Marine Renewable Energy Potential in Guernsey

Introduction to the display

The display begins with a broad introduction to the offshore renewable energy technologies and then moves on to the findings of the recent Exeter University research conducted on Guernsey.

This display is part of the States of Guernsey's Renewable Energy Team (RET) Public Engagement work. The display builds on an exhibition that was part of the UK's Economic & Social Research Council's Festival of Social Science.

The display is based on work undertaken by the States of Guernsey's RET and research carried out by the University of Exeter.

For more information & to provide feedback please visit www.guernseyrenewableenergy.com or contact: mat.desforges@gov.gg; peter.barnes@gov.gg; p.g.devine−wright@exeter.ac.uk

About RET

The Renewable Energy Team (RET) was formed by the States' Commerce and Employment Department and the work will be part of the new Environment and Infrastructure Committee.
RET's mandate is to investigate the potential for macro renewable energy projects and to facilitate and consent the development.

RET Vision – Long Term Legacy

Overall vision: *"Guernsey will generate **local, affordable, renewable energy,** initially for local consumption, which is **low carbon** and will provide greater **energy security** and **independence while making a contribution to a lasting commercial, financial and environmental legacy."***

RET Mission

To prepare the groundwork for development of renewable energy in the near to longer term, RET will ensure that all the required political, legislative and commercial processes (including leasing) and approvals are in place by 2018, as well as a base line environmental and resource understanding of Guernsey waters, and continued public engagement to ensure local support and acceptance.

This is to enable at least the initial deployment of local macro renewable energy generators in the early 2020's if economically viable.

RET Top 3 objectives for 2016

Effective public engagement and communication aligned to a developed communications strategy – look to ensure that the people of Guernsey are engaged and well informed of the local position with regards to renewables.

Undertake the next stage of feasibility work for a 30 megawatt (MW) offshore wind array in Guernsey waters, in conjunction with Guernsey Electricity Ltd, so that an informed decision on how to progress can be made.

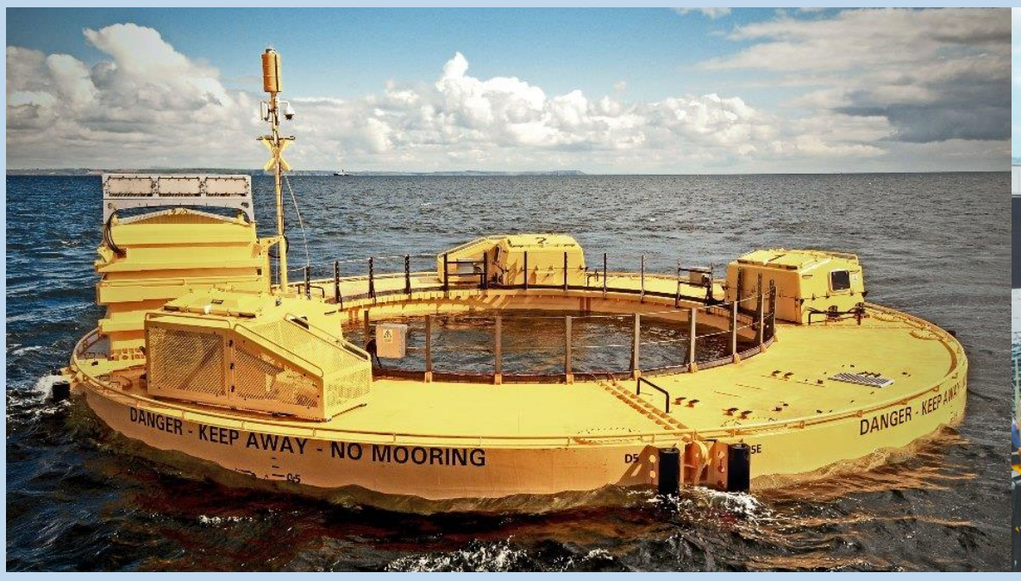
Facilitate Guernsey obtaining control of the seabed and extension of territorial seas to 12 nautical miles.

UNIVERSITY OF EXETER STATES OF GUERNSEY

Frequently Asked Questions – When? How? Why? How

Q. ***When is marine renewable energy likely to be developed in Guernsey?***

- Development is dependent on a number of factors for renewable energy sources (wind, wave or tidal) and the specific technology that is preferred. All developments would be limited by cable laying requirements.
- **Wind energy** is a relatively commercially mature technology and so it is most suited to near term development.
- **Wave energy** and **tidal stream energy** systems are currently pre commercial demonstrators – there are no wave or tidal stream arrays anywhere in the world.
- It is likely wave and tidal will take some time to become viable and unlikely that they will be developed in Guernsey until into the 2020s. If there is an acceleration in development Guernsey is in a position to adopt wave and tidal at an earlier date.



Q. ***How is RET developing marine renewable energy in Guernsey's waters?***

- RET is working with local, UK and French experts and UK & French Universities to improve our understanding of the renewable resources available around Guernsey. This includes how the waters are used and how renewable energy development may impact upon those activities and the environment.
- A detailed understanding of the environment is important to ensure informed decisions can be taken by the States and, in time, the consenting body.
- RET & Commerce and Employment have proposed, and the States has passed, legislation that will enable Guernsey to regulate renewable energy and protect the environment within its waters. It forms part of a streamlined application process that will facilitate development.

