

Appendix 2:
Wave Energy Network Connection Point -
Site Evaluation and Selection Report

WAVE ENERGY NETWORK CONNECTION PROJECT

SITE EVALUATION AND SELECTION REPORT

EXECUTIVE SUMMARY

JUNE 2008

Report No. 4M006-R1



Site Evaluation and Selection Report

Executive Summary

1 Introduction

Ocean Energy, as a source of renewable energy, has been the subject of ongoing research and development over the past few decades. In recent years prototype devices have been proposed and developed by a number of ocean energy companies internationally and in Ireland. These devices (Wave Energy Converters) are been designed to operate in different wave environments and at different depths.

Following completion of a consultation process that had begun in 2002, the Marine Institute and Sustainable Energy Ireland submitted a jointly developed Ocean Energy Strategy for Ireland (1) to the then Department of Communications, Marine and Natural Resources.

The rationale for seeking to develop a network connection point to which full size pre-commercial wave power converters could be coupled during their early stages of development is outlined in the report and is shown to form a key part of the Ocean Energy Strategy for Ireland.

2 Principal components

Successful development of a potential ocean energy test site requires that a number of criteria are satisfied by each of the candidate sites. The principal components which the Irish Wave Energy Test Site (WETS) is intended to have are listed below,

- The site should be located in an open ocean location off the West coast of Ireland.
- A maximum generating capacity of 5MW should be accommodated as permitted by the Commission for Energy Regulation (CER).
- A water depth range of between 50m and 100m should be available. (It is envisaged that a provision for nearshore devices in shallower water depth could also be accommodated if necessary).
- Appropriate logistical support should be available locally (Logistic support facilities and shelter within reasonable distance).
- A network connection at medium voltage level. The relative extent and cost of upgrading the local electricity network to accommodate power inputs from the site should be taken into account.

These principal components translate into the following ideal requirements for a WETS in Ireland. It is envisaged that ideally the Irish site should have;

- Deep water close to the coast with a high energy level

- A non rocky seabed to facilitate cable burial and anchoring (some nearshore devices may require a hard seabed substrate for anchoring)
- Good proximity to a well equipped marine support base
- Good proximity to sheltered waters
- Good proximity to the existing electrical network
- Good road access
- Good central operating base accommodation
- Sheltered location for bringing cables ashore
- Low environmental sensitivity and impact on other stakeholders

It was recognised that the decision making process had to take place subject to numerous constraints and that the process itself would probably reveal more issues to be addressed.

Briefly these included:

-Technical Issues

- The need to cater for depths in the range 50 – 100m as close inshore as possible.
- The need to avoid extensive rocky sea bed areas.
- Electrical connection issues.
- Cable landing issues (trenching or horizontal directional drilling)

- Environmental / Planning Issues

- The need to recognise environmental constraints such as designated marine and terrestrial areas (CSACs, NHAs, pNHAs, SPAs and potential protected habitats such as subtidal and intertidal reef structures) and to avoid or minimise potential impact on such sites
- The related issue of planning permission where applicable to land side development.
- Recognition of stakeholder issues that would only arise after a site had been selected.
- Keeping the scale of operations at a level that would minimise environmental obligations and overall cost.

- Regulatory and Legal

- The level of interaction likely to be necessary between the several agencies jointly involved in permitting in a novel technological area e.g. Commission for Energy Regulation, Local Authorities, Coastal Zone Administration Division.
- Strategic Environmental Assessment

- Social

- The need to establish realistically the strength and aptitude of engineering and marine services likely to be available in the support harbour.
- Ultimate attitude of land owners, fishermen and people living near the sites or support base.

3 Preliminary site screening

A preliminary site screening process showed that a degree of compromise would be necessary, particularly as the investment level available for a test site is likely to be much smaller than could be justified for a larger scale commercial development.

