

Policy Brief

Wave energy innovation needs

Our 2050

This is one of a series of policy briefs to summarize ongoing findings related to the research project, 'Our 2050 – Opportunities for Ireland in a Low Carbon Economy', which is on the economic and societal opportunities arising from the transition to a low carbon economy and the policies needed to achieve this transition



The Our 2050 project is addressing four key questions:

1. What will Ireland's future energy use look like? In particular, how will we generate electricity? How will we heat our buildings? What modes of travel will we use?
2. What technologies are most likely to play leading roles in Ireland's transition to a low carbon economy?
3. What strengths can Ireland play to, and what opportunities can Irish-based firms avail of?
4. What policies are needed? What do government, firms, universities and individuals need to do, individually and collectively, to achieve the transition?

This policy brief addresses the critical challenge faced when answering the fourth question.

Wave energy innovation needs for deployment in Ireland by 2050

What is the potential for wave energy technology in Ireland and what are the innovation needs to realise that potential? To decarbonise the energy system by 2050, Ireland will need to dramatically enlarge its low carbon technology portfolio. Ireland has significant wave energy resource potential in the surrounding sea (21 TWh, see Figure 1); although the technological challenges for fully commercial wave energy are significant, we have developed scenarios of Ireland's energy future that examine the cost reductions necessary for wave energy to be competitive by 2050. Comparing these cost reductions with historic cost reduction profiles from wind energy and solar PV show a precedent for such energy technology cost reductions (Figure 2). Wave energy technology has specific technical challenges to overcome, but the broader energy system must also be able facilitate the deployment of wave energy technology. Innovation on technology and system innovation would help technology deployment and cost reductions. This policy brief adopts the following two approaches to derive insights to wave energy innovation needs in Ireland:

1. Long-term future energy scenarios (using integrated energy system model Irish TIMES), which provides insights to the level of costs reductions for wave energy to compete in a low carbon energy system
2. Analysis of the innovation needs required for wave energy technologies to achieve cost reductions that enable deployment, which includes analysis of the role of stakeholders, policy, market, & infrastructure

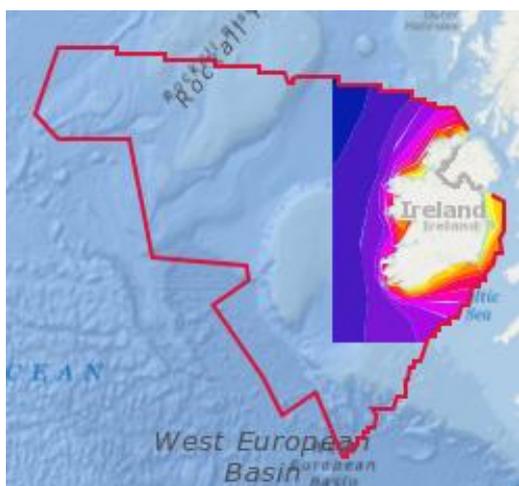


Figure 1 - Wave Energy Resource Atlas Ireland 2005

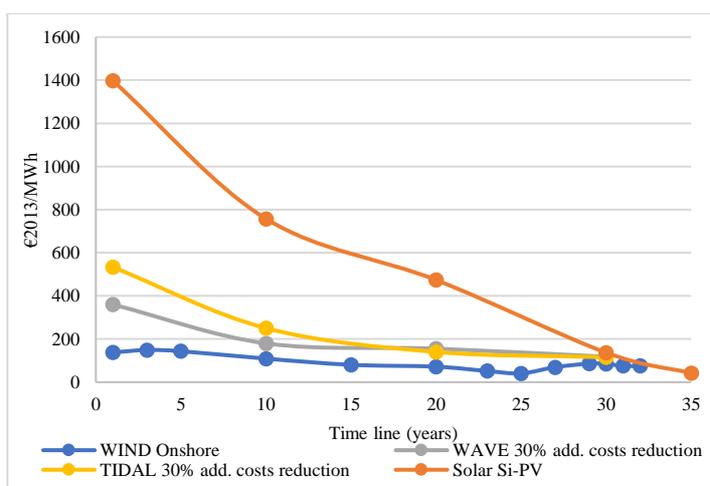


Figure 2 - Historical precedent technology costs reduction

Key messages

The following ten key messages have emerged from this work on innovation needs for wave energy to help decision-makers, particularly governments, address the deployment of this technology.

Technology innovation

1. *There is a need for a standard wave energy device design.* Without a standard design, it is challenging for a broader supply chain and industry to grow. Momentum towards a standard wave energy device design would also galvanise collaboration between national and international research centers.
2. *There is a need for scale-up at the technological level which would improve costs and performance efficiency of wave energy.* Unit-level scale-up typically arises after standardization, but if rushed is often not successful. Niche market activity can be an opportunity to investigate economies of scale.
3. *There is a need for knowledge sharing and international collaboration.* International innovation programmes can help coordinate research momentum towards a standard design. Historical evidence shows how technology innovation benefits from international innovation programmes particularly in term of sharing technical achievements.

Market innovation

4. *There is a need for a niche market for experimentation and learning to help wave energy technology improve reliability and costs without being exposed to full commercial pressure.* A niche market can help a design to improve in a way that contributes to the standardisation process. The engagement of both government and incumbent industry in the niche market development can also help with financial support.
5. *There is a need for potential access to large market.* Beyond the niche market stage, wave energy will need access to large stable markets as an incentive for investors to sufficiently invest in a technology such that it bridges the technological valley of death. Irish TIMES modelling results show that an increase in electricity demand is associated with higher deployment of wave energy.

System innovation

6. *There is a need for local industry and supply chain development.* The role for Ireland in the wave energy sector will be dependent on a capacity to develop an industry in the country including the overall supply chain. Technical know-how and knowledge from other industries can contribute to the formation of a local supply chain, e.g. the expertise to manufacture a technology will be different from the expertise to develop it. Historical evidence points to the positive contribution that wider industry can make to commercialisation.
7. *There is a need for integrated infrastructure.* To enable the widespread adoption of renewable energy technologies, and particularly wave energy, electricity grid infrastructure will need to be integrated according to the device designs requirements and the distributed electricity generation needs. Grid operators and utility actors should play a primary role at the early stage of development to investigate the feasibility and potential of electricity system integration.

8. *There is a need for clear and prompt regulation and licensing.* Wave energy requires a considerable amount of regulation and permits to be developed and discussed, in order to preserve the sustainability of the sea area. To reach commercialization before regulation is ready could cause risk to investments and lead to delays.

Policy support

9. *There is a need for a balanced energy decarbonisation plan that includes both long-term and short-term perspectives.* Change in the energy system takes time. To achieve transition in the upcoming 30 years will need a stable energy plan and investments, with long-term political commitment. The presence of a clear roadmap is beneficial to increase the confidence of stakeholders to invest in wave energy.
10. *There is a need for sustained political support.* The long timelines associated with developing wave energy technology are a challenge for a political system built around shorter timelines of electoral cycles. Wave energy needs spatial planning, site development analysis, infrastructure investments, and political support. Stop and go policies should be avoided.

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Further Reading

1. *Elia A., Rogan F., Ó Gallachóir B.P. Multi-factors learning curve to describe technology costs reduction: the role of scale effects and spillovers (working paper)*
2. *Elia A., Rogan F., Ó Gallachóir B.P. Wave energy in Ireland - innovation needs for deployment by 2050 (working paper)*

