Impact-free Water

Harnessing the power of wave energy to produce cost efficient sustainable water and power.

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wave powered desalination

The world is facing a water crisis….

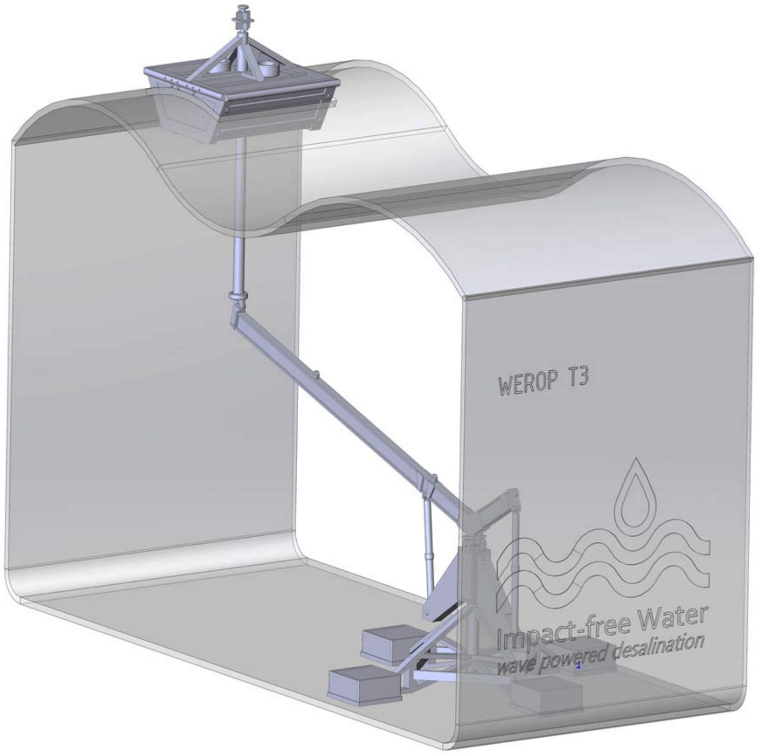
- Water crisis ultimately = food crisis.
- Only 3% of the world's water is fresh water, and 2/3 of that is tucked away in frozen glaciers or unavailable for our use.
- 97% of the world's water is in the oceans.
- ***The problem is pumping this water***, whether for desalination, agriculture, industry or mariculture.

Energy Alternatives?

Wave	Solar	Wind	Eskom
24/7 availability	Only sunny days	Only windy days	Load-shedding!
50 - 85 % capacity factor	10 - 30 % capacity factor	25 - 40 % capacity factor	High
Easy to determine energy levels	Weather patterns vary	Weather patterns vary	Load-shedding issues
Requires no land	Requires lots of land	Requires lots of land	Requires grid connection
Seawater, power, filtration, fresh water	Power only	Power only	power
No noise	No noise	Noisy	Noisy and polluting
No visual impact	Visually obtrusive	Visually obtrusive	Visually obtrusive
40 + year lifespan	25 year lifespan	20 year lifespan	Aging infrastructure
Innovative Technology	Mature Technology	Mature Technology	Fossil Technology

The value proposition

- IFW's wave pump uses **wave energy directly** to pump seawater.
- Electricity free
  - Desalination
  - Mariculture
- Power as a by-product
  Mineral recovery as a by-product.
- In the most environmentally friendly way, earning carbon credits.
- Reducing running costs by up to 35%

