BVGAssociates

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Scottish onshore wind pipeline analysis overview

Can Scotland meet its 20 GW by 2030 target?

December 2023

Introduction

In September 2023 the Scottish Government, Scottish Renewables (SR) and the onshore wind sector launched the Scottish Onshore Wind Sector Deal (SOWSD). Outlining an ambition of 20 GW of operational onshore wind in Scotland by the end of 2030, it included the actions that Government and the sector will take to realise that ambition. To help support the delivery of this 2030 ambition, BVG Associates (BVGA) was commissioned by SR to build an interactive model and database that enables a detailed analysis of the onshore wind pipeline in Scotland. This document outlines the results of using this interactive model to develop pipeline scenarios.

Background and model operation

Scenarios in this analysis were initially applied to the existing pipeline from data available in RenewableUK's EnergyPulse database (EPDB). We then enhanced this existing database with information provided by developers both for projects already within the EPDB and for "future projects" not yet in the EPDB and investigated further scenarios.

A timeline for each project was developed following these milestones[i]:

BVGA's interactive model allows for different dropout filters to be applied to the database to ensure that the pipeline being considered is not over-inflated. In all scenarios presented in this briefing, the following dropout filters were applied[ii]:

- Projects in the EPDB exceeding 4 years at their current milestone, are assumed to be dormant.
- Projects yet to be constructed with a tip height of lower than 150 m and/or generator capacity of < 3 MW are assumed to fail to proceed due to commercial disadvantage.[iii]
- General attrition rate assuming 40% of projects dropout between Inception to Construction Start.

Results

1. Existing Pipeline Scenario: EPDB

Figure 1 shows the timeline out to 2033 considering only the existing pipeline in EPDB. Projects are assumed to spend:

- 3 years in pre-submission (between Inception and Planning Submission).
- 2 years in planning prior to receiving consent, extending to 4 years for "challenged" projects, 50% of projects assumed to be "challenged" resulting in an average time in planning of 3 years.[iv]
- 1 year between granting of consent and construction starting.
- 1 year in construction.
- 25 year operational life.

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[i] Projects actual timelines were never altered, timing assumptions were only applied to future milestones.

[ii] Where developers have supplied project data only the general attrition rate filter applies.

[iii] Where projects had no data on tip height or turbine rating, they have been assumed to dropout. This reduced the overall capacity by the end of 2030 by 0.4 GW.

[iv] This is referred to as the "business as usual (BAU) planning timeline".

