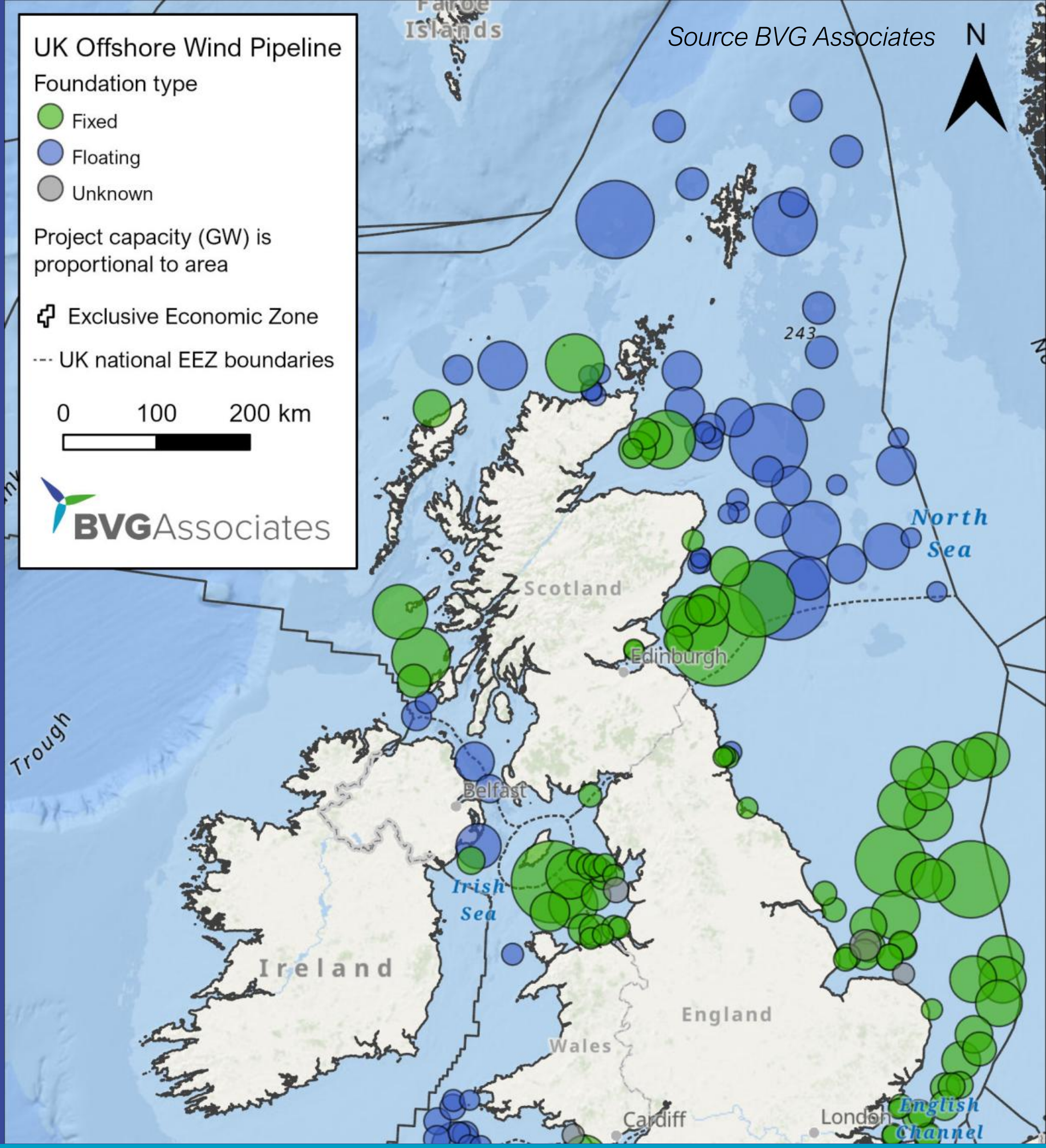
Scottish Offshore Wind Pipeline Analysis

Prepared for Scottish Renewables

Revision 1 – June 2025



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Revision	Description	Circulation classification	Authored	Checked	Approved	Date
1	First public release	Commercial in confidence	GGO	CDB/CDI	GGO	09 June 2025

Circulation classification	Description
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Executive summary (1 of 3)

This Scottish offshore wind pipeline analysis has been created by BVG Associates (BVGA) on behalf of Scottish Renewables (SR), following on from a similar exercise looking at the Scottish onshore wind pipeline. This report looks at:

- The current status of the Scottish offshore wind pipeline
- The potential timeline of progression through to 2040 (and beyond), examining the effect of some core assumptions, and
- A selection of key secondary metrics relevant to the wider support framework required to facilitate the industry.

Note: For simplicity, zero project attrition is assumed and no constraints, such as supply chain or access to capital, are considered, with all projects progressing to operation.

We considered three scenarios for the speed of deployment (slow, medium and fast). The medium scenario, augmented by extensive developer feedback, predicts 39 GW of operational offshore wind in the UK by 2030. The slow and fast scenarios predict 38 and 44 GW respectively (assuming no Hornsea 4). This large range serves as a reminder of the sensitivity of any forecast to the assumptions made around key lifecycle durations such as planning and installation, and emphasises the importance of clarity, consistency and commitment to the underlying supply chain if it is to be ready to provide the required level of resource and support.

We estimate an annual average capital expenditure (CAPEX) of £4.6 billion per year over the next 15 years on Scottish offshore wind – a value similar to the total spend on all infrastructure-related projects in Scotland in 2024 as estimated by the Office of National Statistics (ONS). This will contribute almost 34,000 Full Time Equivalents (FTEs) and £1.2 billion Gross Value Add (GVA) annually between 2029 to 2035 (the peak construction years) to the Scottish economy.

The report highlights the importance of the Scottish offshore wind pipeline to UK net zero ambitions. We show that at the UK level, the medium scenario is behind the assumptions made by Clean Power 2030 (CP2030) – impacted by the suspension of Hornsea 4 - while at a Scotland level it aligns with the CP2030 ambitions.

Executive summary (2 of 3)

At the UK level, the medium scenario aligns well with the Climate Change Committee's Seventh Carbon Budget (CCC7) "Balanced Pathway" assumptions until around 2032, after which it starts to exceed (deliver more capacity, quicker) than the CCC7 assumptions.

We show that clarity on grid connection dates is crucial, noting the current uncertainty brought about by the Connections Reform process. We expect, for instance, that if the connection dates currently in the Transmission Entry Capacity (TEC) register (a list of projects that hold contracts for grid "Transmission Entry Capacity") remain unchanged, the medium pace scenario in Scotland will be delayed.

To meet the medium pace scenario, we estimate that Contract for Difference (CfD) Allocation Rounds (AR) 7 (2025) to 10 (2030) will need to average around 12.5 GW of offshore wind each, with Scotland delivering two thirds of that capacity.

On supply chain metrics we estimate that Scottish projects will require:

- The installation of over 2,900 turbines in less than 15 years. These turbines will require around 18 million tonnes of steel across towers, foundations, and mooring systems (depending on foundation choices).
- Over 12,600 km of array cables and over 11,600 km of transmission cables – equivalent to the output of three or four cable factories. The combined total of 24,200 km would reach over halfway round the Earth.
- 89 offshore substations (80 HVAC and 9 HVDC).
- More quayside laydown area in ports than is currently available, with ports likely becoming a bottleneck during construction, increasing the risk of project delays.

Executive summary (3 of 3)

We note that in general the ability of the Scottish supply chain to support and enable the significant increase in construction and operations over the next 10+ years is uncertain - maintaining even the current level of local content will require significant growth. Continued investment in the supply chain at all levels is essential. This will not only reduce supply chain (and hence project) risk but, if it is significant enough to provide step changes in output, it could consolidate Scotland's "first mover" advantage (especially in floating offshore wind), leading to increased export opportunity into the wider global market.

