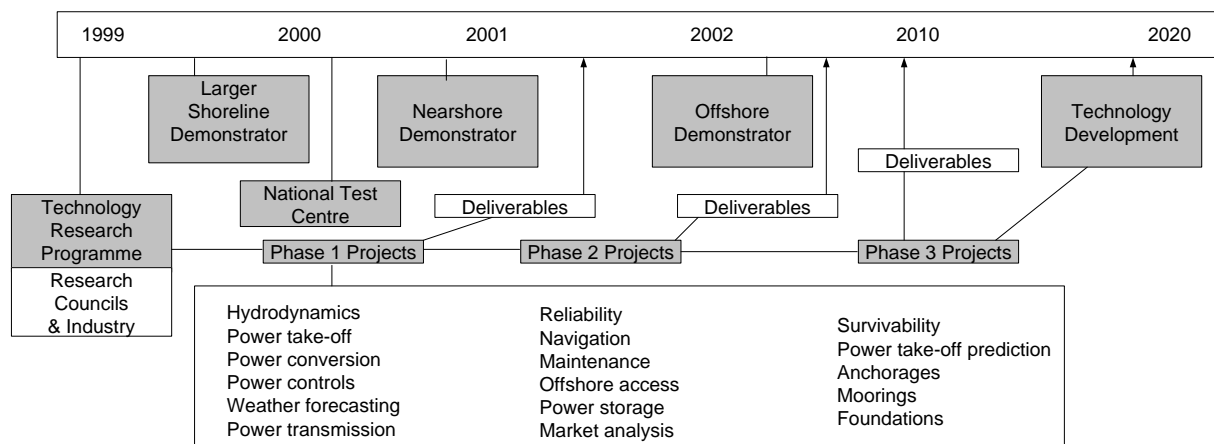


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| <b>REFERENCE</b>            | World Energy Council   |
| <b>Title:</b>               | Survey of Energy Resources – Wave Energy   |
| <b>Date:</b>                | 2001; 2004   |
| <b>Author:</b>              | John Griffiths (2001); Tom Thorpe (2004)   |
| <b>Funded by:</b>           | World Energy Council   |
| <b>Hard copy reference:</b> | ISBN: 0-08-044410-5  |
| <b>URL:</b>                 | <a href="http://www.worldenergy.org/wec-geis/publications/reports/ser/overview.asp">http://www.worldenergy.org/wec-geis/publications/reports/ser/overview.asp</a> (for 2004 Survey)  |
| <b>Date accessed:</b>       | January 2007   |
| <b>Web Format:</b>          | html   |
| <b>IEA topics covered</b>   |  |
| <b>Geographical focus:</b>  | Worldwide  |
| <b>Brief Abstract:</b>      | The World Energy Council publishes a Survey of Energy Resources every three years. The 2001 edition included wave energy and tidal barrages, but not tidal current energy. The 2001 chapter on wave energy, by John Griffiths, provides an excellent summary of the resource, the status of the technology at the time, and recommendations for the way forward in terms of R&D and commercial exploitation. |

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| <b>OUTPUTS</b>                                 |     |
| <b>Short Report?</b>                           | YES |
| <b>Major report?</b>                           | NO  |
| <b>Visualisations?</b>                         | YES |
| <b>Information held on dedicated software?</b> | NO  |
| <b>- which package?</b>                        |     |

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| <b>ARCHITECTURE</b>        |   |
| <b>Timescales used:</b>    | Short term – 1999-2004<br>Medium term 2004-2010<br>Long term - 2010 - 2020  |
| <b>Trends and drivers?</b> | YES   |
| <b>- list</b>              | <ul style="list-style-type: none"> <li>• Kyoto Treaty 1997</li> <li>• UK Review of Renewables 1999</li> <li>• Increased focus on Climate Change issues</li> <li>• The large increase in the price of oil in 2000 from the very low levels of 1998</li> <li>• Large wave resource</li> </ul> |
| <b>Enablers?</b>           | YES (see also 'Applied Research, below)   |
| <b>- list</b>              | <ul style="list-style-type: none"> <li>• greater willingness to engage by the financial community</li> <li>• more collaborative R,D&amp;D across device developers, manufacturers, and service</li> </ul>   |

