Ocean Energy Potential and Research Projects at Stellenbosch

South African Ocean Energy Network

Wednesday 10 October 2012

Cape Town

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Stellenbosch University

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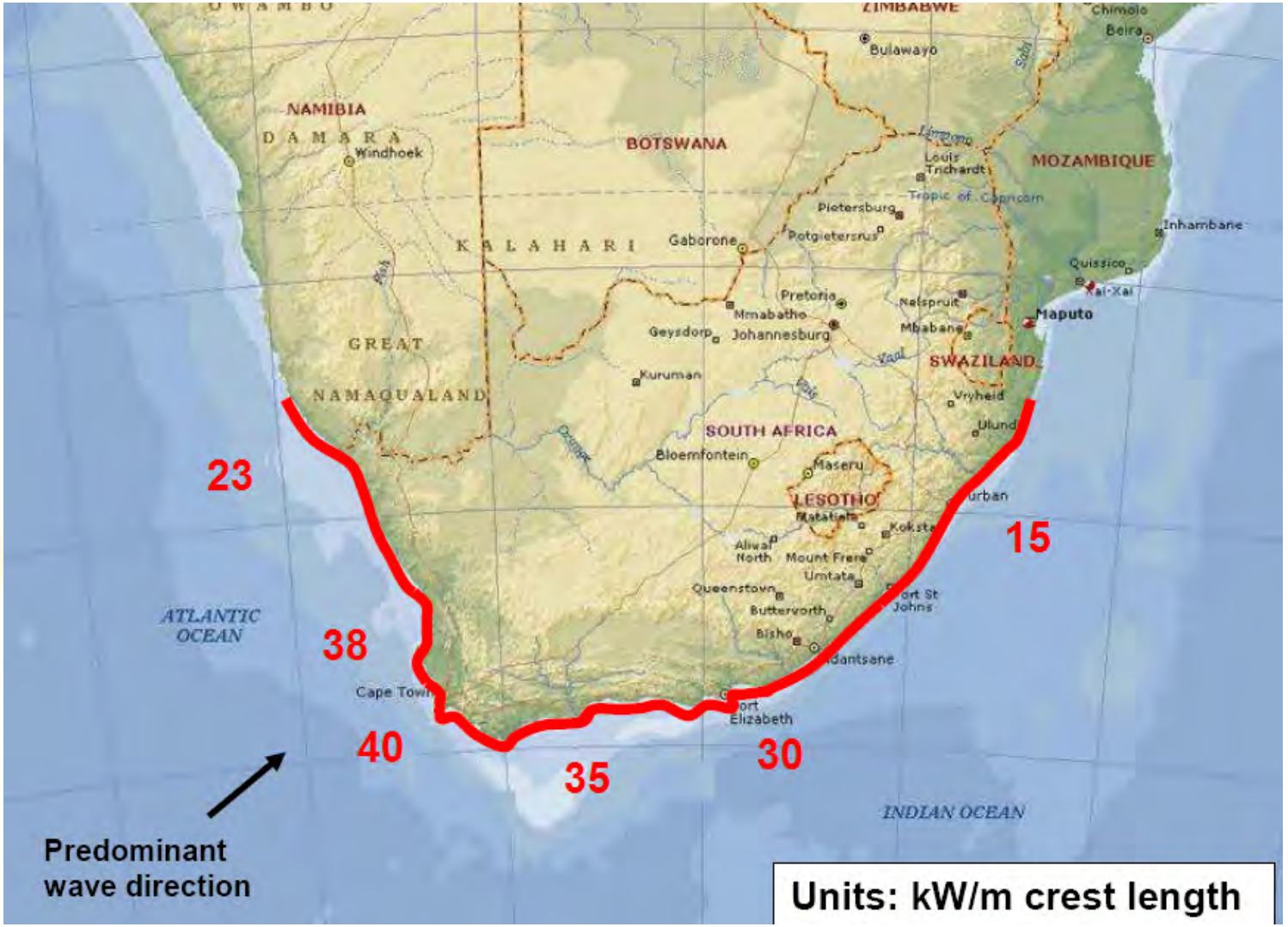
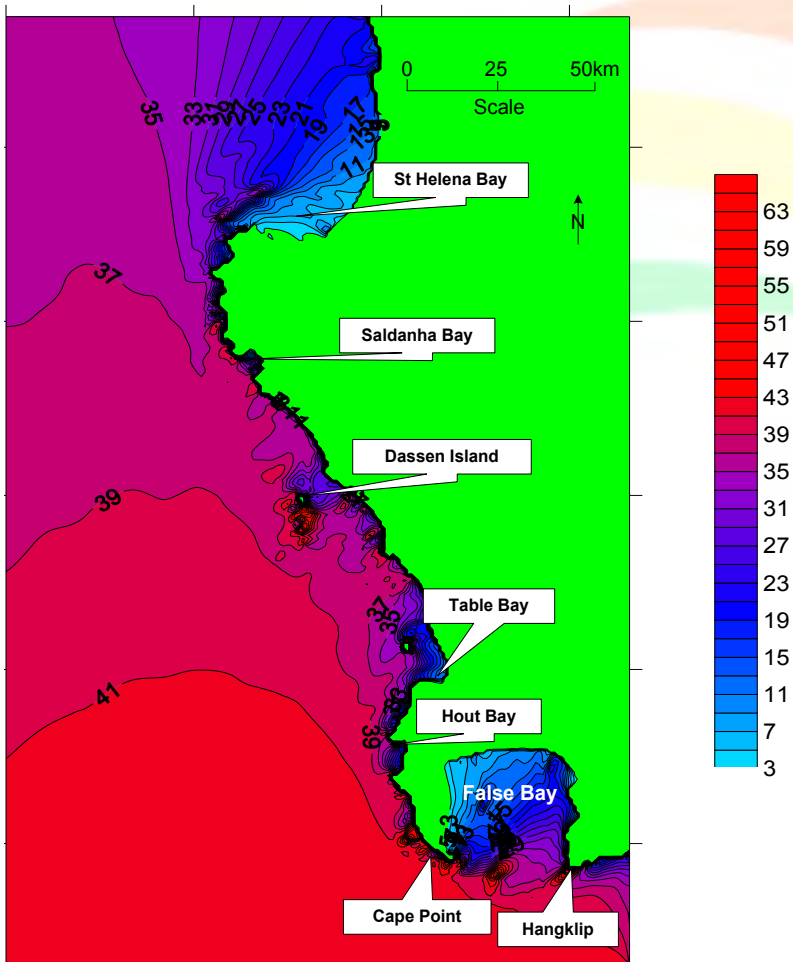
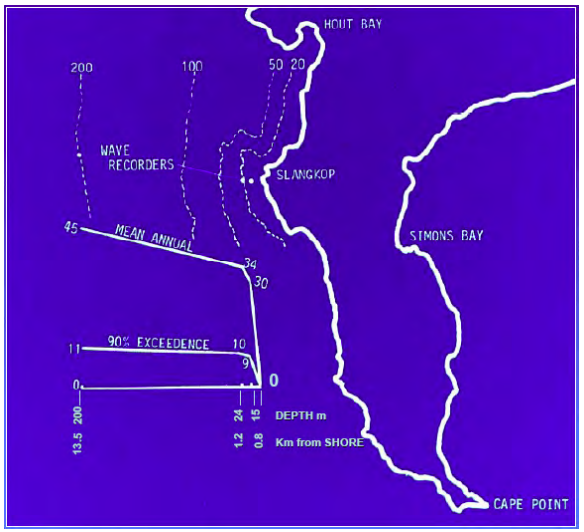
Wave Energy Resource of South Africa



