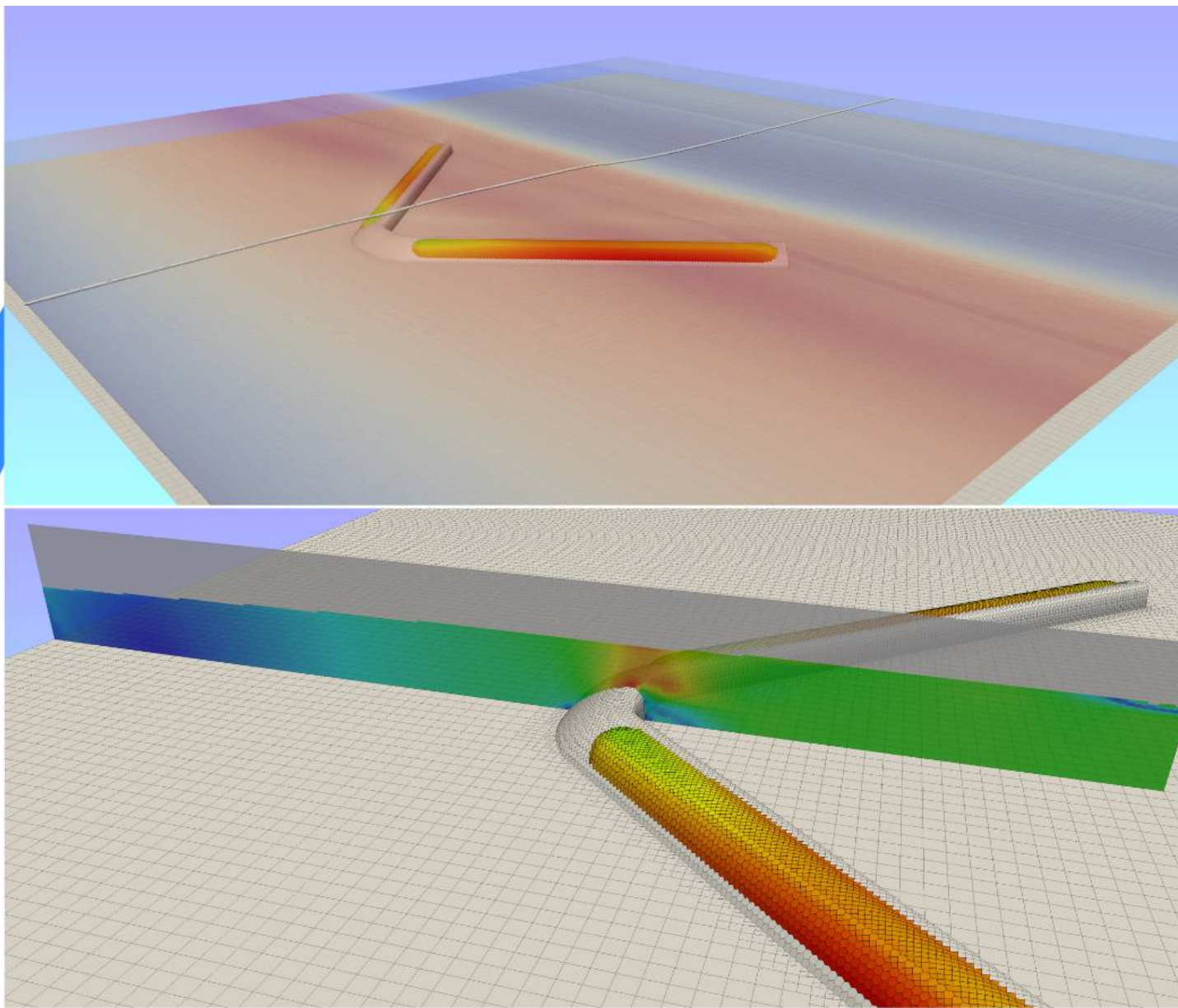
- Floating
- Submerged
- Scale shoreline effects

