The Development of Alderney's Tidal Resource

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Abstract

A large scale commercial tidal power station which could be a world first is to be developed from the large tidal resource in Alderney's waters. Alderney, the third largest Channel Isle, owns its own territorial waters out to the 3 mile limit and has its own government which has enabled it to establish a one-stop, robust consents and licensing procedure to exploit the resource. The Alderney Commission for Renewable Energy was formed specially to oversee and regulate the development of Alderney's renewable energy resources and to ensure an appropriate financial benefit to the Island from their exploitation. Detailed conceptual work by the Commission, a local company, Alderney Renewable Energy Ltd (ARE), and the tidal device developer, Open Hydro, has led to an agreement for ARE to exploit 48 square miles of the territorial waters with a resource of several GW. A first stage is planned to deploy Open Hydro turbines to supply 285 MW to the nearby French grid on the Cotentin peninsula. The remaining territorial waters out to 3 miles and the waters beyond are available for other schemes

Keywords: Alderney Tidal Project, Licensing

1 Introduction

The paper recounts from the perspective of a consents/licensing authority the historical development of a major tidal power station project in the waters of the island of Alderney

2 Background

Alderney is in the Bailiwick of Guernsey in the British Channel Islands. It is approximately 3.5 miles long and 1.5 miles wide and situated 12 miles from the northern end of the west coast of the French Cotentin peninsula with Cherbourg another 12 miles along the northern French coast, Fig 1.

There are fast tidal flows on all its sides with the Alderney Race a notable stretch of water that extends from the Island's east coast to the French peninsula and then along the Island's southern coast. Some work has been published [1-2] on the tidal energy in specific locations in the Island's waters based upon British Admiralty tidal data but the available resource has not been accurately assessed and will be dependent on many environmental and technical issues. It is believed to be many GW out to the 12 mile limit and the present intention is that the resource will be fully established by a combination of detailed surveys and experience from a planned progressive development.

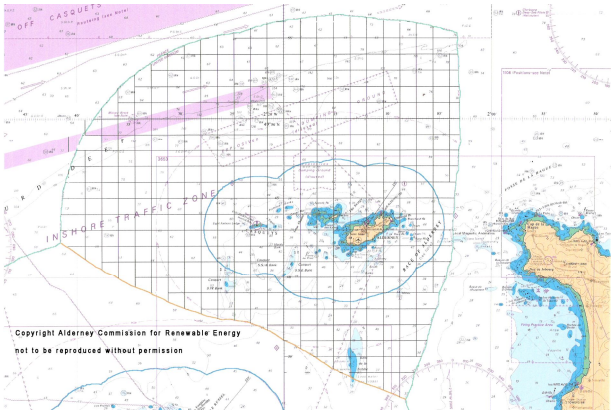

Fig 1: Alderney's location with the 3 and 12 mile limits

In 2003 a local group of entrepreneurs conceived a project to exploit the tidal resource which led to the formation of a local company, Alderney Renewable Energy Ltd. (ARE) to propose and develop such a project and then to the formation of a Commission, the Alderney Commission for Renewable Energy to oversee and regulate the development of all the Island's renewable energy resources with appropriate benefits to the Island. Regulation covers in particular Health and Safety provision and protection of the environment.

The Island is fortunate in owning the seabed beneath its territorial waters out to the 3 mile limit and in having its own elected Government, termed "The States", which enabled it to form the Commission and thereby establish a one-stop robust consents and licensing procedure for tidal and wave power exploitation.

A variety of local factors are relevant to any development. The Island's energy supply is at present dependent solely on oil. Diesel engines are used for electricity generation with a peak demand of approximately 1.5MW and with a projected demand for a completely electric island of 12MW. It follows, an export market is essential for any development to be viable. The only harbour is small and uncomfortable and even unsafe on occasions in north easterly winds. Relevant commercial activities include fishing by a small fishing fleet, world-renowned sport fishing, recreational boating and a significant level of tourism. Finally, there are important environmental and archaeological features, notably:-

- areas of open countryside and coastal paths
- a Ramsar site covering waters to the north west
- a variety of marine fauna and flora
- two colonies of gannets, one of puffins and some seals
- an Elizabethan wreck, half-mile off the north-eastern shore

and,

- coastal sites of archaeological importance dating back to Roman occupation and including Victorian and German World War II fortifications.

An early decision was that for at least initial schemes, there should be no major electrical installations on the Island in the form of sub-stations, power lines or power-conditioning plant except that required for the Island's own power supplies. Also all equipment deployed in the sea should at least initially be at least 20m below the surface to minimize visual impact and inconvenience to shipping and recreational boating with the exception of a few platforms for power aggregation and transmission to market with perhaps in addition some power conditioning.