Q. ***What are the costs of developing marine renewable energy in Guernsey's waters?***

- Renewable energy is generally more expensive than traditional electricity sources such as fossil fuels or nuclear – but in recent years this gap has narrowed significantly for terrestrial renewables.
- Onshore wind and solar costs have reduced considerably and offshore wind costs are falling; however wave and tidal costs remain high due to the nascent state of development. Costs should fall in the future as the industries mature – following the pattern seen for other renewables.
- Many jurisdictions (including EU countries) have subsidies/incentives for renewable energy. Guernsey does not have such subsidies.

Q. ***Why are RET looking to develop marine renewable energy in Guernsey's waters?***

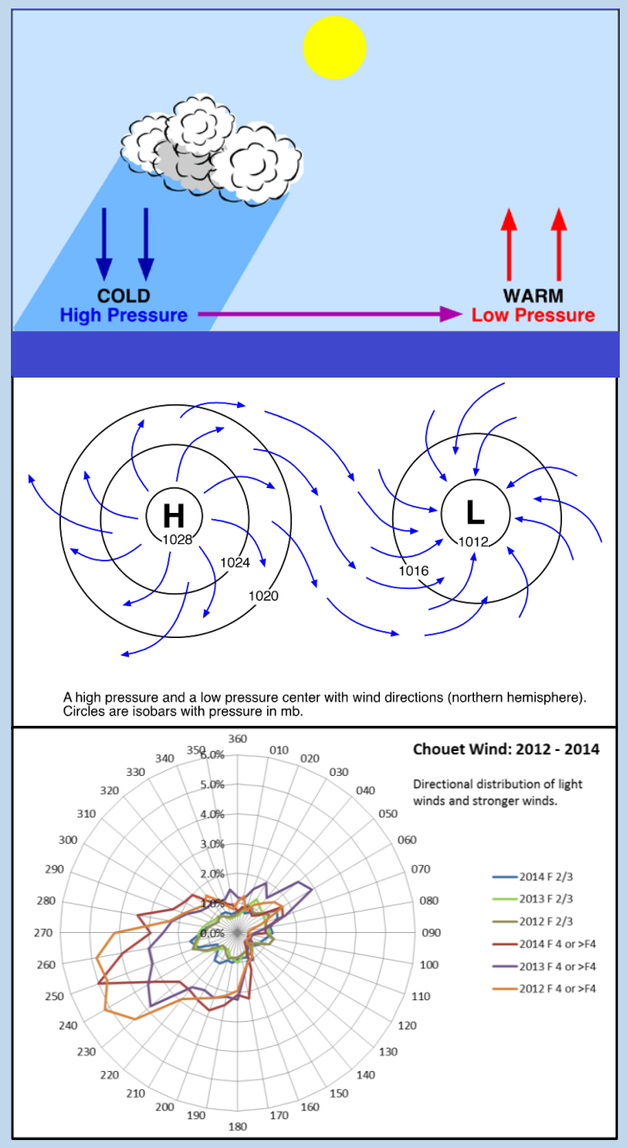
- Unlike fossil fuels (coal, oil and gas) and other combustibles (e.g. wood and landfill gas), renewable energy sources do not result in the release of greenhouse gases (e.g. carbon dioxide) into the atmosphere.
- 42% of the electricity consumed in Guernsey in 2015 came from fossil fuels (with imported nuclear and hydro making up the rest). Most of our transport relies upon oil (petrol and diesel) as well as domestic heating systems that use fossil fuels.
- Marine renewable energy could give us greater independence regarding the cost and security of our energy. It can also contribute to diversifying Guernsey's economy.
- Fossil fuels are imported from foreign countries, increasing Guernsey's vulnerability to external forces. Renewable energy sources (such as solar, wind, wave and tidal) are local, increasing energy security.
- RET are working on how best to benefit from a long term positive legacy for Guernsey in addition to the generation of renewable energy. Examples include setting up a Guernsey research facility and developing local "know how" (Intellectual Property).

UNIVERSITY OF EXETER STATES OF GUERNSEY

Marine Renewable Energy – an introduction

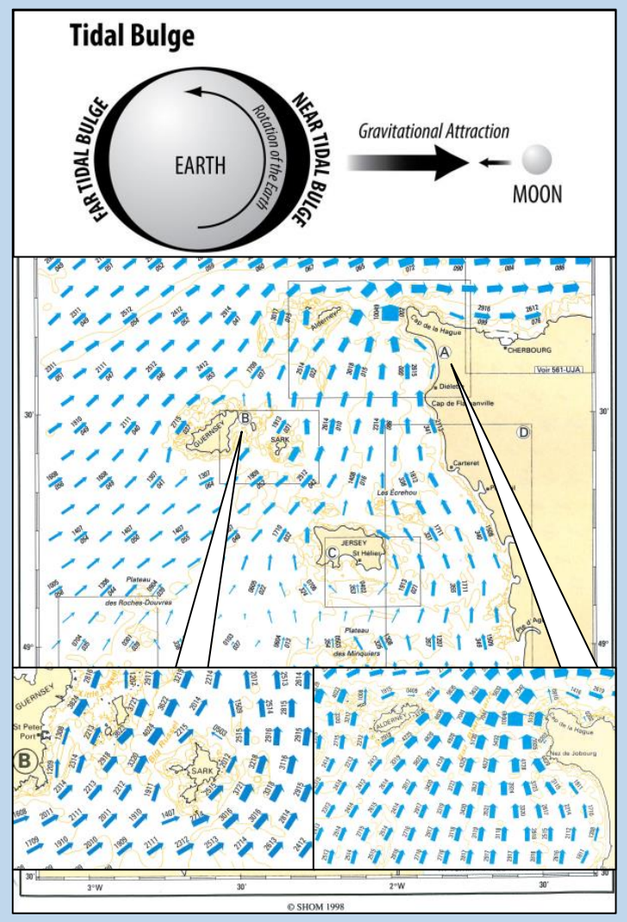
Renewable energy comes from sources that are not depleted when they are used. They include solar, wind, hydro (river), geothermal (heat energy from the earth) and wave and tidal energies.

