Runde Island in Norway, OE device testing and promotion

WEC seminar, Lisboa

15 June 2009

Lars G Golmen
NIVA
and Runde Env. Centre

www.rundecentre.no
Outline of the presentation

• About the Runde Env. Centre
• Status for the *Maren* Wave Energy project
• The plans for the competence centre for ocean energies at Runde
• International cooperation
• Further plans & suggestions
Located on the NW coast of Norway, facing the NE Atlantic and Norwegian Sea.

• Significant wave exposure

• Exposed to the inflowing North Atlantic Current
The sea area around Runde

Nationally unique in terms of marine biodiversity and bioproduction – spawning areas, seabirds, flora/fauna, and wave energy resources
A new marine field research station at Runde, Norway

Also a regional centre and testing facility for ocean energy devices (waves, currents...)

Runde
M/V “Arisan”, 300.000 tdw bulk carrier, aground 2 km off Runde in 1992

Wintertime, only ca 10,000 birds perished

“The coastal area off Runde is the most vulnerable in case of oil spills on the whole coast…”

(DNV study, 2004)
Runde environmental centre ltd., est. 2004

Financial philosophy

- Business development
- Fisheries/resources
- Oil & gas
- Renewable energy
- "Green" practice & projects
- Environmental monitoring

Cooperation with businesses in the region

Energy from the ocean; Waves etc
The REC buildings and infrastructure

- A locally initiated, bottom-up initiative
- Not sponsored yet by government or national institutions (but complying with their political statements…)
- Mostly private funding, and bank loans.
- Public share (Municipality, County) 2 mill NOK; < 5%

**Owners & sponsors:**

Tussa kraft, Jets vakum, Jets Ecomotive, Rolls-Royce Marine, Olympic shipping, Vattenfall, Havila, Marin teknikk, Herøy Municipality, Møre County.

- **New sponsors & investors are welcome!**
REGIONAL INDUSTRY

Shipbuilding & marine technologies
Plus fisheries and fishing technology, strong in the region

"20% steel - 80% technology"
The building, June 2009

The land site, obtained 2006
Ocean energy at Runde

- Test site/trials
- Monitor environmental impacts
- Test anti-fouling means
- Excellent logistics support
- Many adequate vessels (offshore supply etc)
The seas around Runde are in motion!
Waves, hindcast time series

- \( P_{\text{wave}} = 0.5 \times H_s^2 \times T_p \)
- max \( P \): \( \sim 1300 \text{ kW/m} \)
- mid-P: \( \sim 50 \text{ kW/m} \)

Significant wave height[m]

- # points: 75972
- Mean \( H_s \): 2.72m
- Max \( H_s \): 13.2m

Dominating sea state: \( 1 \text{m} < H_s < 2 \text{m} \) (~29%)

- \( \sim 60\% \) of time, \( H_s > 2 \text{m} \)
- \( \sim 20\% \) of time, \( H_s > 4 \text{m} \)
From our study in 2007:

- **Future offshore WEC clusters**
- **Future WECs on/near shore**

- 50-100 kW individual WEC capacity
- 1,000 units deployed
- In offshore clusters, 100-200 units each (10-20MW)
- + Some shorebased WECs
- ≈ 2 TWh/yr
The *Maren* project

- Synergy between Vattenfall, Tussa kraft and REC
- Testing Seabased linear generator type WECs 2009-12 at Runde

**STAGES**

- Negotiations, 2007
- Site approval and clearance, 2008
- Deployments, 2009
- 10 MW cable and grid connection, 2009
- Testing, 2009-2012
- Likely expansion of activities, 2010…
Potensielle nye markeder

1995
Kraft: 80 TWh
Varme: 7 TWh
Ansatte: 8 000
Land: 1
Omsetning: ca. 30 mrd SEK
Resultat: ca. 5 mrd SEK

2006
Kraft: 175 TWh
Varme: 40 TWh
Ansatte: 32 000
Land: > 5
Omsetning: ca. 145 mrd SEK
Resultat: ca. 26 mrd SEK
Our region

Møre og Romsdal county

Norway

Geographic area 2.316 sq. km
46.000 inhabitants
(~20 inhabitants/sq. km, Norway ~15, EU ~115)
8 municipalities

Tussa
Tussa power station
Why Wave Power?

Policy
- Security of supply
- CO₂-abatement
- Job creation

Environment
- Renewable
- No CO₂-emission
- Low impact

Business
- Promising economy
- Large potential
- New market
The test site, according to the prestudy in 2008

Aalesund Cable Bridge Maaganes

Geitmaren
Maren, the wave demo project
a joint venture between Vattenfall, Tussa and REC

The present setup consists of:

- 2 units, 40 kW - Wave Energy Converters (WEC), equipped with respective damping load.
- 1 unit, Submarine Low Voltage Switchgear (LVMS) dimensioned for 2 WECs, with a built-in transformer of 22 kV of output voltage.
- 2 pieces of submarine power cables linking the switchgear with the WECs
- 1 piece of 22 kV - submarine cable approx. 2.5 km linking the switchgear with the electrical grid on-shore.
- 1 unit of measurement system and also 1(one) communication system installed inside the switchgear.
- Optical signal transmission cable
The formalities (2008):

1. Prestudy and site selection: April-May
2. Meetings with local stakeholders: April
3. Submitting the application to NVE: May
4. Evaluation at the NVE: June-July
5. Announcements
6. Publ hearing round: August-September
7. NVE post-processing: October-December
8. NVE issues the permit/consent: December

Total duration of siting and permitting process: 8-9 months
BATHYMETRIC
AND
SUB BOTTOM
SURVEY
RUNDE