Wave Energy Resource in the Western Cape

Mean annual average wave power (kW/m)





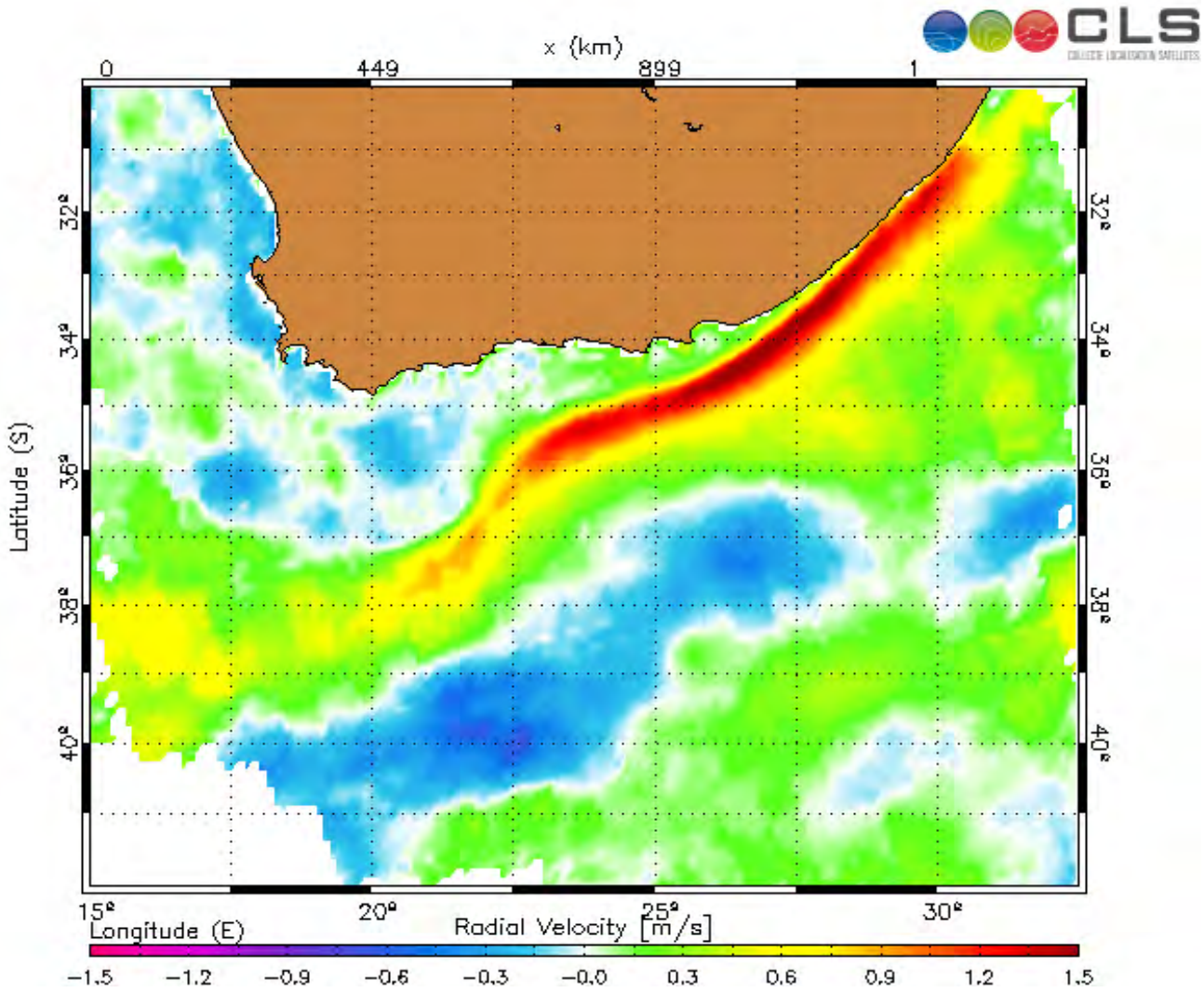
(Geustyn, 1983)

The Cape southwest coast has the best documented wave energy resource along the SA coastline.