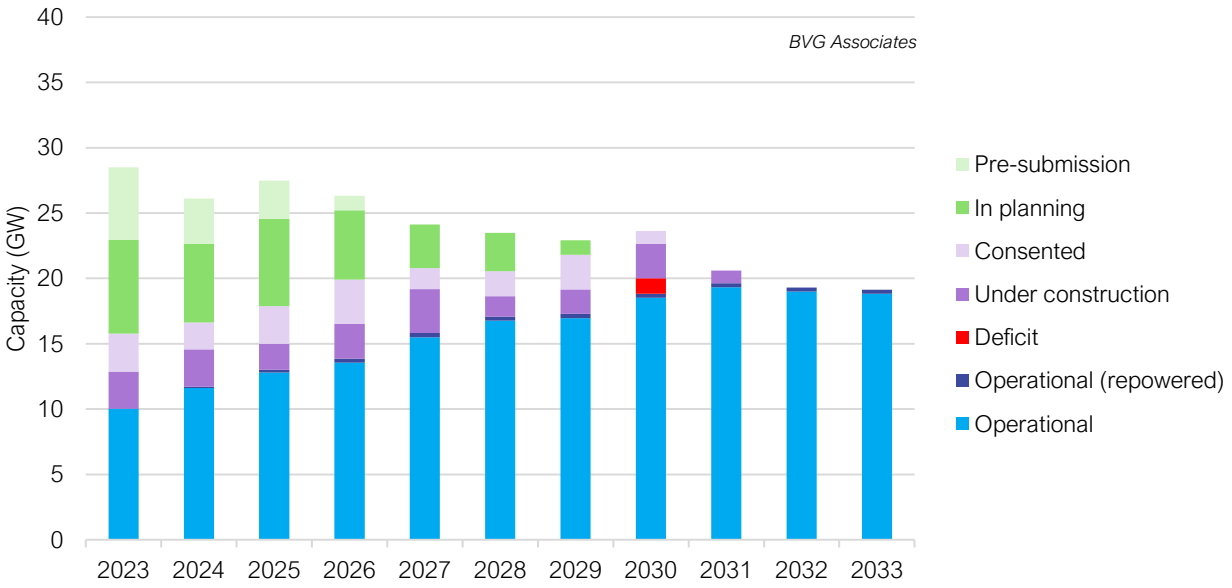

Figure 1: Existing Pipeline Scenario timeline to 2033 considering existing projects in the pipeline only.

In this scenario, 18.8 GW of operational onshore wind in Scotland is achieved by end of 2030 falling short of the 20 GW.

Existing Pipeline Scenario with positive actions applied

Several positive actions, however, can be taken to hit the 20 GW target with the projects in the EPDB already, these include:

1. Using developer supplied timelines; the use of which is analysed further in the Enhanced Pipeline Scenario.
2. Progressing projects which currently have a tip height lower than 150 m or turbines < 3 MW, however, this would likely require reconsenting for larger turbines and modified layouts.
3. Reducing planning durations as committed by the SOWSD to one year in planning, two if "challenged". To represent that other commitments in the SOWSD will likely result in fewer challenges, we reduced the fraction of projects "challenged" from 50% to 20%.
4. Repowering all sites at end of life, assuming doubling the original capacity.

The effects of these on the Existing Pipeline Scenario capacity in 2030 are summarised individually and all combined in Figure 2. Applying all positive actions increases the operational onshore wind in Scotland by end of 2030 to 24.5 GW exceeding the 20 GW SOWSD ambition.

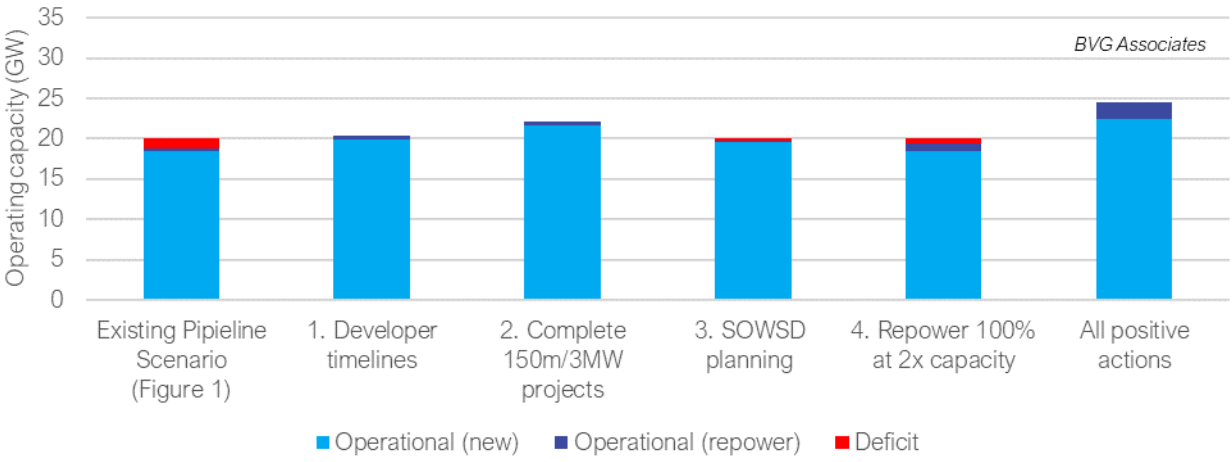

Figure 2: Overview of impact of four individual positive actions on operating capacity in 2030 and their combined affect.

2. Enhanced Pipeline Scenario: EPDB plus Developer feedback

BVGA engaged with 20 developers to review and expand the data in the EPDB, 17 responses were received covering 65% of the existing pipeline capacity.[v] Feedback covered expected milestone dates, whether projects were expected to proceed and corrected data in the EPDB where required. We also gather data on "future projects" not yet in the public domain. We learned of 81 projects with an overall capacity of 11 GW with 8.6 GW of new projects and 2.4 GW arising from repowering existing projects.