Component & Subsystem Field Trails
Como (Wadjuk) site



Prototype Development Walcon Marine, AMC

Certified Tank Testing
AMC – ARC linkage



3D CFD (FSI) Modeling
Curtin University mechanical
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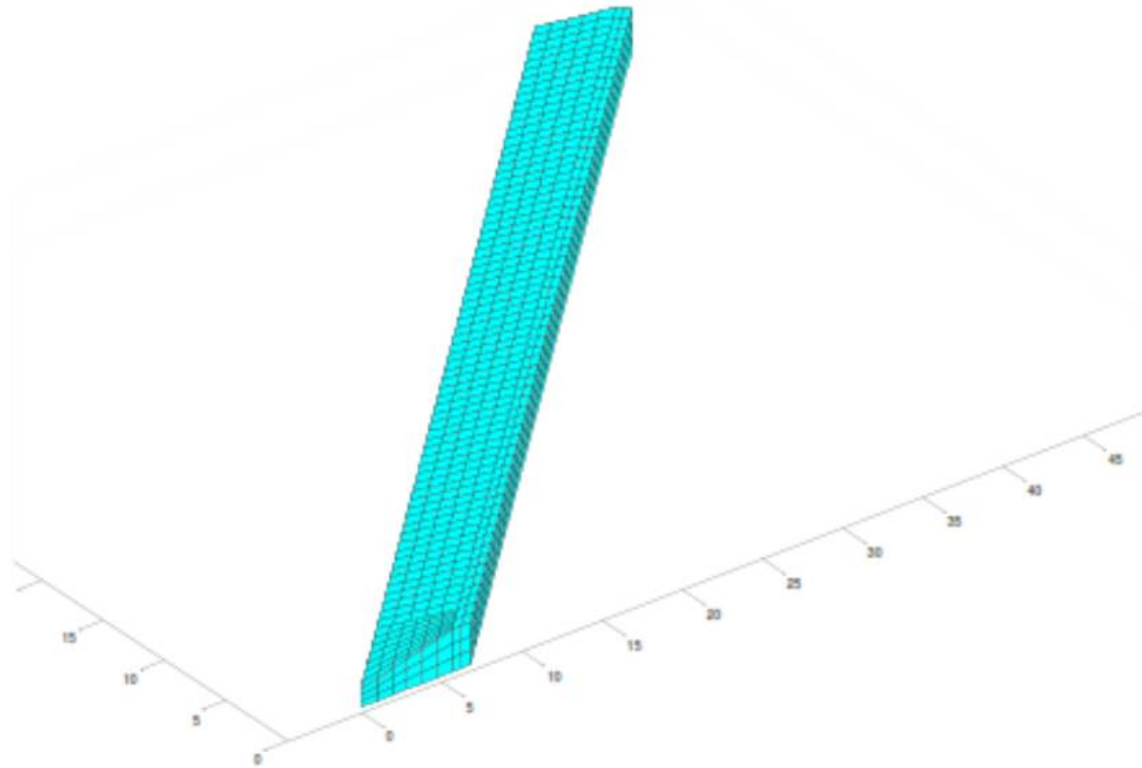


Figure 3: Panels used to represent Bombora WEC

Spectral and temporal modeling ARR, CMST



Certified Tank Testing AMC – ARC linkage



Resilient Ocean Energy

- Floating
- Submerged
- Scale shore

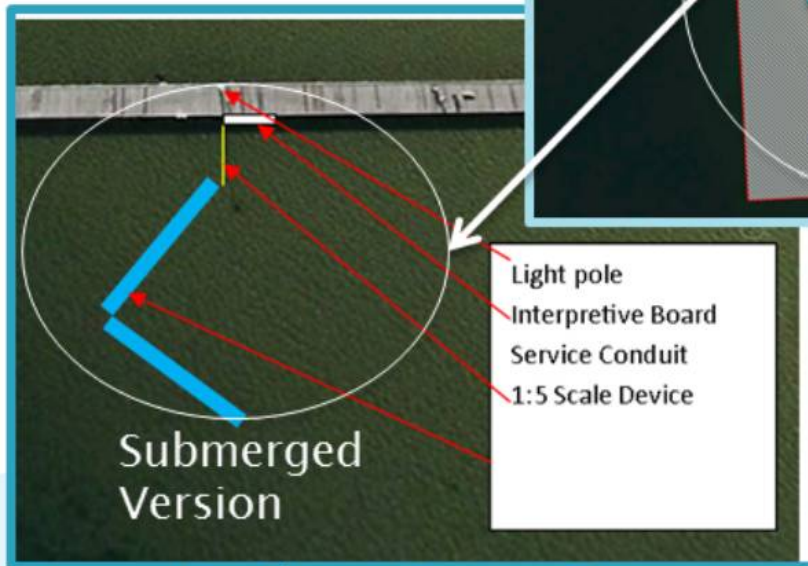
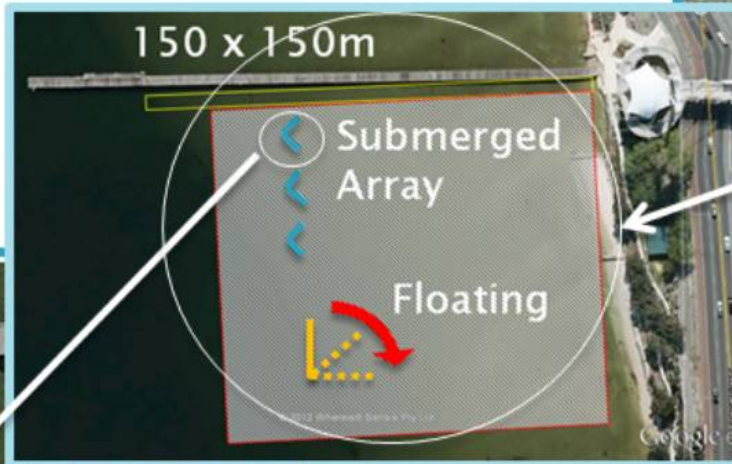
Component & Subsystem Field Test
Como (Wadjuk) site