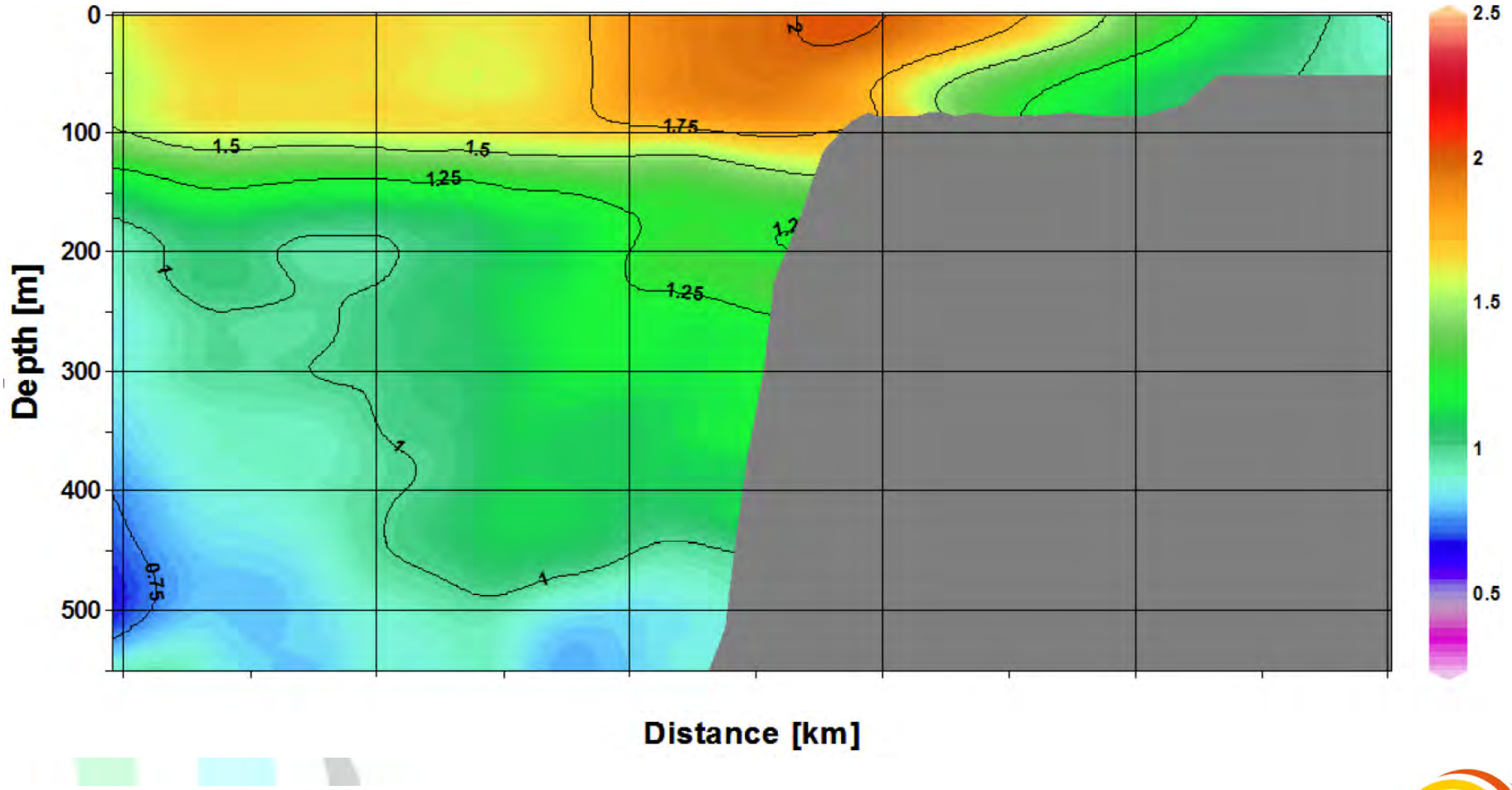
(Joubert 2008)