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|   | providers to avoid duplication and waste. |
| <b>Performance measures/targets?</b>        | YES                                       |
| <b>- list areas</b>                         | See diagram below taken from document.    |
| <b>Mapping of RD&amp;D activities?</b>      | YES                                       |
| <b>Critical assessment of capabilities?</b> | NO  |



**Fig 1** WEC R&D Road-map for Wave Energy, 2001.

|                                   |           |
|-----------------------------------|-----------|
| <b>PROCESS</b>                    |           |
| <b>Methods used:</b>              |           |
| - Desk study?                     | YES       |
| - Consultation                    | NO        |
| - Interviews?                     | NO        |
| - Facilitated workshop(s)         | NO        |
| - Working groups/task force       | NO        |
| - Integrated Process              | NO        |
| <b>Stakeholders engaged:</b>      | NONE      |
| - University based researchers    |           |
| - Other public sector researchers |           |
| - Business – technology           |           |
| - Business – other                |           |
| - Government - energy             |           |
| - Government – SET                |           |
| - Government - other              |           |
| - NGOs                            |           |
| <b>No of people engaged:</b>      |           |
| <b>Budget (if known):</b>         | Not known |
| <b>Commitment to re-visit?</b>    | no        |

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| <b>ACTIONS IDENTIFIED</b>              |                        |
| List of actions?                       | YES                    |
| Actions listed according to timescale? | YES – see figure above |
| Actions prioritised?                   | YES                    |
| Sequencing/dependencies identified?    | YES                    |

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| <b>Responsibility for actions identified?</b> | NO   |
| <b>Types of actions identified:</b>           |  |
| <b>- Basic research?</b>                      | YES  |
| <b>- list areas</b>                           | <p>Griffiths states that there are a large number of topics to be tackled; he lists a few of them for illustrative purposes:</p> <ul style="list-style-type: none"> <li>• moorings – long-term fatigue of lines and connections;</li> <li>• standard couplings for quick-release and re-attachment of moorings and cables;</li> <li>• standard flexible electrical connectors;</li> <li>• reduced-cost production of cables, construction and laying offshore;</li> <li>• modelling of arrays of multiple wave energy devices;</li> <li>• real-time wave behaviour forecasting;</li> <li>• environmentally acceptable fluids for hydraulic systems;</li> <li>• direct-drive power generators;</li> <li>• power-smoothing systems;</li> <li>• electrical power storage techniques and devices</li> </ul>  |
| <b>- Applied research?</b>                    | Recommendations to bring the cost of wave power down to 2-3p/kWh   |
| <b>- list areas</b>                           | <ul style="list-style-type: none"> <li>• the ability of developers, manufacturers and installers to engineer-out cost from devices, especially as greater numbers are manufactured and deployed in arrays;</li> <li>• the commitment of governments and local authorities to streamline planning and regulatory processes;</li> <li>• the development of suitable approaches to grid connection, both for smaller "embedded" supplies and major power sources. This requires governments, electricity distributors and the financial community to collaborate in new ways;</li> <li>• the flow of innovation from R&amp;D on more cost-effective materials, design and construction methods;</li> <li>• mechanisms being made available (under national electricity regulation regimes) to support specific emerging technologies with access to long-term contracts and/or to include wave power in capital grant mechanisms while the technologies mature;</li> <li>• the ability of the wave power industry to show good practice in standardised independent testing and performance assessment methods from an early stage;</li> <li>• the willingness of the financial community to recognise the key role of renewable</li> </ul> |

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|  | energy technologies (including wave energy conversion) as a significant future proportion of the energy balance and to seek positively to invest into it. |
| <b>- Development &amp; demonstration</b> | See Figure of Roadmap above   |
| <b>- list areas?</b>                     |   |
| <b>- Other types of action?</b>          | See 'Applied Research', above   |
| <b>- list other types</b>                |   |
|  |   |