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Written Evidence: Inquiry on Renewable Energy in Wales

This response is submitted by Dr Carla De Laurentis and Prof Richard Cowell. Carla De Laurentis is an experienced researcher working in the field of innovation and economic development with a specific research interest in understanding the mechanisms that lead to an effective diffusion of renewable energy (hereafter, RE) technologies at the regional level and how, and why, regions show different patterns in the emergence of RE systems. Professor Richard Cowell has an international reputation for his research on spatial and governance dimensions of energy transitions, especially for his leading work on the relationship between UK devolution and RE expansion, and the role of spatial planning in RE deployment. The evidence presented here draws from a long-standing interest in RE development in Wales and from research conducted from the 1990s through to the end of 2019. Here we specifically draw from data that investigated how renewable resources become realised in some areas and regions and not in others, offering a fine-tuned analysis of how these differences operate in practice by either hindering or favouring RE deployment in Italian regions and the devolved territories of the UK.

Executive summary

As the prices of electricity from wind and solar become competitive without state subsidy, infrastructure endowment and upgrades may become the pre-eminent challenge in RE expansion, especially so where developers seek scale efficiencies through large projects. Wales has ambitious plans for RE expansion (e.g. the Welsh Government's commitment to 70% energy generation by 2030) and as larger generation projects are introduced, the cost and planning controversy, that might rise around siting, planning and consenting of network infrastructure and inter-regional interconnectors, might cause Wales to miss their RE aspirations. It is therefore increasingly important to consider more carefully, the relationship between energy infrastructure networks (transmission and distribution) and decentralised RE at the local scale, and what Wales can achieve as the 'middle level' in a three-tier governance system to steer infrastructure upgrading. Sharing some evidence that emerged from the aforementioned research, this response to the Call for Evidence recommends that Welsh ministers, in collaboration with the UK governments and energy network operators, explores the following opportunities:

- a. To implement local and regional solutions to overcome problems and infrastructure bottlenecks, as a way of addressing the limited scope (for Wales) of shaping the electricity infrastructure networks as RE uptake increases;
- b. To facilitate the identification and operation of sites that could benefit from energy storage and electrical engineering to enhance system stability and security, with Wales becoming a *test bed* and *early adopter* of new socio-technical advancements.

These opportunities for collaboration and experimentation can mobilise investment and economic opportunities to aid Wales's post-Covid-19 economic recovery.

The evidence provided addresses the following points highlighted in the Committee's call for evidence:

Q2. How should the UK and Welsh Governments work together to support the development of RE projects in Wales?

Q8. What opportunities are there for RE to aid Wales post-COVID-19 economic recovery?

Q2. How should the UK and Welsh Governments work together to support the development of RE projects in Wales?

1. The growing priority to accelerate progress towards net-zero greenhouse gas emissions (IPCC, 2019¹) has renewed emphasis on the need to increase the development and deployment of RE. Delivering 'net-zero' by 2050 will require increased efforts in RE deployment and accelerated action to progress in addressing the challenges that delivering RE deployment, at all scales, entail. Accommodating high RE penetration demands the careful planning and consideration of the far-reaching challenges that affect pre-existing energy network infrastructure. The rules that regulate it, and the way in which renewal is governed and financed, by who and at what geographical scale, have an important role in influencing RE potential (IEA, 2020²).
2. Regulatory and governance relationships between the national and sub-national levels offer opportunities for the particular qualities of local and regional setups to be considered and for regions and devolved territories to contribute towards energy system change promoting RE deployment. However, network infrastructures become an important mediating factor, and a possible source of tension between energy resource endowment and institutional/ governance structures. While regions and devolved territories display differences in their incentives, capacities and capabilities to increase RE deployment, their capability to act is often affected by a limited scope to shape the electricity infrastructure networks as RE uptake increases. Nevertheless, while infrastructure steering at the regional level is considered problematic, grid capacity and infrastructure upgrades (including new developments, maintenance and delivery) becomes a site-specific issue that stresses that other tiers of governance, in particular the sub-national level of the region, can play an important role in steering infrastructure requirements.
3. In the UK, since privatisation, key decisions are taken by arms-length regulators that operate on a cross-Britain basis. To some extent, regulatory arrangements might increase the difficulty to drive forward major system reinforcements and network developments. The constitution of energy markets and the presumption in favour of competition has promoted infrastructure renewal largely driven by demand, with new grid elements or upgrades being added as producers wish to connect to the grid. However, getting to 'net zero' in a socially inclusive way may drive the need to go beyond project-led response mode. Italy has displayed a more coordinated approach to infrastructure renewal and governance. The national transmission operator (TERNA) is required by law to provide a National Electricity Transmission Grid Development Plan, which lays out expected grid investments over a ten-year period, allowing for significant grid investments to upgrade the transmission and distribution network with the explicit goal of reducing congestion on the network. Likewise, in the UK, there is a statutory duty to ensure the maintenance and long-term development of, and investment in, infrastructure renewal with network operators introducing planned reinforcement, development and investment in their business plans as part of the regular processes of price review.