Modelled the annual average wave power using hindcast wave data

Ocean Current Resource around South Africa



Agulhas Ocean Current Data



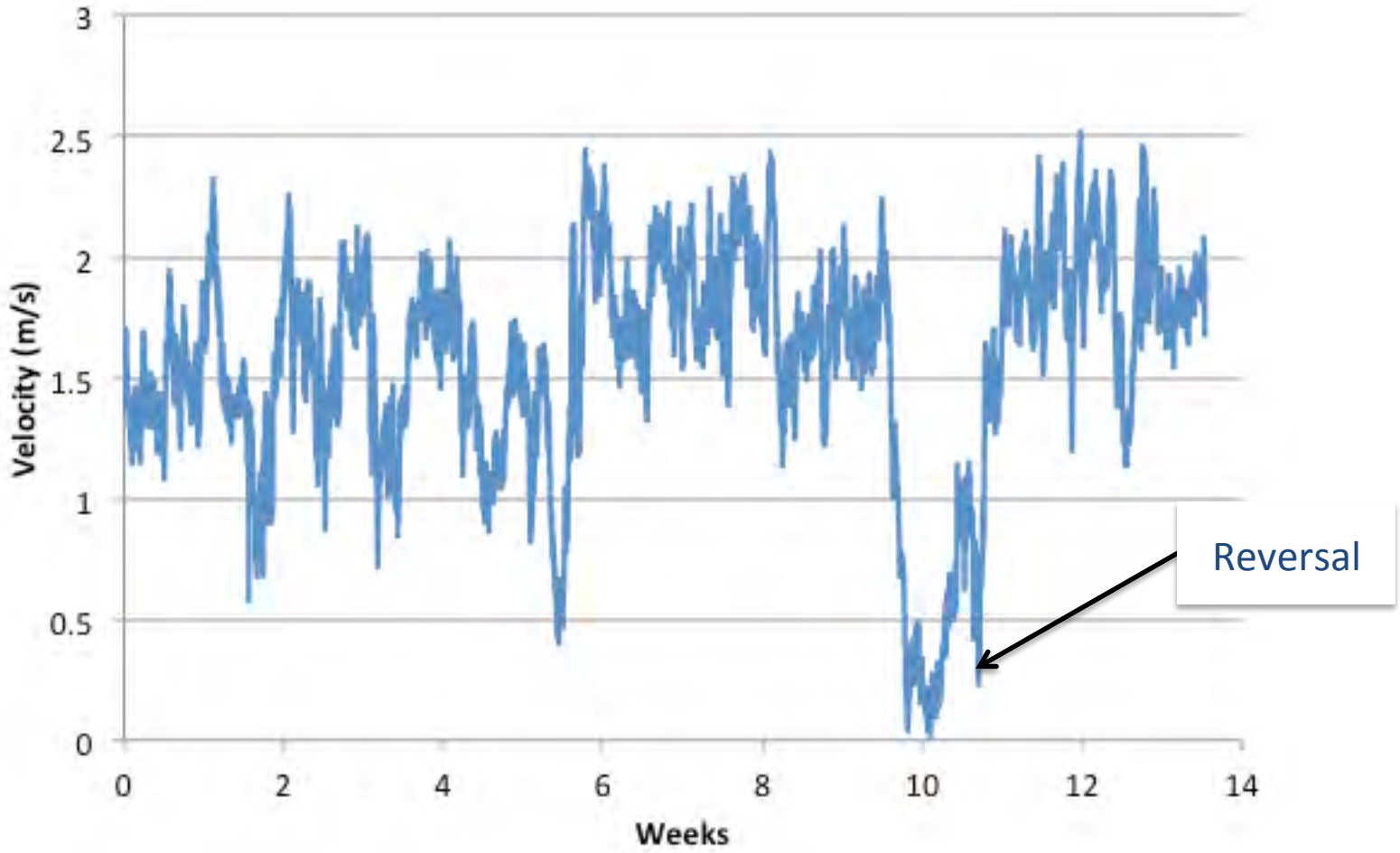
Agulhas Ocean Current Data

- Eskom measurements are available
- Few other sources, Lutjeharms, satellite data, etc.
- Average current speed 1.2 m/s - 1.5 m/s
- Max current speed 2.5 m/s
- Depth 20 m (or very near the surface!)
- Distance from shore, approx 10 km
- Water depth, approx 100 m
- Natal pulses, reversals!
- Occasional large waves
- Extended periods of low velocity flow

Agulhas Ocean Current Measurements

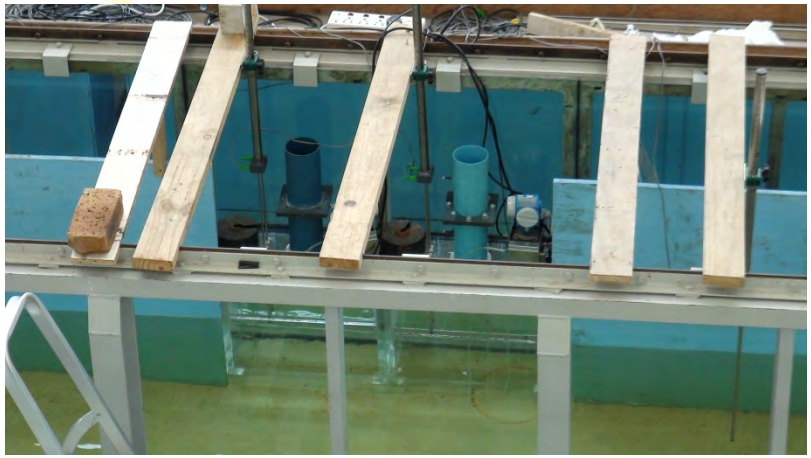
- Measured in 3 month periods with ADCPs at numerous sites.
- Data accuracy ?
- Discrepancies ?
- Availability?
- Interpretation?