Prototype Development Walcon Marine, AMC

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Multi Purpose

- Floating
- Submerged
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Resilient Ocean Energy

Component & Subsystem Field Trails
Como (Wadjuk) site

Engineering and Design (FEED)
Study

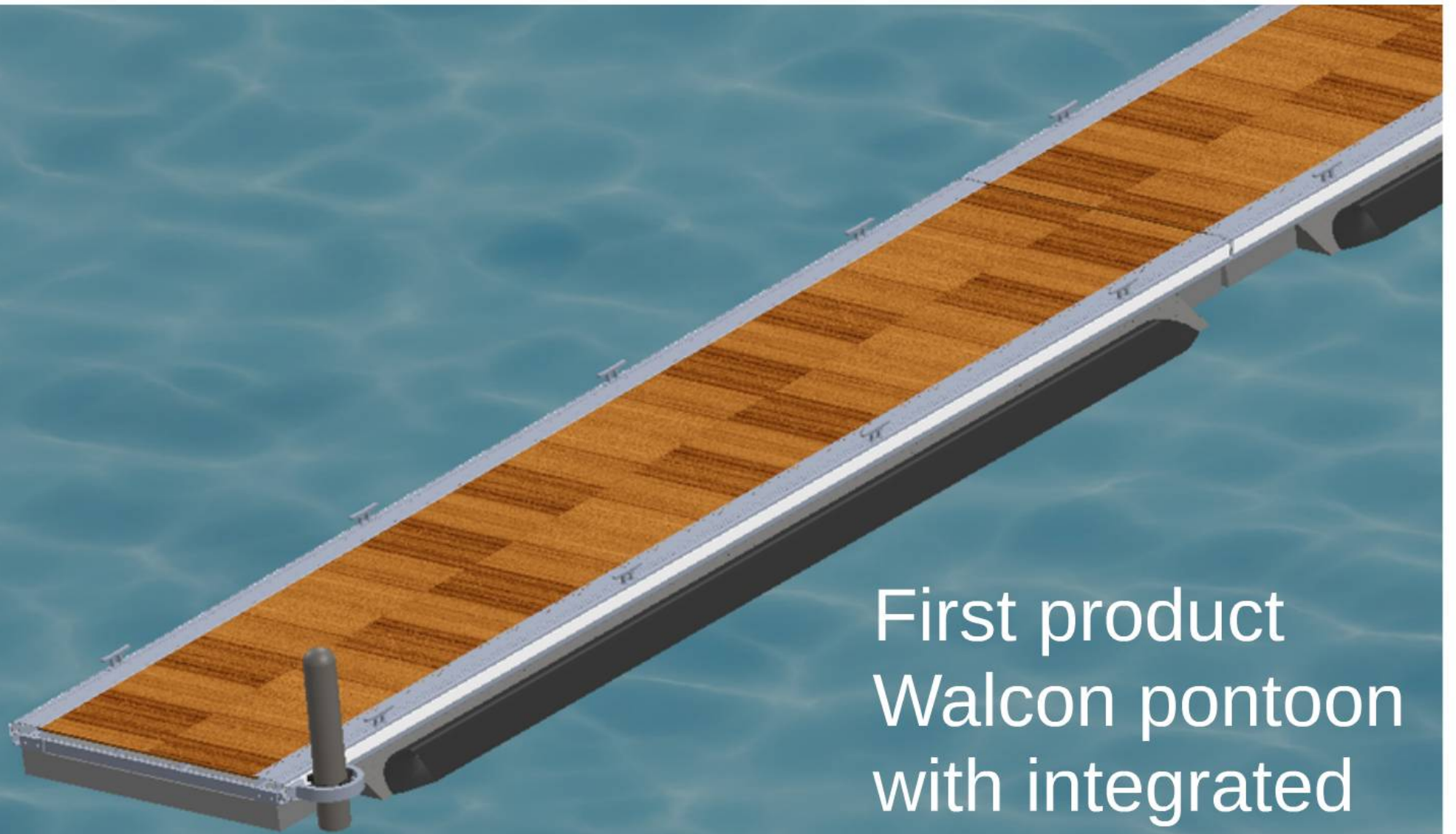
IP Protection (International – PCT)

Como Jetty Prototyping Site

Product
pontoon
integrated
ra system

Front End Engineering and Design (FEED) Feasibility Study

IP Protection (International – PCT)



First product
Walcon pontoon
with integrated
Bombora system

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