Figure 3 shows the timeline out to 2033 including "future projects" and utilising developer advised dates and project data where provided. Where no developer advised timelines were provided, timelines in Existing Pipeline Scenario were used changing only the time in planning, using accelerated timeline expected from the SOWSD (SOWSD planning timeline):

- 1 year in planning prior to receiving consent, extending to 2 years for "challenged" projects, 20% of projects assumed to be "challenged" resulting in an average time in planning of 1.2 years.

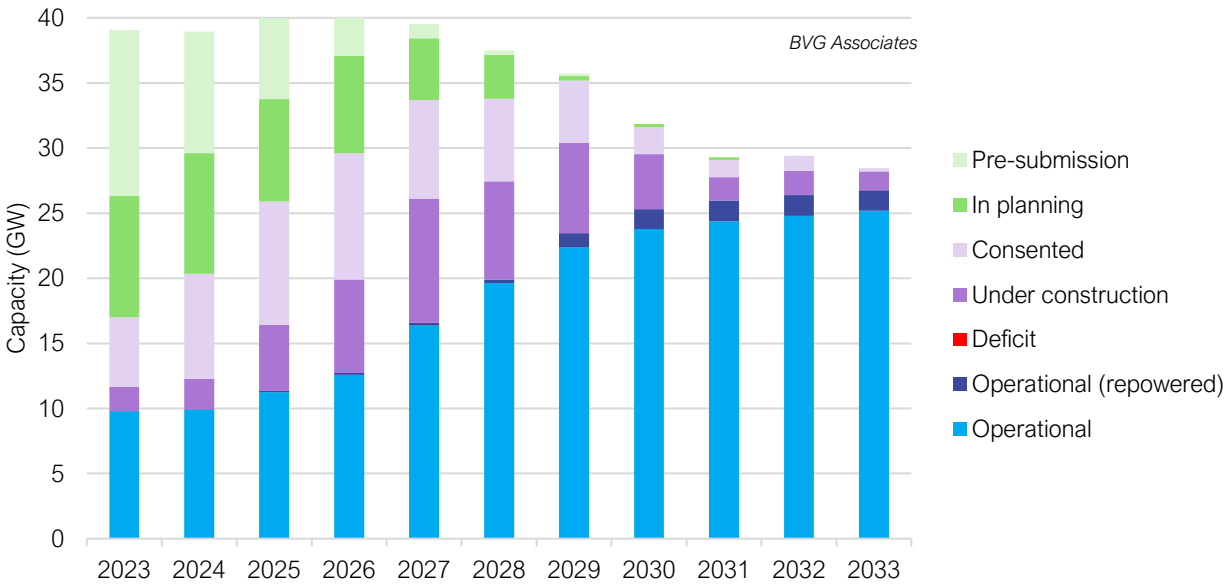

Figure 3: Enhanced Pipeline Scenario timeline to 2033 including "future projects" and accelerated planning timeline.

In this scenario, 25.3 GW of operational onshore wind in Scotland is achieved by the end of 2030 exceeding the 20 GW SOWSD ambition.

Other scenarios

To analyse the effect of the inclusion of "future projects", applying different timelines for planning and for data source used (business as usual planning timeline or SOWSD planning timeline and developer timelines and data or EPDB timelines and data, respectively), and the effect of including additional repowering several other scenarios were run. The scenarios were:

1. Existing Pipeline Scenario with developer timelines and data used where provided and SOWSD planning timeline applied to projects yet to go through planning without developer feedback. This scenario provides a baseline which meets 20 GW. This is the "low end" CfD scenario on page 7.
2. "Future projects" included, developer timelines and data used where provided and business as usual planning timeline applied to all projects yet to go through planning without developer feedback.

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[v] Developers response received from: ScottishPower Renewables, SSE Renewables, EDF Renewables, ESB, Energie Kontor, Vattenfall, Statkraft, Muirhall, Fred. Olsen Renewables, RWE, RES, Banks Renewables, Renantis, Community Windpower, Belltown Power UK Wind, Force 9 Energy.

