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Acronyms

Acronym	Description
ADCP	Acoustic Doppler Current Profiler
AEP	Annual Energy Production
AR	Allocation Round
CAPEX	Capital Expenditure
CfD	Contract for Difference
DECEX	Decommissioning Expenditure
DEVEX	Development Expenditure
EMODnet	European Marine Observation and Data Network
FiT	Feed-in Tarrif
GIS	Geographic Information System
IRR	Internal Rate Of Return
LCOE	Levelized Cost Of Energy
NH	Normandie Hydroliennes
O&M	Operations and Maintenance
OPEX	Operating Expenditure
ORE Catapult	Offshore Renewable Energy Catapult
PPA	Power Purchase Agreement
PPE	French Government's Multiannual Energy Programme
RMS	Root Mean Square
ROV	Remotely Operated Vehicle
SAC	Special Areas of Conservation
SCI	Special Conservation Interest
SER	French Renewable Energy Trade Association
SPA	Special Protected Area
SSSI	Site of Special Scientific Interest
TIGER	Tidal Stream Industry Energiser Project
TSE	Tidal Stream Energy

Executive Summary

The Raz Blanchard, otherwise known as the Alderney Race, is a stretch of water between the Island of Alderney and the French mainland. It has a long-standing reputation as a location of significant tidal energy potential and has been the focus of numerous academic studies.

There is a significant commercial demand for establishing tidal stream farms in the area. As a part of the Tidal Stream Industry Energiser (TIGER) Project, two enterprises, namely Normandie Hydroliennes and HydroQuest, are developing tidal arrays at different sites in Raz Blanchard. The primary objective is to install multi-megawatt commercial arrays at both locations, which will serve as a starting point for building more extensive farms generating hundreds of megawatts in the future.

This work is being supported by the TIGER Project, a €48.4m Interreg-funded project assisting developments at six sites in the Channel region between the UK and France.

This report aims to assess the potential of the Raz Blanchard region for a commercial TSE array. This report describes the site characteristics and quantifies the deployment potential across the Raz Blanchard region. The report targets prospective project developers, investors, policymakers and suppliers who would benefit from an updated holistic and third-party evaluation. Our study consists of the following aspects:

- *A Literature review*: including descriptions of the site's history, the main stakeholders, regional support and schemes and the flow conditions.
- *A Geographic Information System* (*GIS) analysis*: to assess the size of the commercial farm that could be built, identify potential impacts on other sea users and show the potential barriers and geographical aspects that must be considered.
- *A techno-economic analysis*: to estimate the levelized cost of energy (LCOE) that a representative farm at the site could achieve and the CfD strike price that would be required to encourage project development and private investment. We considered optimistic and pessimistic industry cases and applied learning rates to gain insight into the trajectory of LCOE and appropriate CfD strike prices over time.

From our analysis, we provide the following insights into the site:

- The Raz Blanchard region has strong local currents. There do not appear to be any significant conflicts with other sea users as the site and the surrounding area have little to no significant fishing or commercial shipping activity. The exception could be environmental designation areas, as the site is situated within a Special Conservation Interest (SCI) area and the presence of Special Protected Areas (SPAs).
- The Raz Blanchard site has a good range of depth, allowing for greater flexibility in the types of technology deployed in the area, including both fixed-bottom and floating devices. The site is also suitable for next-generation larger rotor devices. Moreover, shallower waters closer to the coast could be suitable for smaller devices or demonstrators.
- The techno-economic assessment considers two hypothetical tidal farms example; Phase 1 (132MW) and Phase 2 (264MW):

- Phase 1: by 2030, our model indicates that an LCOE of £98.7 – 149.8/MWh could be achieved for a 132MW farm of 2MW devices, with a central estimate of £118.4/MWh.
- Phase 2: by 2033, our model indicates that an LCOE of £95.3 – 143.8/MWh could be achieved for a 264MW farm of 2MW devices, with a central estimate of £111/MWh.

- It should be noted that the analysed farms' capacities are hypothetical and idealised, purely based on the area as indicated by the GIS. In reality, the site's challenging physical characteristics, particularly the uneven bathymetry, may limit the capacity of deployment.

To summarise, our analysis shows that the Raz Blanchard region has great potential for a commercial array that could provide meaningful amounts of predictable power into the grid. However, a coordinated lobbying effort should be initiated, working with industry groups and local companies to drive for the government to adopt regular auctions for tidal energy projects. This can provide the necessary incentives for developers to invest in the site and help accelerate the pace of development. Additionally, engaging with local councils and government could help build support for TSE projects in the region, attracting investment and supporting the industry's growth.

Figure 1 – The Raz Blanchard passage.[1]

1 Introduction

The Raz Blanchard, otherwise known as the Alderney Race, is a stretch of water between the Island of Alderney and the French mainland. It has a long-standing reputation as a location of significant tidal energy potential and has been the focus of numerous academic studies. It has been estimated that the straight contains approximately 50% of France's total tidal stream resource, where multi-gigawatts of tidal stream technology could be deployed. [2]

There is currently high commercial interest in the region as a location for tidal stream farms. In this case, two companies are developing tidal arrays in the region as part of the TIGER project: Normandie Hydroliennes (NH) and HydroQuest. Both of these companies have leases at different locations in the Raz Blanchard, which TIGER is supporting through various project work packages. The overall aim is to deploy multi-megawatt commercial arrays at both locations, which will be the first step towards larger farms of hundreds of megawatts in the future.

This site report provides a description of the site characteristics and quantifies the deployment potential across the Raz Blanchard region.

1.1 Normandie Hydrollienes (NH)

NH is a joint venture partnership of the following organisations:

- Proteus Marine Renewables: UK-based power generator with a portfolio including the 6MW MeyGen Phase 1A tidal stream farm in the Pentland Firth, Scotland.
- AD Normandie: The regional agency for the French region of Normandy.
- Normandie Participations: Regional investment fund.
- EFINOR: An industrial group specialising in engineering and manufacturing.

The combination of Proteus's strong tidal track record, the French regional knowledge of AD Normandie and Normandie Participations means that NH is well-positioned to become a

[1] https://www.boatsnews.com/story/31517/the-passage-of-the-raz-blanchard-explained

[2] https://royalsocietypublishing.org/doi/10.1098/rsta.2019.0490

leader in the French tidal stream market. In addition, Proteus secured a contract for difference (CfD) for the next phase of MeyGen in the UK auction; Allocation Round (AR4) 4.[3] In May 2021, Proteus also had their turbine at Naru Island in Japan approved by the government, passing pre-use inspection tests.

1.2 HydroQuest

HydroQuest is a French tidal stream developer. A market leader in France, HydroQuest has tested several iterations of their device in recent years; this included 80kW devices on the Rhone River attached to barges and, more recently, their 1MW turbine at EDF's Paimpol Brehait test site in 2019. This turbine had it’s testing duration extended by 12 months totalling 2 years as part of the TIGER project.

HydroQuest also has an interest in the UK market. In 2020 they signed an agreement with the Morlais tidal stream energy project in Wales.[4] Morlais, off the coast of Anglesey, covers 35km^2 and is owned by social enterprise Menter Môn. Moralis is fully consented with grid connection infrastructure in construction, and up to 240MW of tidal stream energy could be deployed at the site in the future.

1.3 TIGER activities

Both NH and HydroQuest are project partners on TIGER. The two tidal stream projects in the Raz Blanchard are going through the consenting process, with consent variations being submitted to update licenses to incorporate respective updated tidal technologies as well as increase the capacity of farms being developed. Both developers are discussing potential Capital grant and revenue subsidy support with the French government via ADEME, the French Agency for Ecological Transformation.

2 Site history

Plans for commercial tidal developments in the Raz Blanchard were made in 2013. As a result, two lease applications were submitted and granted: one by ENGIE and one by EDF Renewables, both projects share an export cable landing point and must collaborate to minimise local disruption as part of the licence conditions.

In 2017 ENGIE abandoned their planned farm due to GE, their turbine supplier, pulling out of the market.[5] So in 2020, ENGIE transferred this lease over to NH.[6]

In 2018 the European Commission approved a 14MW array in the Raz Blanchard. This was to be developed by OpenHydro, consisting of seven of their 2MW tidal turbines, and operated by EDF. This project was cancelled after Naval Energies, the parent company of OpenHydro, withdrew from the sector, forcing OpenHydro into liquidation. EDF transferred this site lease to HydroQuest.

[3] https://saerenewables.com/sae-successfully-secures-government-support-to-deliver-the-next-phase-of-world-leading-tidal-projects/

[4] Ocean Energy Europe - HydroQuest, Magallanes and SABELLA sign agreement with Morlais project (electricenergyonline.com)

[5] https://france3-regions.francetvinfo.fr/normandie/manche/raz-blanchard-projet-ferme-hydrolienne-tombe-eau-1170451.html

[6] Normandy Prefecture approves transfer of 12MW tidal power development lease from Engie to Normandie Hydroliennes - Ocean Energy Resources (ocean-energyresources.com)

3 The region

3.1 Alderney

Alderney is one of the Channel Islands and part of a British Crown dependency. It is the second largest island in the Bailiwick of Guernsey.

The population was recorded at 2,141 as of March 2022.[7] While between 2010 and 2014, the population fell by about 10%, this trend has reversed in recent years. The dependency ratio rose from 0.61 to 0.87 between 2010 and 2020, meaning there are fewer working-age people as a percentage of the population. The population increased by 2.0% since March 2022. A key desire is to encourage more young and working-age people to the island.

Alderney relies on fuel imports. Electricity is supplied on island by Alderney Electricity Ltd, generated by an oil-fired power station on the island. A marine tanker supplies the oil. Currently, the electricity price on Alderney is 32.25p/kWh..[8]

Tidal stream energy has been proposed in Alderney waters before. Alderney Renewable Energy Ltd was awarded an exclusive 65-year license to develop a tidal project in Alderney waters by the regulator, Alderney Commission for Renewable Energy. In 2014 they partnered with OpenHydro to develop a 300MW farm, which was originally due to be commissioned in 2021, however their license was revoked in 2017.

