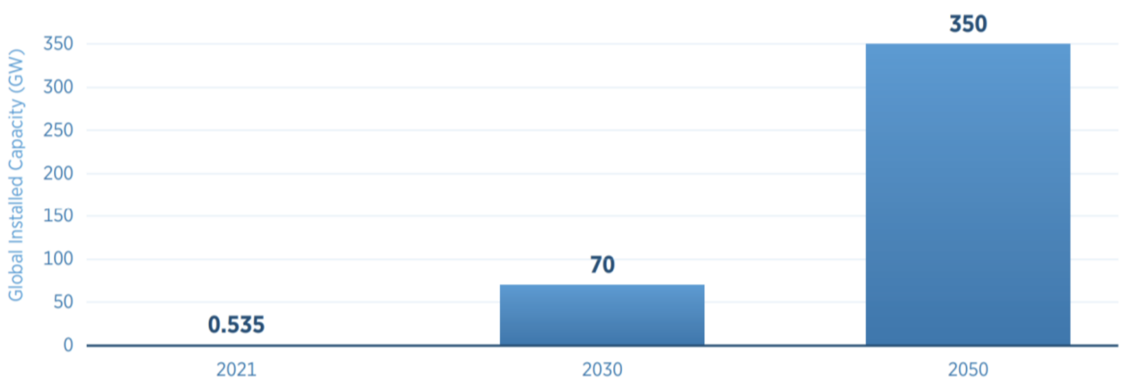
UNSG Report – Ocean and Laws of the Sea

IRENA Contribution

Excerpts from "IRENA and OEE (2023), Scaling up investments in ocean energy technologies, International Renewable Energy Agency, Abu Dhabi"

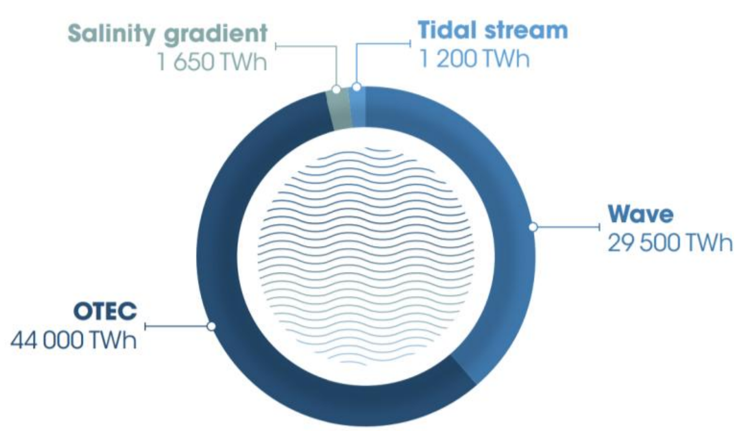
Ocean energy is one of the technologies that must be scaled up for the energy system to reach full decarbonisation (IRENA, 2023). As shown in **Figure 1**, with a global market potential of 350 gigawatts (GW) by 2050 (IRENA, 2022), ocean energy can provide clean, local and predictable electricity to coastal countries and island communities around the world.

Figure 1 – Projected global installed ocean energy capacity in 2030 and 2050



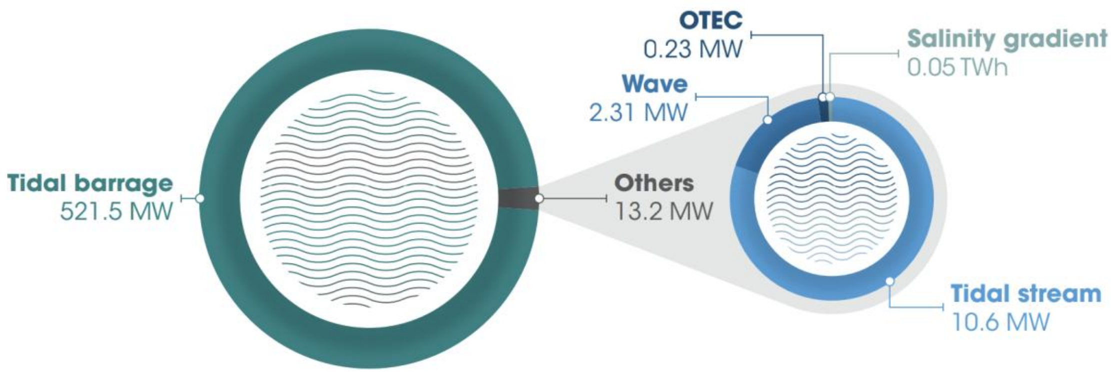
Ocean energy technologies are usually categorised according to the resource they use to generate energy. Tidal stream and wave energy converters are the most mature solutions applicable across different geographies. Additional technologies exist that are able to extract energy from temperature gradients, differences in salinity concentration and the movement of ocean currents. Figure 2 below show the technical energy potentials of these ocean energy technologies.

Figure 2 – Global Ocean Energy Potential



According to IRENA's current estimates, the global installed capacity of ocean energy technologies is 0.535 GW – as shown in **Figure 3**

Figure 3 – IRENA estimate for global deployment of ocean energy technologies



To reach appropriate volumes and facilitate cost reductions - at industrial deployment scale - ocean energy will need to develop utility-scale projects connected to main electricity grids. Some secondary markets will still be of interest - for example, for specific designs such as aquaculture, oil and gas decarbonisation, and hydrogen production. However, these alternative applications will not be enough to provide the necessary capacity to support a sustainable energy transition within a short time horizon. Co-location with other renewable energy sources, such as offshore wind or floating photovoltaic (PV) systems, can also be applied to optimise the power production profile and the use of marine space.