Marine renewable energy means power generated by **wind**, **wave** and **tidal** energies that come from coastal and sea areas (the marine environment). The technologies used for offshore wind are most developed; wave and tidal energy technologies are still in early stages of development and relatively few examples exist worldwide.



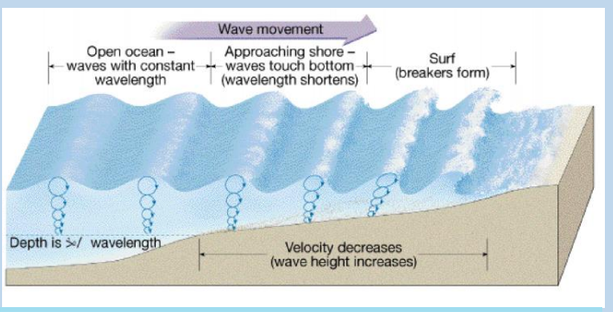
Offshore Wind Power is created by differences in air pressure – caused by uneven heating of the air – with air moving from high to low pressure; wind direction is influenced by the rotation of the earth (the Coriolis effect). The technology is similar to onshore wind, with devices in offshore waters where they are more exposed, so greater power is available. Guernsey's prevailing westerly winds offer an opportunity – especially with the advancement of floating platforms.

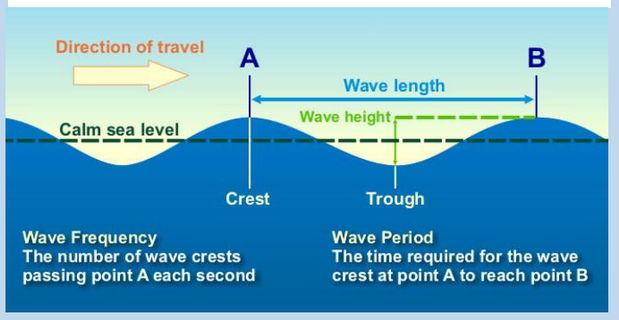
Tidal Stream Power is created by the gravitational pull of the moon causing the "tidal wave" or "the tides". The resource is greatest (fastest) where there is tidal constriction, often between two land masses (e.g. the Big Russel) or around peninsulas. The Andritz Hydro Hammerfest device (pictured left) is due to be deployed as part of the MeyGen project in Scotland's Pentland Firth in 2016.



Tidal Range Power is also created by the tides, but it uses changes in water depth. The resource is best where differences between high and low tide are greatest. While Guernsey has a reasonable tidal range, it has no natural estuarine regions – which are most suited to tidal range. There are numerous bays, however most are shallow and would require significant wall construction to be viable.

Wave Power is created by the wind out to sea blowing over the surface of the water, creating a swell due to friction. Rotation of water particles within the swell causes the wave to move forward. Wave energy involves converting the motion of the wave into electricity. It is more predictable than wind power. Wave power reduces as the water shallows, but with 50m+ depths within a couple of miles of the shore, Guernsey can take advantage of this resource.





RET aims for Guernsey to be in a position to take advantage of its natural resources when the technologies are commercially viable.