The island has an ongoing interest in renewable energy, as a way to become more self-sufficient, reduce energy prices and reduce their emissions. Alderney published a draft of energy policy in 2022.[9]

3.2 Guernsey

Guernsey is the largest island of the Bailiwick of Guernsey. As of June 2022, Guernsey recorded a population of 63,950, indicating a population increase of 0.8% since June 2022. Increasing population has been a trend for several years, with population increases of 0.6%, 0.0% and 0.8% being seen from June 2019, 2020 and 2021, respectively (recorded over 12 month periods ending in September).[10]

Regarding age demographics, the median age in March 2020 was 43 and 45 for males and females respectively, with the island's dependency ratio increasing from 0.48 to 0.56 between 2010 and 2020, showing a similar but less severe trend as is being seen on Alderney.[11]

A substantial portion of Guernsey's electricity demand is supplied through a subsea interconnector with France which runs via Jersey, thus reducing the extent to which it relies on fossil fuel imports. Diesel generators are used to support the island's energy demand as

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[7] https://alderney.gov.gg/data

[8] https://alderney-elec.com/electricity/electricity-charges/

[9] https://alderney.gov.gg/CHttpHandler.ashx?id=160989&p=0

[10] https://www.gov.gg/population#:~:text=On%2030th%20June%202022%2C%20Guernsey's,%2C%200.0%20and%200.8%25%20respectively.

[11] https://www.gov.gg/CHttpHandler.ashx?id=135941&p=0

they act as a back-up. One of the benefits of utilising electricity imports from France is that much of the generation originates from low-carbon sources such as nuclear.[12]

Some electrical supply issues have been experienced in recent years with the subsea interconnector. The GJ1 (the section of cable which runs between Guernsey and Jersey) suffered multiple faults between 2018 and 2019 and cost £30 million to replace. To mitigate any future threats to energy security from France, proposals have been made to construct a direct subsea link between Guernsey and France (known as the GF1).[13] While installing additional small-scale renewable generation should be a priority, a direct interconnector has been cited as a cheaper and more efficient option compared to installing grid-scale renewables. One of the main reasons being that intermittency issues can be avoided when making reductions in the amount of oil-fired generation on the island.[14]

The States of Guernsey have been looking into the wave and tidal resource around the island of Guernsey as early as 2008 before establishing the Guernsey Renewable Energy Commission in 2010 whom provide oversight of marine renewable energy in the Island's territorial seas. In 2011 environmental assessments were carried out to determine the impacts associated with the installation of marine energy devices. By 2017 Guernsey published their Renewable Energy Strategy which established a long-term approach towards offshore wind, wave and tidal. However, despite the publication of a strategy for marine technologies, the exact time at which marine energy devices are installed will be determined by the reduction in cost of each respective technology.[15]

3.3 Jersey

Jersey, officially known as the Balliwick of Jersey, is the largest and most populous of the Channel Islands. Over the last 20 years Jersey has seen significant population growth, going from 87,186 in 2001 to around 107,800 in 2019.[16] Much of this population growth has been due to net migration, with 1,000-1,500 arrivals coming to Jersey each year from 2015 to 2019.[17] With the island having a positive net migration, projected dependency ratios are only expected to rise to 0.6 to 0.63 by 2035 if current migration levels continue, this is still an increase from a dependency ratio of 0.5 seen in 2015.[18]

Focusing on Jersey's energy mix, as of 2020, 57% of Jersey's energy consumption was met via petroleum products, although this was mainly for purposes of road fuel and heating oil. When looking at oil used specifically for electricity generation, annual consumption fell from 80,000 tonnes/annum in the early 1990's down to just 442 tonnes/annum in 2020, with this

[12] https://www.gov.gg/CHttpHandler.ashx?id=123716&p=0

[13] https://guernseypress.com/news/2021/05/06/talks-under-way-on-direct-cable-link-with-france/

[14] https://guernseypress.com/news/2019/10/05/direct-cable-link-to-france-should-be-a-top-priority/

[15] https://www.gov.gg/energy

[16] https://www.gov.je/Government/JerseyInFigures/Population/Pages/PopulationStatistics.aspx#anchor-1

[17] https://www.gov.je/Government/JerseyInFigures/Population/Pages/Population.aspx

[18] https://www.gov.je/SiteCollectionDocuments/Government%20and%20administration/R%20Population%20Projections%202016%2020161013%20SU.pdf

dramatic fall being attributed to the installation of the subsea interconnector between Jersey and France.[19]

In terms of future energy ambitions, the States of Jersey government has published both an energy plan pathway to 2050[20] and a carbon neutral strategy.[21] For the energy plan pathway one of the main strategies to futureproof the energy system was to move towards *"renewable sources of energy where it can be justified on grounds of economics, security and sustainability"*, with part of this involving the implementation of micro renewables in the domestic sector. For the carbon neutral strategy, less mention was given to the installation of greater amounts of renewables as was given to reduce energy demand while increasing overall energy security and keeping prices affordable.

An initial tidal stream feasibility study for Jersey was undertaken in 2010. The study found that Jersey's total tidal resource was equivalent to around half of the island's energy demand, however only a small amount of this could realistically be extracted. A further feasibility study was completed in 2017. Its main conclusions were that the tidal stream industry had not progressed as much as would have been hoped and that Jersey's tidal stream resource would only serve around 6% of the island's electricity demand and 2% of its total energy demand at prices far higher than that of exports from France, thus making it a non-cost-effective source of electricity at present.[22]

3.4 Normandy

Normandy is a cultural region situated in the North of France, with modern Normandy being roughly coextensive with the medieval Duchy of Normandy which also included the Channel Islands. Between 1956 and 2015 was split between Upper Normandy and Lower Normandy before being merged into one administrative region. The population of Normandy is approximately 3.3 million, with the region being divided between five administrative departments (Calvados, Eure, Manche, Orne and Seine-Maritime). The main centres of population include Le Havre, Rouen, Caen and Cherbourg-en-Cotentin.[23]

In terms of age demographics, approximately 60% of the population are of working age.[24] However, there is a trend of young people leaving Normandy for employment opportunities elsewhere. Compared to the French average, agriculture and manufacturing represent a higher share of the regional employment in Normandy, with the main manufacturing sectors being automotive and aerospace industries. The automotive industry employs around 45,000 people and 70% of French automotive research and development is situated in Normandy with the help of Movéo competitiveness cluster. Aerospace employs 13,500 people in

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[19] https://www.gov.je/SiteCollectionDocuments/Government%20and%20administration/R%20Jersey%20Energy%20trends%202020%2020210811%20SJ.pdf

[20] https://www.gov.je/SiteCollectionDocuments/Government%20and%20administration/R%20Pathway%202050%20Energy%20Plan%20Appendices%20(size%202mb)%20DM%2020140325.pdf

[21] https://statesassembly.gov.je/assemblypropositions/2019/p.127-2019%28re-issue%29.pdf?_gl=1*f4konv*_ga*Mzc5OTc3MzMwLjE2MzU1MDQxOTU.*_ga_07GM08Q17P*MTYzNTUxMjEyOS4zLjEuMTYzNTUxMjE5Mi4w

[22] https://www.gov.je/Government/Pages/StatesReports.aspx?ReportID=3559#:~:text=In%202010%20the%20investigations%20concluded%20that%20Jersey%20had,of%20Jersey%2C%20in%20the%20Alderney%20Race%20for%20example.

[23] https://www.citypopulation.de/en/france/cities/normandie/

[24] https://www.citypopulation.de/en/france/reg/admin/R28__normandie/

Normandy, with many of these jobs centred around the design, testing and production of Ariane heavy-lift space launch vehicles and nacelles for aircraft engines.[25]

Normandy, like the rest of France, currently has a substantial portion of its electricity supply provided via nuclear power, with three operational nuclear power plants being located in Normandy. These plants are Flamanville, Paluel and Penly which have a combined capacity of 10.72GW (excluding Flamanville reactor 3 which is scheduled to come online in 2022).[26] Despite nuclear being the dominant source of electricity generation in France, wind energy is beginning to become a larger part of the energy mix, with much of this increase being attributable to the French government's Multiannual Energy Programme (PPE), in which the programmes main objectives are reducing fossil fuel consumption and ensuring a clear, fair and sustainable energy transition. The PPE aims to vastly increase onshore wind capacity while developing the French offshore wind sector.[27] Normandy as a region possesses large quantities of untapped wind potential across its 650km of coastline that will help France achieve its goal of 5GW of offshore wind by 2028. Furthermore, Normandy has some of the best tidal resource in Europe within the Raz Blanchard.[28]

At present, there are multiple offshore wind farms in the development phase in Normandy, these include projects near Courseulles, Fécamp and Dieppe, of which will be covered in more detail in section 3.3.[29] Furthermore, there is ongoing plans to develop a 1GW offshore wind farm with six pre-selected bidders engaging in a 'competitive dialogue' to lower project costs and support implementation.

3.3 Offshore wind projects

As mentioned in section 3.3, there are multiple offshore wind projects underway in Normandy with a tender process also ongoing to build an additional 1GW wind farm by 2028.[30] In addition to the mentioned wind farms off the coast Normandy, in neighbouring Brittany, there is also significant offshore wind development with the construction of the Saint-Brieuc wind farm which will be in relative proximity to potential tidal sites at the Raz Blanchard. Below in Table 1, a list of offshore wind projects in Normandy is displayed.

Table 1 – Offshore wind projects in Normandy.