As ocean energy technologies capacities are deployed (especially wave and tidal), the cost of this energy will be reduced through economies of scale, the streamlining of supply chains and improvements to devices. The business models and technologies for ocean energy are similar to those for offshore wind energy and can achieve similar cost reductions. Large-scale deployment of ocean energy will deliver the most dramatic cost reductions, as has been the case for offshore wind.

Some of the key avenues to scale up investments in ocean energy technologies to accelerate their deployment moving forward and thereby contribute to cost reductions are as follows:

At the R&D and prototype stages, promote the development and/or replication of stage-gate programmes globally while simultaneously maintaining grant funding.

- R&D and prototype projects aim to test components or devices and do not generate revenue. For this reason, grants are critical to finance this stage - particularly the deployment of first prototypes in open waters. The addition of a 100% public funding channel, via precommercial procurement, represents an innovative and essential way to sustain financing for this phase. This addresses the negative externalities of technology development.

- Full funding of initial prototype deployments allows core ideas to be tested and verified. This "proof of concept" then allows developers to seek some private investment for the next and more costly stage of technology development, although public support will still be needed.

- The stage-gate approach fosters innovation by requiring technology developers to compete against each other based on standardised criteria. It thus ensures the best use of public funding and lowers the need for this funding. As the awarded projects are deployed, they support the development of local supply chains in participating countries.

At the demonstration and pre-commercial phases, leverage combined finance solutions to their highest potential.

- Pilot farms are generally project-financed, combining several sources of public and private grants, debt and equity into a package. They are expected to generate electricity and (some) revenue for private investors. Grants are no longer sufficient to ensure that projects are delivered.

- Combining different public instruments will foster a good use of public funding, as some instruments can make others cheaper. A successful financial jigsaw should include:

    - Grant funding - to reduce the total financing requirement and cost of finance.
    - Public-supported equity - to improve access to capital and lower the cost of finance.
    - Public-guaranteed loans - to improve access to capital and lower the cost of finance.
    - Insurance and guarantee fund - to cover technical risk, reduce financial exposure and allow private investors to fill the remaining financing gap at a lower cost.
    - Revenue support - to finance operational expenditure (OPEX), interests from debt and dividends for equity.

- No single public support instrument will be sufficient to deliver ocean energy demonstration and pre-commercial projects. A range of support mechanisms must be available to finance a project at the lowest cost to the public purse.

At the industrial roll-out phase, ensure that revenue support is earmarked to attract private investors.

- Grants can cover only a portion of the overall project costs, decreasing as the technology becomes more commercial. Equity/debt providers demand higher returns for innovative projects. Wholesale electricity prices alone are not sufficient to cover those returns without a top-up. This may motivate private capital providers, given the potentials for technical leadership and a first-mover advantage in a new ocean energy market.

- The establishment of revenue support schemes specific to ocean energy projects at the national level is essential. It is highly recommended that proposed schemes enable the first demonstration and pre-commercial projects to go ahead and set a clear signal that support will be in place for a subsequent industrial roll-out. In most, if not all, cases, support can be provided to ocean energy within existing national support frameworks for renewable energy.

- Competitive auctions are a more recent type of revenue support, while feed-in tariffs or renewable certificate systems were common in the past 20 years. All can deliver well, if properly designed. For auctions specifically, it is recommended that separate “pots” be earmarked. These pots should establish a minimum amount of funding or capacity deployment solely for ocean energy. Other innovative renewable technologies can also be included in the pot, as long as they have not yet been deployed at scale.

- The development of a tax system can also be used to provide revenue support, without impacting electricity bills or public expenditure. Large companies buy electricity from producers via power purchase agreements. Without revenue support, ocean energy PPAs will be more expensive than PPAs from other energy sources. A system of tax credits allows companies to claim this extra cost back via reduced tax bills. The PPAs allow ocean energy projects to attract the necessary revenue, but this is funded through foregone tax revenues rather than a levy on electricity consumers.

Streamline and reduce timelines for licensing and consenting and adopt an "adaptive management" approach.

- Streamlining and reducing lead times to deliver projects is a top priority for the wind industry, and it is also a significant demand in the ocean energy sector. A lead time of a maximum of one year for permitting processes is considered best practice and should be implemented by national/regional authorities, including through the provision of deadlines for processes.

- Also critical is the need to adopt an "adaptive management" approach for licensing and consenting decisions. When making decisions, authorities take on small short-term risk to gain new knowledge about environmental impacts. These learnings then inform future decisions. Authorities progressively reduce uncertainties about the impacts of ocean energy, while still controlling risk.

References

IRENA (2022), World energy transitions outlook 2022: 1.5°C pathway, International Renewable Energy Agency, Abu Dhabi, www.irena.org/publications/2022/Mar/World-Energy-TransitionsOutlook-2022

IRENA (2023), "Ocean Energy", www.irena.org/Energy-Transition/Technology/Ocean-energy (accessed 27 February 2023).