3. "Future projects" included, EPDB timelines used where provided and business as usual planning timeline applied to all projects yet to go through planning.
4. "Future projects" included, EPDB timelines used where provided and SOWSD planning timeline applied to all projects yet to go through planning.[vi]
5. Enhanced Pipeline Scenario plus 50% of projects at end of life repowered at twice their original capacity.[vii] This is the most ambitious of the scenarios, achieving 25.7 GW of operational onshore wind by 2030. It was used to produce Pipeline KPIs provided on pages 6 to 7 and is the "high end" CfD scenario on page 7.

Figure 4 summarises the capacity achieved in 2030 in each of these scenarios. In all cases where "future projects" are included, the 20 GW target is likely to be exceeded.

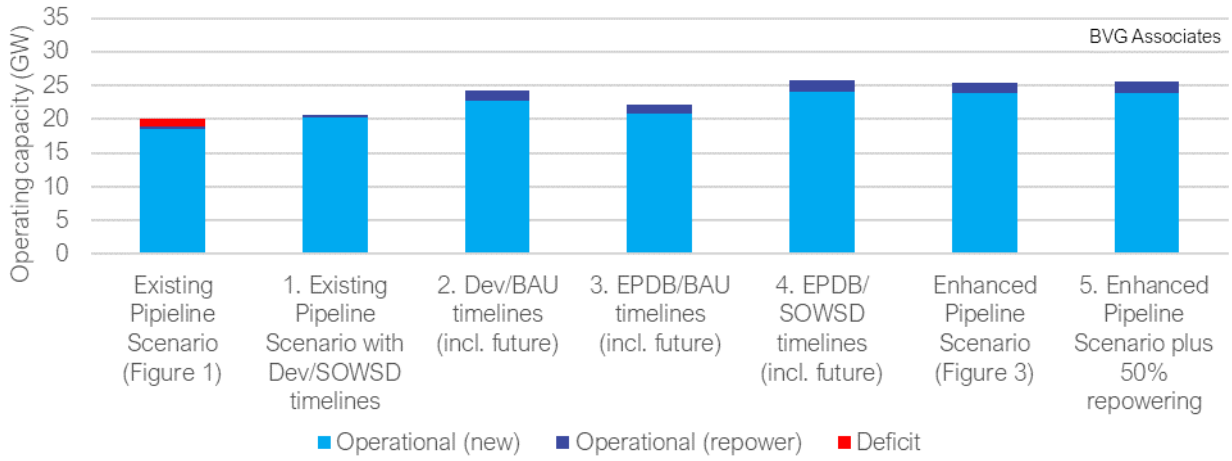

Figure 4: Comparison of the capacity achieved in 2030 of all scenarios run through the model.

Pipeline KPIs

The model can also convert the expected scenario timeline into practical metrics that will help industry and key stakeholders consider the impact of the timeline's deployment. We have focussed on:

- Number of projects going through planning.
- Number of abnormal loads. In construction and decommissioning, 7 loads per turbine assumed: 3 blades, 2 tower sections, 1 nacelle, 1 transformer. For operational projects we have assumed 0.05 loads per turbine, based on previous work on failure rates. Crane movements not included.
- Community benefit (£). Assumed all projects contribute £5,000/MW/year.
- Required onshore wind capacity in CfD rounds (GW). Assumed route to market is via CfD for all and CfD award 3 years prior to operation.

Figures 5 through 8 show the number of projects going through planning, number of abnormal loads and value of community benefit for the Enhanced Pipeline Scenario plus 50% Repowering – the most ambitious of the modelled scenarios.

[vi] This scenario also reaches 25.7 GW, however, as it doesn't use developer data, it does not account for projects which developers informed us will not proceed. We therefore think that the Enhanced Pipeline Scenario plus 50% repowering scenario is more realistic which is why this is presented as the "most ambitious" scenario.

[vii] Additional repowering has a small effect on the overall capacity in 2030 as the model only adds repowered projects where actual repower (developer informed or already in EPDB) in a year does not meet the 50% at twice the capacity minimum.