One of the levers Scotland has control of in terms of reducing project risk is the ability to decrease planning timelines. We recommend that reducing the time required for projects to complete development and planning should remain a key focus to help mitigate for risks likely to be introduced elsewhere in the development and construction processes.

Whilst it is not possible to predict precise timing of future offshore wind deployment, this report highlights its scale and potential significance to Scotland's economy and supply chain, and the importance of ensuring it is enabled with appropriate policy, regulation and support.

Contents

The main content of this report is contained within the following three sections, followed by a summary at the end:

1. Overview

Where we explain the background to this work, summarise the current status of the Scottish offshore wind pipeline, and describe the model.

2. Timelines

Where we present the impact on the pipeline given various assumptions regarding speed of development and construction. We establish the impact of grid availability and examine the impact on supporting infrastructure such as the planning system and the Contracts for Difference (CfD) scheme.

3. Supply Chain Considerations

Where we examine the demands of the pipeline on key supply chain areas such as cables and ports, and the opportunities the pipeline provides in terms of jobs and value to the Scottish economy.

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Part 1: Overview

This section covers the background to this work, the current status of the Scottish offshore wind pipeline, and provides a description of the pipeline model developed to support the analysis.

Overview

BVG Associates (BVGA) were asked by Scottish Renewables (SR) to undertake an analysis of the Scottish offshore wind pipeline, based on known projects and their current status.

The purpose of the work is to provide a quantitative analysis of the demands and opportunities presented by the offshore wind pipeline in Scotland.

Using a model with the ability to vary key parameters to help examine different timeline scenarios, this analysis will benefit SR and the wider wind industry by:

- Providing insight into the likely timelines of consenting decisions
- Supporting informed discussions on the likely demands placed on Scottish infrastructure and supply chains (such as port facilities)
- Supporting informed discussions on the likely demands placed on global supply chains (such as vessels)
- Supporting informed discussions with key stakeholders (such as the fishing industry and local communities)
- Supporting informed discussions on what anticipated deployment and enabling actions are required to achieve UK and Scottish deployment, clean energy and net zero ambitions targets to 2030 and beyond
- Supporting discussions at the UK level describing the impact of the Scottish pipeline on national ambitions
- Helping to inform future discussions on CfDs
- Providing greater detail on the potential benefits and opportunities provided by offshore wind, and
- Increasing our understanding of the effects of slippage/advancement of Scottish projects.

Current Status – Scottish Offshore Wind Projects

Scottish projects account for almost half of the current UK pipeline.

The current (March 2025) Scottish offshore wind pipeline is shown opposite. There are:

- Nine operational projects, totalling 3.85 GW
- One in construction (0.45 GW)
- Five with consent (2.2 GW), and [a]
- Eight in planning (14.2 GW).

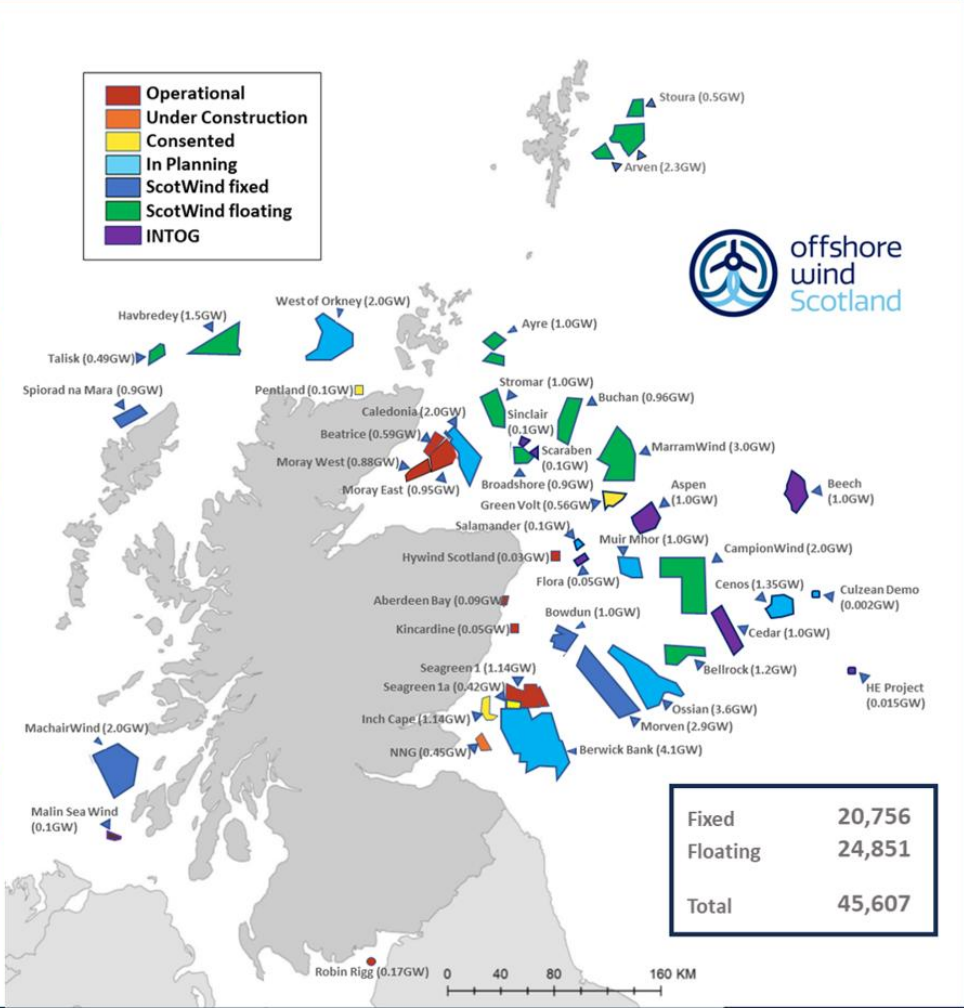
A further 23 projects (~25 GW) are currently in development (not yet in the planning system). These projects are being developed following seabed allocations from either Innovation and Targeted Oil and Gas (INTOG) or ScotWind leasing rounds.

Scotland provides a potential 46.3 GW out of the current UK potential of 93.7 GW. [b]

[a] Culzean Demo project has since received planning consent.
[b] Hornsea 4 not included.

Source: Offshore Wind Scotland (https://www.offshorewindscotland.org.uk)