Project Name	Location	Project Capacity (MW)	Status	Commissioning Date
Fécamp	Normandy	500	Under Construction	2023
Saint-Brieuc	Brittany	496	Under Construction	2023
Courseulles-sur-Mer	Normandy	448	Under Construction	2024
Dieppe - Le Treport	Normandy	496	Under Construction	2024
TBA	Normandy	1000	Development	2028

[25] https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/base-profile/normandie

[26] https://en.wikipedia.org/wiki/List_of_power_stations_in_France#:~:text=Nuclear%20%20%20%20Name%20%20%20,1986%20retired%201998%20%206%20more%20rows%20

[27] https://www.gouvernement.fr/en/multiannual-energy-programme-its-aims

[28] https://world.businessfrance.fr/nordic/2020/08/25/normandy-the-next-step-for-the-nordics-on-the-way-to-energy-transition/

[29] https://world.businessfrance.fr/nordic/2020/08/25/normandy-the-next-step-for-the-nordics-on-the-way-to-energy-transition/

[30] https://www.rechargenews.com/wind/power-and-oil-giants-in-frame-as-field-narrows-for-1gw-french-offshore-wind-prize/2-1-1001346

Regarding offshore wind projects elsewhere in the Raz Blanchard, previous studies have been undertaken for both Guernsey and Jersey to gauge the benefits of installing offshore wind capacity. For Guernsey, a 2017 study was published which assessed the benefits and drawbacks of constructing a 30MW project. Out of the findings, benefits included improvements in energy diversification, security of supply, price certainty and lower carbon emissions. However, drawbacks had to be considered, which included increased costs compared onshore generation and electricity imported from France.[31]

Studies conducted on offshore wind viability for Jersey concluded that constructing a site off the western edge of Jersey's territorial waters would be commercially feasible. Furthermore, it has been estimated that around three times of Jersey's electricity demand can be extracted by exploiting just 5% of Jersey's territorial waters.[32]

3.4 Port facilities

3.4.1 St Peter Port Harbour and St Sampson Harbour

The two main harbours on Guernsey are located at St Peter Port and St Sampson and are operated by Guernsey Harbours. Guernsey Harbours is part of the States of Guernsey's trading assets and operate a broad range of maritime functions, with approximately 98% of freight imports and 100% of hydrocarbon fuel imports being handled by them. They oversee the operation and management of Guernsey's two main harbours at St. Peter Port and St Sampson. Berths are available for commercial ships up to 135m in length. Dry berths for vessels up to 80m long are also available at St Sampson. In addition to berth facilities, both harbours also have crane facilities, with weight limits up to 62 tonnes at St Peter Port and 7 tonnes at St Sampsons.[33]

3.4.2 Port of Jersey

The Port of Jersey is the main entry point for imports on Jersey, with 98.6% of all goods entering Jersey via the port.[34] It is operated by Jersey Harbours which is responsible for administering commercial aspects at the port as well as marine services. There are numerous berths available at the Port of Jersey which are suited to a wide range of vessels such as small passenger vessels, cruise ships, tankers and cargo ships, with berths as long as 158m long.[35]

With Jersey Harbours also being involved in marine services, several of these may be of benefit to the tidal industry that operates around the Raz Blanchard in the future. Examples of these include engineering and project management, mooring and anchor handling, remotely operated vehicle and dive support, and towing and pushing.[36]

3.4.3 Port of Cherbourg

Located in Cherbourg-en-Cotentin, Normandy, the port contains Cherbourg Harbour, the largest artificial harbour in Europe and the second largest in the world. Historically Cherbourg has been a manufacturer of naval ships but today the harbour is most commonly used for accommodating ferries from the UK and cargo ships from abroad. Operations at the

[31] https://gov.gg/article/160125/Offshore-wind-study-published

[32] https://www.bailiwickexpress.com/jsy/news/focus-it-time-plug-gap-our-energy-security/#.YYD1YG3P02x

[33] http://www.harbours.gg/article/152097/Commercial

[34] https://www.ports.je/jerseyharbours

[35] https://www.ports.je/jerseyharbours/commercial/openingservicesfacilities/

[36] https://www.ports.je/jerseyharbours/marineservices/

port of Cherbourg are overseen by Cherbourg Port[37] which is part of the Ports of Normandy, a public body which is also responsible for the running of Caen-Ouistreham and Dieppe port.

Of the three ports managed by Ports of Normandy, Cherbourg is of importance in the field of offshore renewables with it having a blade production facility for offshore wind and was also selected by EDF as the assembly site for turbines which are to be installed at the Courseulles-sur-Mer and Fécamp wind farms.[38] Beyond offshore wind, Cherbourg is also home to the world's first plant built specifically for the construction of tidal turbines which became operational in 2018, making it a location which could be of high strategical importance for future tidal stream projects being developed at the Raz Blanchard.[39]

3.4.4 Port of Lézardrieux

Located in Brittany, the Port of Lézardrieux is set to be used for as the main maritime transport hub for the Saint-Brieuc wind farm. It is here where crews will be transferred to the wind farm site to carry out a range of maritime operations.[40] With the Port of Lézardrieux being used for offshore wind operations, it should also be considered as a site where crews can be transferred to carry out installation and maintenance activities for future tidal stream projects at the Raz Blanchard.

4 Viable farm locations

For this analysis, we used GIS datasets and analysis methods to indicate the areas available within the region for future commercial farms. This also includes considerations of potential exclusions that could impact project viability. The motivation is to give context beyond TIGER, when future sites are being examined for next generation technology.

4.1 Methodology

4.1.1 Tidal flow speed data

For the Geographic Information System (GIS) study we chose an analysis area encompassing the wider Raz Blanchard area, including the Alderney Race.

Tidal flow timeseries data were provided by the University of Caen Normandy, a TIGER project partner. University of Caen Normandy produced a hydrodynamic model of the English Channel using TELEMAC-2D. The model was constructed on an unstructured grid with variable cell sizes ranging from 10km to 200m. The model was forced by 11 tidal constituents provided by the TPXO 2008 atlas. The TELEMAC-2D model was validated within the OceanQuest project with six (one-month long) Acoustic Doppler Current Profiler (ADCP) timeseries. Mean RMS errors on current speeds ranged between 0.23 and 0.42m/s depending on the location of the ADCP within the Raz Blanchard. For the present tidal-stream resource assessment, the model produced 1-year long data of depth-averaged current speeds and water elevations. The year 2020 was selected as a reference because it

[37] https://www.cherbourg-port.fr/news-port-of-cherbourg.php

[38] https://windeurope.org/policy/topics/offshore-wind-ports/activities/windeurope-welcomes-ports-of-normandy-as-a-new-member/

[39] https://www.offshore-energy.biz/naval-energies-opens-cherbourg-tidal-turbine-plant/

[40] https://www.energyglobal.com/wind/21042021/construction-begins-on-saint-brieuc-offshore-wind-farm/

is associated to a mean annual resource within the 18.6-year lunar cycle (Thiébot et al., Appl. Oc. Res., 2022).[41]

4.1.2 Data from technology providers

Several technology providers were contacted, to understand the deployment constraints that affect their specific devices. They were asked about their current generation of technology as well as the trends that they anticipated for future device generations. This covered the following aspects:

Device properties

- Device rating
- Rotor diameter (nominal and minimum/maximum envisioned)
- Rated flow speed
- Cut-in and cut-out flow speeds
- Clearance above and below device
- Design water depth range (min and max)

Farm properties

- Farm size (at given date)
- Design turbine spacing
- Approximate farm energy density
- Foundation properties:
- Preferred foundation type
- Corresponding design conditions (seabed gradient, seabed type, installation vessel required)

Transmission system properties

- Maximum distance to shore (to prevent high transmission losses)
- Devices per subsea hub
- Grid requirement (based on farm size, kVA)

Devices included small (<500kW) and utility scale (2MW+) fixed devices and utility scale floating devices.

[41] Thiébot J., Guillou N., Coles D., Guillou S. (2022) On nodal modulations of tidal-stream energy resource in north-western Europe. Applied Ocean Research, 121, Article 103091.

We used this data to assign appropriate technologies for the three sites of interest.

4.1.3 Environmental constraints

We devised a list of various environmental constraints to investigate across the wider region. The aim was to indicate which factors could cause problems for larger commercial TSE projects.

Hard constraints we considered were:

- Areas close to shipwrecks (<250m)
- Oil and gas platforms, boreholes and exploration zones
- Offshore wind farms and other marine renewables (operational and in development)
- Dredge spoil dumping sites
- Site agreements for mineral/aggregate extraction
- Dumped munitions

We also mapped soft constraints. Development in these areas could be possible but would require more detailed site assessment and evaluation. These included:

- Vessel traffic
- Marine protected areas: Site of Special of Scientific Interest (SSSI), Special Protected Areas (SPA), Special Areas of Conservation (SAC)
- Seabed sediment type
- Location of grid

Main data sources included:

- SHOM[42] (bathymetry data)
- European Marine Observation and Data Network (EMODnet) data portal (human activities, e.g. dredge spoil dumping, dumped munitions)
- RTE (transmission lines)

4.2 Tidal stream energy scoping maps

4.2.1 Flow speed

Raz Blanchard is a progressive tidal system where peak currents occur at high and low water. The water transiting through the race is accelerated in a 15km large area located between the Island of Alderney (Channel Island) and the Cap de la Hague (France). At several locations, especially on the eastern side of the race, tidal currents exceed 5m/s

[42] https://www.shom.fr/

during spring tides.[43] In addition to high current velocity magnitude, the current of the Raz Blanchard is characterised by a reduced temporal variability over semi-diurnal and fortnightly time scales and also by reduced misalignment between the ebb and flood phases of the tidal cycle, making this site optimal for the deployment of turbines.[44]

Figure 2 (top) shows the peak spring tidal current across the region, a proxy for the energy available in the flow. Peak tidal currents exceeding 5m/s indicate economically viable sites and large areas where tidal currents speed exceed 3.5m/s across the map.

The Raz Blanchard tidal site has gained a reputation as one of the best sites in Europe and globally, with an estimated 1-2 GW capacity.[45] In addition, the site benefits from strong flow speeds in both French and Alderney territorial waters, which makes it an attractive location for tidal energy development.