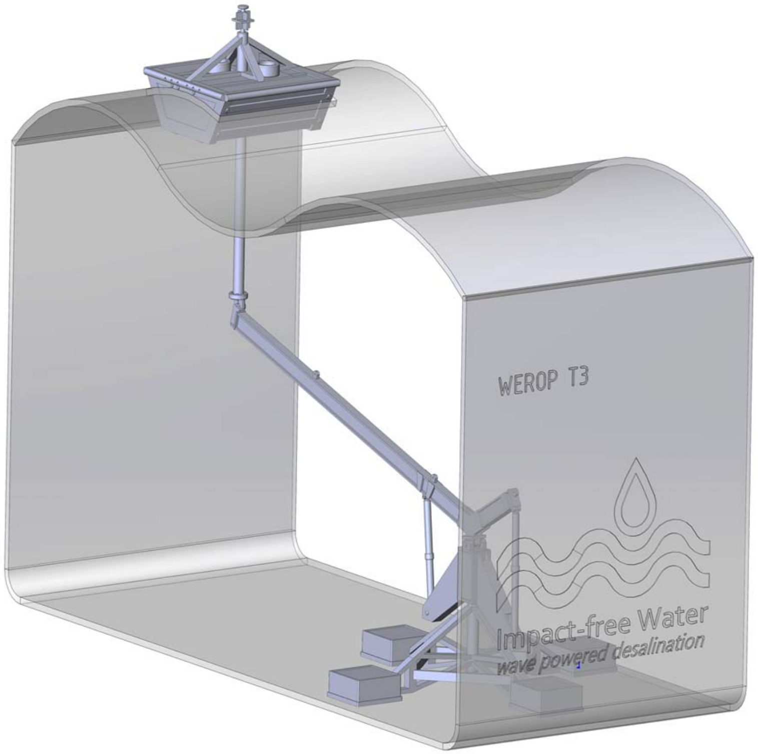


Unique Selling Points

- Optimized size-to-strength balance
- Scalability
- 3 in 1 Solution
  - **Direct power usage**
  - **Pre-filtration**
- Maintenance friendly design

Client Business Options

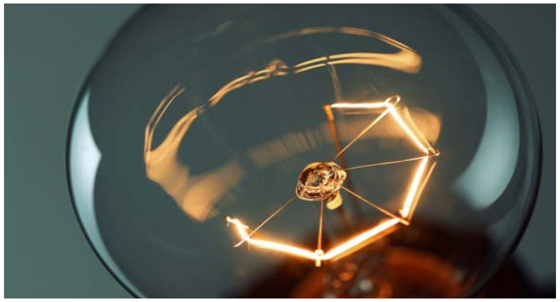
- Offtake agreement
- Sale and maintenance fee



Clients

- Water scarce municipalities
- Mariculture
- Off-grid communities
  - Water
  - Power
- Coastal agriculture
- Coastal industry



Current clients

1 **University of Namibia**
- Mariculture project at the Henties Bay Campus
- Design phase

2 **Thapi-Aquakulcha**
- Mariculture project at the Coega Development Zone
- Using fresh & seawater, and
- Power, all from the same wave pump
- Letter of confirmation for off-take for Thapi phase 1

3 **Saldanha**
- Test site for RO integration
- Water will be available for a community project

Research Permit granted for a number of test sites
LOI's obtained from a number of interested mariculture operations

Proof of Concept

- PoC signed off in 2016 – all deliverables met
- Pumped at pressures in excess of 100 Bars
- Pre-filtration proven, and improved based on results and lessons learnt
- Removed in working order – minor wear and tear, no corrosion
- Deployment and maintenance techniques validated and improved
- Integrated with a third-party SWRO system
- F-Type system developed out of results of PoC

Core Team

Simon Wijnberg - IFW Founder & CEO

He has 30 years of marine experience ranging from naval operations and coastal engineering management to oceanographic field work within the international oil and gas industry. "My passion for contributing towards a bright future for our children has driven me to dedicate my life towards enabling sustainable development".

Anton Berkovitz, CA(SA) – IFW Business Director

Anton's background is in the Investments Industry, where he had over 20 years of experience, holding executive roles in Governance, Technology and Operations, before going consulting in 2008. Anton joined IFW in 2015

Neil Parker - IFW Project Development & Management.

Neil joined IFW in 2016, Neil has been working in the construction and renewable energy sectors for over 25 years, including participation in the South African Renewable Energy Independent Power Producers Program

Non- Executive Directors

Craig Matthysen - IFW scientific advisor

CEO Lwandle Technologies - provides marine environmental services in marine and coastal ecology to clients involved in coastal and offshore construction
and development.

James Workman (USA) - IFW water industry advisor

Water Expert - senior adviser to the World Commission on Dams under Nelson Mandela, and then a consultant to corporations, governments and international NGOs.

Mike Woodborne – IFW Namibia and Australia

25 years involved in exploration and mining development projects in both corporate, executive and operational management roles with specific experience in recent years in managing and developing projects within the small cap, venture capital markets.

