CAT11 1) A Case for Green Energy Innovation 2) Gás na Coiribe 3) Attribution Science

The global imperative to transition to sustainable energy sources is undeniable. The path towards a greener future is often fraught with complexities, political inertia, societal factors and entrenched economic interests.

The **Kyoto Protocol** was an international treaty, which extended the 1992 United Nations Framework Convention on Climate Change (UNFCCC). State Parties committed to cut greenhouse gas (GHG) emissions. The Protocol was adopted on 11 December, 1997, entering into force on 16 February, 2005. Eight gases were covered: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrocarbons (HCs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), nitrogen trifluoride (NF_3). A second commitment period, in 2012 (the Doha Amendment), extended the Treaty to 2020. The U.S. did not ratify the treaty, on the basis it placed few constraints on developing countries. 51 (mostly developing) countries also did not ratify it. Others (Canada, Japan, New Zealand and Russia) withdrew from the deal.

The Paris Climate Agreement of 2015 replaced the Kyoto Protocol and included commitments from all major GHG-emitting countries to reduce GHGs. The Agreement is a separate instrument under the UNFCCC, rather than an amendment of the failed Kyoto Protocol. This latter, nonetheless, remains an important part of environmental and conservation history.

There is no global consensus on limiting fossil fuel production. The interests of fossil fuel-producing nations (e.g. Saudi Arabia, Russia and the US) do not align with those of nations which want serious climate action.

The global pursuit of sustainable energy has, nonetheless, led to significant investments in solar and wind technologies. These have benefited from substantial government support and investment over the past number of decades, leading to the emergence of large, multinational corporations which dominate these markets. The commercial development of solar panels began in the 1970s, with significant commercial scale-up occurring in the 1990s and 2000s. Wind turbine development took off in the 1980s, with major growth in the 2000s driven by government incentives and technological advances.

Whilst these technologies have made substantial progress, they often face challenges related to cost, reliability and environmental impact. Wave energy, harnessed from the kinetic energy of ocean waves, offers a vast, untapped resource, which could significantly to contribute to global energy needs. A new approach to renewable energy, importantly incorporating wave energy, offers sustainable and cost-effective solutions.

The Oyster 800 wave-energy device, in operation at the European Marine Energy Centre's (EMEC's) Billia Croo site https://undark.org/2024/04/29/scotland-ocean-power/

The Oyster 800 is a near-shore wave energy device which captures energy from ocean waves and converts it into electricity. It is more powerful and efficient than its predecessor, the Oyster 12. Devices like the Oyster 800, developed by Aquamarine Power (founded in 2005), present a compelling proposition. A pioneering wave energy converter, it demonstrates the viability of harnessing this consistent energy source. Its design involves a hinged flap, which captures wave energy and converts it into electricity. The device shows promise for large-scale deployment.

Commercialization has been hampered by a combination of regulatory barriers, market dominance and public and political apathy. It is, nonetheless, imperative to explore innovative solutions like wave energy. Its scalability, combined with its predictable and consistent nature, makes it an attractive addition to intermittent sources like solar and wind power. Devices like the Oyster 800 harness the immense energy potential of ocean waves, offering several advantages:

- **Reliability:** Wave energy is less susceptible to weather-related fluctuations than solar and wind power.
- **Environmental Impact:** Wave energy devices have minimal visual and ecological impact compared with large-scale solar and wind farms.
- **Cost-Effectiveness:** With advancements in technology, wave energy has the potential to become a highly cost-competitive source of renewable energy.
- **Different motivations** for climate action can be accommodated. Some individuals and politicians are driven by an ideology for protecting the environment, without economics considered. Others are motivated by commercial and social justice concerns.

The Potsdam Institute for Climate Impact Research's findings highlight the ineffectiveness of **96%** of current climate policies. The need for a fundamental rethinking of climate policy frameworks is analysed with a focus on evidence-based, impactful solutions. International cooperation is essential to address the global challenge of Climate Change. However, there is a lack of consensus on limiting fossil fuel production and the absence of concrete actions to reduce greenhouse gas emissions. The political landscape is often characterized by a lack of urgency and ambition – or indeed by political polarization - when it comes to addressing Climate Change and transitioning to sustainable energy systems. Faced with electoral pressures and short-term political cycles, politicians tend to be reluctant to support bold initiatives which challenge the status quo. Their approach, in tandem with their electorates, is rather to have a political argument when a particular emergency erupts. To address challenges and accelerate the transition to a sustainable energy future, actions are necessary:

- **Governmental Barriers:** Governments often prioritize established technologies like solar and wind power. They could provide targeted support for a diversified energy mix, including innovative technologies like wave energy - through research funding, regulatory incentives and supportive policies.
- **Grid Integration Challenges:** Integrating variable renewable energy sources such as wave energy, into existing power grids, can pose technical and economic challenges. Governments could support the development of smart grid technologies and flexible energy storage solutions to address these issues.
- **Special Interest groups:** Large corporations, including solar panel and wind turbine manufacturers, have established global supply chains and have significant vested interests in maintaining their market dominance. For example:

- Solar: First Solar, JinkoSolar, SunPower, Trina Solar, Longi Solar and
- Wind: Vestas, Siemens Gamesa, Renewable Energy, Goldwind, Nordex

- **The dominance** of solar and wind technologies allows politicians to claim progress on Climate Change without taking significant risks. First Solar, a leading solar panel manufacturer, has been a major player in the solar industry since the early 2000s. Vestas, a Danish wind turbine manufacturer, has a long history of dominating the global wind turbine market.
- **Public Perception and Political Will:** Understanding of renewable energy is often limited. A lack of awareness about wave energy and other emerging technologies can impact negatively on energy security. Education about the benefits of a diversified energy mix could foster public and political support.