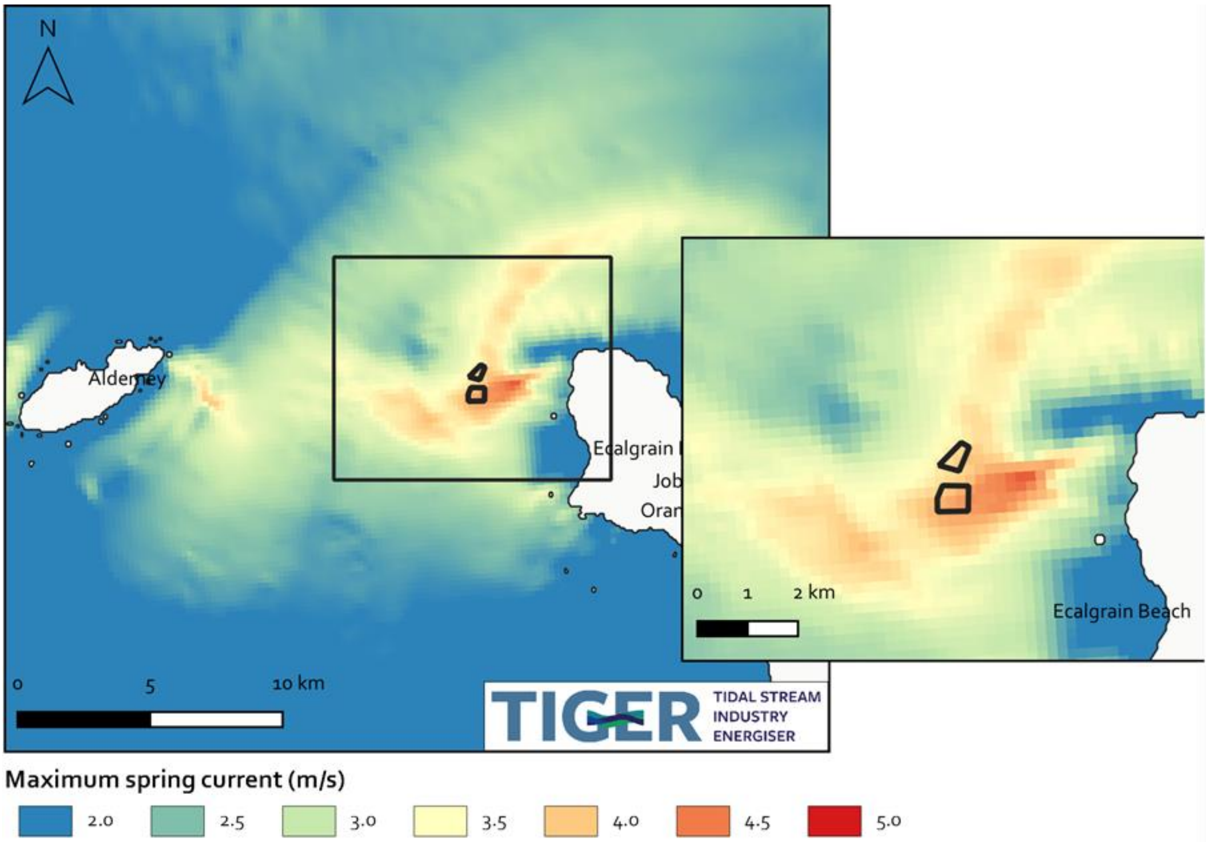
4.2.2 Bathymetry

Figure 2 (bottom) shows the bathymetry across the region. The Raz Blanchard tidal site has water depths suitable for various device concepts, including both fixed-bottom and floating devices. The site is also suitable for next-generation larger rotor devices (24m+ rotor diameter, horizontal axis). Additionally, shallower waters closer to the coast could be suitable for smaller devices or demonstrators. It is worth noting that the water gets deeper to the north of the two lease areas.

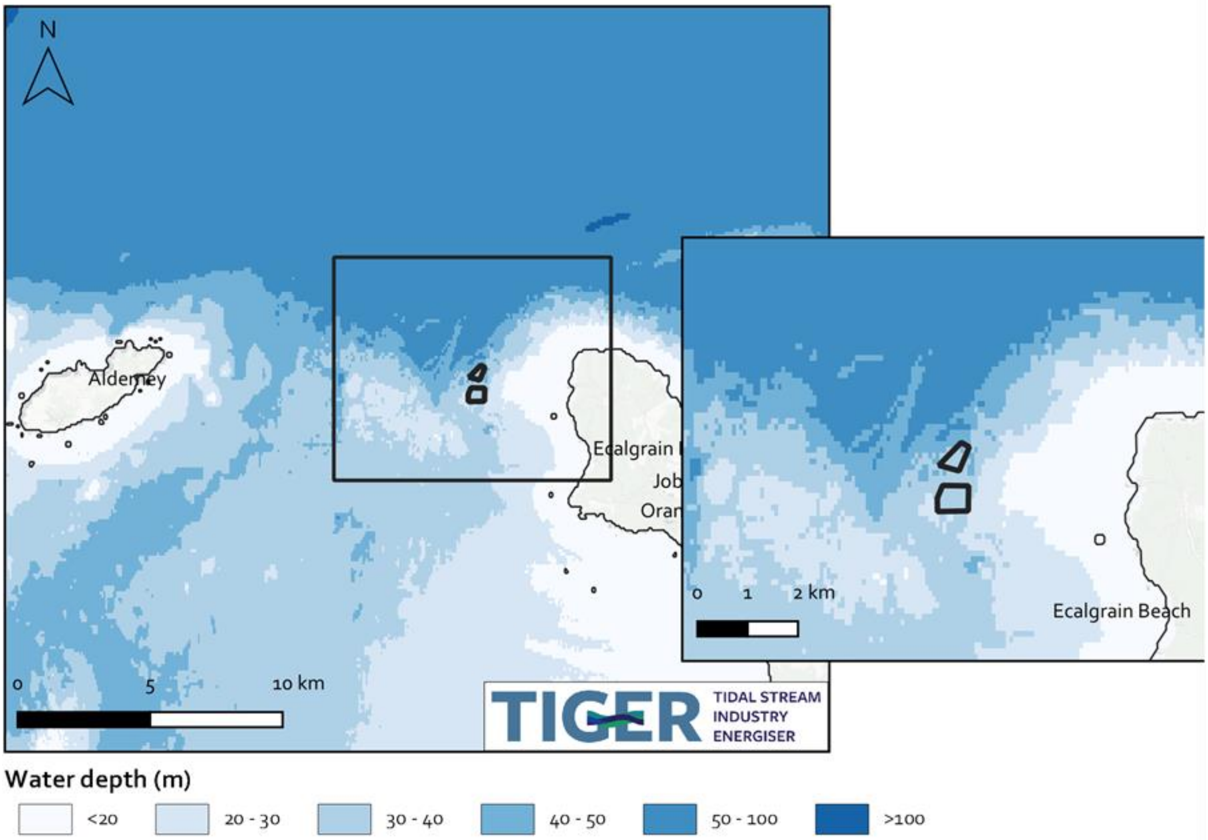
[43] D. Coles, L.S. Blunden, A.S. Bahaj (2017) Assessment of the energy extraction potential at tidal sites around the Channel Islands. Energy, 124 (2017), pp. 171-186

[44] Guillou Nicolas, Neill Simon P. and Thiébot Jérôme (2020). Spatio-temporal variability of tidal-stream energy in north-western EuropePhil. Trans. R. Soc. A.3782019049320190493

[45] https://www.renewableenergymagazine.com/ocean_energy/atlantis-study-identifies-2-gw-of-tidal-20180426



Flow speed data provided byUniversity of Caen Normandy. Generated using Telemac.



SHOM,2015. Atlantic Bathymetric DTM (Homonim Project). https://dx.doi.org/10.17183/MNT_ATL100m_HOMONIM_WGS84

Figure 2 – Maximum spring tidal velocities (top) and bathymetry (bottom) across the Isle of Wight region.

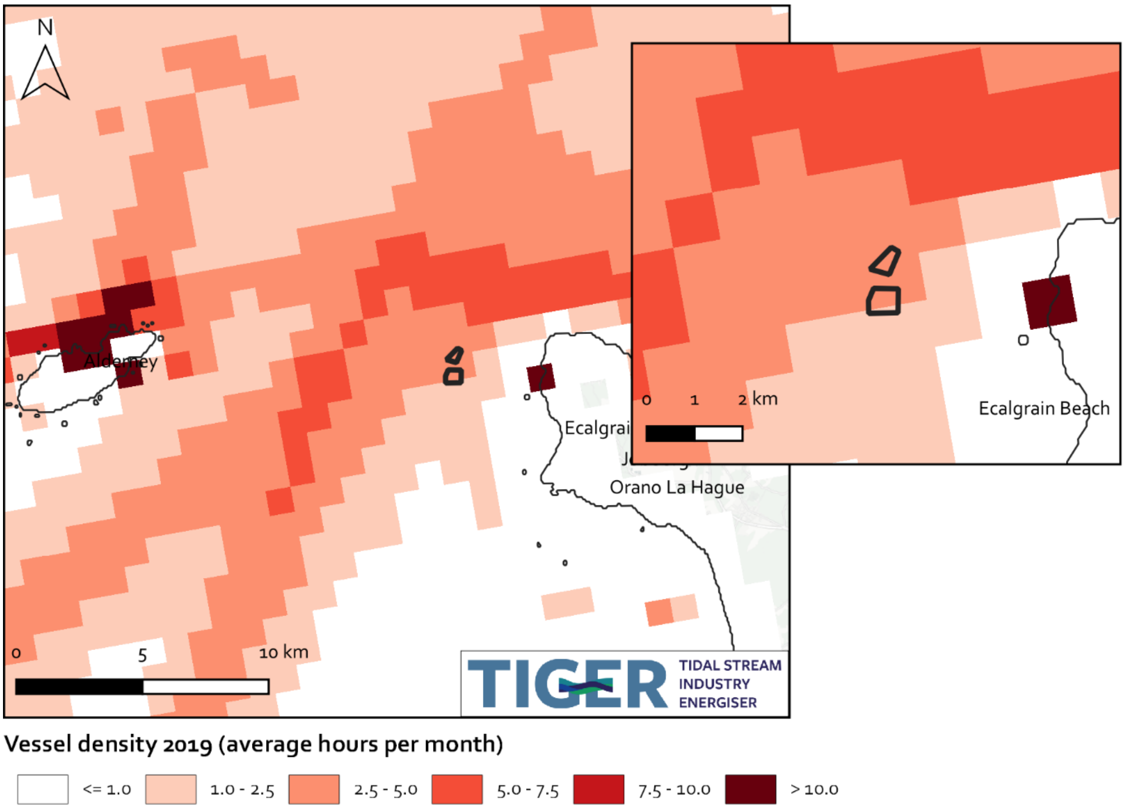
4.2.3 Vessel traffic

Figure 3 (top) shows vessel traffic density across the region with units of average hours per month. While the Raz Blanchard tidal site is generally suitable for tidal energy development, there are some challenges to be aware of. For instance, to the north of the site, a reasonably busy stretch of water could make it more challenging to develop a large floating farm. In addition, the data resolution for the site is relatively coarse, which could be an area for improvement better to understand the potential of the site for tidal energy.