	SITE	DEVELOPER	CAPACITY
Original Projects	Robin Rigg	RWE Renewables	174MW
	Hywind Scotland	Equinor	30MW
	Aberdeen Bay	Vattenfall	93MW
	Levenmouth	ORE Catapult	7MW
	Beatrice	SSE/Red Rock Power	588MW
	Kincardine FOW	KOWL	48MW
	Moray East	Ocean Winds/Inpex/CTG/Equitix	950MW
	Seagreen 1	SSE Renewables/TotalEnergies	1075MW
	Moray West	Ocean Winds and Ignitis Group	882MW
	NNG	EDF Renewables/ESB	448MW
	Seagreen 1a	SSE Renewables/TotalEnergies	420MW
	Inch Cape	Red Rock Power/ESB	1142MW
	ForthWind	Cierco	12MW
	Pentland FOW	Copenhagen Infrastructure Partners	100MW
	Berwick Bank	SSE Renewables	4150MW
ScotWind Fixed	West of Orkney	RIDG, Corio and TotalEnergies	2000MW
	Caledonia	Ocean Winds	2000MW
	Bowdun	Thistle Wind Partners	1008MW
	MachairWind	ScottishPower Renewables	2000MW
	Morven	BP and EnBW	2907MW
	Spiorad na Mara	Northland Power and ESB	840MW
ScotWind Floating	Muir Mhor	Vattenfall and Fred Olsen Seawind	1005MW
	Ossian	SSE Renewables, CIP and Marubeni	3610MW
	Arven	Mainstream RP and Ocean Winds	2300MW
	Ayre	Thistle Wind Partners	1008MW
	Bellrock	BlueFloat Energy¦ Nadara Partnership	1200MW
	;	BlueFloat Energy¦ Nadara Partnership	900MW
	Buchan	Buchan Offshore Wind	960MW
	CampionWind	ScottishPower Renewables and Shell	2000MW
	Havbredey	Northland Power and ESB	1500MW
	MarramWind	ScottishPower Renewables and Shell	3000MW
	Stoura	ESB Asset Management	500MW
	Stromar	Orsted/BlueFloat Energy/Nadara	1000MW
	Talisk	Magnora Offshore Wind	495MW
INTOG Round	Green Volt	Flotation Energy/Vargrønn	560MW
	Culzean Demo	TotalEnergies	3MW
	Salamander	Ørsted/Simply Blue Group	100MW
	Cenos	Flotation Energy/Vargrønn	1350MW
	Aspen	Cerulean Winds	1008MW
	Beech	Cerulean Winds	1008MW
	Cedar	Cerulean Winds	1008MW
	Flora	BP Alternative Energy Investments	50MW
	Harbour Energy	Harbour Energy	15MW
	Malin Sea Wind	ESB Asset Development	100MW
	Scaraben	BlueFloat Energy/Nadara	100MW
	Sinclair	BlueFloat Energy/Nadara	100MW



Note on Projects

The pipeline model was populated by the data in RenewableUK's (RUK) Energy Pulse Database (EPDB).[11]

The dataset of all offshore wind projects in the UK was extracted from EPDB on 4th Dec 2024, with adjustments made to accommodate published changes over time (such as the suspension of Hornsea 4).

For the Scottish projects, we supplemented the EPDB information with assumptions on key dates as provided to us by developers. Out of the 38 Scottish projects yet to reach operation, we received expected future operational dates for 19 of them. These expected dates were provided to us in confidence and for the purpose of this work only.

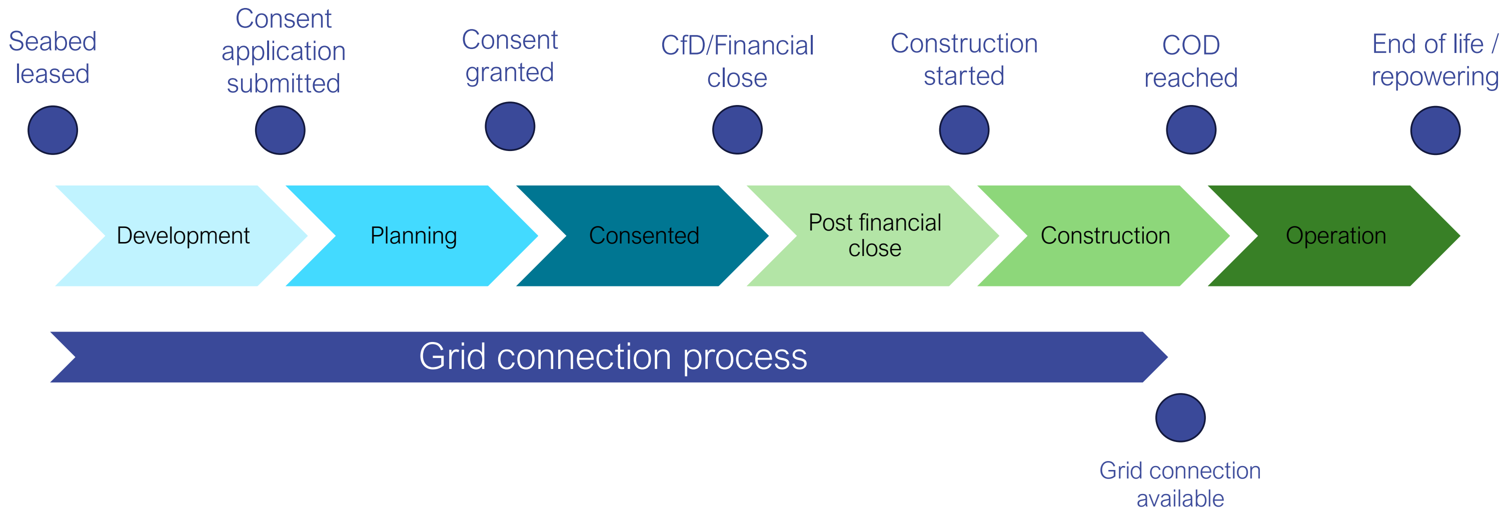
The analysis presented in this report is based only on projects that are in the EPDB dataset. For example, it includes the 4.5 GW assigned to the Celtic Sea Floating Offshore Wind Leasing Round 5 (defined in EPDB as three 1.5 GW projects) but it does not include any capacity related to future developments in the Celtic Sea or elsewhere (such as the recent agreement between Great British Energy (GB Energy) and The Crown Estate (TCE)) to lease a further 20 to 30 GW of seabed before 2030 or the recent TCE announcement to increase the capacity of existing wind farms by up to 4.7 GW.

We expect all the projects in the current pipeline to be operational by 2038. The majority of graphs in this report extend only to 2040 for this reason (as everything "flat lines" after this date), though we do include a graph out to 2050 (slide 18) to show how the work reported here aligns with wider UK ambitions/expectations. This graph includes the notional 20 to 30 GW of potential future capacity mentioned above which, when added to the timeline, shows close alignment with the CCC7 ambition for 2050.

Project milestones – current and future

The current status for all projects was taken from RenewableUK's Energy Pulse Database (EPDB).[11]
For each project, future project milestones were set using the following priority:

- Estimated dates from the developers, where provided, else
- Assumptions based on the following three scenarios for future build-out rates:
  - Low/slow
  - Medium, and
  - High/fast.



With expected operational dates provided for half of the Scottish projects, the default milestone dates established using these three scenarios were therefore only applied to the remaining Scottish projects plus all the "rest of the UK" projects. These scenarios are discussed further in the following two slides.

Future Scenarios

For projects without estimated future dates provided by the developers, the pipeline model allows the user to vary the duration of the six key project phases:

1. Development
2. Planning
3. Consented
4. Post financial close
5. Construction, and
6. Operation

The model bookends these phases with two further phases:

0. Pre-lease allocation – where a project is identified but does not yet have a seabed lease, and

7. Decommissioning – where a project is decommissioned after reaching its end of life.

The analysis presented in this report considers the impact of three different scenarios shown in the table below. Where two values are shown they indicate differences between fixed/floating projects. For simplicity, the duration of each phase does not vary with the size of the project.