The formulation of generic licensing together with the specific licence for the ARE project took four years to November 2008. The Commission decided during that time that a Strategic Assessment was required to cover strategic environmental, technical/economic and social/economic factors and one was accordingly obtained from AEA Technology plc. It helped clarify various matters, reinforce Commission views and gave the States an independent overview of the advantages and potential consequences of exploitation of the Island's tidal resource.

3 Licensing

In the formulation of the licensing arrangements the Commission had to take into account a variety of factors and objectives. No examples specifically devoted to tidal power were available and the course adopted was to adapt with some major alterations, the UK Crown Estates Model for Offshore Wind Farms. The main features in the formulation were:-

- an effective one-stop robust consents procedure
- coverage of a range of activities including in particular cable laying, installation of generation devices, power aggregation platforms and the generation and transmission of electricity
- the release of survey data obtained by licensees to the Commission
- assurance that the potential licensee has adequate finance
- an appropriate financial return to Alderney for the exploitation of its waters which would include minimum payments to cover poor performance by licensees
- termination of licences for in particular lack of finance, resource development or non-payment of fees
- lengthy licence periods to attract the large investment sums required
- effective harvesting of the resource which would keep pace with engineering advances expected for this developing technology
- a good standard of engineering assured by certification

and,

- a decommissioning plan with adequate financial provision which would include coverage for licensee bankruptcy.

An early action by the Commission was to divide Alderney and its waters within the 3 mile limit into 99 blocks each with, in general, an area of 1 square nautical mile as specific identifiable sites. 96 of these blocks were nominated for possible future licensing irrespective of their suitability for resource exploitation with existing or envisaged technology: in fact a significant number include features such as areas of shore, shallow patches or rocks which would require major engineering innovation. Fig 2

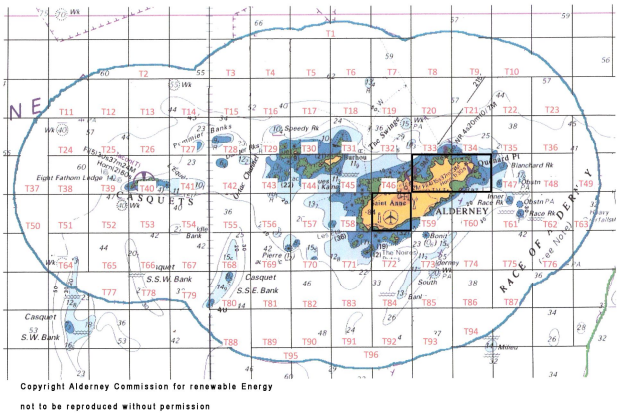

Fig 2. Block arrangement within the 3 mile limit

Generic licence arrangements which could be tailored to particular schemes including the ARE project were finalised in 2008. The potential licensee has first to obtain a licence which gives rights to carry out surveys in specific blocks and subject to obtaining later an appropriate Operating Consent, rights to install

and operate equipment in specific blocks. An Operating Consent has to be obtained for the development of each block singly or in a group according to a plan for the whole concession. This arrangement is well suited to an infant technology like tidal power in that development can proceed in stages with the progressive application of experience in a series of Operating Consents within a major concession.

The consents requirements have been defined in a guide. They are not onerous for licences but are detailed for Operating Consents for which they have to include:

- the developer's HSE policy
- an Environmental Impact Assessment which must satisfy the specified Statutory Consultees, namely
  Alderney Harbour Authority
  Alderney Fisheries Officer
  Alderney Sailing Club
  Alderney Fishing Boat Owners Association
  Alderney Diving Club
  Alderney Wildlife Trust
  Alderney Maritime Trust
  Alderney Society (archaeology)
  and should include an environmental monitoring programme to embrace for example the influence of development on flora/fauna, seabed movement and possible electromagnetic field effects on the behaviour of fish
- a detailed equipment deployment plan covering generation devices and seabed cabling
- a decommissioning plan

and,

- certification of all engineering works. Det Norske Veritas (DNV) has been nominated by the Commission as the preferred Classification Society although exceptionally certification by some other specified Societies can be considered.

Finally, any on-shore works have to be approved by the Island's Building Development Control Committee which is a States body responsible for all domestic and commercial development above the high water mark.

The financial returns to Alderney are achieved by a combination of licence fees and a tariff on actual or notional minimum generation sales.

Conditions to assure effective harvesting of the resource as technology and knowledge advance include a required time schedule for development of the concession to be negotiated with the licensee and regular mandatory reviews of experience from developed blocks and engineering developments to promote thereby the deployment of the most efficient devices in the most efficient manner.