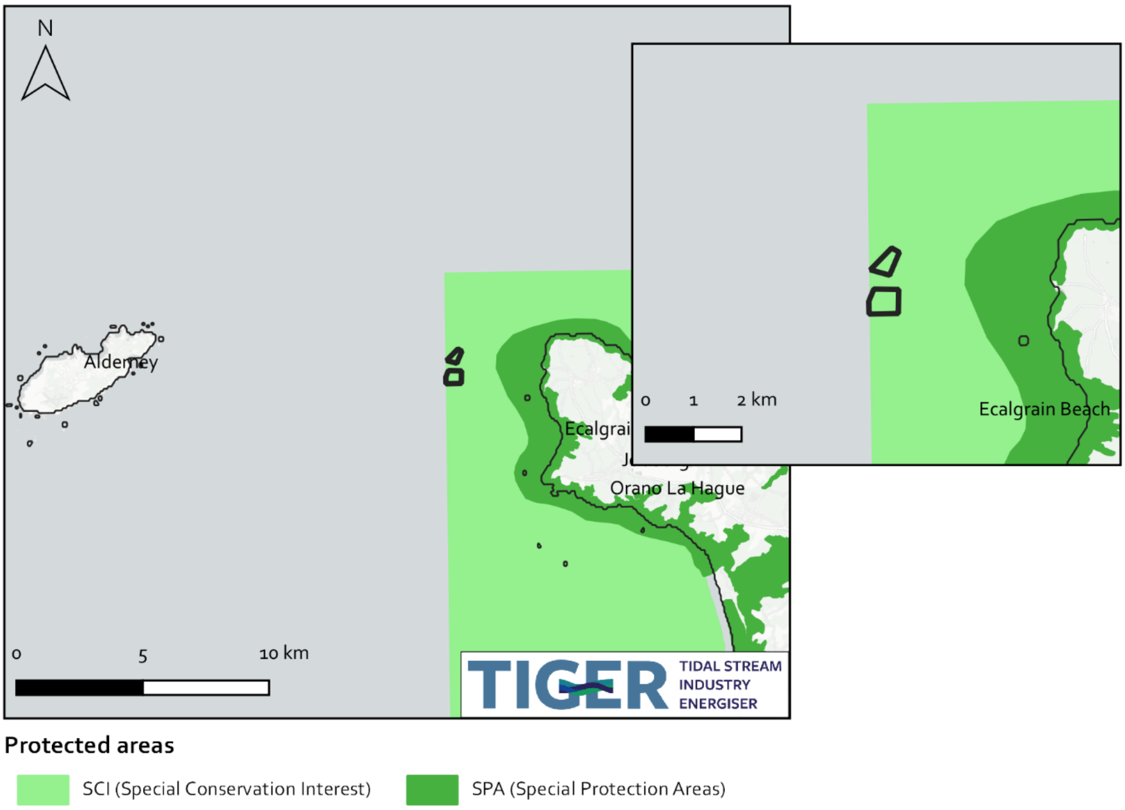
4.2.4 Environmental protection areas

Figure 3 (bottom) shows the designated environmental areas across the area. The Raz Blanchard tidal site is situated within a Special Conservation Interest (SCI) area, with both lease areas falling within it. However, previous leases were granted to EDF and ENGIE, so this is not perceived as an issue. Additionally, there is a Special Protection Area (SPA) around the coastline, which means that any substation built would need to consider the potential impact on birds. As for the cable, it would need to route through the SCI and SPA, which could add some steps from a consenting perspective. Although this is unlikely to be a barrier, it might result in additional requirements for a larger commercial site.

Ultimately the presence of SPAs and SACs is likely to increase the timescales associated with consenting to a project and may mean more environmental monitoring is required adding to the development costs of any project. However, SPAs are less of a concern for TSE projects compared to wind farms, as the submerged rotors can only affect diving birds.



Data obtained from the European Marine Observation and Data Network (EMODnet). The maps are based on AIS data yearly purchased from Collecte Localisation Satellites (CLS) and ORBCOMM.



Data obtained from the European Marine Observation and Data Network (EMODnet)

Figure 3 – Vessel density (top) and designated environmental protected areas (bottom) across the Raz Blanchard region.

4.2.5 Fishing activity

Figure 4 (top) shows the fishing activity across the region, where the data presented is sourced from the Global Fishing Watch data portal. The dataset for the Raz Blanchard tidal site indicates low fishing activity in the analysis area, so this is not deemed a constraint to tidal farm developments. However, it should be noted that this data is only indicative. Nonetheless, for a larger commercial project, engagement with local fisheries is advisable for this site to ensure that the project does not have a negative impact on their activities.

4.2.6 Seabed sediment

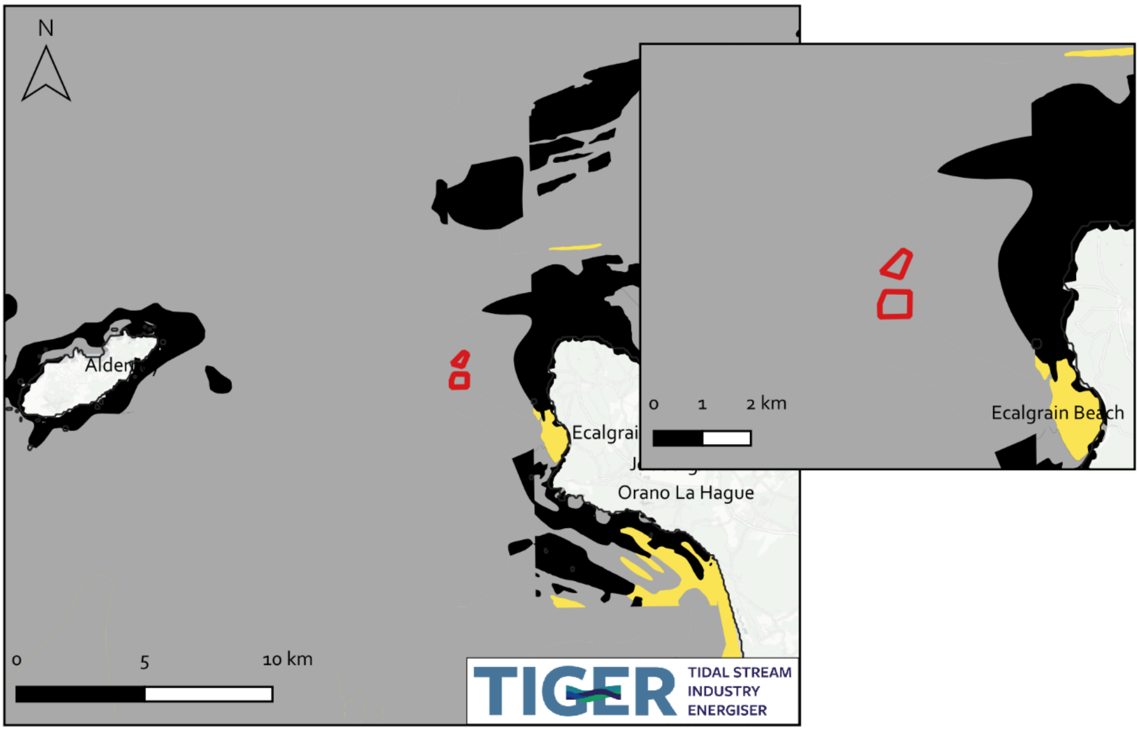
Figure 4 (bottom) shows the seabed sediment types across the region, categorising the seabed into five broad categories, and is based on survey data that has been interpolated over larger areas.

The dataset used in this analysis for the Raz Blanchard tidal site indicates coarse-grained sediment, which could be suitable for both piled and gravity base foundations. Additionally, the seabed sediment is characterised with rock and boulders towards the coastline, which means that it is unlikely that the cable could be laid on the seabed and may need to be buried. However, this is a typical consideration for any tidal stream project.

Fishing % of year (2016-2019)

0% 3% >5%

Data derived using the Global Fishing Watch data portal.



Seabed sediment type

1. Mud to muddy sand 2. Sand 3. Coarse-grained sediment 4. Mixed sediment 5. Rock & boulders

Data made available by the EMODnet Geology project, http://www.emodnet-geology.eu funded by the European Commission Directorate General for Maritime Affairs and Fisheries.

Figure 4 – Commercial fishing activity (top) and seabed sediment classification (bottom) in the Raz Blanchard region.

4.2.7 Extreme significant wave height (50-yr)

Figure 5 shows the extreme significant wave heights in the region, the 1 in 50 year extreme. This dataset was provided by ABPmer, who generated it using their SEASTATES North West European Shelf Wave Hindcast Model. The estimates are considered to be realistic, with similar patterns of variance compared to other data sources, however are not locally validated and are hence treated as indicative estimates. Data is interpolated to a 3km^2 grid. The SEASTATES model is primarily a deep-water model, and as a result does not adequately represent model shallow water effects (e.g. shoaling, refraction, wave breaking).

With these caveats in mind, the map indicates that 1 in 50 year extreme waves are less than 8m across the wider area. Tidal turbines would have to be designed with this in mind to ensure survivability, and future studies are necessary to examine any localised effects.