(Years)	Slow	Medium	Fast
Development	4.0	3.0	2.0
Planning	4.0	3.0	1.5
Consented	2.0	1.5	1.0
Post financial close	2.0	1.5	1.5
Construction	2.4/3.2	2.4/3.2	2.4/3.2
Total time to operation	14.4/15.2	11.4/12.2	8.4/9.2
Operation	30.0	30.0	30.0

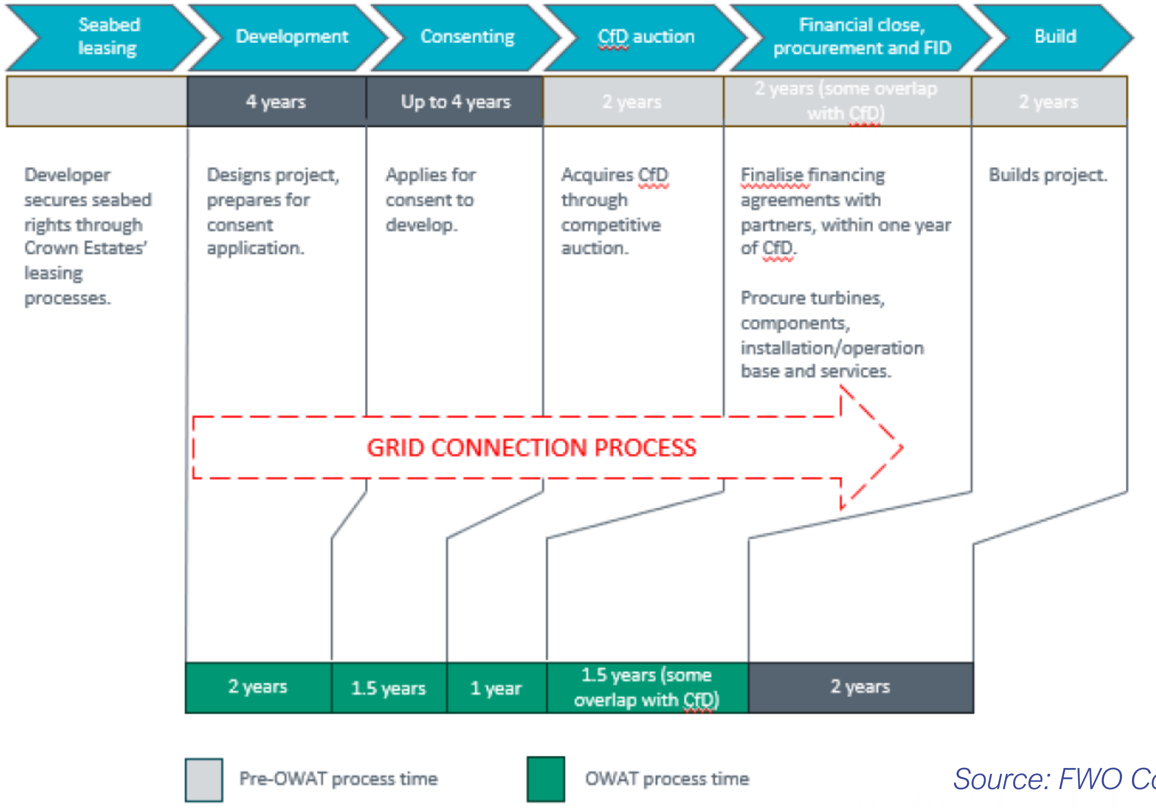
The following slide adds further explanatory notes on these future assumptions.

Note on Scenarios

The development timelines for the slow/medium/fast scenarios (used only for the projects developers did not provide planned timelines on) were taken from the "*UK 2050 Offshore Wind Deployment Scenarios*" report by ORE Catapult (OREC) and the Floating Offshore Wind Centre of Excellence (FOW CoE) from September 2024. [1] We chose these to ensure consistency between the work reported here and other analyses from the wider industry. FOW CoE themselves set the durations to align with those set out in the "*Independent Report of the Offshore Wind Champion*" to the Offshore Wind Acceleration Taskforce (OWAT) in 2023. [2]

The FOW CoE report assumes two years for construction regardless of whether a project uses fixed or floating foundations. We chose to override this by using the average construction periods provided by the developers, on the basis that this was a more informed estimation of future construction periods. The average developer estimations were 2.4 years for fixed foundation projects and 3.2 years for floating. Both of these values reflect the average size of these future projects.

The FOW CoE analysis sets attrition rates for each scenario. We have chosen to ignore attrition rates for the majority of this report to aid clarity and readability. Unless stated otherwise, the results shown in this report assume 0% attrition.



Source: FWO CoE / OWAT

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Part 2: Timelines

Future deployment scenarios

Timelines

In this section we focus on the expected pipeline of future projects, showing the sensitivity of the pipeline to different assumptions on speed of progress for projects where we have no estimates of future milestones from developers.

We look at the pipeline at both UK and Scotland resolution, comparing different pipeline scenarios with key national objectives from sources such as CP2030 and CCC7.

We look at the split of fixed and floating foundations, we investigate the impact of grid connection dates, and we consider the demands placed on the contract for differences mechanism.

Timelines

The following two slides show:

- The breakdown of Scotland's pipeline (by project lifetime phase) to 2040 for the "medium" scenario, and
- Expected operational capacity for the UK and Scotland to 2050, with annotations.

These figures are based only on current projects that are registered in the EPDB and assume zero attrition (i.e. all projects progress to operation).

The UK operational capacity begins to reduce from the late 2030s due to early smaller sites reaching end of life and being decommissioned. However, the dotted line from late 2030s to 2050 is included to indicatively represent additional leasing The Crown Estate (TCE) have alluded to (future timelines unknown at this time) which would broadly align with CCC7 (Balanced Pathway) ambitions. [9]

The CP2030 ambitions plan for 43 GW (new dispatch) to 51 GW (further flex and renewables) of operational offshore wind by 2030 at UK level.[3]

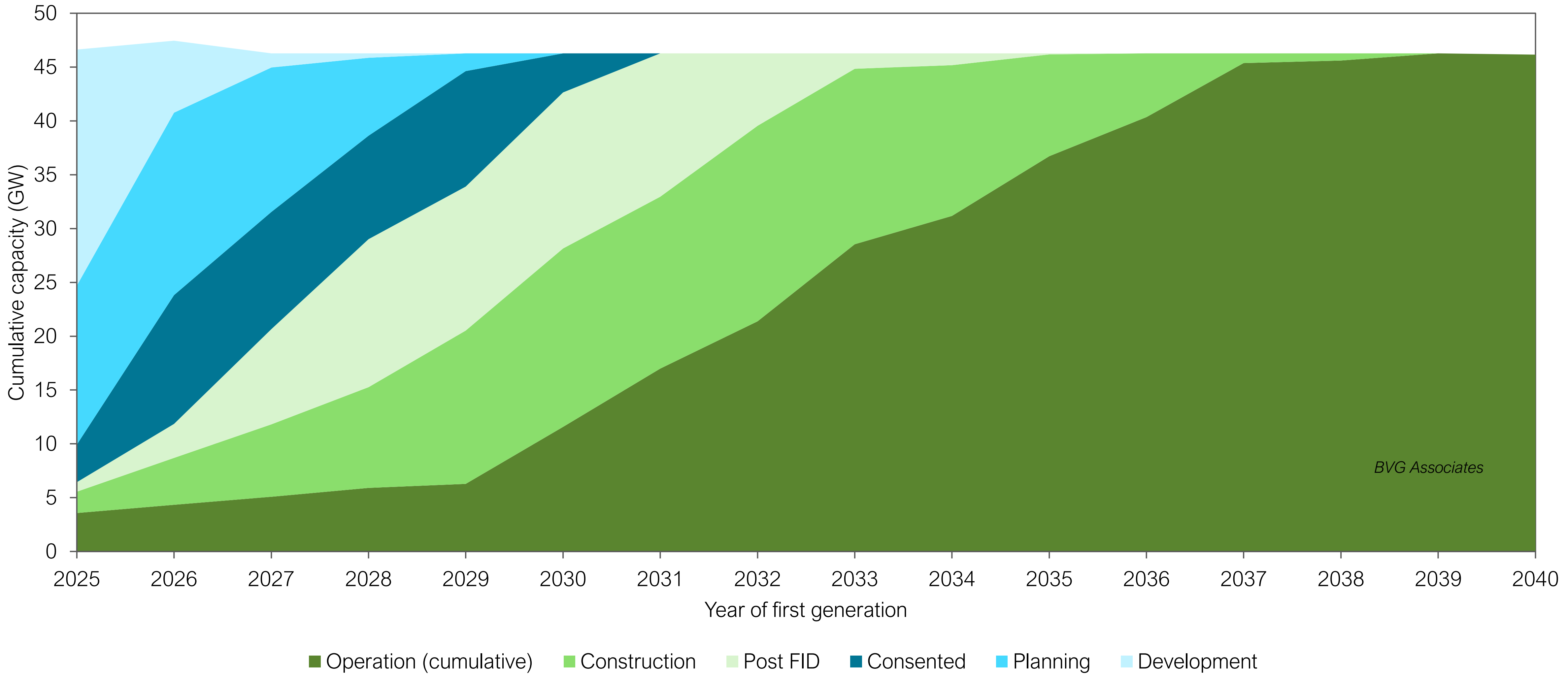
Our modelled medium pace scenario estimates an operational capacity of 39 GW at UK level, with 12 GW of that supplied by Scottish projects. The 39 GW figure is below the range expected by CP2030 for the UK. The 12 GW in Scotland is within the range expected (9.7 to 12 GW).