The reviews update assessments of the available resource, the minimum generation level for each block, sales tariff and consider the re-equipment of blocks.

4 The Project

The ARE project evolved over 4 years into the present licence scheme for the development of a large scale commercial tidal power station.

The commission decided at an early stage that the financial risks had to be borne wholly by the developers, none by Alderney. It was appreciated that whilst ARE and the Commission had knowledge in many fields, which in time proved invaluable, there was initially no specific experience of tidal power and that ARE would have to acquire the capability which should be demonstrated by the achievement of a generation target. After a year's work and negotiation by the Commission and ARE a 5 year agreement was signed between ARE and the States at the end of 2005 (the 2005 Agreement), the main features of which were:

- ARE had exclusive rights to survey all the waters out to the 3 mile limit for the five year term of the Agreement
- a generation target was set of 500MWH within any 6 month period within the term of the Agreement
- certification of the engineering associated with the generation target had to be obtained with a DNV Feasibility Certificate

and,

- successful attainment of the generation target would give ARE the right to apply for a licence to exploit commercially 48 blocks (i.e. 50% of the nominated waters out to the 3 mile limit) together with the right to chose these blocks within a specific time, although the States could conditionally decide at that point against any commercial exploitation.

It was envisaged initially that the target generation would be achieved in a small experimental array of approximately 4 turbines from different device developers. To this end several device developers made presentations to ARE and the Commission to no effect, until it was agreed Open Hydro would undertake the task with just its turbines. The company was to carry out its initial device testing at EMEC and therefore the target generation was to become a pilot plant for evaluation under Alderney conditions. A site for the array was identified at the eastern end of the Swinge, the channel immediately north of Alderney. However detailed survey work of the site established it was not ideal and another more suitable was chosen in the Race.

In 2008 Open Hydro was granted consent approval to deploy and operate the pilot array. However coincidentally the strategy of the project changed from early technical validation to the need to secure a market for commercial power. The technical testing of the turbines at EMEC had gone well. Turbine base deployment tests had been carried out successfully with a specially built barge, a trial connection had been made to the Orkney grid and the DNV certification was proceeding well. In contrast market availability seemed limited. The domestic Island market was too small and the UK market, although massive, was unattractive because it required a large capital investment for a long export cable and UK Renewables Obligation Certificates (ROCs) were currently unavailable for power generated in and transmitted from the Channel Isles. In this situation France being near at hand was the obvious market but the grid capacity was limited in the Cotentin peninsula. In 2008 an opportunity came to ARE to secure 285MW of grid capacity in the peninsula and therefore with the changed project strategy the Commission agreed to an ARE proposal to abandon the pilot test and the 2005 Agreement and to proceed directly to the development over a 25 year period of a power station in 48 blocks of ARE's choice with the first stage of 285 MW to France. The States also agreed with the proposal with a decision not to exercise its option against exploitation. Accordingly a licence to the above effect was granted to ARE in November 2008.

Priority tasks now to be started are detailed surveys, to establish, firstly the current marine ecology as a base to assess the effects on the environment of the development and secondly the potential energy resource and possible cabling routes, after which major decisions have to be taken which include in particular:

- the designation by ARE of the 48 blocks they are to develop
- the development schedule for the blocks

and,

- the choice of generation device(s). It is accepted that at present Open Hydro turbines should be suitable but that ARE might propose other machines nearer the time of deployment if they are available, have advantages and satisfy the required criteria.

Alderney will be able to accommodate administrative functions and be a base for small boat activities, but lay-barges and major engineering work involving for example the assembly and maintenance of turbines will have to be located at a convenient port with the necessary industrial facilities and non tidal deep water berths, such as Cherbourg.

5 Further Development

A large resource will still remain available in the non-designated blocks in the 3 mile limit and in the waters beyond. Its exploitation will probably require for some blocks the development of further technical capability and would be dependent on market availability which would be radically improved by an expansion of the local French grid, ROC assignment to Channel Island generated power transmitted to the UK or a reduction in power generation cost to that for conventionally generated power.

Alderney's tidal resource extends beyond its waters to the neighbouring waters of the other Channel Isles and France. There is naturally interest in the development of these other waters and the Commission is promoting its view that there would be major benefits if the relevant administrative bodies in all the Channel Isles (and perhaps France) co-ordinated their consents and licensing to avoid complicating anomalies and to ensure effective overall development.

Acknowledgements

The project has progressed to the present stage because of major contributions by approximately 15 members, past and present, of the Commission, States, ARE, and Open Hydro.

References

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[2] A Owen. Tidal Stream Resource Assessment for the Channel Isle Area. The Robert Gordon University, 2005.