UNIVERSITY OF EXETER STATES OF GUERNSEY

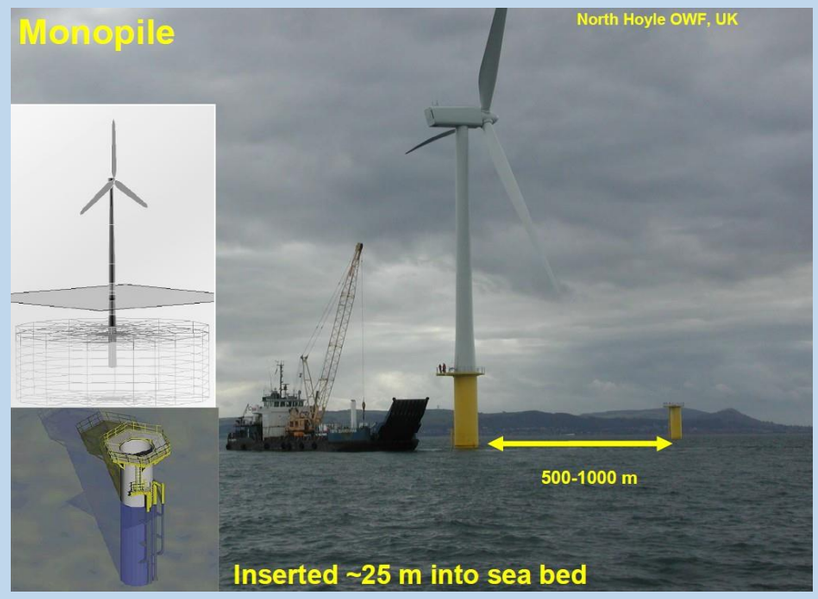
Offshore Wind Energy – an introduction

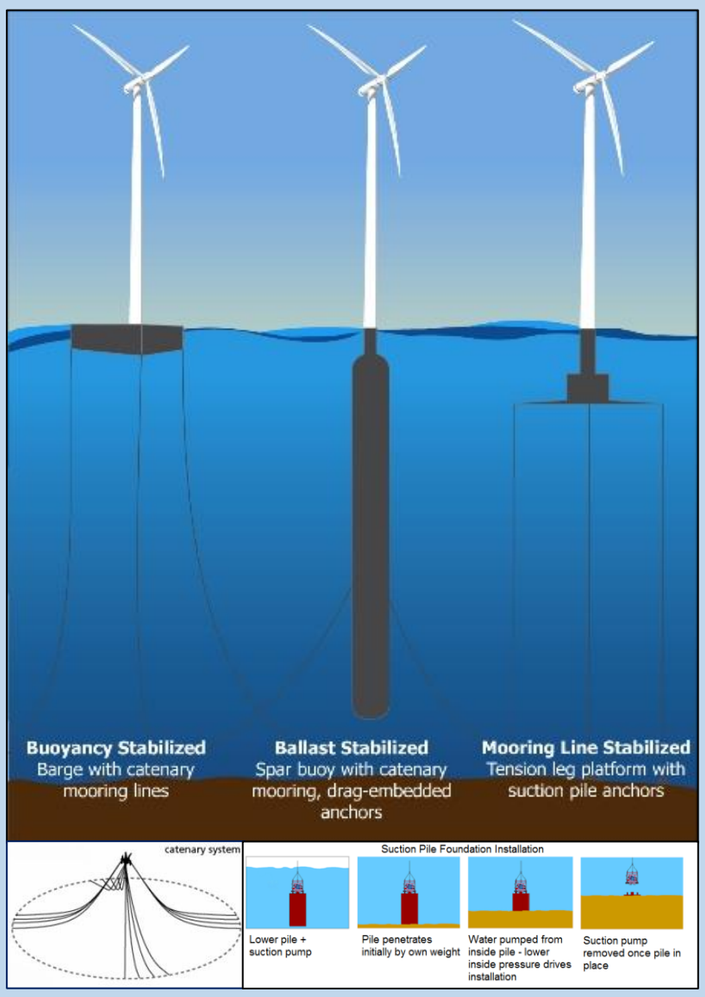
- Offshore wind energy involves building wind turbines in the sea.
- The UK is number one in the world for offshore wind power generation in terms of installed capacity, and has the biggest plans for projects up to 2020.
- Building wind turbines at sea is more expensive than on land, since construction and maintenance is more difficult, and rough sea conditions means that devices have to be very durable to withstand winter storms.
- But wind farms can be much bigger in scale at sea, with less potentially people directly affected in comparison to an onshore wind farm.

- The planning process for offshore wind farms involves a number of important issues, including:
  - Assessing potential impacts on bird and fish populations
  - Checking for interference with aircraft radar
  - Shipping and flight navigation
  - Impact on the landscape/seascape

- Research has shown that building wind turbines at sea can be controversial, since the view out to sea from the shore is one of the most valued characteristics for residents of coastal towns, and for towns that rely upon tourist visitors.

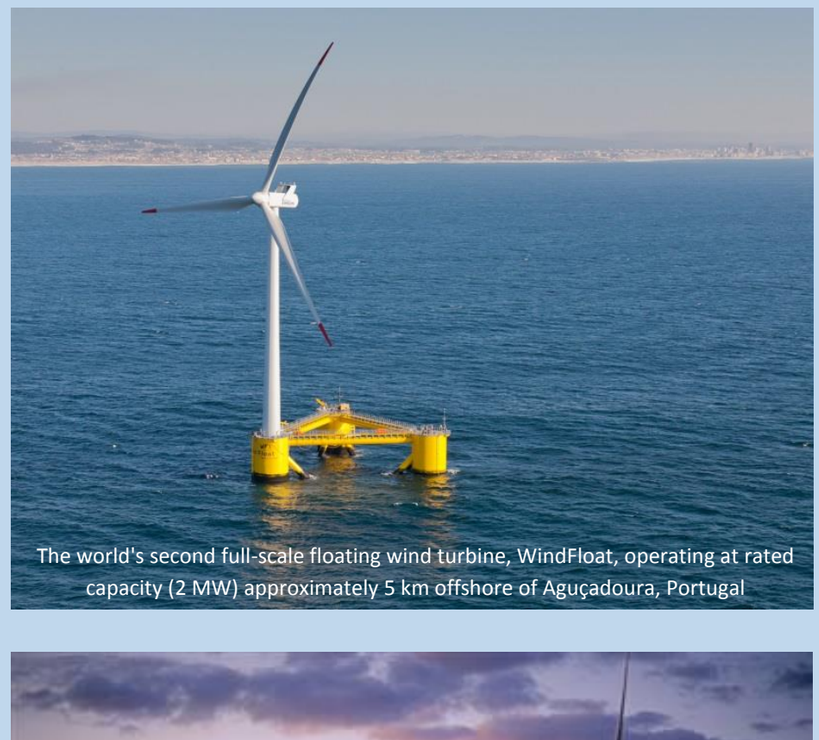
Fixing wind turbines to the sea bed is one of the engineering challenges involved in offshore wind energy. Newer designs aim to float turbines on the water surface to allow access to deeper waters.





The industry has identified 3 basic methods of stabilising floating wind developments:

- The buoyancy platform consists of a barge base with catenary mooring lines (named after the shape of the curve of the line). These lines form a curved shape and raise the resistance of the anchors.
- Ballast platforms include a spar buoy (tall, thin buoy noted for its balance), catenary mooring, and drag-embedded anchors.
- Mooring line platforms consist of a tension leg platform with suction pile anchors.