Estimations for operational capacity by 2030 are sensitive to timeline assumptions. The fast scenario, with reduced development timelines, estimates around 44 GW at UK level by 2030 (just reaching CP2030 new dispatch target), while the slow scenario estimates only 38 GW.

We include the CCC7 "Balanced Pathway" ambition of offshore wind for reference. We show that the medium scenario matches well with the CCC7 path out to 2030, after which the medium scenario is slightly ahead of (i.e. deploying faster than) CCC7.

We include two additional references from the Network Electricity System Operator (NESO) – "*Beyond 2030*" and "*Future Energy Scenarios (FES) 2024*". [4], [12] The medium scenario closely reflects the Beyond 2030 predictions, while the FES 2024 values for 2050 indicate an inevitably wider range of possible futures at that further horizon.

Timeline for Scottish Projects in the Current Pipeline – Medium Scenario



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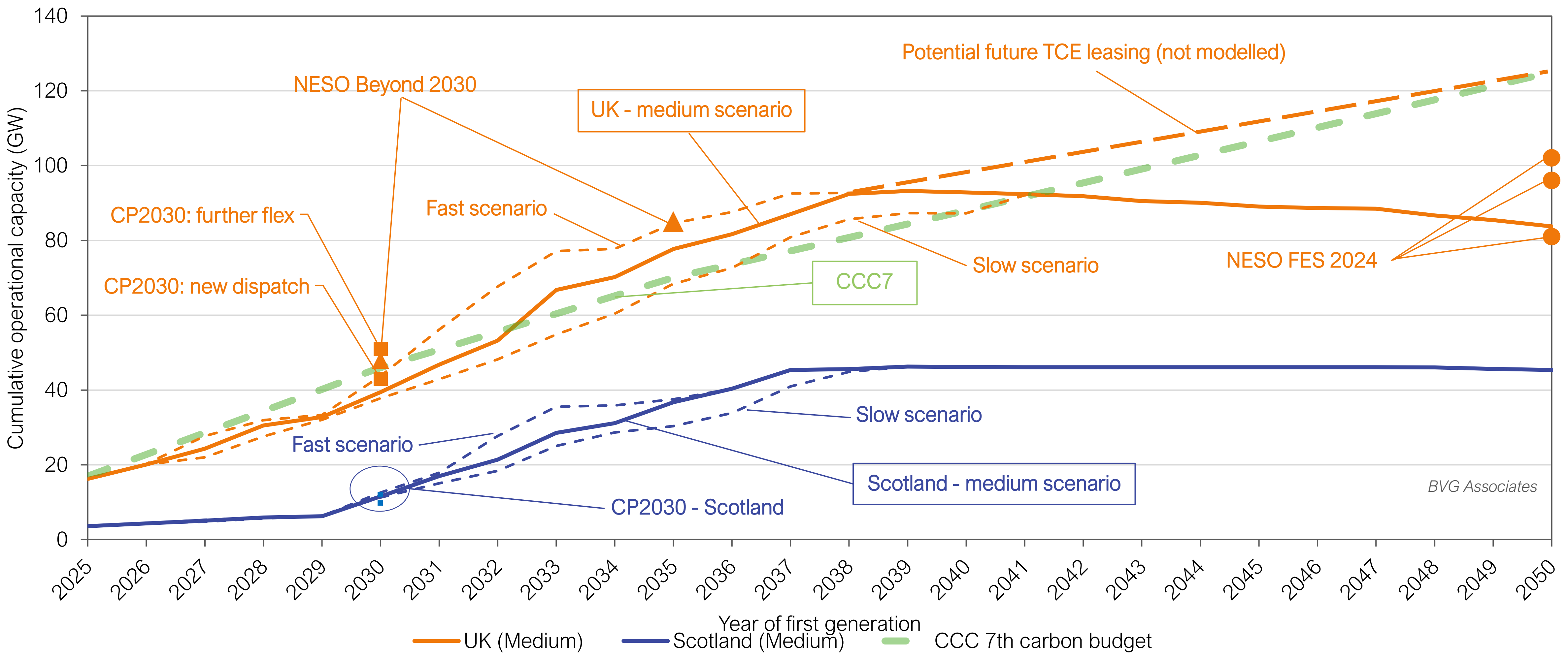
Timeline for Projects in the Current Pipeline



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Scenario (GW)	2030	2035	2040	2050
BVGA – Slow (UK)	38	68	87	
BVGA – Medium (UK)	39	78	93	
BVGA – Fast (UK)	44	85	93	
CP2030 – Further Flex (UK) [3]	51			
CP2030 – New Dispatch (UK) [3]	43			
NESO Beyond 2030 (UK) [4]	48	85		
CCC7 Balanced Pathway (UK) [9]	46	70	88	125
NESO FES 2024 (Holistic) (UK) [12]				102
NESO FES 2024 (EE & HE) (UK) [12]				96
NESO FES 2024 (Counterfactual) (UK) [12]				81
BVGA – Slow (Scotland)	11	30	46	
BVGA – Medium (Scotland)	12	37	46	
BVGA – Fast (Scotland)	13	38	46	
CP2030 – Further Flex (Scotland) [3]	12			
CP2030 – New Dispatch (Scotland) [3]	10			

Fixed and Floating Foundations

The following two slides show the expected split of operational capacity between fixed and floating foundations for the UK and, separately, Scotland.

These figures:

- Are for the medium growth scenario
- Are based only on current projects that are in the pipeline with no further leasing from TCE (other than the 4.5 GW in the Celtic Sea which are included) or Crown Estate Scotland (CES), and
- Assume zero attrition (all projects progress to operation).