¹ IPCC. (2019) Global warming of 1.5°C: Summary for Policymakers (revised version). Switzerland: Intergovernmental Panel on Climate Change.

² IEA. (2020) Global Energy Review 2020. Paris: International Energy Agency.

4. Although the Italian energy system follows a different regulatory regime from that of the UK, it experienced a large increase of RE installed capacity between 2010 and 2012, requiring changes both at transmission and distribution levels, ranging from dispatch operations (to increase system efficiency) to the introduction of mechanisms to enhance performance and measurement of frequency regulation and the construction of new lines. There are benefits in looking at how Italy has addressed some of the infrastructure problems following a rapid increase in RE penetration as network and congestion problems have been felt differently across Italian regions. Some regions, such as Apulia and Sardinia have experienced higher levels of congestion due to the physical constraints of their respective local transmission and distribution networks, experiencing over-production problems under certain conditions (for example strong solar radiation and strong winds combined with low consumption). This strongly echoes the problems that Wales has faced in relation to planning for RE expansion in rural areas, where notional energy resource coincides with limited existing grid capacity.
5. The Italian transmission operator has significantly upgraded the transmission network to reduce congestion, and while some of the network upgrades planned by both the distribution and transmission operators in both Apulia and Sardinia have been completed (or nearly completed), the bulk of improvement is still awaiting the authorisation required. This is important as spatial planning is included in the list of 'concurrent' legislative competences shared by the national and the regional levels and while coordination across different levels has been problematic, it is the relationship that regions can establish with network operators to better address and overcome issues related to particular infrastructure development that can facilitate and speed up the consenting processes. The political decision making and steering of infrastructure renewal at different spatial levels, and the opportunities to establish relationship and coordination across national and sub-national levels of governance become therefore increasingly important.
6. The regional government of Apulia, for instance, to facilitate infrastructure upgrades, has collaborated with network providers on the programming of electricity network infrastructure enhancement (via infrastructure governance round tables) and signed a Memorandum of Understanding between the regional government and TERNA for the application of the Strategic Environmental Assessment procedure for the planning consent of the programme of interventions of the high-voltage power grid. This is significant as it emphasises the relevance of representation in the decision-making processes about infrastructure at the sub-national and other spatial levels and the relationship that sub-national governments can establish not only with other level of governments but also with network operators both at transmission and distribution levels. It shows that it is crucial for the Welsh Government to get involved in the SEA of prospective network expansion attendant on their RE expansion strategies (TAN8 and now the NDF) as this is recognised as one factor creating problems at the project level.
7. In addition, network bottlenecks and limitations experienced in Apulia and Sardinia have also offered the opportunities for Apulia and Sardinia to become key regions for the experimentation of innovative technologies and electrical infrastructure, and herein lie further potential lessons for Wales. This will be discussed in more detail next in relation to Q8.

Q8. What opportunities are there for RE to aid Wales post-COVID-19 economic recovery?

8. The two regions have rendered their territory available for infrastructural investment and mediated potential constraints challenges in infrastructure provision to solve physical and material bottlenecks, providing the opportunities to experiment with new socio-technical advancements.