The world's second full-scale floating wind turbine, WindFloat, operating at rated capacity (2 MW) approximately 5 km offshore of Aguçadoura, Portugal

Middlegrunden wind farm near Copenhagen, Denmark

This offshore wind farm is notable because, unlike UK offshore wind farms, it is partly owned as a cooperative.

50% of the value of the wind farm is owned by 10,000 citizen investors, who receive an annual dividend.

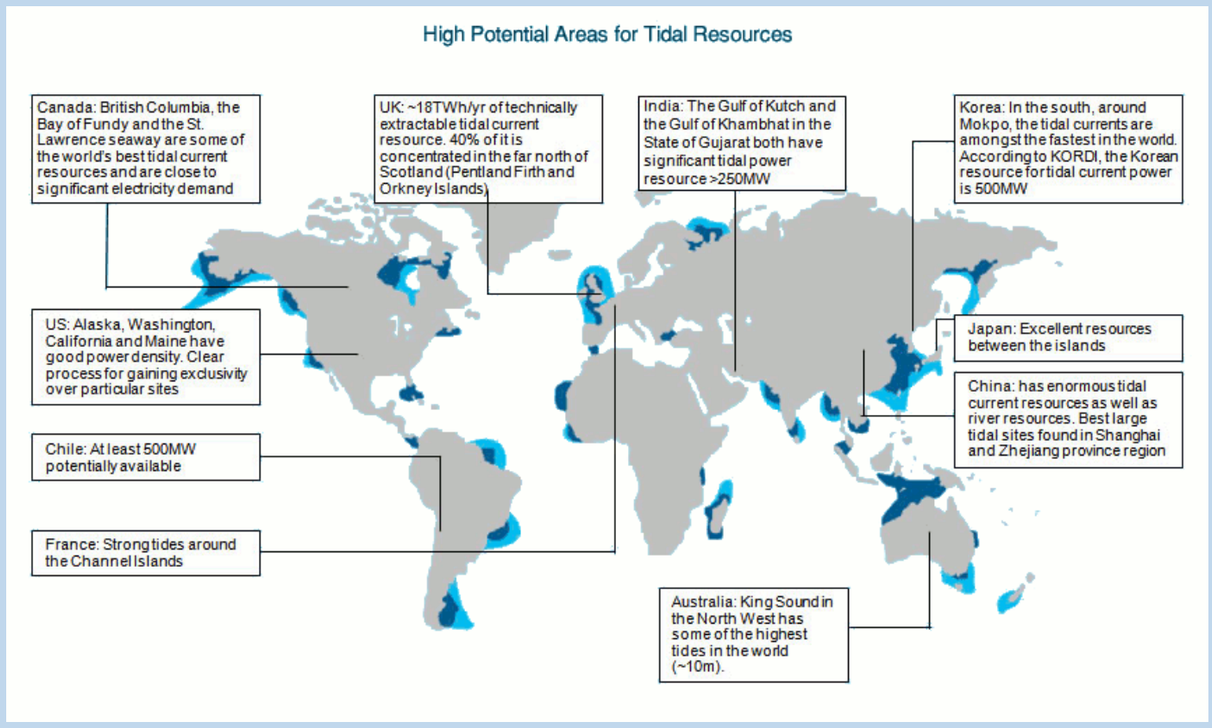
A common practice in Denmark, it is one of the reason why wind farms are often more popular in that country than in the UK.

UNIVERSITY OF EXETER STATES OF GUERNSEY

Tidal Stream Energy – an introduction

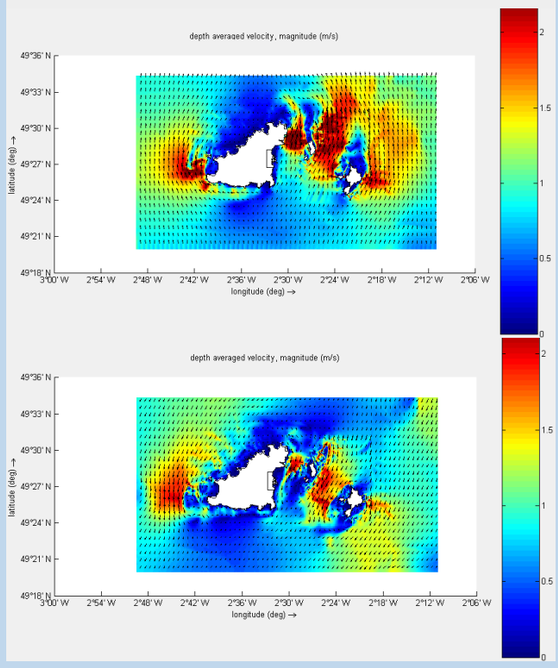
- Tides are caused by the pull of gravity exerted by the moon and sun on the Earth.
- **Tidal stream devices** use fast-flowing currents of water caused by tidal constrictions that are often caused by channelling through narrow seas such as the gap between two islands (e.g. Herm and Sark).

Tidal resources



- Global resource estimates vary; tidal stream energy capacity may exceed 120GW globally and supply more than 150 TWh annually, well in excess of UK domestic consumption.
- The UK's resource is estimated to be more than 20 GW (excluding the Channel Islands).
- The Bay of Fundy in Canada potentially contains as much as 30 GW of capacity.
- China coastline is more than 22,000km with an estimated power capacity of 3.5 GW.
- Other areas with significant resource potential include Australia, New Zealand, North America, Argentina, Russia, France, India & South Korea.

