OPTIMALLY ALLOCATING RENEWABLE GENERATION IN IRELAND: A LONG-TERM OUTLOOK UNTIL 2050

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EVIDENCE FOR POLICY

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Optimally allocating renewable generation in Ireland: a long-term outlook until 2050[1]

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INTRODUCTION

The Irish energy white paper released in December 2015 states the objective of diversifying electricity generation from renewable energy sources (RES-E). While onshore wind is planned to continue to make a significant contribution, the question arises which roles other RES-E technologies, such as solar PV, wind offshore or bioenergy, will play in the future. Moreover, the Irish 2030 target for RES-E is about to be set. Since the electricity demand growth in future is uncertain and the national target is yet unknown, this creates a high uncertainty around the overall amount of RES-E required. In this uncertain context, this research seeks to provide support for

1. achieving the national RES-E target determined as percentage share of energy demand in a cost minimal way under consideration of different diversification approaches, and

2. long-term planning of the electricity system by providing insight into the future regional distribution of generation and demand under different scenarios.

In order to address the uncertainty in the demand development (from today's perspective largely driven by the growth and connection of data centres) and in the 2030 targets, we consider two different demand development cases (high / low) and three different 2030 targets for RES-E in Ireland (45%, 50%, 60%), which are assumed to increase to 70%, 80% and 90% by 2050 respectively. For each of these cases, we further distinguish between three diversification scenarios: (1) a pure cost minimal scenario (Least Cost), (2) a scenario that assumes a predefined minimum level of diversification of RES-E sources (Diversify) and (3) a scenario that

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assumes a predefined minimum level of rooftop PV in addition to scenario (2) (Diversify+PV). We developed an optimisation model specifically designed for the analysis of these scenarios.

RES-E EXPANSION ON A NATIONAL LEVEL

In the Least Cost scenario, RES-E expansion basically happens through wind onshore only – regardless of the demand case. In the Diversify scenario, until 2030, the most preferred technologies beyond wind onshore are wind offshore and biomass. After 2040, this scenario also sees expansion in ground-mounted solar PV in the high demand case. In the Diversify+PV scenario, there is significant capacity expansion in rooftop PV from 2030 onwards but no expansion in ground-mounted PV. The amount of installed capacity by technology type varies significantly between the demand cases. In the Least Cost scenario, more than 12 GW of wind onshore will need to be installed by 2050 for the high demand case and a RES-E target of 90%, while less than 9 GW will need to be installed for the low demand case and a RES-E target of 70% in 2050. In terms of the cost effects, we find that the Diversify scenario leads to a moderate increase in discounted costs of around 6% until 2050 compared to the Least Cost scenario. In contrast, the Diversify+PV scenario leads to an increase in discounted costs of around 20% until 2050.

RES-E EXPANSION ON A REGIONAL LEVEL

In the Least Cost scenario, the most favourable locations for wind on the west coast and in the North of the island are subject to the strongest expansion. These capacity hotspots change in both Diversify scenarios. For instance, rooftop solar PV has its most preferable conditions in the South and requires a sufficient amount of population to have the required roofs available, thus generation shifts southwards in the Diversify+PV scenario.

POLICY IMPLICATIONS

Our results show that the uncertain growth in electricity demand creates enormous challenges for policy and planning in terms of compliance with RES-E policy targets defined as % shares of the overall electricity demand. Moreover, we find that, unsurprisingly, wind onshore proves to be the dominant technology across all scenarios. However, bearing in mind the extremely high values of onshore wind capacity that are required to comply with the long-run RES-E targets, it should be noted that these imply enormous space requirements and will almost inevitably lead to problems in relation to public acceptance and land-use planning in general as other research has shown.

This research did not account for costs of grid expansion. Therefore, the higher costs of diversification and PV are likely to be at least partially compensated by lower grid expansion costs in the Diversify scenarios since the RES-E generation is more scattered over the country in these scenarios, and the rooftop PV capacities in the Diversify+PV scenario will mostly be installed in areas of high demand. Nevertheless, our results shed light on the tradeoff between the objectives of cost minimisation and diversification. While RES-E diversification may implicitly contribute to reducing concerns in relation to acceptance and land-use planning, it

doesn't come for free. It will therefore be important to understand the tradeoffs people make between different RES-E portfolios and the corresponding costs.

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