- **International Cooperation:** Despite concerns about Climate Change, international efforts to reduce GHG emissions have been ineffective. International cooperation and enforcement is essential.

To unlock the full potential of wave energy and other innovative technologies, a fundamental shift in energy policy and public perception would help. Governments can prioritize duly agglomerated policies and encourage investment in research and development, streamline regulatory processes and create level playing fields - for all renewable energy technologies.

The global solar power market size was valued at $253.69bn in 2023, is projected to be worth $273bn in 2024 and reach $436.36bn by 2032. Investments in wind energy technologies reached $217bn in 2023.

Ireland ratified the **Paris Agreement** on 4 November, 2016. Ireland's commitments under the Paris Agreement, effectively to be met through the European Union's Nationally Determined Contributions (NDCs). The Climate Action and Low Carbon Development (Amendment) Act 2021, sets out a legally binding path to net-Zero emissions, no later than 2050 and to a 51% reduction by 2030. **https://www.gov.ie/en/press-release/9336b-irelands-ambitious-climate-act-signed-into-law/** In 2023, the EU adopted a set of Commission proposals for its climate, energy, transport and taxation policies - to ensure a cut in net GHG emissions, by at least 55%, by 2030. **https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2030-climate-targets_en**

https://pixabay.com/images/search/extreme-weather/

If all the Irish PAMs planned were fully implemented, an Environmental Protection Agency (EPA) report says only a 29% reduction in GHG emissions will be achieved by 2030, short of the legally binding 51% target. EPA Director General **Laura Burke** said there are only seven years left to act. The EPA said additional emissions result from strong economic growth and related energy demands, so cancelling out cuts achieved by the Climate Action Plan. **https://www.rte.ie/news/2023/0601/1387019-epa-climate-report/**

Climate Action Plan 2024 builds upon measures and actions required to deliver the carbon budgets and sectoral emissions ceilings. The Plan provides a roadmap for taking decisive action to halve Ireland's emissions by 2030 and reach net zero by no later than 2050, as undertaken in the Climate Action and Low Carbon Development (Amendment) Act 2021. **https://www.gov.ie/en/publication/79659-climate-action-plan-2024/** These reports indicate wave power could feature in **an elaborated policy document (**economics included).

Conclusion: The future of sustainable energy can be secured by a diverse approach which combines all available technologies, taxes, regulations and intellectual effort. Only by overcoming obstacles posed by various political, economic and societal factors, can the full potential of renewable energy be harnessed and the impacts of Climate Change mitigated.

[Constructing a responsible Climate Policy will involve, firstly, the study of relevant literature by appropriately qualified people. Sources for this include the International Renewable Energy Agency (IRENA), the International Energy Agency (IEA), the Intergovernmental Panel on Climate Change (IPCC); scientific journals like Nature, Renewable Energy, Energy Policy, Nature Energy, Nature Climate Change, Science; and industrial journals like Renewable Energy World and Windpower Monthly**.]**

Blathnaid O'Dea, in PV (Photovoltaic) Magazine – (**https://www.pv-magazine.com/**)
- 6 November, 2024 – notes that Sustainable Energy Authority of Ireland (SEAI) said there is no scenario in which Ireland will meet its 2030 solar deployment capacity of 8 GW, with existing measures in place.

2) Gás na Coiribe (nó Ghort na Coiribe) a luíonn siar ó thuaidh de chósta na hÉireann, timpeall 80km ó Cheann Iorrais

The Irish Corrib Gas Field in Co. Mayo, Ireland, was developed by Shell. As feedstock for chemical production, gas can (per cubic metre) be most economically advantageous. Long-term contracts for high-value products with stable, growing demand provide price stability for industries essential to the global economy. Combusting the entire reserve will net c$3.5bn. Electricity and heating is lower in the value chain than conversion into chemicals and high-value products. Using the gas for high-value uses, would have netted the Irish State from c$7bn to $17.5bn.

3) Attribution Science: Linking Climate Change to Extreme Weather

A new type of research called ***Attribution Science*** can determine, not if Climate Change caused an event, but if Climate Change made some extreme events more severe and more likely to occur, and if so, by how much. Climate Change is increasing the number and strength of these events. However, determining that Climate Change contributed to an event does not mean it *caused* the event.

https://pixabay.com/images/search/extreme-weather/

The World Weather Attribution (WWA) initiative (an international collaboration of scientists) does real-time analyses of extreme events - right after they occur - to determine out how much Climate Change played a rôle in them. Attribution Science helps the prediction of the likelihood or severity of a particular event happening today - compared with how it might have unfolded in an imaginary world which humans have not warmed. Because natural variability always plays a rôle, even if an extreme event is found to have been made more likely by Climate Change, that does not necessarily mean that the probability of this type of event will increase every year. Researchers from **Maynooth University** and **Met Éireann** have collaborated with the WWA to conduct attribution studies on extreme weather events in Ireland

When an extreme weather event occurs, scientists first determine how frequently an event of that magnitude might occur, based on historical and observational data. Having good observational data going back a long way is important. WWA says the dataset should go back to the 1950s at least and ideally to the 19th century. Events with long observational records which can be simulated using computer models, especially those connected to temperature (eg heat waves), deliver the most accurate answers.

If an extreme weather event occur twice as often - in today's climate model - as it does in the counterfactual climate model, then Climate Change is determined to have made the event twice as likely as it would otherwise have been. **https://news.climate.columbia.edu/2021/10/04/attribution-science-linking-climate-change-to-extreme-weather/**