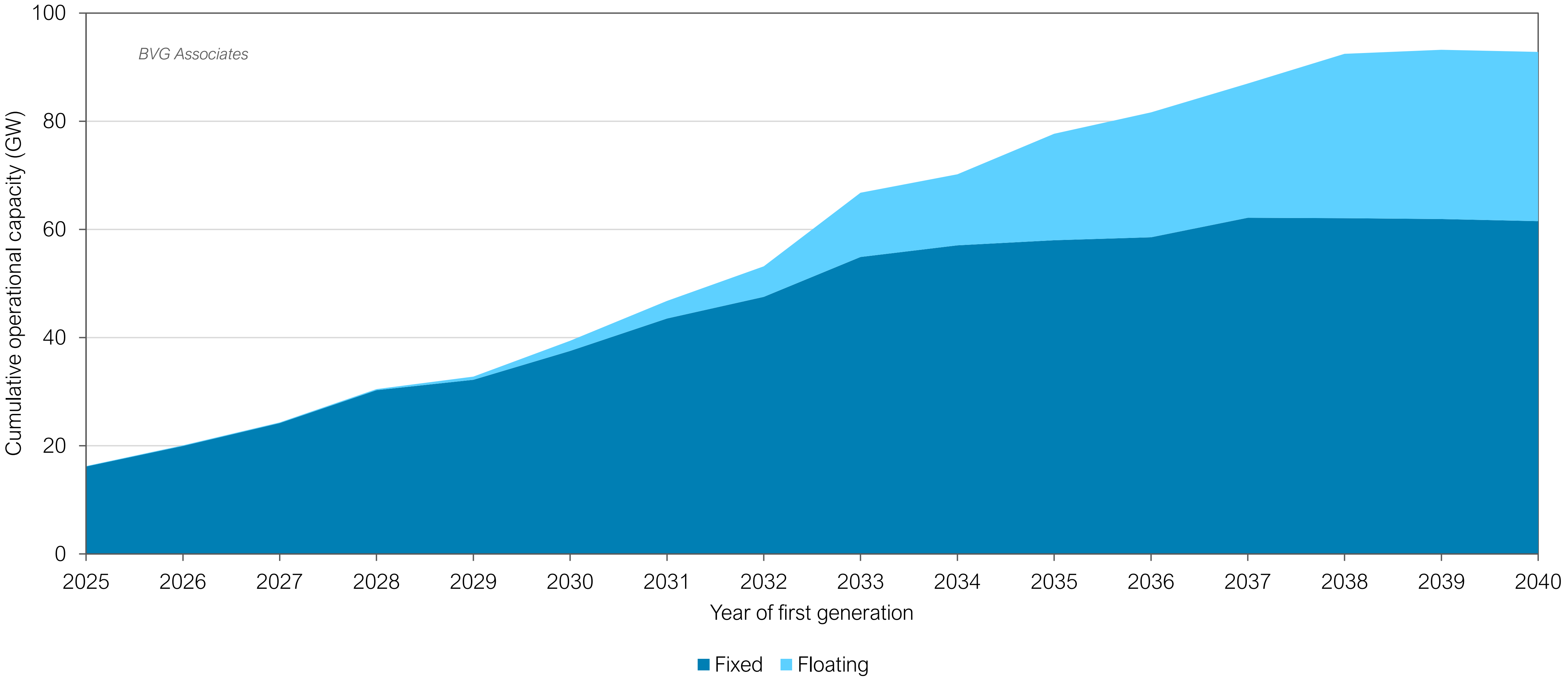
For both Scotland and the wider UK the analysis indicates that floating projects will start operation in significant capacities from the early 2030s. The medium scenario shows a clear increase in floating capacity in the first half of the decade.

This increase is particularly noticeable in Scotland where the medium scenario indicates that floating would account for around half of all operational offshore wind by 2035.

Analysis of the rate and volume of the turbine and foundation installation is provided later in the "Supply Chain" section.

The rate and ambition for the buildout of floating offshore wind are both significant. In addition to the supply chain and infrastructure-related considerations discussed here, successfully achieving these ambitions will require a continued focus on both driving down costs and implementation of appropriate policies to support the delivery of this significant opportunity.

Fixed and Floating for Projects in the Current Pipeline (UK)



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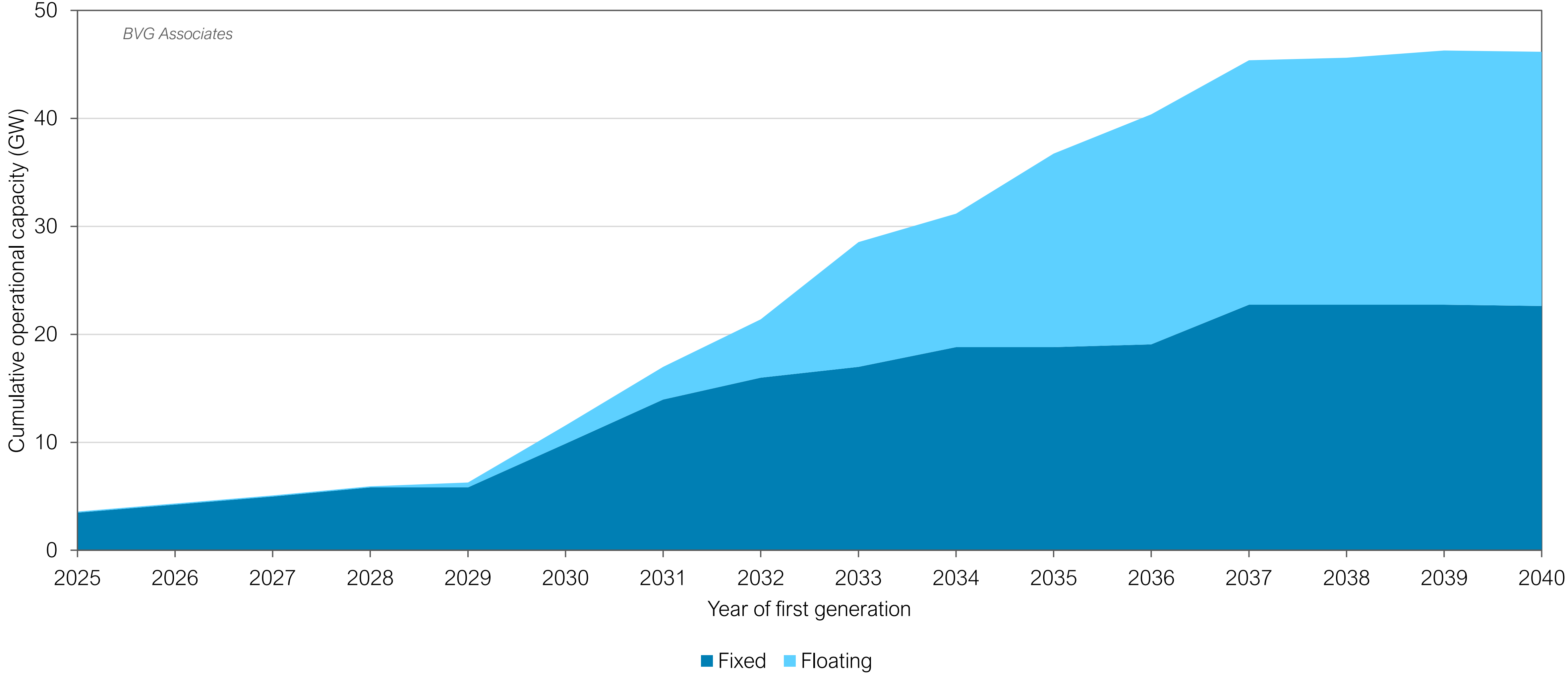
Fixed and Floating for Projects in the Current Pipeline (Scotland)



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New Grid Connections - Scotland

The following slide shows the amount of new offshore wind capacity connecting from Scottish offshore wind projects based on the three scenarios.

These timelines do not incorporate existing Transmission Entry capacity (TEC) register information.

These timelines show how the Scottish pipeline could progress if grid connection capacity was available in time for each project's Commercial Operations Date (COD) in the three scenarios.

In subsequent slides we show that if we incorporate what we know of the current situation with the grid connection queue, the medium scenario could be delayed by at least one or more years.