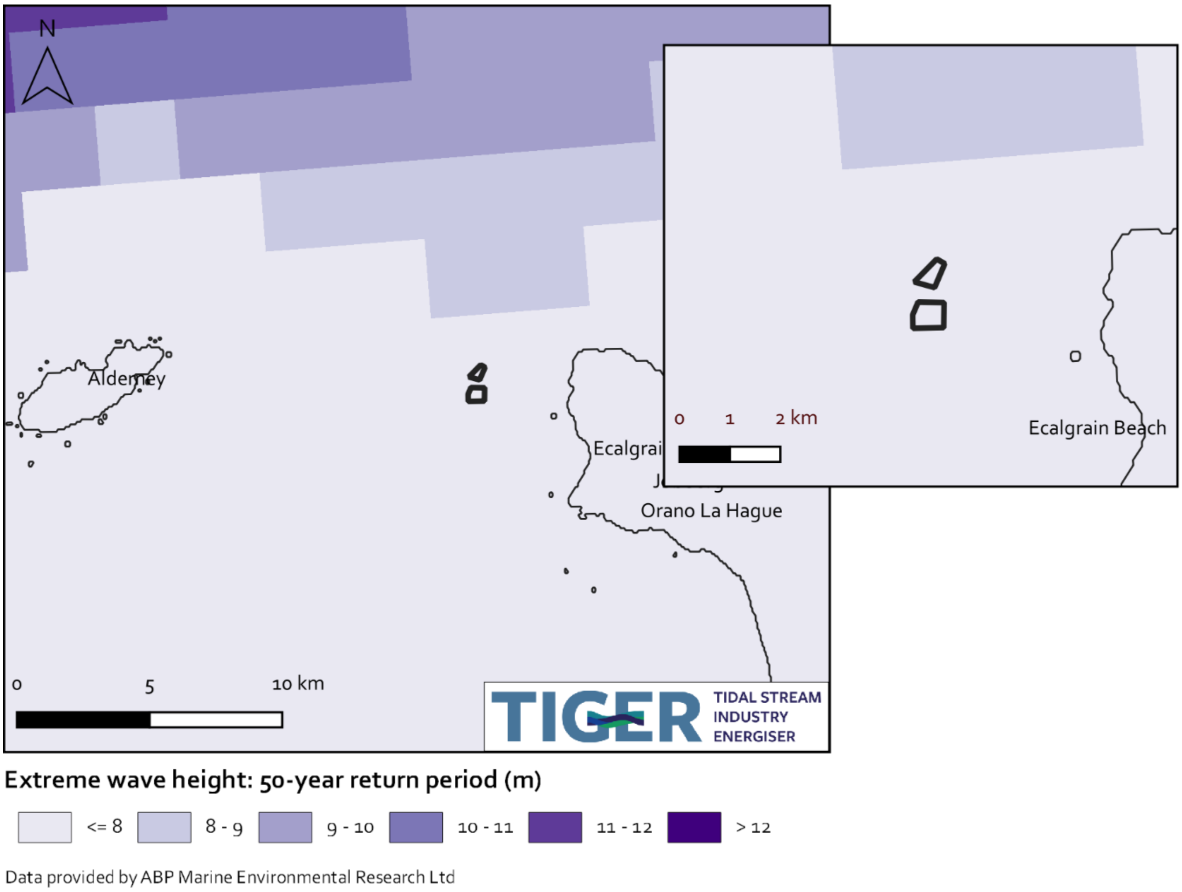
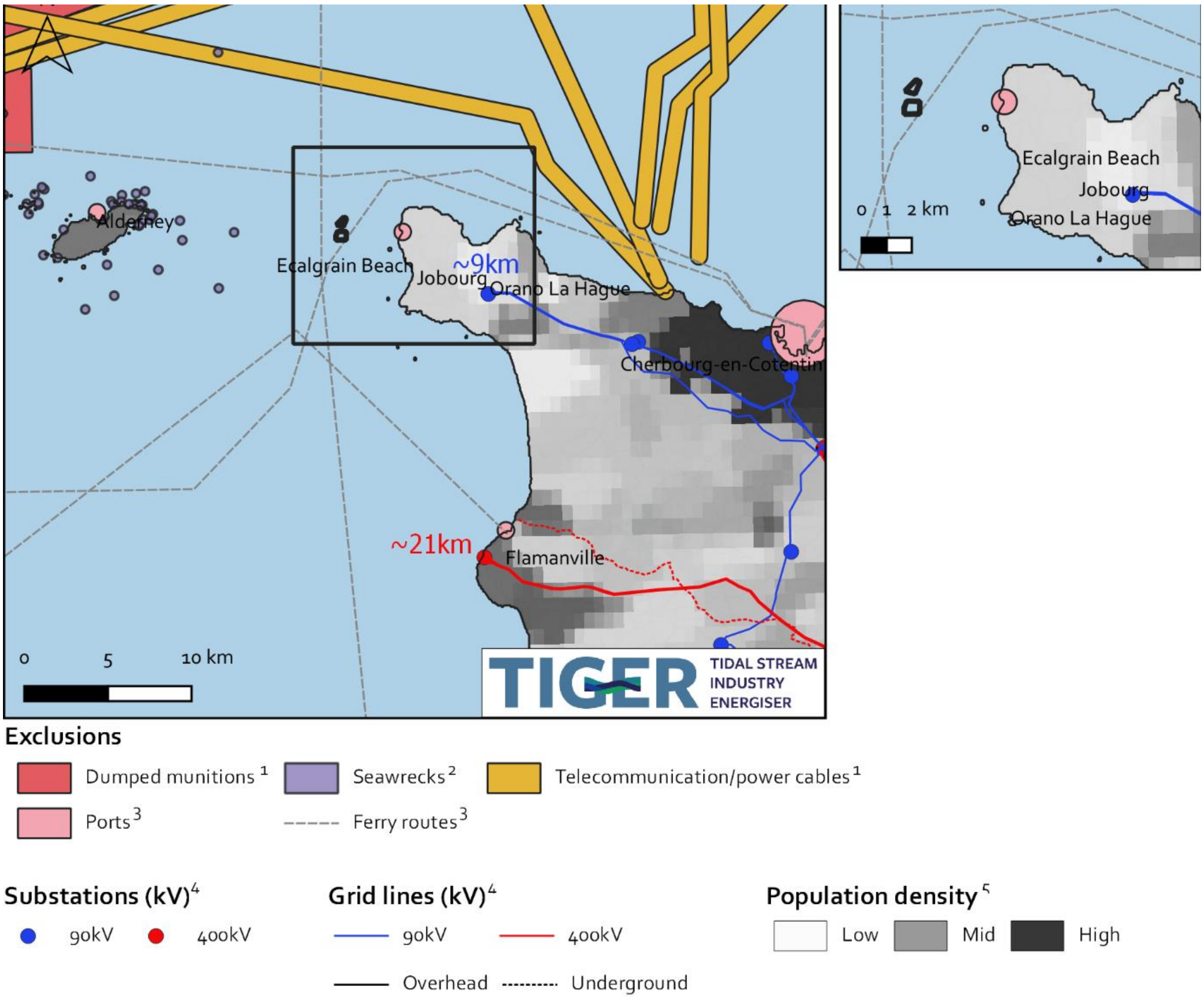


Figure 5 – Extreme significant wave height (50-year return period) across the region.

4.2.8 Hard constraints and grid

Figure 6 shows hard constraints, namely areas of seabed that other sea users use.

The Raz Blanchard tidal site is largely free from exclusions, except for some ferry routes. There is also a low population density in the nearby area, which can result in more scope for onshore civils and less opposition to any plans. HydroQuest and NH plan to export power at 20kV to Ecalgrain Beach. However, a larger 100MW or GW scale project would likely need to connect to the grid at Flamanville, assuming there is the capacity (although this was not examined in this study). The preferred option would likely be to make landfall near Ecalgrain beach, with a collector substation taking in array cables and transmitting this power via, for example, 200kV cables to Flamanville, either subsea or on land.



1: Data obtained from the European Marine Observation and Data Network (EMODnet)
2: Contains public sector information, licensed under the Open Government Licence v3.0, from the UK Hydrographic Office
3: Devised using local maps and knowledge
4: RTE owned substations and infrastructure, obtained from the Open Data Energy Networks (ODRÉ) platform.
5: Center for International Earth Science Information Network - CIESIN - Columbia University. 2018. Gridded Population of the World, Version 4 (GPWv4): Population Density, Revision 11. Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC).

Figure 6 – Offshore constraints and sea use across the region.

4.2.9 Proposed farm boundaries

Figure 7 shows the areas available for commercial sites identified from the GIS analysis.

Based on expected French timescales, a TSE farm for the Raz Blanchard tidal site was modelled into two phases. Phase 1 would involve a 132MW farm with 66 turbines by 2030, while Phase 2 would add an additional 132MW, resulting in a total of 264MW by 2033.

It should be noted that the turbine positions on the map were generated in GIS and are purely illustrative. In reality, the farm layout would be more carefully designed in order to minimise losses.

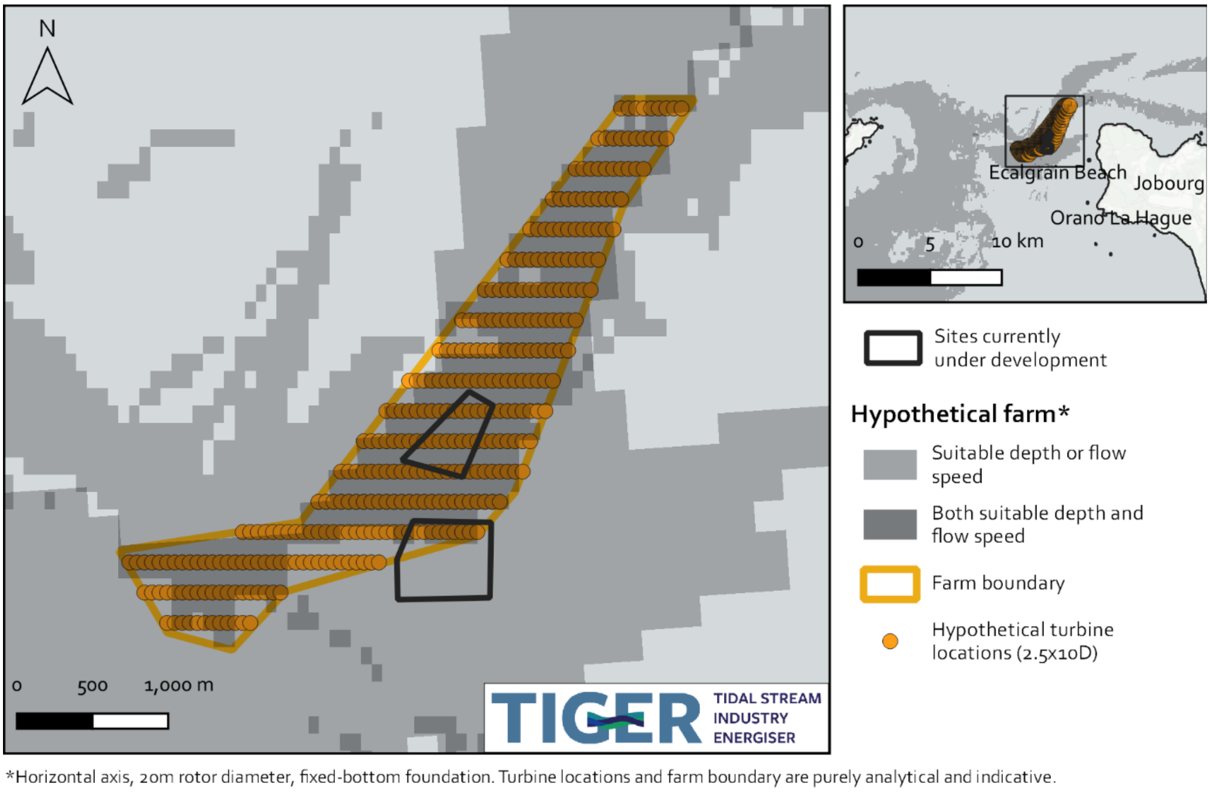


Figure 7 – Areas identified as suitable for commercial scale TSE projects.