Identification of Guernsey peak tidal speeds and direction – averaged through the water column



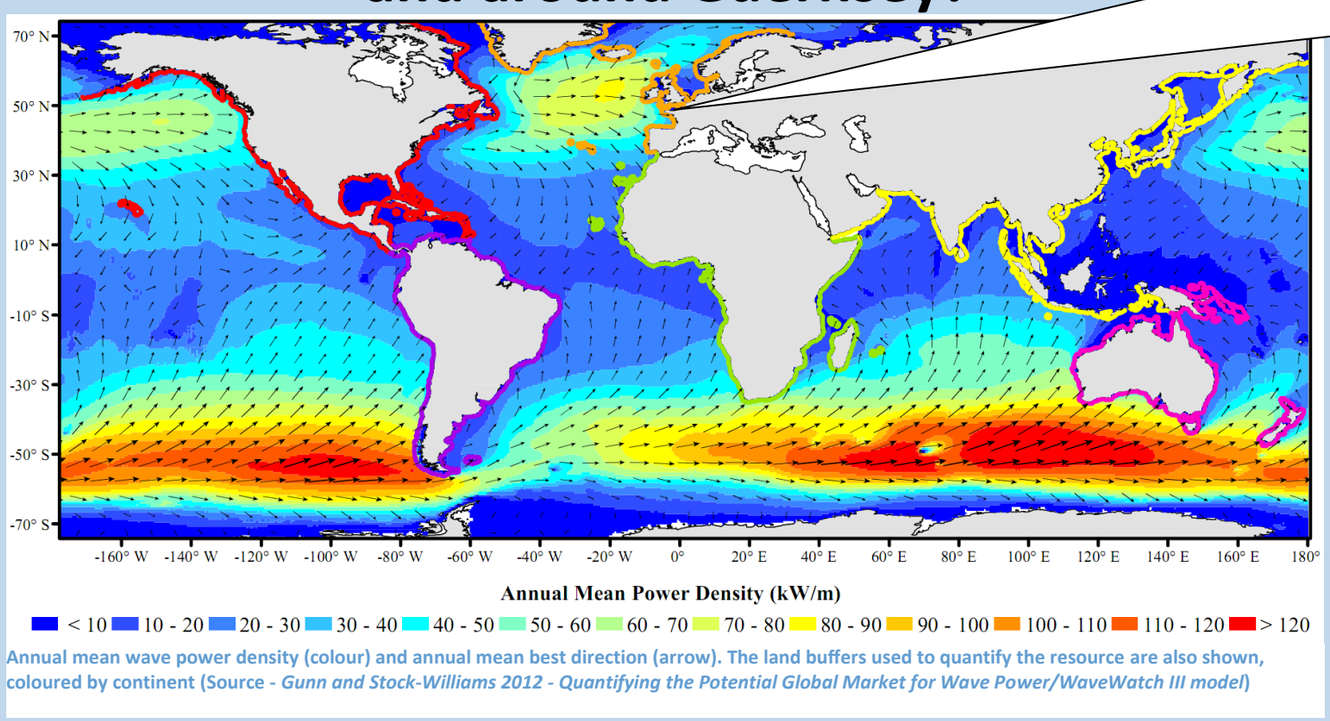
Strangford Lough, Northern Ireland

"SeaGen S" in Strangford Lough, Northern Ireland, (pictured left) was one of the first grid connected tidal stream devices (2008). Below the surface two rotating turbines produce enough electricity to power 1500 homes annually. It will be decommissioned in June 2016. University of Exeter research found that local residents supported the project and felt proud that a world-leading energy project was located nearby.

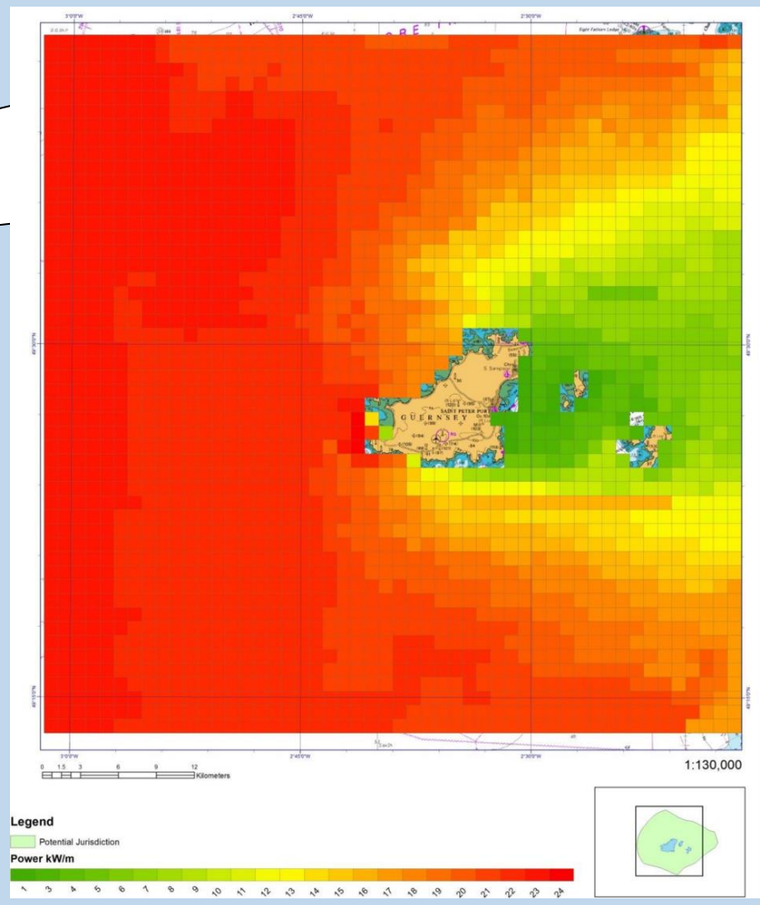
Wave Energy – an introduction

- Waves are formed by the wind out to sea blowing over the water surface, creating a swell due to friction.
- **Wave energy devices** convert the motion of the wave into electricity. Currently, different technical designs are being trialled to do this as efficiently, cheaply and robustly as possible.