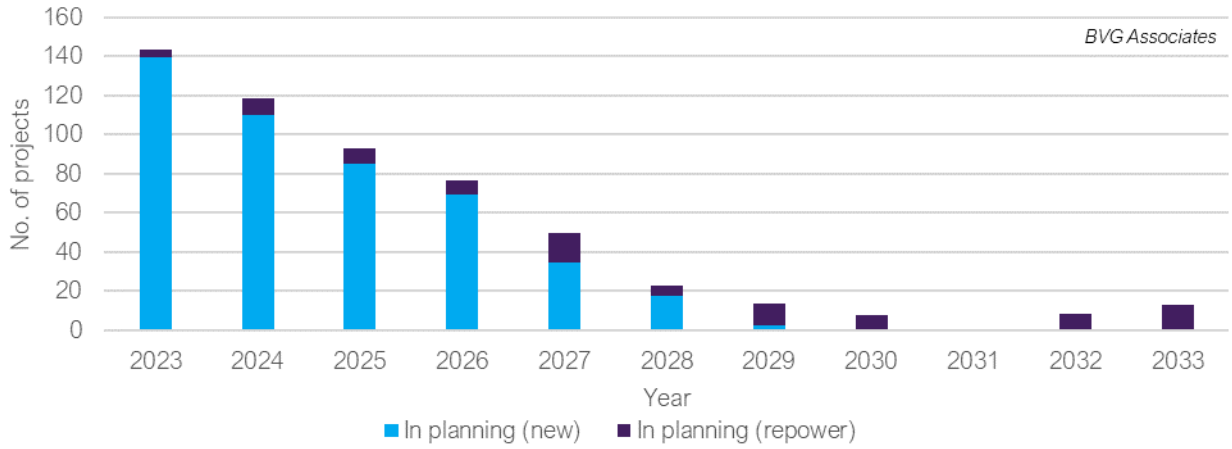

Figure 5: Projects in planning to 2033, Enhanced Pipeline Scenario plus 50% Repowering.

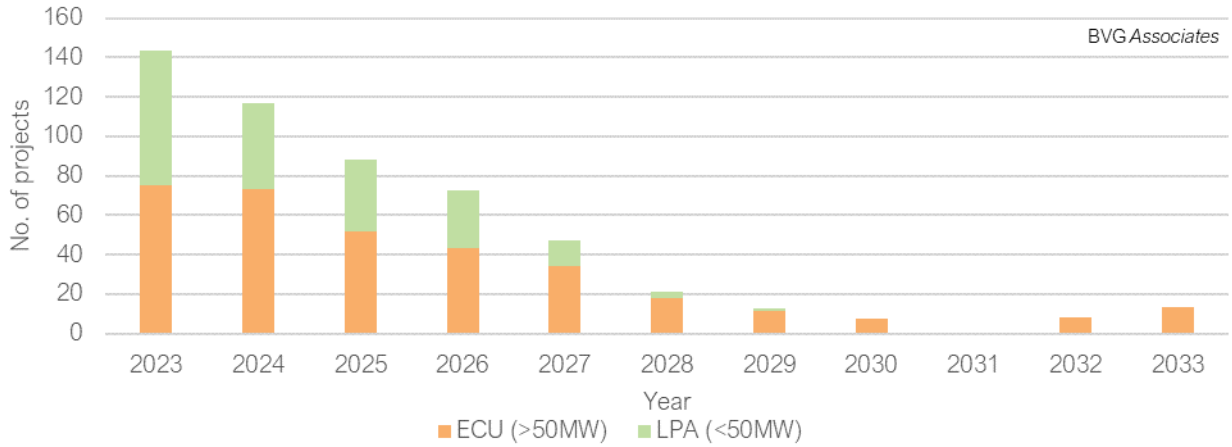

Figure 6: Projects in planning to 2033 by planning authority; Energy Consents Unit (ECU) or Local Planning Authority (LPA), Enhanced Pipeline Scenario plus 50% Repowering.

Figure 7: Abnormal load movements required to 2033, Enhanced Pipeline Scenario plus 50% Repowering.

