A contribution to

An analysis of medium to long-term impacts on the Australian Oceans

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1.1 Ocean renewable

Offshore energy production is diverse and complex. It includes wind, wave and tidal energy and represents a small portion (0.03%) of the global energy production. In 2015, the global capacity of ocean energy was 562 MW, 32 MW more than the year before, with 90% provided by South Korea, France, the UK and Canada (Ernst and Young and Associes, 2016). However, the potential is large and ocean energy has the advantage to be more predictable than onshore energy. Hence, policy support has been growing in several countries.

Offshore wind is the main source of offshore electricity. It has been in use commercially for several years but is relatively immature compared to onshore wind generation (BREE, 2012). According to the International Energy Agency (IEA), cumulative grid-connected wind capacity reached 18 GW for offshore wind and 497 GW for onshore wind in 2017. The global offshore wind cumulative capacity is expected to reach 52 GW by 2023 (IEA, 2018). Offshore wind progressed to 60 TWh in 2017, with a 32% generation growth, which is however not sufficient to meet the Sustainable Development Scenario (SDS) target of 270 TWh in 2025 and 540 TWh in 2030. The final approval of the European Union's 2030 renewable energy targets and their implementation will be determinant for the accelerated growth of offshore wind sector.

Currently, there are no offshore wind farms in Australia. A project (Star of the South) is at the feasibility phase, to install wind turbines off the South coast of Victoria's Gippsland region. No other projects are planned as the cost of offshore wind is still high compared to onshore wind and solar in Australia. However offshore wind may eventually become competitive as its cost decreases rapidly.

Wave and tidal energy technologies are still new. Targeting of niche-markets (aquaculture, desalination, offshore platforms, coastal protection, overtopping devices, etc) may provide opportunities since ocean energy cannot yet compete with established renewable energy technologies (i.e. wind, solar).

Currently various types of designs of Wave Energy Converters (i.e. mechanical pendulums, oscillating water columns, heaving buoys, etc) are considered. Eventually a couple of technologies will emerge as robust, which will allow for the sector to grow faster. Tidal energy technology is not as complex as wave energy technology (Manasseh et al., 2017) but tidal energy production usually has high costs, and the number of sites with sufficiently high tidal ranges is limited.

Australia has large wave energy resources because of its vast coastline and its exposure to the Southern Ocean (M. Hemer et al., 2018; M. A. Hemer & Griffin, 2010; Manasseh et al., 2017). Projects are mainly at the research and development stage or, for a few of them, at commercial demonstration stage. On the contrary, only a few regions are of interest for tidal energy. These include parts of Bass Strait in Tasmania, and King Sounds and Torres Island on the North coast. No proper assessment of the resources has been done yet (Griffin & Hemer, 2010) but a project funded by the Australian REnewable Energy Agency (ARENA) aims at assessing the resource and feasibility to Australia's future energy mix.

An additional challenge for Australia is the distribution of electricity. Most of the population is concentrated near the coast around a few cities in a non-uniform manner. However, ocean energy infrastructure can be associated with coastal protection, which can be relevant in the context of sea level rise and increased storms frequency, and may help make it commercially viable.

1 References

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