Delivering Marine Energy
A host community’s perspective

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Why does Orkney want renewable energy?

To create sustainable employment and economic vitality!
The technology pathway

• First deployments at wave site:
  – Wave Roller & Pelamis 1 between 2003-5
• Focus moves to tidal site:
  – Open Hydro, piled and gravity base (2006/7)
  – TGL (2007 and onwards)
• Wave energy devices come again:
  – Aquamarine Oyster 1 (2009)
  – EON (Pelamis 2) (2010)
• More tidal technologies (2010)
  – Atlantis (2010)
  – Voith monopile (2010/11)
• Growing interest
  – Aquamarine Oyster 2 (2011)
  – Scotrenewables (2011)
  – Flumill (2011)
  – Hammerfest Strom (2011)
  – Scottish Power (Pelamis 2) (2011)
  – Seatricity (2012)
• 16 technology deployments involving over 20 permits, over 50 surveys and over 600 marine operations
### Education and employment

Over 200 people now employed for/studying marine renewables in Orkney

<table>
<thead>
<tr>
<th>Sector</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testing</td>
<td>25</td>
</tr>
<tr>
<td>Environmental</td>
<td>25</td>
</tr>
<tr>
<td>Shipping</td>
<td>69</td>
</tr>
<tr>
<td>Support</td>
<td>22</td>
</tr>
<tr>
<td>Developers</td>
<td>40</td>
</tr>
<tr>
<td>Students</td>
<td>20</td>
</tr>
<tr>
<td>Others</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>221</strong></td>
</tr>
</tbody>
</table>

Monthly wage bill £500k, at the moment 70% supported by EMEC related work, 15% by PFOW and 15% export markets
Who will be involved in future?

- Workforce of 1000 by 2020 ... or is it 2015?
  - Engineers 200?
  - Scientists 100?
  - Managers 100?
  - Administration 100?
  - Mariners 200?
  - Manual workers 200?
- Where from
  - 50% need previous relevant experience
  - 25% skills transfer
  - 25% new recruits
- We have 20% already
The reason that marine renewables has been so successful in Orkney is because the community has backed it with hard cash and commitment.

Total investment in marine energy over £200M

Orkney is helping make things happen!

**Orkneys cash investment**

- Harbours £20M
- Boats £12M
- Buildings £3M
- Cranes £2M
- Radar coverage £1.2M
- Data & research £1M
- Marketing £1M
- **Total to date** £40M
Local wind investment in Orkney

• 700 micro turbines
  – >3.5MW
  – € 6000/kW
  – 5kW units
  – €21M
  – Tariff €350/MWh
  – Capacity factor 40%
  – Payback for unit 5yrs

• 15 large turbines
  – 22,5MW
  – €2000/kW
  – 1500kW units
  – €45M
  – Tariff €125/MWh
  – Capacity factor 45%
  – Payback for unit 4 yrs
Growing generation capacity

2012 70% of Orkney’s electricity demand supplied from renewables

Output trackers
• www.oref.co.uk
• www.aquatera.co.uk
What infrastructure will we need and when?

What will this region need to deliver 1 GW of marine renewables capacity:

- Prototype/demonstration devices: 50 (Now-2014)
- Expanded/new ports: 3-4 (Now-2014)
- Assembly/maintenance yards: 2-3 (Now-2014)
- Work boats: 20-30 (Now-2015)
- Large purpose built vessels: 10 (Now-2015)
- Local workforce: 500-1000 (Now-2015)
- New houses: 300-600 (Now-2015)
- Expanded and new offices: 50 (2012-2015)
- Sub stations (off/onshore): 10-20 (2014/15)
- New 132kv connections: 50-150 km (2014/15)
- Converter stations: 2-3 (2016/17)
- HVDC grid connection: 2 (2016/17)
Who should own wave projects

Technology provider

Project developer

Energy market/Utility

Service provider

Host community
Why invest - what are the incentives

• Cheaper energy
• Less volatile energy prices
• Energy security
• Stimulus to local supply chain
• Return on investment
• Promoting green destination image
  – Carbon offsetting
• Personal commitment/interest
Who has the money?

• Customers pay for energy
• Utility accumulates capital/credit to invest in generation capacity
• Utility also buys energy from specialist energy providers
• Energy providers raise money from institutional and private investment with public support
• Public sector has some budget available for carbon transition
• Supply chain costs may out weigh technology costs
• Local communities can better understand investment risks, hold key to licensing
How much? - starting a 100MW+ wave project

<table>
<thead>
<tr>
<th>Preparation phase</th>
<th>Cost</th>
<th>Timescales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning</td>
<td>Euro 50k</td>
<td>Months 1-3</td>
</tr>
<tr>
<td>Project screening</td>
<td>Euro 150k</td>
<td>Months 2-6</td>
</tr>
<tr>
<td>Financial, Technical, Planning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIA scoping</td>
<td>Euro 50k</td>
<td>Months 6-12</td>
</tr>
<tr>
<td>EIA baseline studies</td>
<td>Euro 250k</td>
<td>Months 4-18</td>
</tr>
<tr>
<td>Technical feasibility study</td>
<td>Euro 100k</td>
<td>Months 12-18</td>
</tr>
<tr>
<td>Full EIA assessment</td>
<td>Euro 150k</td>
<td>Months 12-18</td>
</tr>
<tr>
<td>Submission of application</td>
<td>Euro 50k</td>
<td>Months 18-24</td>
</tr>
<tr>
<td>Licence negotiation</td>
<td>Euro 50k</td>
<td>Months 24-28</td>
</tr>
<tr>
<td>Finding technology partner</td>
<td>Euro 50k</td>
<td>Months 18 onwards</td>
</tr>
<tr>
<td>Public consultation</td>
<td>Euro 100k</td>
<td>Months 2,6,10,14 &amp; 20</td>
</tr>
<tr>
<td>Overall</td>
<td>Euro 1 million</td>
<td>28 months</td>
</tr>
</tbody>
</table>
Investment case

Planning
• Up front investment of €1M
• Pause points at €200k/6 months and €500k/12 months
• Local content could be 25%-50% of work
• Value to local economy €250k-500k

Execution
• 100MW farm would yield
  – €40M/yr @ 150/MWh; 30%
  – €65M/yr @300/MWh; 25%
• €3M/MW CAPEX; €20M OPEX/yr
• Payback in 15 years
  – @ €150/MWh; CP 30%)
• Payback in 7 years
  – @ €300/MWh; CP 25%)
• Local content €18M/yr capital and €10M OPEX = €28M/yr
Conclusion

• Maybe marine energy needs to motivate investment from local communities and customers directly as well as institutional finance – it seems it will all depend upon investment risk