Public Report

Grid & Marine Spatial Planning Workshop

Held at Wilton Park House, Dublin, 31st January 2019

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Executive Summary

The group workshop on Grid and Marine Spatial Planning (MSP) was attended by the EirWind consortium members, members of the EirWind Advisory Group (EAG) and invited attendees.

The workshop commenced with an address by Declan Meally of SEAI, followed by a project progress update for the EAG delivered by Val Cummins. Rory Mullan of Mullan Grid presented an overview of current and proposed grid capacity and developments and an analysis of potential wind curtailment in 2030 and 2040 curtailment analysis. Paul Leahy framed the issues to be discussed at the workshop and the overarching question for participants was: "**What are the critical grid issues that require action in order to deliver significant offshore wind capacity in Irish waters in the next five years and in 2030?**"

Participants worked in groups to discuss five critical issues that require action in order to deliver significant offshore wind capacity in Irish waters (foreshore and beyond) in the next five years and in 2030. These were: 1. strategies and operations for grid operators; 2. interconnection; 3. offshore wind farm foreshore grid connections and consenting; 4. long-term European supergrid; 5. offshore wind to hydrogen production, logistics, infrastructure, and potential fuel for transport sector.

The issues which featured most strongly in the group discussions were:

- Markets are a key challenge. The hydrogen economy in Ireland is non-existent at present. Hydrogen as a fuel for land and maritime transport is not well developed. Given the limited size of local Irish energy markets compared to the available offshore wind resource, and the potential saturation of the electricity grid if large-scale offshore wind is developed, access to international markets, as well as large-scale electrification of the Irish heat and transport sectors, will be required.
- The need for improvements in Ireland's current transmission infrastructure to access international energy markets, including electrical interconnection, gas pipelines, grid upgrades (and possibly offshore grids).
- Development of hydrogen energy storage infrastructure should be explored, especially given the limited gas storage currently available in Ireland and the cessation of storage operations at Kinsale.
- The Maritime Area and Foreshore (Amendment) Bill is in urgent need of enactment and implementation, and should be aligned to consenting of grid and offshore facilities. A 'champion' in government could expedite this.
- Costs featured strongly. Electrolyser technology is dropping in cost, but projects may still not be feasible from a LCOE perspective. The focus here should be on how Ireland can be competitive in international markets. One advantage is the high capacity factors for offshore wind which should reduce wind plant CAPEX.

Outputs of Group Discussions

Issues and strategies for high voltage grid/transmission network operators

Current and future grid developments

Regarding current network capacity, EirGrid is to publish figures for the East Coast offshore grid capacity in the coming months. The East Coast has the highest available capacity currently. The overall available grid capacity is c. 1-2 GW. Grid capacity is extremely limited in the northwest, with no available grid capacity in Donegal, for example. Are there alternative solutions for transmission systems for the west and northwest coasts (possibly even offshore grids)? Medium term investment is also required for the south coast (Cork and Southeastern corridor). Major onshore electrical infrastructure developments are not envisaged for the Celtic Interconnector project. For the purposes of this report, grid connections are assumed to be direct connections to the transmission system, i.e. 40 MW or greater capacity, unless otherwise indicated.

There is approximately 2000 MW of contracted wind capacity, which is yet to be constructed. There appears to be a favourable climate with the Commission for Regulation of Utilities (CRU) and EirGrid to facilitate offers for some offshore projects in the next couple of years.

Grid capacity is being offered in batches, termed the “enduring connection process” (ECP) – batches 1,2,3. These are analogous to the previously used “gate” process. The ECP-1 batch is currently being processed and first connection offers will be made in 2019. Grid offers for offshore wind will be required early in the 2020s in order to allow offshore wind farms to be connected by 2030. The ECP-1 documentation mentions that the CRU reserves the right to direct the system operator to prioritise connections of generation and DS3 services in areas with potential threats to security of supply, which is most likely to occur in the Dublin region.

The grid development strategy should facilitate the development of offshore renewable energy. In order to accommodate large scale offshore wind, grid connection could be constructed underwater, around the island, rather than across it, but costs would have to be examined carefully.