Agulhas Ocean Current

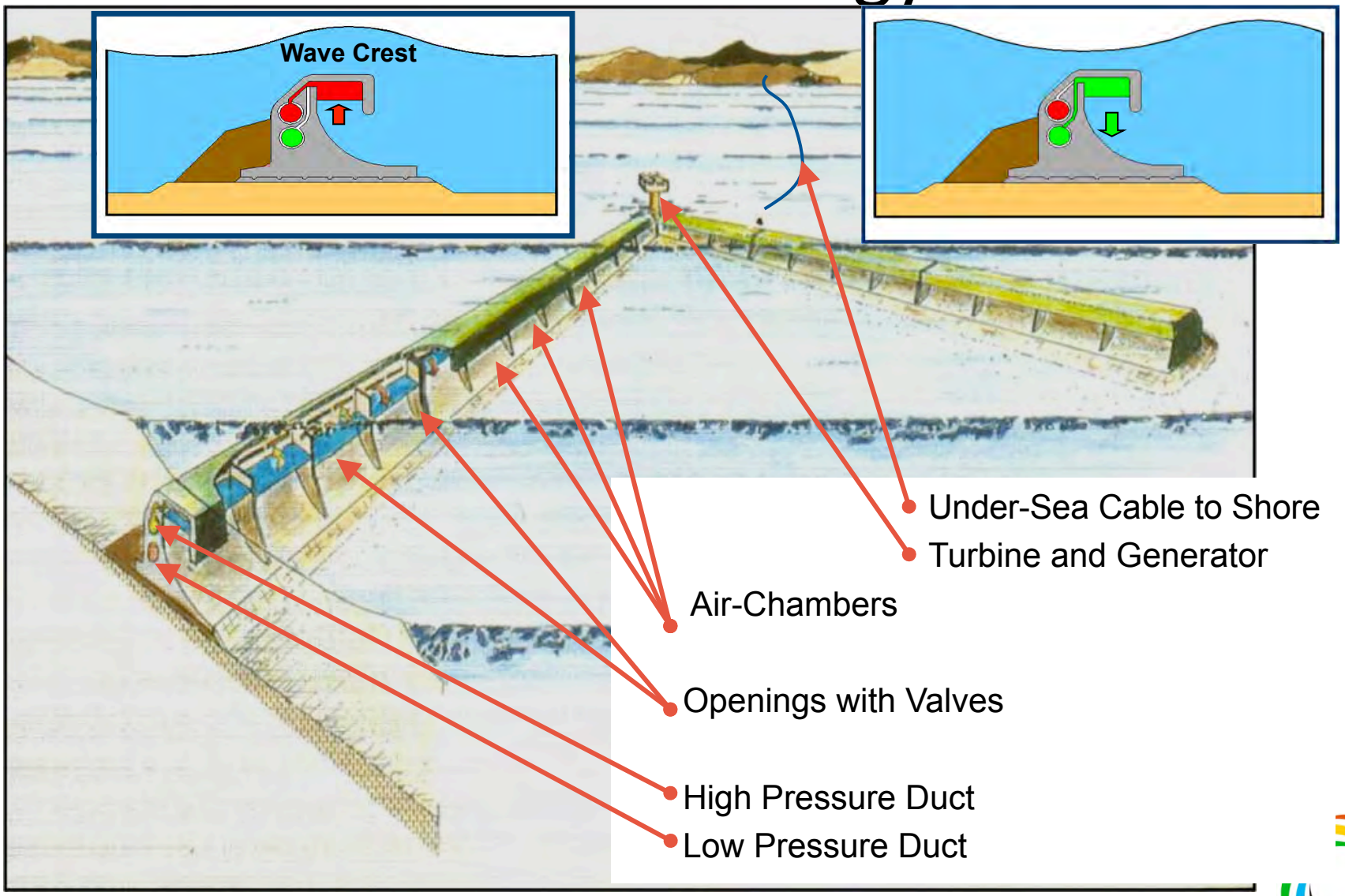


Stellenbosch Wave Energy Research

- Stellenbosch University active since 1978
- Numerous Masters and PhD
- SWEC

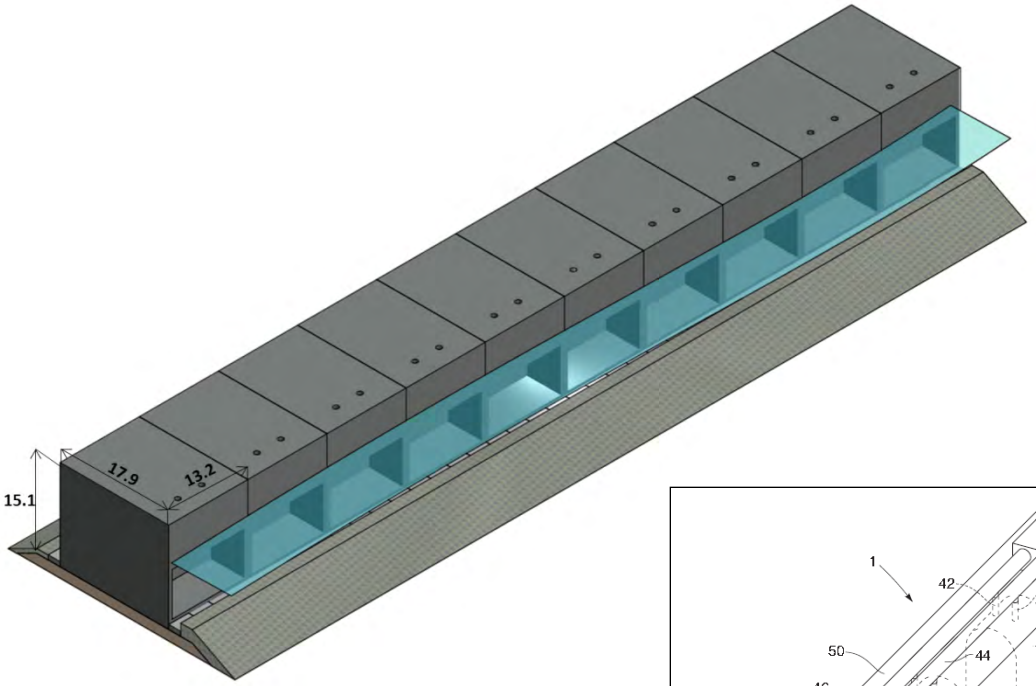


Stellenbosch Wave Energy Converter



ShoreSWEC in Granger Bay

ShoreSWEC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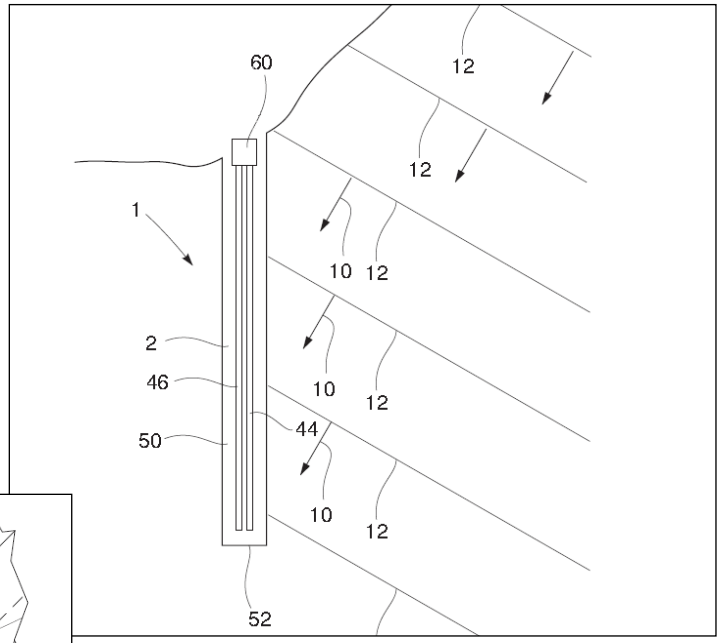
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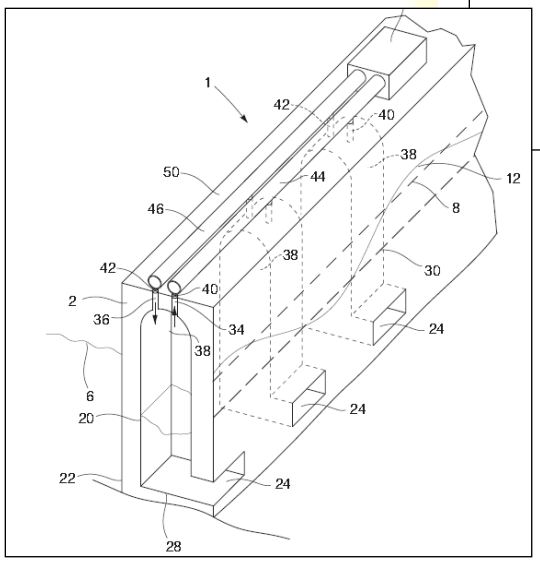
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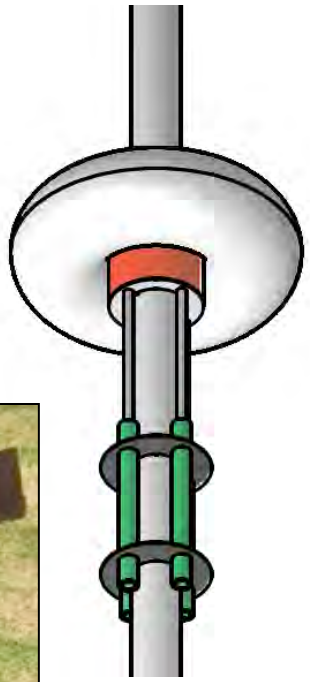
22
24
28

South African Wave Energy Research

- Stellenbosch University (2007-present)
  - **James Joubert** (PhD) – Design and development of the ShoreSWEC through numerical modelling and experimental tests
  - **Jacques du Plessis** (MSc.Eng) – Design and testing of a model point absorber with hydraulic power take-off system
  - **Paul Ackerman** (MSc.Eng) – Numerical airflow model and turbine design