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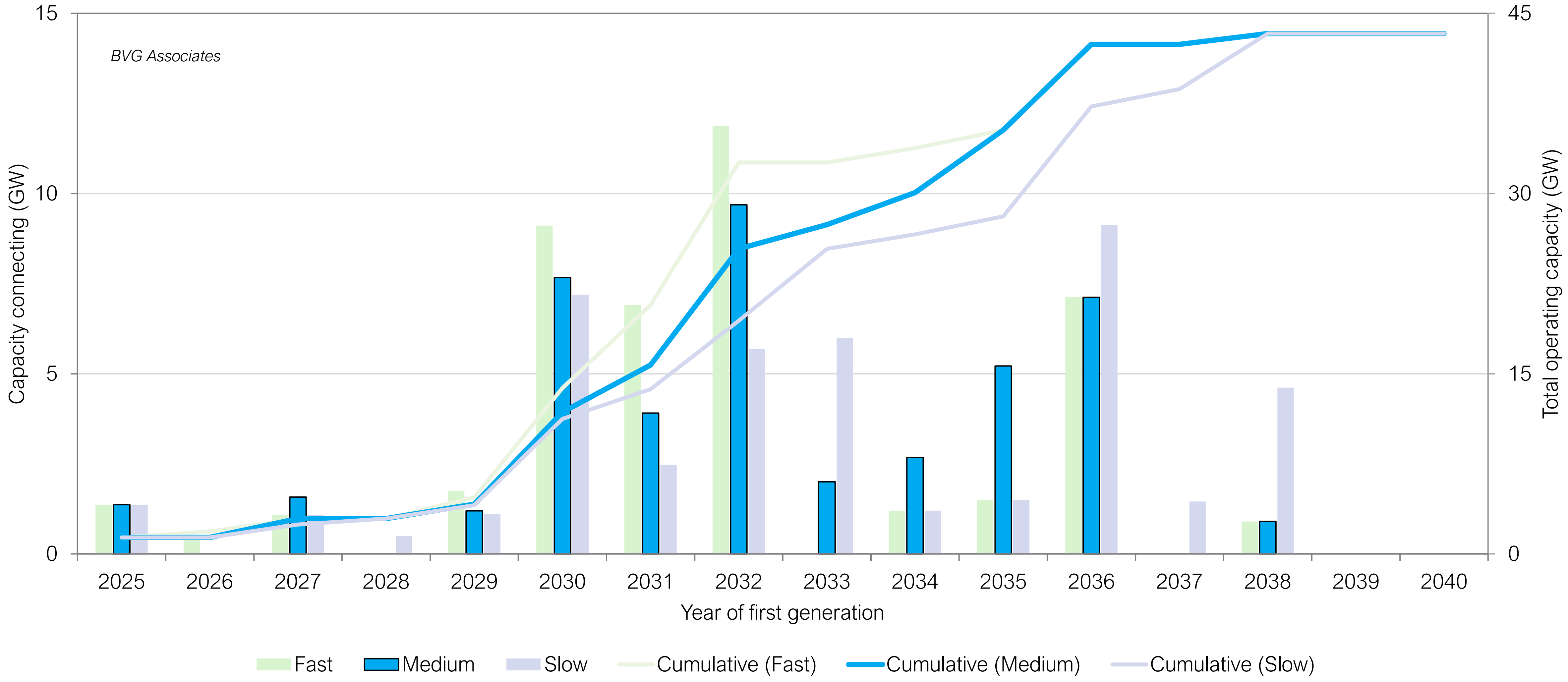
New Grid Connection Capacity Required - Scotland



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Grid Connections

The following three slides show the potential impact of the current grid connection queue on the medium scenario. To do this, we delayed the COD of any project to align with the revised connection date. Projects with a connection date before the expected COD were unaffected.

We show two variations:

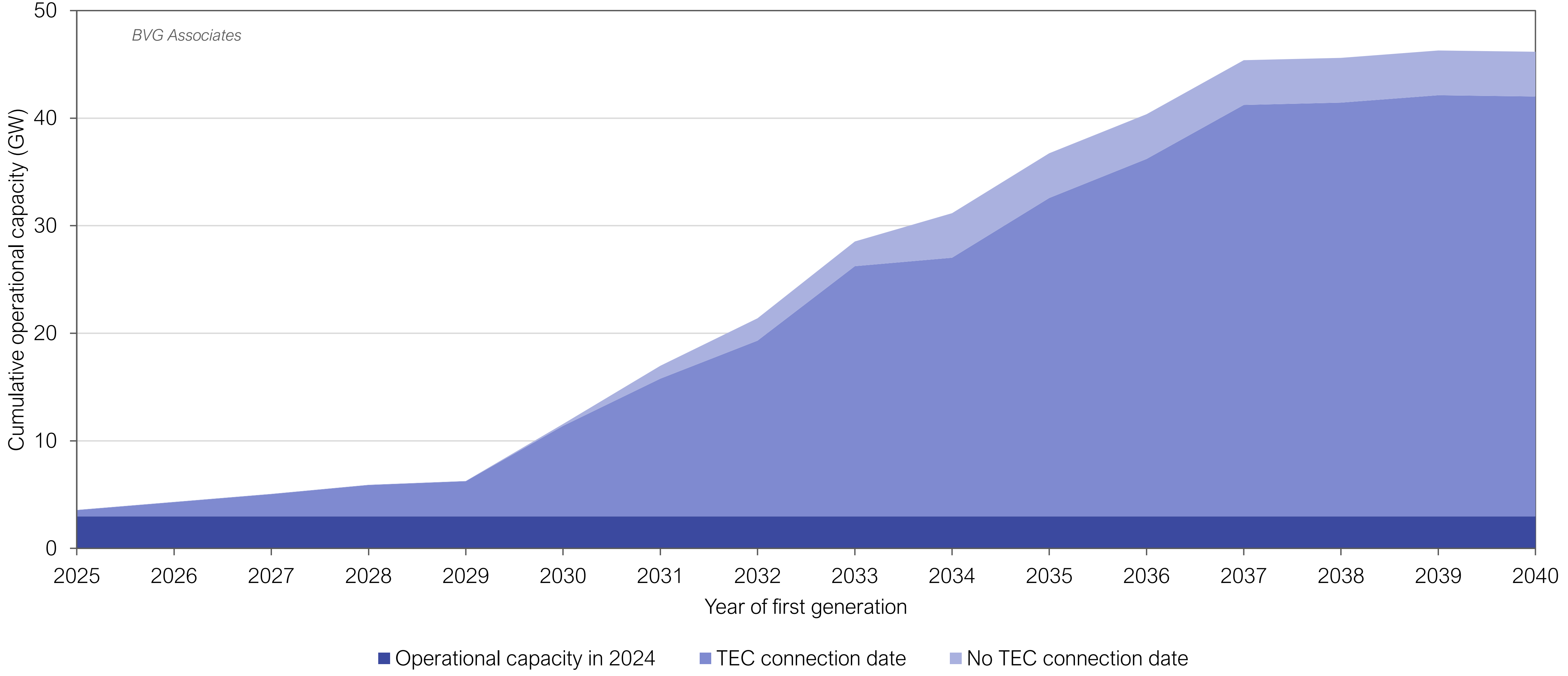
1. Taking into account any known connection dates as per the TEC register.[7] Projects with no known connection date proceed at the previous pace defined by either the developer or the medium scenario. This delays the medium scenario by up to one year in the early 2030s.
2. As (1), but projects with no known connection date are given a connection date of Jun 2035. This delays the medium scenario by up to a further year in the early 2030s.

Due to the ongoing implementation of Connections Reform, revised dates for projects with existing connections will not be issued until after the publication of this report. Thus, for the purposes of this analysis, connection dates are assumed as those currently displayed in the TEC register as of April 2025 (recognising the TEC register's limitations as a complete source of information). With reference to the two variations listed opposite:

1. Adding the known TEC register connection dates into the model pushes the medium scenario back by about one year. Looking at slide 27, the 17 GW that could be achieved by 2031 (in the medium scenario) is pushed back a year to 2032.
2. Then, setting any remaining projects – those with currently no connection date in the TEC register – to have their connection date in 2035 (on the basis that there will be no availability prior to this, though it is recognised this assumption may not materialise) delays by around another year. Looking at slide 28, the 17 GW that could be achieved by 2031 is pushed back to around 2033.