Wind Curtailment

Wind curtailment is being examined in detail in two ongoing projects, a curtailment study being carried out by Mullan Grid, – funded as an SEAI RD&D project – for which a report is due at the end of March. Curtailment will also be one of the focuses of the EirGrid-led EU-SysFlex Horizon 2020 project[1]. EirGrid’s goal is to limit curtailment to 5% by 2030 by identifying measures to achieve this, for example building more interconnection.

Energy lost because of downward dispatch (including both curtailment and constraint) of wind generation was c. 5% in 2018[2], and will remain at this level by 2020, even with mitigation measures in place. The SEAI project includes a specific focus on ‘long curtailment’ events, up to 100h in duration. It was commented that batteries are **not** the sole solution to curtailment on a high wind system. It was also commented that a new “DS3 (Delivering a Secure Sustainable Electricity System)

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[1] EU-SysFlex Project Website, http://eu-sysflex.com/about/

[2] Eirgrid, All Island Quarterly Wind Dispatch Down Report 2018. Available: http://www.eirgridgroup.com/site-files/library/EirGrid/2018-Qtr4-Wind-Dispatch-Down-Report.pdf

v. 2.0" programme may be required in order to reach long-term goals for integration of wind energy without incurring significant curtailment.

Wind and solar photovoltaic technologies are not currently eligible for DS3 priority status according to the CRU's connection policy transitional arrangements[3]. If a connected wind generator installs a different type of technology and increases its MEC in order to provide DS3 system services then it would be eligible provided the additional MEC comes from a non-wind / non-solar technology.

Smart grids and demand management are likely to play a role in achieving greater offshore wind integration also. The projected increase in electricity demand (e.g. electrification of heat and transport, and new data centres) also needs to be taken into account. System services will provide stability and increased system flexibility, and this is an area where batteries, as well as electrolysers, can play a role.

1500 MW of conventional energy generation currently needs to be kept on the system for energy security. The more we can free up on this, the better for renewables (assuming that sufficient dispatchable generation remains). The 'peakiness' of wind and solar generation represent a challenge for Ireland, but increasing wind capacity factors, particularly offshore, will mitigate this. For example, Oriel's capacity factor will be up to 44.3% with Siemens 6 MW turbines.

Strategies for interconnectors (including designed/existing and future capacity and European supergrid)

Adding interconnection and storage will reduce wind curtailment, assuming we can export when we have a surplus in generation. Demonstration or pre-commercial farms (incorporating storage behind the meter) may be an additional measure to an European super grid – we need to look at the global market, for example countries with gas infrastructure. It would also be worth investigating why existing interconnectors are operating sub-optimally, e.g. during curtailment periods, before further interconnection is added.

Two electrical interconnectors are presently operational; two more are proposed – Celtic with 700 MW capacity and GreenWire with 450 MW. However, it is not yet known how such interconnectors will operate. It is difficult to predict the prevailing direction of electricity flows and the main sources of electricity (renewable, fossil or nuclear) which will flow on these interconnectors. Considering the proposed Celtic interconnector between France and Ireland, there is no guarantee that Ireland will be able to export electricity during periods of high wind, as market conditions in France will influence prices (e.g. if France is producing cheaper nuclear electricity at the same time). Unless market arrangements are negotiated, this will not be addressed.

Therefore realistic scenarios and models are needed in order to quantify the extent of export opportunities for Irish offshore wind. The EU policy framework with respect to Cross-Border co-operation on Renewable Energy Sources is also relevant here[4]. For example, it may be possible to demonstrate that imports of offshore wind electricity generated from Ireland may help to fulfil local RES targets in France. Such measures would need bilateral agreements, market strategies as well as quotas/targets for renewables.

[3] Commission for Regulation of Utilities, Connection Policy Transitional Arrangements 2016. Available: https://www.cru.ie/wp-content/uploads/2017/07/CER17090-CER-decision-on-Partial-Capacity-Release.pdf
CER/16/284

[4] See: Ecofys and eclareon (2018): Cross-Border Renewables Cooperation. Study on behalf of Agora Energiewende. Available: https://www.agora-energiewende.de/fileadmin2/Projekte/2017/RES-Policy/144_cross-border_RES_cooperation_WEB.pdf

All of the above factors will influence decisions regarding if, and where, to build interconnection capacity, and the quantity of offshore wind to be installed, which will need to feed into the MSP process.