How much wave energy is there globally and around Guernsey?

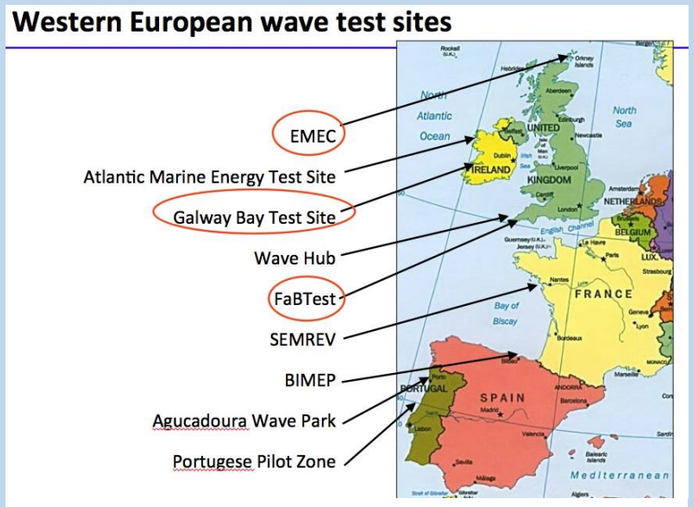


Annual mean wave power density (colour) and annual mean best direction (arrow). The land buffers used to quantify the resource are also shown, coloured by continent (Source - *Gunn and Stock-Williams 2012 - Quantifying the Potential Global Market for Wave Power/WaveWatch III model*)



The northern hemisphere wave climate is more seasonal than the southern hemisphere, with significantly more energy in the winter months than the summer. There is also a greater expanse of open water in the southern hemisphere. This is why the greatest annual resource is found in the southern hemisphere

Wave energy devices are being tested in several European locations



UNIVERSITY OF EXETER STATES OF GUERNSEY

Engaging with the Public

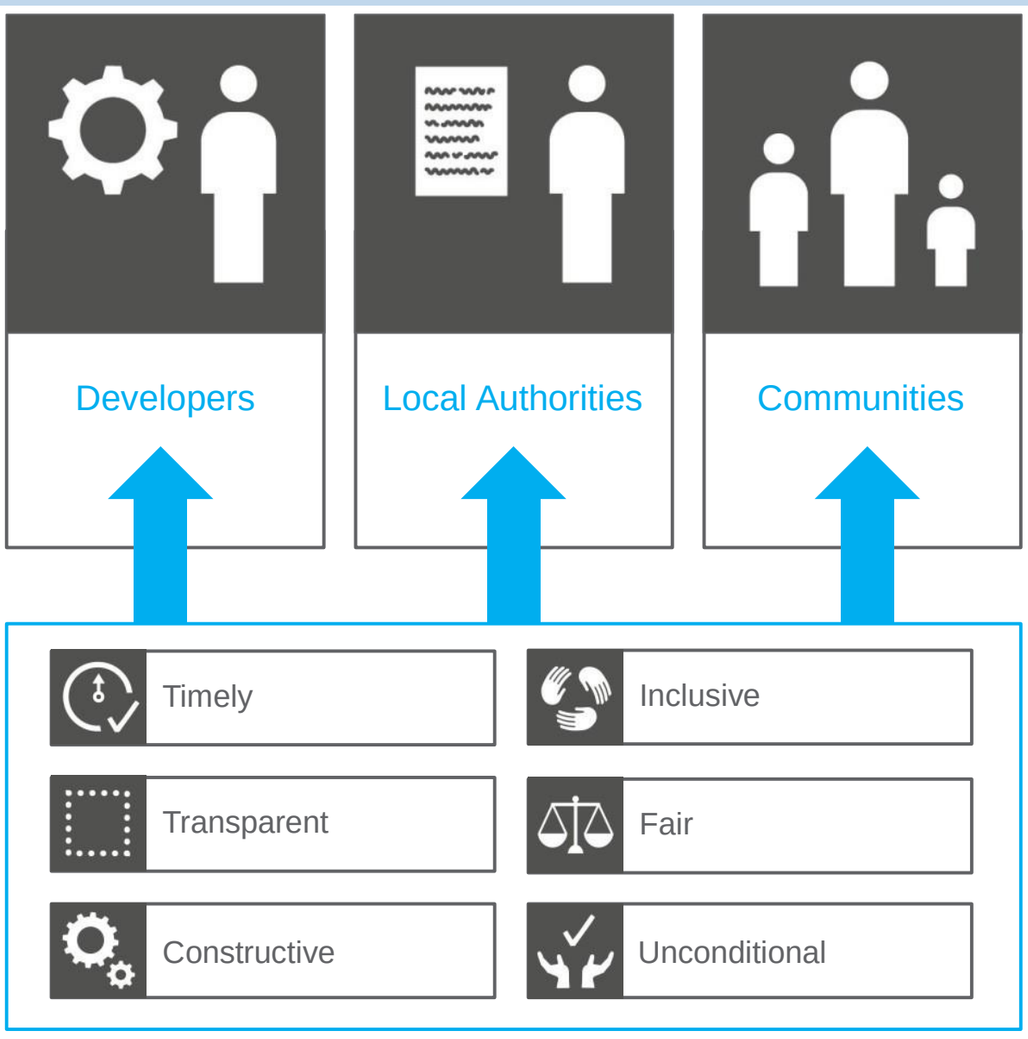
Public engagement is common practice as part of any renewable energy project. It involves informing those affected by a project about what it will involve and gaining their feedback about these proposals.