5 Techno-economic assessment

In this section the economic potential of the Raz Blanchard in the medium term is investigated. This includes commentary on the capacity available, the levelized cost of energy (LCOE), and the revenue support that would be required to enable further developments beyond the lifetime of the TIGER project.

5.1 Methodology

The techno-economic assessment was made up of the following steps:

1. Define representative commissioning dates, technologies and farm sizes for TSE projects.
2. Devise annual energy production (AEP) estimates, based on the above.
3. Feed AEP and turbine specification into techno-economic model to calculate LCOE.

4. Identify appropriate CfD/Feed-in Tarrif (FiT) for the sites, based on appropriate deployment timescales and project internal rate of return (IRR).

5.1.1 Modelled farms

The modelling of two 132MW farms for the Raz Blanchard tidal site was undertaken with the intention of echoing the French industry's request to the government for regular and dedicated TSE auctions. Therefore, the focus was on the medium term (the next ten years) rather than short-term pilot projects or long-term GW scale projects. This approach strikes a balance between encouraging investment and demonstrating the technology's potential without becoming overly idealised and hypothetical or too small-scale to generate commercial interest. The analysis assumes present-day technology; 2MW with 20m rotor diameter devices. The devices are fixed bottom and horizontal axis, but the site properties suggest that a range of technology types, including vertical axis and floating devices, would be suitable. It should be noted that while the analysis is representative and indicative, the use of larger devices with better economies of scale could lead to greater LCOE reduction.

Table 2 summarises the project assumptions that were chosen for the analysis. The project's commissioning dates of 2030 and 2033 were chosen for Phase 1 and Phase 2, respectively.

Table 2 – Device and farm assumptions used for the techno-economic analysis.

Property	Unit	Phase 1	Phase 2
Commissioning year	-	2030	2033
Farm size	MW	132	264
Foundation type	-	Fixed-bottom	Fixed-bottom
Representative device rated power	MW	2	2
Representative device rotor diameter	m	20	20
Number of devices	units	66	132

Techno-economic analysis

Approach

We devised representative costs for the projects and technologies using data from TIGER project partners and calculated LCOE using standard industry assumptions at an appropriate commissioning date. We projected costs into the future by applying anticipated industry-wide learning rates, as have been witnessed in other energy technologies (e.g. solar, offshore wind).

For the farms we calculated appropriate CfD strike prices by analysing the lifetime revenue and costs and benchmarking the strike price to a project IRR. We back calculated the CfD revenue support required to achieve different levels of project IRR (excluding tax and debt financing) to determine an appropriate strike price.

We calculated LCOE and IRR metrics for three scenarios: Baseline, Optimistic and Pessimistic, modelled with different input assumptions, to indicate the uncertainty and potential range of values that could be expected.

Modelling assumptions: costs

To model the future cases we first derived the present day case (assumed 2022). Data sources included bills of materials from TIGER partners, data from ORE Catapult cost models and wider industry knowledge. A market forecast was created considering the likely buildout based on current sites with consented capacity. This aligns with projections from organisations like the MEC and European Commission[46].

Turbine capital expenditure (CAPEX) and foundation costs were sourced from TIGER partners, cross checked and adjusted to represent the device ratings being considered. Transmission costs were obtained from ORE Catapult datasets used for offshore wind. Development (DEVEX), insurance, contingency and decommissioning (DECEX) costs were modelled as percentages of the total CAPEX, in line with estimates from both the TSE and offshore wind industries.

Installation, planned O&M and unplanned O&M were sourced from TIGER partners and checked using a purpose built model. This model was created in Microsoft Excel. It uses a frequency-based approach, calculating the costs of marine operations by calculating the timescales of the operations and multiplying by the charter rate of a suitable vessel. The model also includes costs of vessel mobilisation and demobilisation, spare parts and considers the distance that vessels need to travel to and within the farm. For the unplanned O&M the model assumes a fixed number of interventions per year. The model can choose whether to mobilise a vessel each time, or to keep a permanent vessel on a long term charter, selecting the cheapest option.

The farms were deemed too large to connect to the local distribution network, as is planned for the HydroQuest and NH TIGER projects. We assumed that assume strings of devices are connected into an intermediate collector station at Ecolgrain beach and then connected to the 400kV substation at Flamanville. This is achieved via a ~20km subsea cable.

Vessel costs were obtained from ORE Catapult models and cross-checked with TIGER partners. We assumed that a multicat with diver/remotely operated vehicle (ROV) support could be used for inspection and minor repair on site.

Reductions in CAPEX and operating expenditure (OPEX) were modelled by applying learning rate-based reductions to the various cost items. These were set between 8 and 17%, depending on the cost category, reflecting the longer-term learning rate as has been seen historically for other renewables.[47] Learning reduction was not applied to transmission charges.

Modelling assumptions: AEP

University of Caen Normandy, a TIGER project partner, provided capacity factors and wake losses considering different farm densities and arrays locations. TELEMAC-2D hydrodynamic model was used to carry out the simulations. In those simulations, tidal arrays were represented by an enhanced drag spread out over the area occupied by arrays.[48] The effect of turbines on the tidal flow was thus idealised. Indeed, tidal arrays were modelled as

[46] The MEC want the UK government to adopt a target of 1GW of marine energy (wave and tidal) by 2035. The European Commission have a deployment target of 100MW of wave and tidal by 2025 and 1GW by 2030

https://www.oceanenergy-europe.eu/wp-content/uploads/2022/06/Last-Stop-to-2025.pdf

[47] https://royalsocietypublishing.org/doi/10.1098/rspa.2021.0469

[48] Thiébot J., Bailly du Bois P., Guillou S. (2015) Numerical modeling of the effect of tidal stream turbines on the hydrodynamics and the sediment transport - Application to the Alderney Race (Raz Blanchard), France. Renewable Energy, 75, pp. 356-365.

a whole rather than as a set of individual turbines (deployed at specific locations) interacting with each other.

5.2 Results: Phase 1 (132MW)

Error! Reference source not found. Figure 8 shows the LCOE as calculated for the three scenarios. In all three cases, most of the LCOE is in the device CAPEX. Note that the LCOE prices are quoted in £2012 terms to be consistent with the with UK CfD prices and for consistency and ease of comparison between TIGER site development reports.

The baseline LCOE is at £118.4/MWh with a net capacity factor of 26.5%. The optimistic scenario at £98.7/MWh, is largely driven by the higher capacity factor assumed (net capacity factor of 28.6%) as well as slight reductions assumed in transmission and installation. The pessimistic scenario at £149.8/MWh assumes a lower net capacity factor of 25% (assuming both a lower gross capacity factor and slightly higher losses) as well as a more expensive device cost and foundation. As our data for these components was limited for a one-off device, we wanted to examine the case of higher costs.

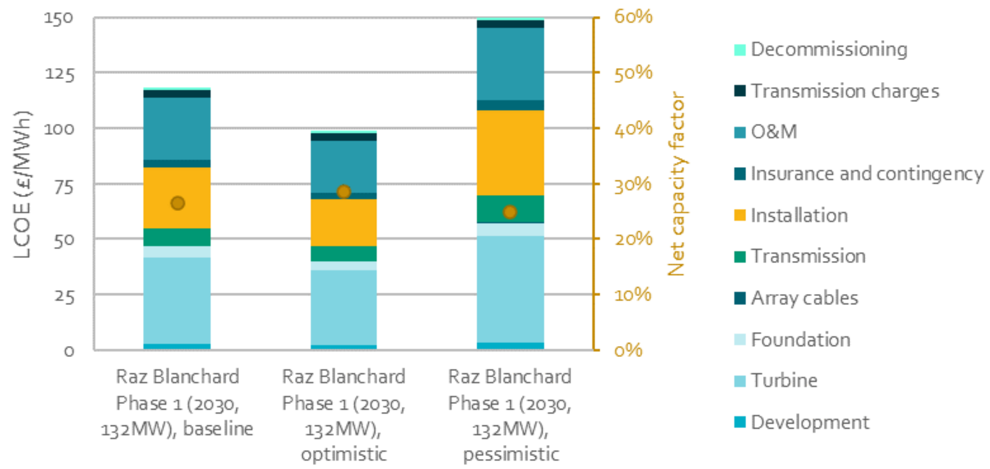


Figure 8 – LCOE breakdown for the three scenarios devised for the Raz Blanchard Phase 1 case. Net AEP is shown on the secondary Y axis.

Figure 9 shows the project IRR achieved as a function of the CfD strike price. We estimate that a 10% IRR could be achieved for a strike price of £178/MWh, although this does not include debt or tax. For the optimistic scenario, the strike price falls to £157/MWh for a 10% IRR. Conversely, for the pessimistic, the strike price rises to £206/MWh.