  - **Bavesh Kooverji** (MSc.Eng) – Development and testing of system to measure bidirectional airflow of an OWC
  - **Felipe Guerrero** (MSc. Civil Eng) Focussing wave basin
  - **James Joubert** (MSc. Civil Eng) – Resource assessment of the South African southwest coast
  - Linear generator development and testing for a point absorber(Electrical Engineering)
- University of Cape Town
  - **Jonathan Frick** (MSc.Eng) - Environmental and regulatory requirements for wave energy projects on the South African coast
- University of the Witwatersrand
  - Linear synchronous generator

Stellenbosch Wave Energy Projects

- Ship-integrated WEC for semi-stationary vessels – for De Beers Marine
- Feasibility studies on various WECs
  - Wave Air Generator
  - OEMP
  - Roman Bay

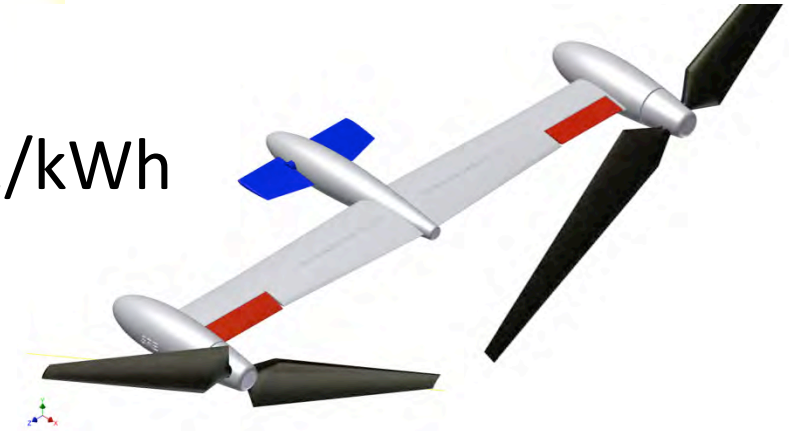


Stellenbosch Ocean Current Research

- Since 2007

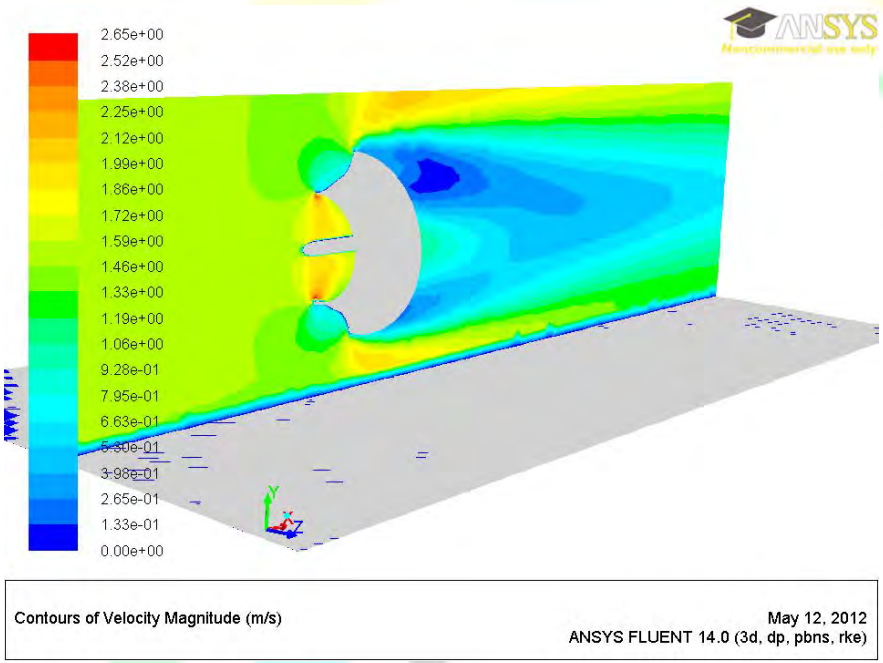
5 final year projects; 2 x M.Sc.Eng.