9. Apulia, for instance, made use of collaborative governance between public and private research organisations, businesses and regional, national and international bodies to provide solutions to the infrastructure bottleneck, allowing regional actors to participate in addressing these. While a number of infrastructure solutions to upgrade the transmission and distribution networks have been implemented by TERNA, the regional government and regional intermediary organisations (such as the regional development agency) have actively participated in promoting innovative solutions, and testing, to address infrastructure bottlenecks, including identifying key sites for the experimentation, provision of resources, networks and socio-technical expertise.
10. The regional government of Apulia, to facilitate infrastructure upgrade, has promoted working with one of the main distribution providers in the region and the national government, on a programme of structural interventions for the development of the distribution network and smart grids- a regional smart grid development- funded via European structural and convergence funds to support RE integration in the distribution network.
11. Apulia has also explored testing and piloting innovative solutions, for instance via a 39 MWh EU FP7-funded pilot plant for hydrogen-based storage for grid balancing (Ingrid). This was opened in Troy, in the province of Foggia, an area with many wind and photovoltaic plants where production peaks and power grid limitations mean energy cannot be locally used or transported. Building from this experience, the region became again the location of a spin-off project, the Store and Go project, a Horizon 2020 project, which explored how the renewable power used in the existing electrolyser established within Ingrid to generate hydrogen can be integrated and operated within the existing gas network.
12. Similarly, Sardinia also has become a 'high-tech hub' for the experimentation of storage applications and to test the use of Synchronous Compensators. Sardinia's infrastructure challenges have provided the opportunity for the national transmission operator to experiment storage applications, piloting some of the main storage technologies currently available on the market and test their performance in terms of system regulation and security, in collaboration with national research institutes, and to test the use of Synchronous Compensators to enhance system stability and security. Importantly, some of the work already conducted took place in an area that already hosted a TERNA substation (TERNA owned the site).
13. While a denser network of regional, national and international organisations can facilitate regional participation to innovative solutions, as the Apulian case shows, so does the spatial organisation of the network operators themselves. TERNA has operating facilities in both regions and developments and experimentation occurred in areas where TERNA already hosted a substation (Apulia) or owned the site (Sardinia).
14. Summarising, although both Apulia and Sardinia have experienced higher levels of congestion due to the physical constraints of their respective local transmission and distribution networks, they have also managed to establish relations with network operators to: i) facilitate and speed up the consenting processes; ii) collaborate with network providers on the programming of electricity network infrastructure enhancement and iii) identify opportunities into infrastructure limitations to become key sites for the experimentation of innovative technologies (e.g. electricity storage). These played an important role to overcome the constraints of the electricity grid and distribution network to RE expansion and promoted innovation in infrastructure solutions.

15. These examples indicate how these opportunities around the development, testing and deployment of infrastructure solutions can provide both a response to environmental problems and a source of regional development opportunities (for investment, skills and supply chain development potential). These opportunities can occupy a pivotal role in the post-pandemic economic recovery.

What lessons for Wales?

16. There are a number of policy, governance and geographical similarities between the Italian cases and Wales. These include shared interest in RE expansion, operating within a multi-tier governance system, and rural areas with limited grid capacity being likely sites for renewable expansion. Wales has ambitious plans for RE expansion and as larger generation projects are introduced, the cost and planning controversy, that might rise around siting, planning and consenting network infrastructure and inter-regional interconnectors, might cause Wales to miss out reaching their RE aspiration. It is therefore increasingly important to consider more carefully, the relationship between energy infrastructure networks and decentralised RE at the local scale, and what Wales can achieve as the 'middle level' in a three-tier governance system.

17. While there are opportunities to further explore and foster cross-sector energy decarbonisation at a more localised scale, the evidence provided suggests that, in terms of infrastructure upgrade and renewal, some of the existing challenges that Wales is facing in terms of energy network constraints could be overcome if Wales proposes to become a *test bed* and an *early adopter* of new socio-technical advancements by facilitating the identification and operation of sites that could benefit from energy storage and electrical engineering to enhance system stability and security.

18. Our research suggests:

- the importance of representation of the Welsh Government in the decision-making processes about infrastructure at the regional and other spatial levels;
- the pro-active collaboration on SEA of prospective network expansion requirements;
- the establishment of formal and informal networks (with network providers, research organisations, energy businesses and local innovators) that can mobilise resources and expertise to identify sites for experimentation;
- collaboration with an array of key actors at national and regional levels engaged in the promotion of RE and infrastructure renewal;
- mobilise resources and explore the channelling of investment opportunities derived by the proposed UK Shared Prosperity Fund to go beyond project-led response mode network development, influencing decision making to address the need for a long-term strategic infrastructure plan;
- plan and identify strategic priorities around infrastructure investment in Wales;
- ensuring the Welsh government develops the skills and capacity to engage creatively with prospective innovations that would create network capacity for RE expansion and energy storage, especially in its rural areas.

19. In conclusion, the Welsh Government is well suited to play a relevant role in coordinating the array of key actors at national and regional levels engaged in the promotion of renewable deployment and infrastructure renewal. Collaborative relationship, as the Italian examples show, can be effective not only in enabling extensive exchanges of expertise but also in influencing

outcomes (e.g. facilitating consenting processes, enhancing infrastructure, and allowing regions to become sites of experimentation with innovative technologies). In doing so, Wales could lead a process of negotiation of priorities around infrastructure investment in Wales to address not only the need for a long-term strategic infrastructure plan that can help Wales deliver its commitment to 'net-zero' and RE targets but also to mobilise investment and economic opportunities to aid Wales' post-Covid-19 economic recovery.

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