BEE Partners & Supporters

lwandle MARINE ENVIRONMENTAL SERVICES

nafasi water

Javan Fabrications (Pty) Ltd

WATER RESEARCH COMMISSION

ROYAL ACADEMY OF ENGINEERING

wader WATER TECHNOLOGIES DEMONSTRATION PROGRAMME An initiative of the Department of Science and Technology and the Water Research Commission

technology innovation AGENCY

OCEANHUB AFRICA

The value

- Assume a 6 MLD desal plant costing
  between R45m and R60m
  excl finance charges

- Cash flow of R12 per kL produced
  -> R26m per annum

- Payback period = 2 years on Capex

The value - local

- SA probable municipal desalination tenders
  - Port Elizabeth (Coega) — 60 MLD
  - Cape Town — 90 MLD
  - Durban — 100 MLD
  - Western Cape municipalities — 6 x 5 MLD
  - Eastern Cape municipalities — 4 x 5 MLD
  - KZN municipalities — 4 x 5 MLD
  - Namibia — 30 MLD
- Aquaculture / Agriculture
  - SA abalone farms (20 farms @ 75 MLD) — 1,500 MLD
  - Namibia — 500 MLD

The value
- international

INTERNATIONAL POTENTIAL

(all with sufficient wave energy)

- Island communities –
  Cape Verde, Ille de Sol, Canary Islands, Reunion, Mauritius, Comoros
  Pacific islands
- West coast of
  South America, Australia, North America, Madagascar
- **UNAM flagship project in Namibia**

NB more than 2,4 billion people live within 100 km of the coast

Thank You!

Contact us:

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simon@impact-freewater.com
anton@impact-freewater.com
neil@impact-freewater.com

www.impactfreewater.com

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Appendices

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Appendices

- The numbers
- WEROP footprint
- Why wave energy?
- Future developments

Average Project Installation

(500 kL pumped/hr)

Activity	Description of Work for Phase 1	Timing (month) On-site	Timing (month) Off-site
EIA and Permitting	Complete requisite site EIA and ECC application for the proposed operations	Prior to project	Prior to project
Site Preparation	Site Surveys and Detailed Engineering Design	1-3	1-2
Build Unit	Wave Powered Unit construction		1-2
Pipeline	Define specifications, purchase and delivery to site		2-3
Transportation	Transportation of pumps and materials to site	4	4
Site works	Land works including site preparation,	3-5	
Commissioning	On site implementation and connection of all units	5-8	

- Implementation is dependent on the weather and sea conditions & the site

Average Project Cost

(500 kL pumped/hr, 12 MLD abalone farm)

Activity	Description of Work for Phase 1		Budget ZAR
EIA and Permitting	Complete requisite site EIA and ECC application for the proposed operations		Client responsibility
Site Preparation	Site Surveys and Detailed Engineering Design	Range:	2,500,000 4,000,000
Build Unit	Wave Powered Units FT10 construction - *4 pumps at R 2,500,000 each* *(subject to ruling international steel price)*		10,000,000
Pipeline (site dependant)	Define specifications, purchase and delivery to site *(costs vary depending on distance from shore & international steel price)*	Range:	4,300,000 7,000,000
Transportation	Transportation of pumps and materials to site *(costs vary depending on distance from nearest port)*	Range:	1,500,000 2,000,000
Site works	Land works including site preparation, subcontracted	Range:	1,000,000 2,000,000
Commissioning	On site implementation and connection of all units *(Costs are site and weather dependent)*	Range:	4,500,000 7,700,000
Maintenance	Monitoring, evaluation and routine maintenance	Per annum:	750,000
Overheads	Project management, travelling and accommodation		2,500,000

- Costs exclude reverse osmosis units and other add-ons
- A mark-up of 15% still provides an average saving of 15% over the asset lifespan