- Sea Renewable Energy (Pty) Ltd
  - Tethered wing with two trailing turbines
  - Rotordiameter 21 m
  - LCOE R 2.34/kWh to R 3.42/kWh

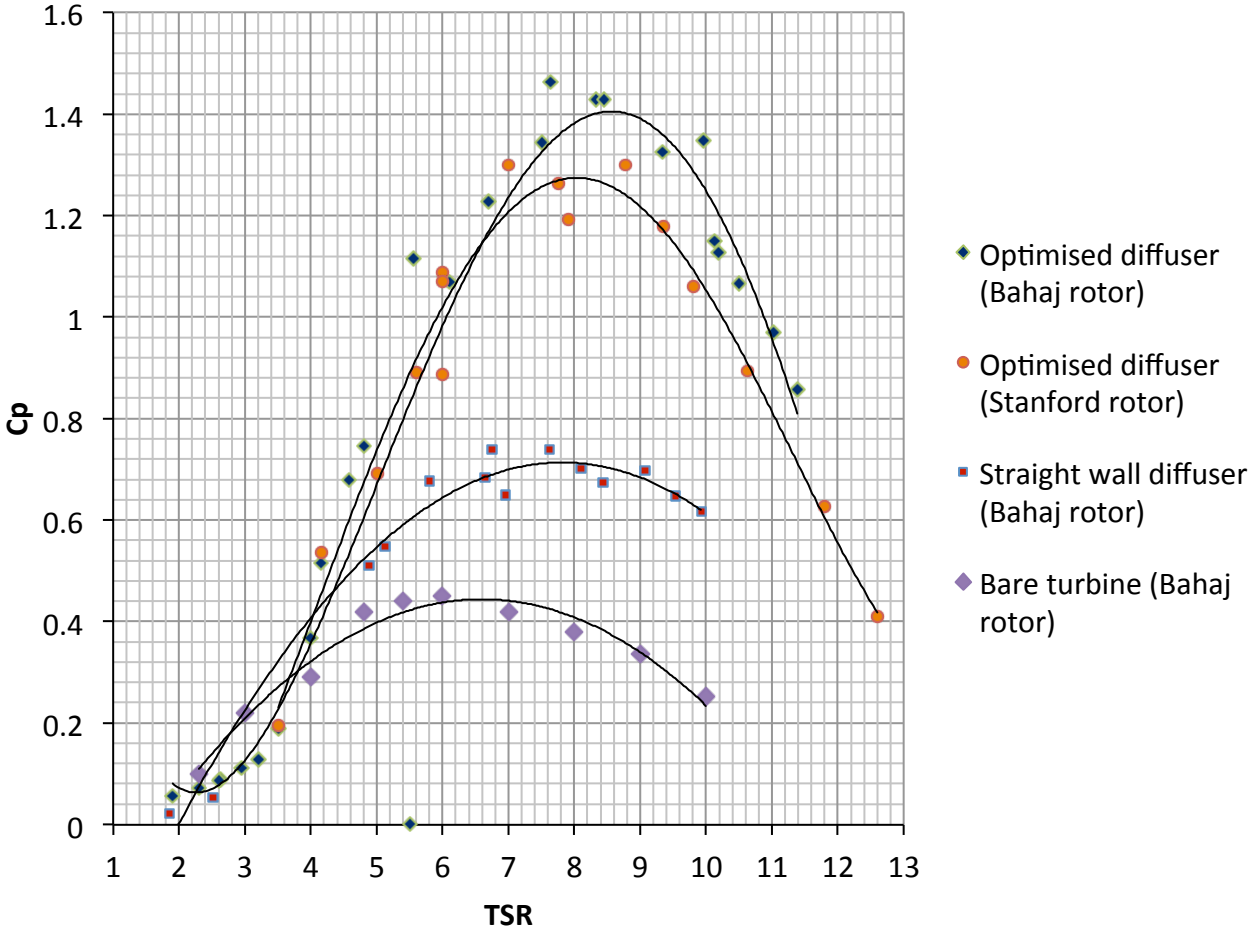


Stellenbosch Ocean Current Research

- Simple shroud, twice the power
- Optimised shroud, 3.5 times the power

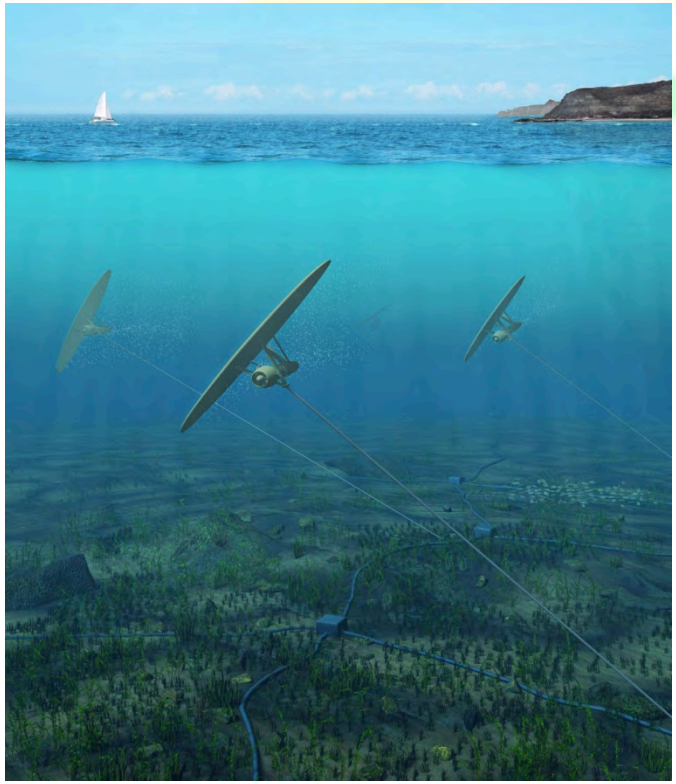


Stellenbosch Ocean Current Research



Open Innovation Challenge

- Stellenbosch University entered with consortium partners SRE and Minesto
- Asked to submit full proposal for second round



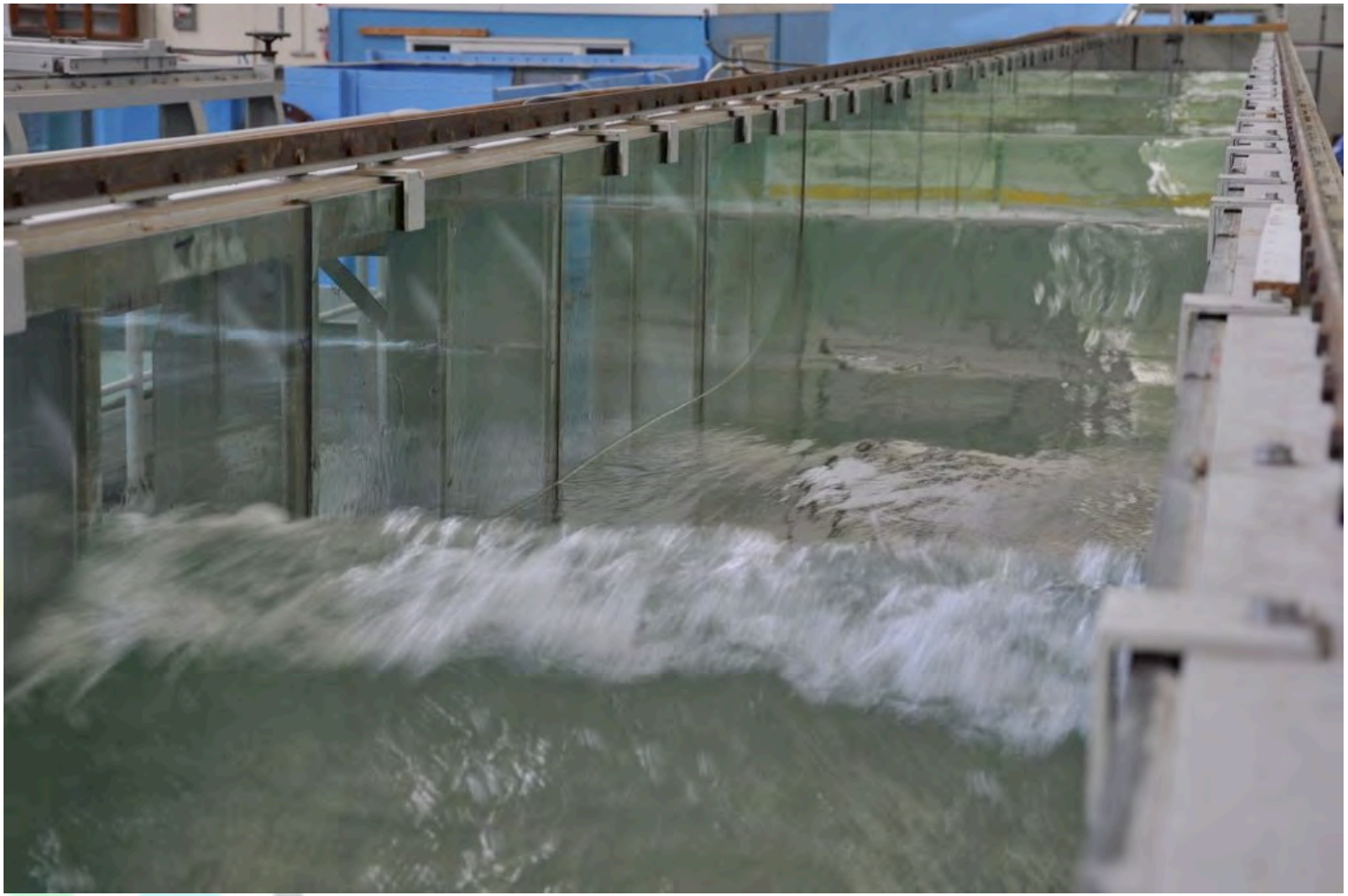
Conclusions and Way Forward

- SA has an attractive wave and ocean current energy resources that can be exploited for electricity generation
- ***Wave Energy***: Converters are still under development, commercial systems are still a few years off; Wave energy complements wind energy in the Western Cape
- ***Ocean Current***: Suitable converters are not currently available; "24/7" operation is vey attractive for base load; surface current and distance to shore poses unique challenges.
- Wave and Ocean Current technologies still need to be supported by R&D grants and then by subsidies (FITs) to develop commercially viable converters in future

Acknowledgements

- Josh Reinecke
- Prof TW von Backström
- James Joubert
- Jacques du Plessis

Questions ?



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