PLUG INTO WAVE ENERGY

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WaveRoller panel moves back and forth following the movement of water.

Panel moves back-and-forth following the waves.

Power take-off converts the back-and-forth movement to electricity.

10 – 15 meters water depth.
OVERVIEW OF THE COMPANY

AW-ENERGY HAS DEVELOPED AND PATENTED A GROUND-BREAKING CONCEPT AND PRODUCT DESIGN, KNOWN AS WAVEROLLER®

PIPELINE OF COMMERCIAL PROJECTS WITH ACTIVELY ONGOING DEVELOPMENT IN 8 COUNTRIES ON 4 CONTINENTS

INDEPENDENT THIRD PARTY PERFORMANCE VALIDATION BY DNV GL AND ONGOING TECHNOLOGY CERTIFICATION BY LLOYD’S REGISTER

STRONG IPR: 33 WORLDWIDE PATENTS, + 34 PATENT APPLICATIONS CURRENTLY IN THE PROCESS

The inventor of the WaveRoller® Mr. Rauno Koivusaari runs today company’s offshore operations.
MEGATRENDS AND THE €500 BILLION MARKET OPPORTUNITY
IEA: “ELECTRICITY DEMAND INCREASES BY MORE THAN 40% TO 2030”

In total, some 7 200 gigawatts (GW) of capacity needs to be built in order to keep-up pace with increasing electricity demand while also replacing existing power plants due to retire by 2040 (around 40% of the current fleet).

Seven out of every ten units of additional electricity generation through to 2030 is projected to be low-carbon, bringing the share of total electricity generation from low-carbon sources from one-third today to nearly 45% in 2030.

Given the right market conditions – there is the potential to install +700 GW of ocean energy by 2050, creating 160,000 direct jobs and saving up to 5.2 billion tonnes of CO2.
THE LARGEST UNTAPPED RENEWABLE RESOURCE – 500+ GW POTENTIAL GENERATING CAPACITY

Same size market as wind & solar
- The wave energy market is foreseen to reach the same size as wind and solar markets
  - The investment into CAPEX alone is over €500 billion

Stable power production
- Waves fluctuate less than wind and sunshine throughout the day and year, thus providing a more stable source of power

Highly predictable electricity
- Far more predictable than any other intermittent source of renewable energy – highly reliable forecasts are available for up to 5 days ahead

* Highlighted countries have high wave energy market potential
PROJECTS SPEARHEADING THE COMMERCIAL ROLL-OUT

INDUSTRY FLAGSHIP PROJECTS SPEARHEADING COMMERCIAL ROLL-OUT

30MW+

Ireland  France  Portugal  Portugal  Chile  Mexico
WestWave  Wattmor  Ondas de Peniche  Swell  South Sea 1  Baja C
DEMONSTRATION SUCCESS
WaveRoller 300 kW demonstration power plant

- Three units, 100 kW each
- Grid connected to the Portuguese national grid
- Located in NATURA 2000 area
- Performance independently validated by DNV GL
Key facts, results and what they mean to customers and us

  - Real track record in the ocean operations
- Offshore operations time reduced from initial 12 to 3 hours per operation - benefits of learning-by-doing is clear
- Over 5000 fully operational test hours
- System efficiency and power output performance in line with the dry-land PTO test facility results
- System efficiencies and performance validated by Garrad Hassan (now DNV GL)
- Numerical model predictions in line with the open sea operational results and validated by Garrad Hassan (now DNV GL)

Cumulative generation [MWh]
1000h sample
100kW unit, Peniche

(28 August 2014 – 6 October 2014)
FIRST OF A KIND (FOAK)
UNLOCKING THE CUSTOMER PROJECT DELIVERIES
FOAK PROJECT OVERVIEW

Scope
• Technology verification and certification
• Supply chain development
• Service model development

= Manufacturing, delivery of 350 kW rated commercial WaveRoller unit (FOAK) and operations

Facts:
• 0.35 MW nominal capacity / 1 WaveRoller unit
• Installation in Peniche, the same site as project SURGE & SWELL/NER300
• Developed during 2015 - 2016
• Operations starting in 2017
• 0.6 GWh targeted annual output

Portuguese partners in global operations:

and currently more in negotiations...

Funded by:
3RD PARTY VALIDATED - BANKABLE TECHNOLOGY

WAVEROLLER LEADS THE TECHNOLOGY CERTIFICATION

WaveRoller has been evaluated in accordance with DNV RP-203 2011 Qualification of new technology and DNV-DSS-401, 2012 Qualification Management.
OPPORTUNITIES FOR PORTUGAL
### Projects Overview

**Portugal**

**Ondas de Peniche**

- 1 MW nominal capacity
- Installation in Peniche
- Developed during 2016-2017
- Full-scale operation 2018 onwards
- 1.7 - 2 GWh targeted annual output
- Project funding:
  - Candidate for Poseur grant funding

**Portugal**

**SWELL**

- 5.6 MW nominal capacity
- Installation in Peniche
- Developed during 2016-2019
- Full-scale operation 2020 onwards
- 11 - 12 GWh targeted annual output
- Project funding:
  - EUR 9 million EU NER300 grant
  - EUR 13.5 million private investments
  - EUR 1.5 million Carbon Fund grant

**Participation to projects:**

- Globally leading WaveRoller wave energy technology with internationally recognized utility company and industrial partners
- Internationally recognised Portuguese excellence and research centre WavEC
- Strong local Portuguese industrial supply chain with established track record of successfully delivering WaveRoller technology
PORTUGUESE ECONOMY BENEFITS IN SHORT- AND LONG-RUN BY PARTICIPATING IN WAVE ENERGY PROJECTS

Projects FOAK, Ondas de Peniche and SWELL

Total of \textbf{mEUR 40} investments

Continuous benefits for Portuguese economy

- Shipyards
- Component manufacturers
- Construction companies
- Coating
- Local communities
- Electricity utilities
- Fisherman
- Universities & more ...

Benefiters of growing wave energy industry
The charts show a representative sample of power output measured at grid connection point from 350kW WaveRoller. During 100 hours of continuous operation the generated cumulative output measured at grid connection point was 22.59 MWh.