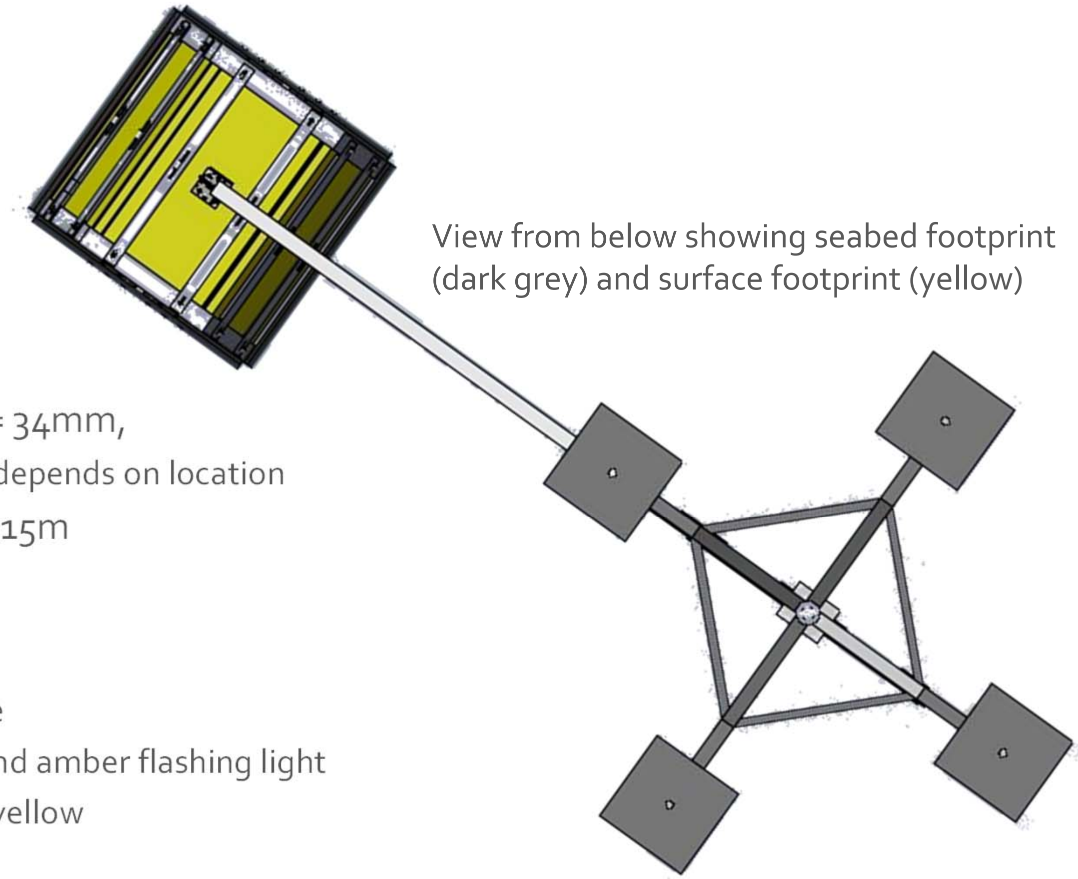
Average Project Cost

(500 kL pumped/hr, 6 MLD desal. plant)

Activity	Description of Work for Phase 1		Budget ZAR
EIA and Permitting	Complete requisite site EIA and ECC application for the proposed operations		Client responsibility
Site Preparation	Site Surveys and Detailed Engineering Design	Range:	2,500,000 4,000,000
Build Unit	Wave Powered Units FT10 construction - *4 pumps at R 2,000,000 each* *(subject to ruling international steel price)*		8,000,000
Pipeline (site dependant)	Define specifications, purchase and delivery to site *(costs vary depending on distance from shore & international steel price)*	Range:	4,300,000 7,000,000
Transportation	Transportation of pumps and materials to site *(costs vary depending on distance from nearest port)*	Range:	1,500,000 2,000,000
Site works	Land works including site preparation, subcontracted	Range:	1,000,000 2,000,000
Commissioning	On site implementation and connection of all units *(Costs are site and weather dependent)*	Range:	4,500,000 7,700,000
Maintenance	Monitoring, evaluation and routine maintenance	Per annum:	750,000
Overheads	Project management, travelling and accommodation		2,500,000

- Costs exclude reverse osmosis units and other add-ons – range R12m to R18m
- A mark-up of 15% still provides an average saving of 15% over the asset lifespan

Footprint FT4



View from below showing seabed footprint (dark grey) and surface footprint (yellow)

- Seabed:
  - Base = 16m²
  - Pipeline ID = 34mm,
    - Length depends on location
  - Depth 10 to 15m
- Sea Surface:
  - Buoy
    - 6m wide
    - Radar and amber flashing light
    - Canary yellow
- Horizontal plane
  - Space required per pump = 7 x 7

Why wave energy?

- Because waves originate far out to sea and can travel long distances without significant energy loss, power produced from them is much steadier and more predictable than other renewable sources, both day to day and season to season. This reduces project risk.
- Wave energy contains roughly 1,000 times the kinetic energy of wind, allowing much smaller and less conspicuous devices to produce the same amount of power in a fraction of the space.
- Power from ocean waves is produced around the clock, whereas wind velocity tends to die in the morning and at night, and solar is only available during the day in areas with relatively little cloud cover.
- Being much smoother and more consistent than wind or solar, wave power production results in higher overall capacity factors.
- Wave energy varies as the square of wave height, whereas wind power varies with the cube of air speed. As water is 850 times as dense as air, this results in much higher power production from waves averaged over time.
- Estimating the potential resource is much easier than with wind, making financial modelling more accurate, an important factor in attracting project lenders.
- Wave energy needs only 1/200 of the land area of wind and requires no access roads. Infrastructure costs are far less;
- Wave energy devices are quieter and much less visually obtrusive than wind devices, which typically run 50-100 metres in height plus the blades, and usually requiring remote siting with attendant high transmission costs.
- When constructed with materials developed for use on off-shore oil platforms, ocean wave power devices cost less to maintain than those powered by wind.