Offshore wind farm grid connections and foreshore consenting

There is a pressing need for alignment of planning and consenting processes, (i.e. the Maritime Area and Foreshore (Amendment) Bill – MAFA), and the grid connection regime. This avoids project risk and wasted time. A grid offer can only come if there is a consent in place. Grid consenting needs to be done in the next two years, to deliver offshore wind in the 2020s.

Some participants expect that MSP is going to be policy orientated rather than zone orientated. This is important to get things moving for the newer sectors, although MSP can only inform the design and operation of MAFA or a similar framework.

Clarity needs to be achieved in foreshore licensing, and in adjacent terrestrial land-use planning frameworks, from the point of view of grid connection points. If high voltage connections are used, communities living nearby may also perceive risk, similar to onshore wind grid connections in populated areas. It was noted that objections are most likely to arise where the connection lands. Underground connections were therefore suggested but these have significant additional cost and environmental implications.

A consistent message on this topic was that delivering MAFA and having high-profile government champions are necessary in order to effect the necessary changes.

Offshore wind - hydrogen production, logistics, coastal infrastructures, and potential fuel for transport sector (both maritime and land)

Infrastructure

Regarding potential reuse of existing offshore gas infrastructure (e.g. Kinsale gas platform), the absence of a regulatory framework to cater for alternative use of the gas platforms is an issue. Re-purposing could entail Hydrogen or offshore power to gas plants / synthetic gas plants. Offshore wind farms to power offshore platforms is one possible co-location scenario which could be applied in Ireland. Security of gas supply is a further attractive domestic aspect of hydrogen production from offshore wind in Ireland.

Markets should be secured where hydrogen can easily be sold – a global incentive for Green Hydrogen production could support this.

Transportation

Options for the transport of hydrogen should be considered: pipeline, tankers, trailers, as a liquid (there is a trade-off of cost versus distance). The existing gas network could be used, subject to maximum allowable hydrogen blend limits. It should be borne in mind that transportation is one of the highest costs of offshore production. Regarding connection with the existing gas network – one recommendation is not to do so right now until there is greater clarity on regulations. The current problems are more technical in nature – it is not clear what percentage of hydrogen can be injected into the Irish gas network. In Germany and France this may be up to 20%.

Storage

There is also a need to find storage, given the limited current storage capacity in Ireland, the cessation of storage operations at Kinsale, and implications of Brexit for the use of UK-based storage[5]. The limited seismic activity around Ireland is an advantage for gas storage, but known suitable locations are limited. Underground storage of hydrogen could take place possibly in the depleted Kinsale gas storage if geologically suitable or in Larne (Northern Ireland) – at an old salt mines site previously proposed for a compressed air energy storage plant. Developing storage in e.g. depleted gas fields may have implications for marine spatial planning. It is proposed that the existing caverns and potential storage facilities should be mapped.

Costs and Market Issues

Electrolyser costs, fuel cell costs, were once very expensive, but it is now possible to look at hydrogen in a serious way.

Regarding a pilot offshore power to gas production plant – this is not economically viable yet. There is no incentive to go in this way (ENGIE had the opportunity to commercialise it – linked to LCOE estimated a few years ago of €80/MWh to €60/MWh for a 500 MW power plant). The costs depend on levelised cost of electricity (LCOE) of the wind farm(s). This may have dropped since the ENGIE estimates were made.

If you import from offshore to onshore, then transform it onshore, in some countries you will have to pay taxes on electricity you are producing to generate hydrogen. If the transformation is carried out offshore, you do not pay taxes. The difference can be huge in terms of the final cost of hydrogen. A further advantage of onshore production is that it is seen as safer and easier. Therefore, in the short term, onshore hydrogen production is more viable. In the medium to long-term (5-10 years), this may change, but a key question is where is the demand? If demand is close to the coast, then it makes sense to keep producing on the coast. If production is for export to international markets, perhaps production should be offshore. The footprint of an electrolyser plant is large, so this would be an issue for onshore or offshore, but units can perhaps be 'stacked' vertically to reduce the footprint.

ENGIE is focused on the value chain (e.g. around production, market – to find partners who will buy hydrogen). It is important to look at hydrogen not just as hydrogen but as other products too (e.g. ammonia, methane, methanol, etc.). Public perception and misconception of danger associated with hydrogen is an important issue. However, hydrogen technology is now well-accepted in many countries.