EQUIPMENT USED DURING THE SURVEY

- Survey Vessel – “Nautilus Survey”
- SUBFIGHTER 7500- ROV system
- EM 3002- Multibeam Echosounder
- INNOMAR-Sub Bottom Profiler system
- Sonardyne Fusion acoustic positioning system
- Lodestar Ringlaser gyrocompass
- Topcon RTK GPS
- Reson Sound- profiler
- Seafloor Information System (SIS) MBES-logging software
- NaviPack survey software
- NaviScan survey logging system
- EIVA NaviEdit post-processing software
- EIVA NaviModel Terrain Modeling Software
Conflicts of interest

- Fisheries
- Recreation
- Shipping
- Infrastructures (like cables)
- Military activities
- Protected environmental areas
- Public concern and opinion
- Seascape
- Archaeology and heritage
Environmental impacts

- The scenic view
- Oil in the system
- Conditions on the bottom of the Sea
- The mooring and anchoring system
- Noise
Deploying the wave measuring buoy, January 2009

Deploying the cable and WECs: end of June 2009

Planning and pre-studies

Operation and monitoring

Consent from NVE

WEC Deployment

Seabased-MAREN-Runde

Bøye 1m x 3m

Max 100 m

50 m

Stellverk/ Sentral 8 ton

Generator 10 ton

Fundament, betong 10/30 ton

Rep/tau

Ei kabel

30-50 m

GOLinna
The transformer and cable connection house

(Photos taken June 2nd, 2009)

View towards the site
MAREN, next steps?
We are in negotiations with several developers
The REC role in the project

- Facilitators, make it happen
- Site developers
- Conducting pre-surveys
- Soliciting with stakeholders
- Conducting the EIA
- Managing public meetings
- Input to the permit application to NVE

Test phase, 2009 -:
- Providing shore facilities, boats
- Conducting environmental monitoring studies
- Assisting Vattenfall and Tussa at sea and onshore
- Informing generally the public (Tussa & Vattenfall handle official dissemination of technical matters etc)
**INFRASSTRUCTURE AND LOGISTICS**

*Demonstration and pre-commercial facilities*

- Lack of facilities and finance for transition to market

> Several recent initiatives for facilitating prototypes & demonstration:

<table>
<thead>
<tr>
<th>Country</th>
<th>Test Infrastructure</th>
<th>Max. Capacity (MW)</th>
</tr>
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<tbody>
<tr>
<td>Portugal</td>
<td>Pilot Zone</td>
<td>80 → 250</td>
</tr>
<tr>
<td>UK</td>
<td>EMEC</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Wave Hub</td>
<td>20</td>
</tr>
<tr>
<td>Ireland</td>
<td>Galway Bay</td>
<td>*</td>
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<tr>
<td>Denmark</td>
<td>Nissum Bredning</td>
<td>**</td>
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<tr>
<td>France</td>
<td>SEMREV</td>
<td>2</td>
</tr>
<tr>
<td>Spain</td>
<td>BIMEP</td>
<td>20</td>
</tr>
<tr>
<td>Norway</td>
<td>Runde</td>
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* Not grid connected  ** not specified
Regional competence centre for OEs

Preproject, Jan. - June 2009

Initiated by the County

Present Partners (more are welcome!):

- Herøy municipality
- M&R County
- Rolls-Royce
- Tussa kraft
- Vattenfall
- Jets Ecomotive
- NIVA
- Norw. Res. Council (observers)
- Others, associated

Deal with both children, the layman, and specialists
Competence centre elements…

Ocean energies
- Waves, many concepts, incl Maren
- Tidal, 2-3 concepts
- Seawater heat pump
- Ocean thermal (OTEC)
- Diffusive pumping
- Osmotic power
- Energy from sediments
- Marine bioenergy, algae

The building:
- ENOVA ”pilot house” project
- Energy saving, control systems
- Jets toilet and sewage system
- Sewage bioreactor

Other running projects: C2C sust. islands, waste processing, philosophy of sustainability
"DEMO" installations

Seabased

<table>
<thead>
<tr>
<th>WECs</th>
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<tbody>
<tr>
<td>SW heat pump</td>
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<tr>
<td>Cooling media reservoir</td>
</tr>
<tr>
<td>Ocean currents</td>
</tr>
<tr>
<td>Solar</td>
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<tr>
<td>Marine bio</td>
</tr>
<tr>
<td>Biogas</td>
</tr>
<tr>
<td>Windmill</td>
</tr>
<tr>
<td>The building</td>
</tr>
</tbody>
</table>

STORWAVE

Runde Miljøsenter
Proposed OTEC Platform (Lockheed-M)

12 TW continuously with minimum environmental impact, according to assessments.

A base load renewable, available 24 hours a day, year round

Can generate many useful by-products in addition to electricity

Can cool the ocean surface, thus preventing hurricane growth

Deep water upwelling can boost primary (algae) production, and Next Generation Fisheries
International collaboration

Partners

International Partners

Industry Partners

Public Partners

Hawaii Natural Energy Institute

AGS | AECOM

Sea Engineering, Inc.

oceanlinx

OPT

OCEAN POWER TECHNOLOGIES

Hawaiian Electric Company

Giving you the power

Maui Electric Company, Ltd.

Giving you the power
The Cradle to Cradle concept applied to islands in the North Sea Region

- An international project for innovation and C2C-solutions for water, energy and materials
- A cooperation of governments, island communities, research centers, educational institutions and companies

Interested or want more information?
Contact Province of Fryslân:

The partnership

The C2C project runs within the Interreg North Sea Programme
Runde wants to expand the international relations to promote & develop OEs and, modestly, make our contribution to the global efforts

You are very welcome to contact or discuss with us
post@rundecentre.no

End of presentation.
Thank you!

Lars G Golmen, oceanographer,
Norwegian institute for water research, NIVA, www.niva.no
gol@niva.no

http://www.rundecentre.no