In order to progress the work in the absence of major budgetary provision, initial consultations were held with potential users within Irish Ocean Energy Industry Forum and were also informed by participation in meetings at EU and International level, including with EMEC. (24-28)

While the site is primarily intended to facilitate testing under Irish conditions (resource levels, exposure, network characteristics) and the development of ocean energy technology in Ireland, it is not intended to preclude the testing and demonstration of converters developed elsewhere subject to compliance with an appropriate test site Access Agreement.

Detailed selection criteria were agreed between the Marine Institute and ESB International as part of a consultative process on the project. The views of prospective site users and researchers were taken into account in this consultation (including the addition of particular sites to the original list). The general site properties used in characterising and ranking the respective sites were assessed and input into the evaluation process. An inevitable feature is that compromises have to be made as no 'perfect' site emerged from the process.

The basic technical parameters upon which the preliminary technical assessment was prepared are summarised in Table 1.0 below. The wave energy resource characteristic for a given site is fundamental to its energy potential and hence its viability and commercial attractiveness of the area. Factors such as capacity and distance to nodes on the electrical network have a significant bearing on connection cost.

The sites were initially selected on the basis of the energy resource levels implied by the Accessible Wave Energy Resource Atlas for Ireland (2005), inspection of Admiralty charts and assessment of the electrical network. The sites considered were Sybil Head, Co. Kerry; Goleen Bay, Co. Clare; Annagh, Co. Mayo; Slyne Head, Co. Galway; Bolus Head, Co. Kerry; Slea Head, Co. Kerry and Bray Head, Co. Kerry. Three sites were not subject to submarine geological survey but interpretation of the Admiralty chart data was used to evaluate the sea bed on a preliminary basis, (Figure 1).

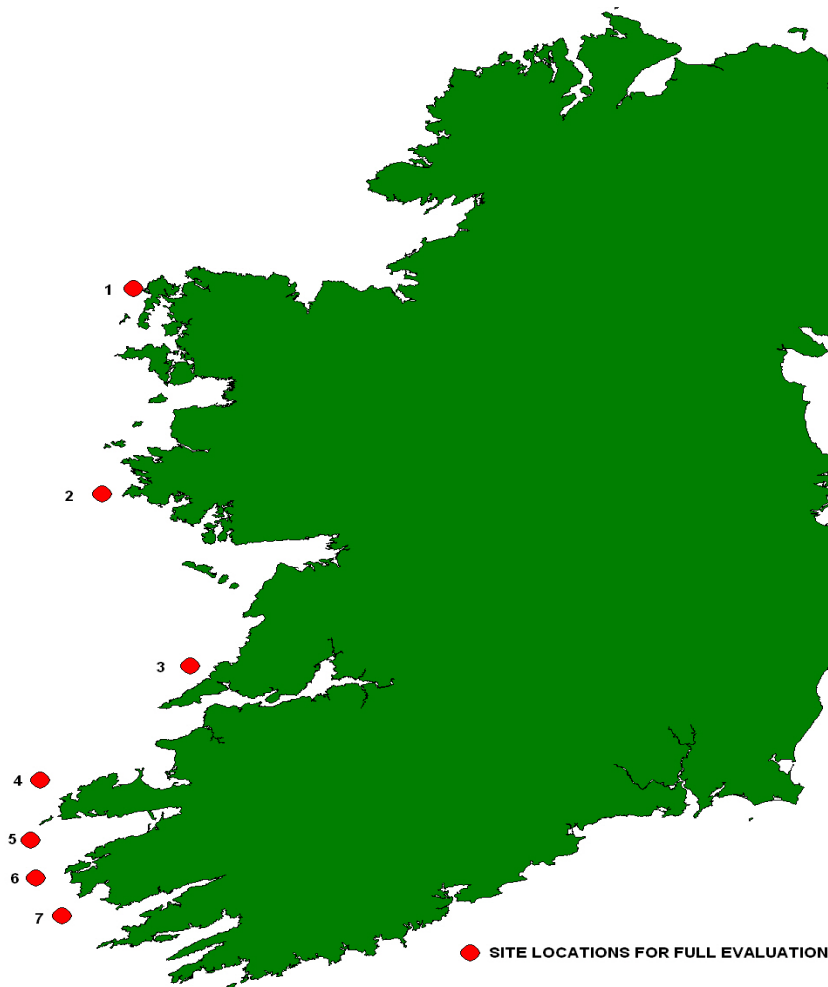


Figure 1: Candidate Site Location for Site Selection and Evaluation Study

The technical information associated with the sites in the following table is factored into the ranking methodology. The characteristics of the individual sites are assessed under technical criteria detailed below in Table 1.