The ask

- **R20 million - secures 20%**
- **Requirements**
  - R3.0m - Upscale T3 model to FT4 model
  - R1.4m - Design and add power absorption function for varying sea conditions
  - R2.0m - Innovation for current pre-filtration mechanism
  - R3.2m - FT4 Demo site installation
  - R1.8m - Marketing and new IP registration
  - R3.4m to clear debt
  - R4.0m to buy out the TIA
  - R1.2m working capital

Future Developments

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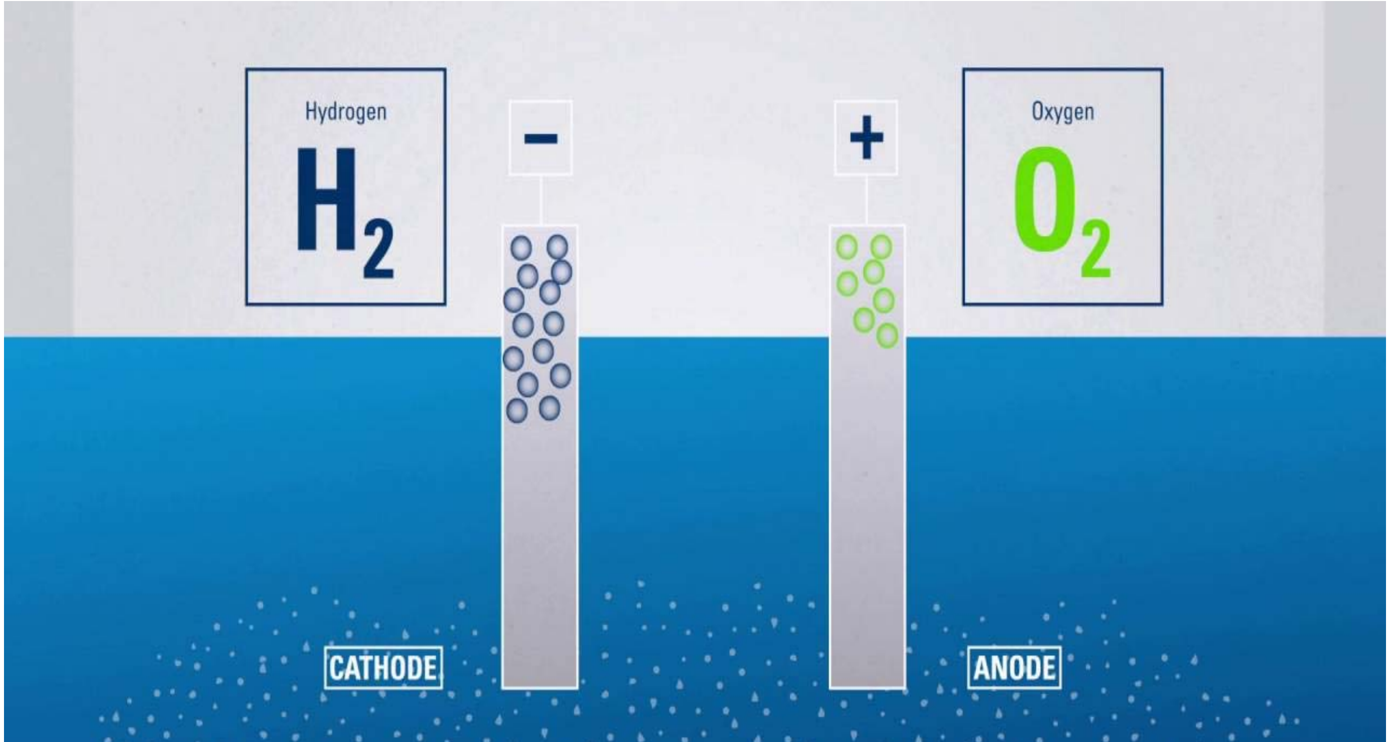
Applied wave energy?



Hydrogen and Oxygen separation through electrolysis of seawater.