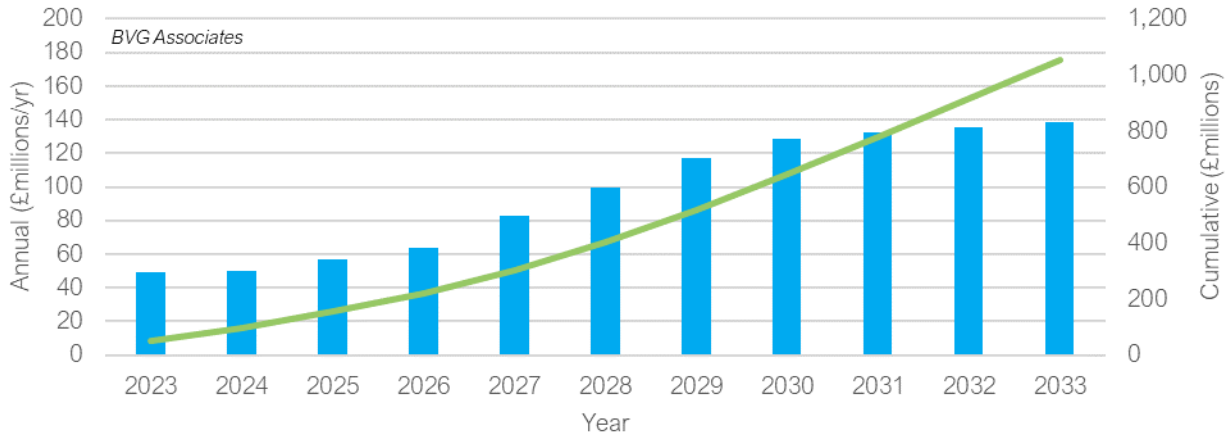

Figure 8: Community benefit paid yearly and cumulatively to 2033, Enhanced Pipeline Scenario plus 50% Repowering.

Table 1 presents the required onshore wind capacity allocation in future CfD rounds for a "low end" and a "high end" CfD scenario. The "low end" is the Existing Pipeline Scenario plus developer timelines and SOWSD planning timelines where developer timelines have not been provided as this scenario just exceeds 20 GW. The "high end" is the Enhanced Pipeline Scenario 50% Repowering which is the most ambitious scenario and reaches almost 26 GW. We have assumed that the UK Government will continue to undertake annual CfD allocations.

Table 1: CfD round allocation requirements arising from Scotland alone.

CfD allocation round	CfD allocation year	Required capacity (GW)	
		Low end	High end
5	2023	1.5 (1.7 actual)	3.0 (1.7 actual)
6	2024	3.4	3.0
7	2025	3.3	3.4
8	2026	2.9	3.6
9	2027	0.4	3.6
10	2028	0.3	0.5

Summary

Our analysis shows that reaching the ambition of 20 GW of operational onshore wind in Scotland by the end 2030 with the existing pipeline is possible provided:

- The timelines that are the current "best estimate" by developers are achieved, and
- The improved planning timelines promised by the SOWSD are achieved.

The probability of achieving this could be increased by ensuring that all projects in the pipeline which are currently at a commercial disadvantage due to turbine characteristics are completed with modified layouts and turbine selection. Even with such projects removed from the pipeline, however, with developers "future projects" included, up to 25.7 GW is achievable by 2030, again assuming SOWSD planning timelines are achieved and that developers "best estimates" are met.

This also assumes that all projects achieve grid connection and have a viable route to market. The first opportunity to secure the latter is through CfD rounds and CfD Allocation Round 5 in 2023 fell short of meeting the 25.7 GW scenario by approximately 1.3 GW. Although CfD Allocation Round 5 met the requirement of the

“low end” scenario, for Scotland to achieve 20 GW by 2030 under either scenario, subsequent rounds will need to increase their allocated capacities to between 3 GW to 4 GW annually.

Our analysis also provides insight into some key industry measures these can be broken down to LPA level per year. Such measures will help industry and key stakeholders better prepare for the demands on planning officers, Police Scotland and Transport Scotland, by establishing likely timelines for projects transitioning through the planning process and the demand for abnormal loads on the roads networks. These will be further analysed in briefings directed at relevant stakeholders.

The BVGA interactive model is available for use to continue developing and analysing the impact of actions and will be updated twice yearly.