Why do it? Engagement can be prompted by any or all of the following motives:

- Gaining public feedback will lead to a better quality proposal
- It is morally right to inform those who will be affected by energy projects
- If you don't, you might face public objections or 'NIMBYism' (Not In My Back Yard)
- It sounds good and will improve your reputation
- You have to, under planning and environmental law
- Engaging with the public can build trust between those involved

Principles of Best Practice

A 2014 report for the UK Government by RegenSW identified 6 key principles to be followed when engaging with communities affected by energy projects:



Timely

All parties should have access to a clear timetable for the development which identifies engagement opportunities. Engagement should begin early so that it takes place when plans can be changed, and when it is cost-effective to make changes. All parties should allow sufficient time for considered and informed responses, and feedback should be provided to enable understanding of how information gathered through the engagement process is used.

Transparent

All parties should be clear about the interests and people they are representing. All information should be provided in a clear, accessible and appropriate form to tell people what they want and need to know, and allow them to decide whether to engage in the process. It should be clear what aspects of the development and community benefits are fixed and why, and what is 'up for debate'. Mechanisms should be in place to allow information to flow in all directions.

Constructive

All parties involved in community engagement should do so in a positive manner and aim to create and strengthen relationships based on mutual trust. Dialogue should be a two way process, meaning those involved should listen as well as contribute.

Action should be taken to foster links with parties who can advise and support on the use of appropriate engagement techniques in the area, and routes to achieving mutually beneficial outcomes.

Inclusive

All parties should seek to understand the full range of local opinion about the proposed development and assist in identifying and engaging people in the wider community. Action should be taken to understand the barriers that may exist to people actively participating and what creative steps could be taken to help build local people's capacity to engage. It is particularly important to support the participation of under-represented individuals and groups to ensure they have an equal opportunity to be heard.

A variety of engagement opportunities should be used to ensure people have a chance to get involved in a way that suits their needs.

Engagement practices should be reviewed and the results of engagement used to identify gaps and inform actions to widen the process and ensure the views of people from across the broad spectrum of the community are heard.

Fair and evidence-based

All parties should acknowledge and respect the rights of all stakeholders to express their views.

Robust factual information and evidence should be sought as the foundation of engagement and a positive way to address differences of opinion.

Participants should be provided with the opportunity to take an active part in developing proposals and should understand how their views have been responded to through the development. Changes made to the development as a result of engagement should be done on the basis of the wider community view and not a vociferous minority.

Unconditional

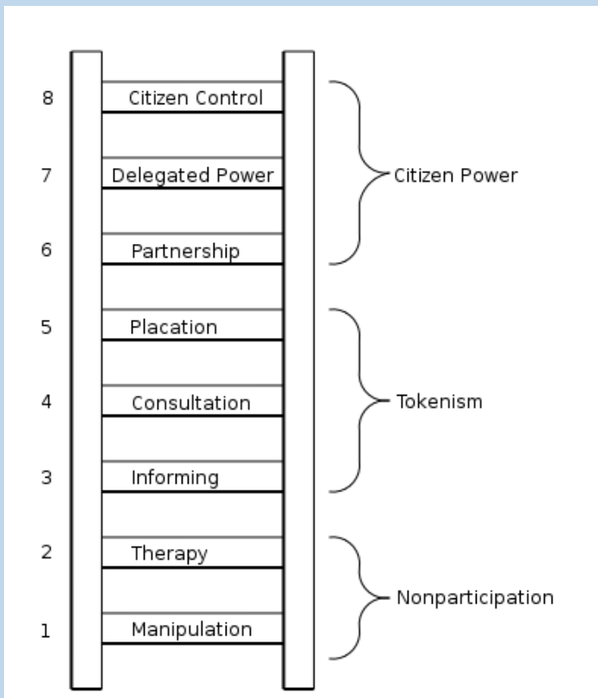
It should be made clear throughout the process that engagement by any party, at any stage, does not imply support for the development, or that approval by the Local Planning Authority is more likely to be achieved.

"Excellent! So that's passed then. All we need do now is draft the consultation document"

It is important to include people in engagement from an early stage in order to avoid the feelings expressed in the satirical cartoon.

Methods of public engagement

- **Information** (e.g. leaflets, displays, websites, Media releases) – this is a one-way flow of information to the public.
- **Consultation** (e.g. questionnaires, focus groups, open days) – this involves some two-way communication between the parties. The PhD based on Guernsey (cited in this display) used questionnaires and focus groups.
- **Deliberation** (e.g. citizens juries) – involves communication at a deeper level and leads to changes in opinions and capacities for all parties. It can also increase trust.



On the left is a **'Ladder of Participation'** devised by Arnstein in 1968. It shows how public engagement is deeply political in nature. It can be a tokenistic attempt to manipulate people to think they have more of a say than they really have, although more commonly now public opinion can make or break a development.

UNIVERSITY OF EXETER STATES OF GUERNSEY