Early on, there was capacity on the grid in Ireland, but now, if we fully develop offshore wind, electricity will saturate market. The hydrogen economy in Ireland is non-existent at present. However, there are a number of advantages and market opportunities for hydrogen production in Ireland, including the need for storage of wind energy, the security of supply / minimising risk by increasing diversity of energy generation. The gas network already exists and there are opportunities to switch from one source of energy to another. Fuel for transport sector and fuel for maritime sector are not well developed, but some large carriers are thinking about hydrogen as a fuel.

[5] Eirgrid/Gas Networks Ireland's "Long Term Resilience Study" (2018) should be consulted here. The study comes out in favour of floating LNG terminals over fixed LNG terminals, gas interconnection and gas storage facilities as means of improving gas security of supply. Available: https://www.dccae.gov.ie/documents/Long%20Term%20Resilience%20Study%202018.pdf

Workshop participants:

- Eirwind Advisory Group members: Declan Meally (DM), SEAI; Patricia Comiskey (PC), SEAI; Joyce Acheson (JC), SEAI; Edwin Mooney (EM), DHPLG; Terry McMahon (TMcH), MI; Sean Cullen (SC), GSI; Edel O'Connor (EO'C), IMDO; Paul Brewster (PB), IMDO
- Invited attendee/speakers: Rory Mullan (RM), MullanGrid Consulting; Erlend Christiansen (EC), EirGrid, Eoghan Tuite (ET), EirGrid, Bernard Dee (BD), EirGrid. EC, ET and BD attended presentations only.
- EirWind Industry Partners' representatives: Niamh Kenny (NK), DP Energy; Clodagh McGrath (CMcG),DP Energy; Agnes Gruschka (AG), Statkraft; Angela Larkin (AL), Brookfield; Peter Campbell (PC), SSE; Guilherme Mello Portugal (GMP), EDPR; Sam Roch-Perks (SRP), Simply Blue Energy; Ben Huskinson (BH), Simply Blue Energy; Camel Makhloufi (CM), ENGIE; Alexi Liedes (ALs), ENGIE; Gary Connolly (GC), ESB; Meadhbh Connolly (MC), ESB.
- EirWind Research Team: Paul Leahy (PL, Chair), UCC; Val Cummins (VC), UCC; Eamon McKeogh (EMcK), UCC (consultant); Andrew Wheeler (AW), UCC; Declan Jordan (DJ), UCC; Nguyen Dinh (ND), UCC; Tiny Remmers (TR), UCC; Prasad Gade (PG), UCC; Yvonne Cronin (YC), UCC; Sarah Kandrot (SK), UCC ; Mitra Kami Delivand (MKD), UCC; Zoe O Hanlon (ZoH), UCC; Emma Jane Critchley (EJC), UCC; William Hunt (WH), UCC.

List of Abbreviations

DS3	Delivering a Secure Sustainable Electricity System
EAG	Eirwind Advisory Group
ECP	Enduring Connection Process
HVDC	High Voltage Direct Current
LCOE	Levelised Cost of Electricity/Energy
MAFA	Maritime Area and Foreshore (Amendment) Bill
MEC	Maximum Export Capacity
MSP	Marine Spatial Planning
OWT	Offshore wind turbine
PAD	Petroleum Affairs Division
SEAI	Sustainable Energy Authority of Ireland
SONI	System Operator for Northern Ireland
UCC	University College Cork

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EirWind is a MaREI Centre's industry-led collaborative research project, co-designing opportunities for the sustainable development of Ireland's marine resources by using offshore wind as a catalyst for innovation. It utilises the concepts of Marine Spatial Planning (MSP) where relevant, including advanced data-analysis, strategic planning, Irish marine and renewable energy policy initiatives and stakeholder management. Research is conducted by five interactive technical work packages (WP) that will develop a data management and spatial analysis framework (WP2), improve cost optimization solutions for future development (WP3), improve methods for stakeholder management (WP4), provide development strategies for the distribution and storage of energy (WP5), assess and synthesize other WP outputs to examine potential environmental and economic impacts (WP6). The project started on 01st August 2018 with a duration of 2 years.

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