| |
|--|
| • Mean annual theoretical wave energy resource |
| • Suitability of seabed for cable laying and burial |
| • Suitability of seabed for plough anchor moorings |
| • Profile of seabed to seaward of test site |
| • Absence of overfalls in projected mooring area |
| • Summary of tidal currents in projected mooring area |
| • Distance from 90m depth contour to cable landfall |
| • Distance from 60m depth contour to cable landfall |
| • Cable landfall exposure |
| • Cable landfall ground conditions |
| • Cable landfall road access |
| • Distance to RIB-suitable pier/slip from 90m contour |
| • Distance to RIB-suitable pier/slip from 60m contour |
| • Distance to nearest marine traffic zone |
| • Distance to nearest deepwater port |
| • Port Facilities |
| • Cost of upgrading local electrical network |
| • Capacity for expansion (network perspective) |
| • Submarine cable costs (Mobilisation/supply and lay including protection) |
| • Planning and environmental considerations (SAC, SPA, NHA) |
| • Road access |
| • Air access |
| • Marine access |
| • Distance to nearest meteorological station |
| • Navigation and maneuvering hazards |
| • Existing markers, lights, beacons and their sphere of influence |
| • Availability of planned or existing wave measurements |
| • Availability of planned or existing tidal measurements |
| • Dry dock capacity |
| • Base availability/vehicle parking/access |
| • SAR |
| • Skilled labour availability |
| • Archaeology |
| • Conflicting sea uses |
| • Decompression chamber access |

Table 1 – Technical Criteria

The Environmental designations which highlight the relative vulnerability of the landfall sites are outlined in Table 2.

| Site Location | SAC | SPA | NHA |
|------------------------|------------|------------|------------|
| Annagh Co. Mayo | Yes | Yes | Yes |
| Bolus Head, Co. Kerry | Yes | No | Yes |
| Bray Head, Co. Kerry | Yes | Yes | Yes |
| Goleen Bay, Co. Clare | No | No | No |
| Slea Head, Co. Kerry | No | No | Yes |
| Slyne Head, Co. Galway | Yes | No | Yes |
| Sybil Head, Co. Kerry | No | No | Yes |

Table 2 – Environmental Designations

From an environmental perspective the landside designations of Goleen Bay were most favourable as is evident from Table 2 however a number of other technical criteria ruled out this site, including seabed topography and geology. In general most regions along the West coast of Ireland had landside environmental designations associated with them of varying extents. In most cases these designations do not preclude development but would require detailed impact assessments to inform the decision making process, i.e. Appropriate Assessments.

Seven primary sites were assessed as indicated in Figure 1 and a scoring matrix was used in the evaluation process to rank the candidate sites. Seabed quality emerged as a key determinant during the project as the presence of an irregular rocky bed across the transition from beach to operating depth was an inhibiting factor at some otherwise attractive locations. The ranked scoring of the candidate sites is listed in Table 3.

| Ranking | Site Name | Ranked Site Scores |
|----------------|------------------------|---------------------------|
| 1 | Annagh Head, Co. Mayo | 374 |
| 2 | Bray Head, Co. Kerry | 335 |
| 3 | Goleen Bay, Co. Clare | 334 |
| 4 | Sybil Head, Co. Kerry | 327 |
| 5 | Slea Head, Co. Kerry | 303 |
| 6 | Bolus Head, Co. Kerry | 298 |
| 7 | Slyne Head, Co. Galway | 291 |

Table 3 – Final Results

4 Conclusion

Annagh Head, Co. Mayo is considered to be the most suitable site as a result of the site evaluation and selection process.