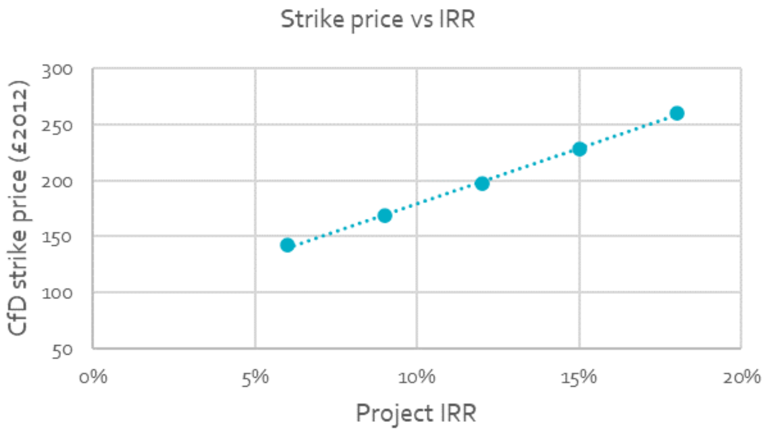


Figure 9 – CfD strike price vs project IRR for the Raz Blanchard Phase 1 baseline scenario.

5.3 Results: Phase 2 (264MW)

Figure 10 shows the LCOE breakdown for the three scenarios. Note that the LCOE prices are quoted in £2012 terms to be consistent with the with UK CfD prices.

The baseline LCOE at £111/MWh with a net capacity factor of 23.5%, is 6.25% lower than the Phase 1, 132MW case. Most costs are assumed to be lower due to the increased learning for the later commissioning date and the better economies of scale for the larger farm.

The optimistic scenario at £95.3/MWh, is largely driven by the higher capacity factor assumed (net capacity factor of 24.7%) as well as slight reductions assumed in transmission and installation. The pessimistic scenario at £143.8/MWh assumes a lower net capacity factor of 21.4% (assuming both a lower gross capacity factor and slightly higher losses) as well as a more expensive device cost and foundation. As our data for these components was limited for a one-off device, we wanted to examine the case of higher costs.

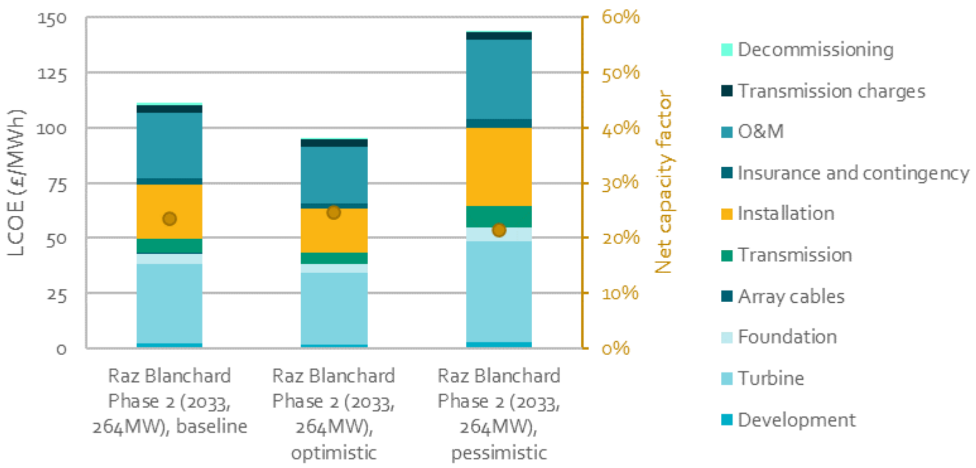


Figure 10 – LCOE breakdown for the three scenarios devised for the Raz Blanchard Phase 2 case. Net AEP is shown on the secondary Y axis.

Figure 11 shows the project IRR achieved as a function of the CfD strike price. We estimate that a 10% IRR could be achieved for a strike price of £169.3/MWh, although this does not include debt or tax. For the optimistic scenario, the strike price falls to £153/MWh for a 10% IRR. Conversely, for the pessimistic, the strike price rises to £204/MWh.

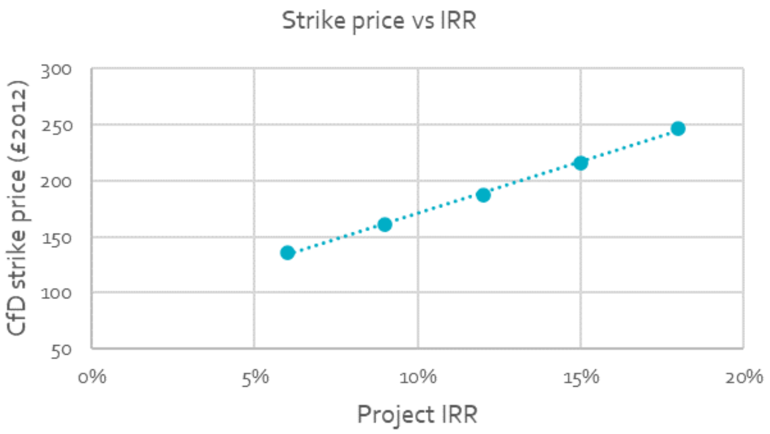


Figure 11 – CfD strike price vs project IRR for the Raz Blanchard Phase 2 baseline scenario.

6 Summary and recommendations

6.1 Summary

This study analysed the TSE potential for the Raz Blanchard region. We have examined a number of different issues, including past track record, ports of interest, geospatial analysis of the available area and techno-economic viability. In this section, we summarise the study and provide recommendations of areas to focus on to ensure that the regional benefits of TSE are captured.

Socio-economic viability

The Raz Blanchard is a location that could benefit from the potential jobs and employment that a TSE site could bring. As a renewable energy technology, the TSE site could provide an opportunity for the local community to be involved in a new industry and benefit from the associated employment opportunities. The TSE site would also have the advantage of being close to several local ports, such as, Jersey, Cherbourg and Lézardrieux, as well as St Peter Port and St Sampson harbours, providing logistical support for the project.

Environmental viability

The Raz Blanchard tidal site is situated within an SCI area and the presence of SPAs, could pose challenges to developing these projects. One potential issue is the impact on cable routes. Protected areas may restrict the placement of cables, limiting the possible routes for transmitting electricity generated by the TSE site. Additionally, certain technologies may be more suitable for use in protected areas than others. For example, some technologies may impact the environment more than others, making them unsuitable for use in protected areas.

However, previous leases were granted to EDF and ENGIE, suggesting that these potential issues have already been considered. Developing TSE projects while minimising their impact on protected areas is possible. This can be achieved through careful planning, site selection, and technology choices. Furthermore, the potential benefits of tidal energy, such as its ability to generate renewable energy and reduce greenhouse gas emissions, make it a promising technology for the future.

Geospatial viability

Several factors could impact the development of tidal energy projects in the area. One positive aspect is that the area's flow speeds are strong; peak tidal currents exceeding 5m/s. Furthermore, the Raz Blanchard site has minor constraints and low interactions with other sea users. This is an important consideration as interactions with other users, such as shipping or fishing, can create conflicts that could hinder the project's development. It is, therefore, paramount to note that any interactions with sea users must be carefully managed and mitigated to ensure that the project is developed sustainably.

From a geospatial perspective, the deployment of 100MW+ projects in the area appears to be feasible. However, it is important to note that factors such as wake interactions and blockage effects could impact the efficiency of the technology. These factors have not been examined in this report and must be carefully considered during the planning and development stages.

The Raz Blanchard site has a good range of depth, allowing for greater flexibility in the types of technology deployed in the area, including both fixed-bottom and floating devices. The site is also suitable for next-generation larger rotor devices. Moreover, shallower waters closer to the coast could be suitable for smaller devices or demonstrators.

Finally, 100MW+ projects would likely need to connect to the grid at Flamanville, assuming there is the capacity, which was not covered in this study.

Techno-economic viability

It is important to note that the techno-economic assessments are high-level and indicative, and a more detailed analysis would be needed to evaluate the economic viability of the projects fully. This information is vital for evaluating a project's economic viability and making investment decisions.

6.2 Recommendations

From this study, we recommend the following future steps:

- **Establish grid viability:** further research into grid connection options for larger 100MW+ farms, especially the feasibility of Flamanville for transmission connection, is required. Furthermore, the possibility of exporting electricity to Alderney and/or Guernsey to the French mainland should be examined. This would require detailed analysis of the existing grid infrastructure, as well as any potential upgrades that may be necessary to accommodate the additional capacity. Such research can provide additional opportunities for revenue generation and increase the overall viability of the project. The research should account for the cost and funding sources of the grid infrastructure. Larger scale projects are necessary to reach economic levels, and so electricity distribution companies need to be brought into the discussion to ensure that there is sufficient grid capacity for future projects.
- **Further investigation into environmental areas:** investigate the implications that SCI and SPA areas might have from a planning and cost perspective. For instance, when planning a subsea cable lay, it is important to consider any marine protected areas along the proposed route and ensure that the cable installation and maintenance activities do not harm the protected species and habitats and minimise the impact on the marine ecosystem. This may involve adjusting the cable route, modifying installation and maintenance activities, and obtaining necessary permits and approvals from relevant authorities. Moreover, complying with regulations related to marine protected areas may increase the overall cost of the subsea cable lay. Additional equipment, personnel, and permits may be required, and delays and other expenses may be associated with modifying the cable route or installation procedures. However, failure to comply with

these regulations can result in fines, legal action, and environmental damage, which can be much more costly in the long run.

- **Expand the study to include more technologies and farm sizes:** it is important to expand studies to include a broader range of technologies and farm sizes, such as floating or vertical axis turbines, sub-100 MW projects, and 500 MW projects. The use of flow models can aid in selecting the most suitable turbine types and farm layouts to maximise energy yield.
- **Coordinated lobbying effort:** a coordinated lobbying effort to be initiated, working with industry groups such as the SER in France and local companies to drive for the government to adopt regular tenders for tidal energy projects. This can provide the necessary incentives for developers to invest in the site and help accelerate the pace of development.
- **Bring the local community on side:** the region is a popular tourist destination, and a tidal farm would offer improvements to local employment, diversifying the local economy. We recommend engaging with the community early on to understand their opinions and encourage support. A community ownership model, whereby the community has a stake in a tidal project and can benefit financially, could be a way to increase support and awareness.