NOTE: These variations assume there are no further delays in building out grid to connect projects other than those detailed above. We highlight that the required scale of grid build out in the UK, and Scotland in particular, is significant and will require to be progressed at pace to minimise the risk of further delays.

Scottish Projects – Medium Scenario



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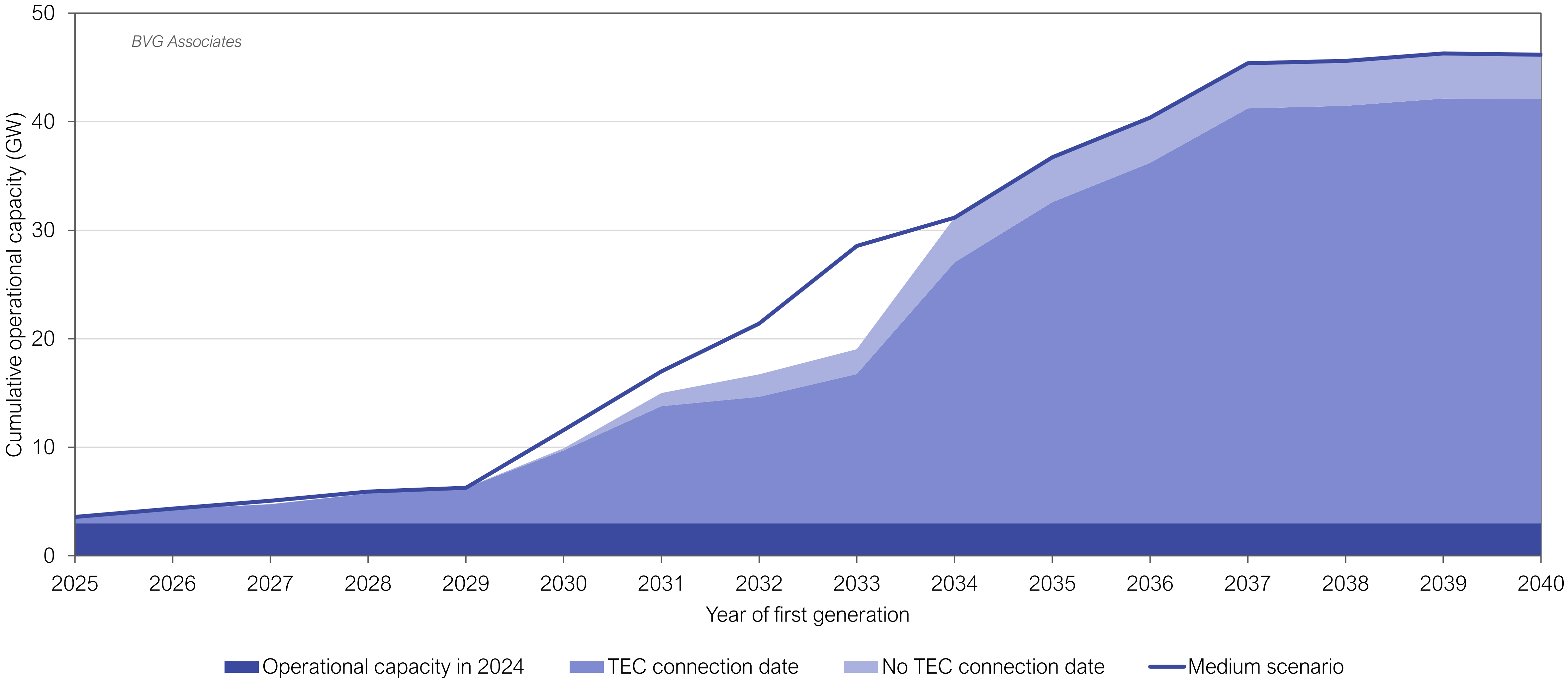
Scottish Projects – Effect of Known TEC Register Dates



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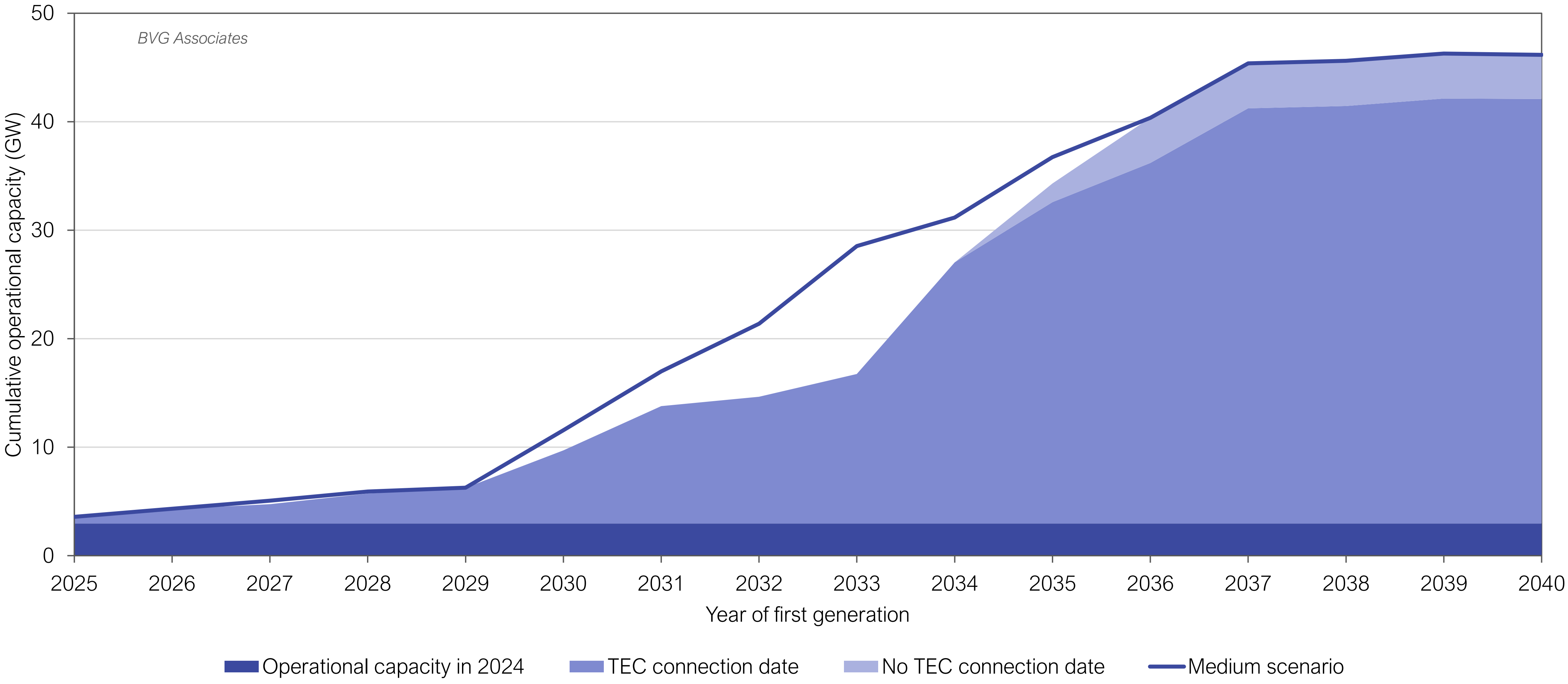
Scottish Projects – Projects with no TEC Register Date → 2035



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Planning Decisions

The following two slides show the key metrics of:

- Number of Scottish projects in the planning system, and
- The number of consent decisions required each year for Scottish projects.

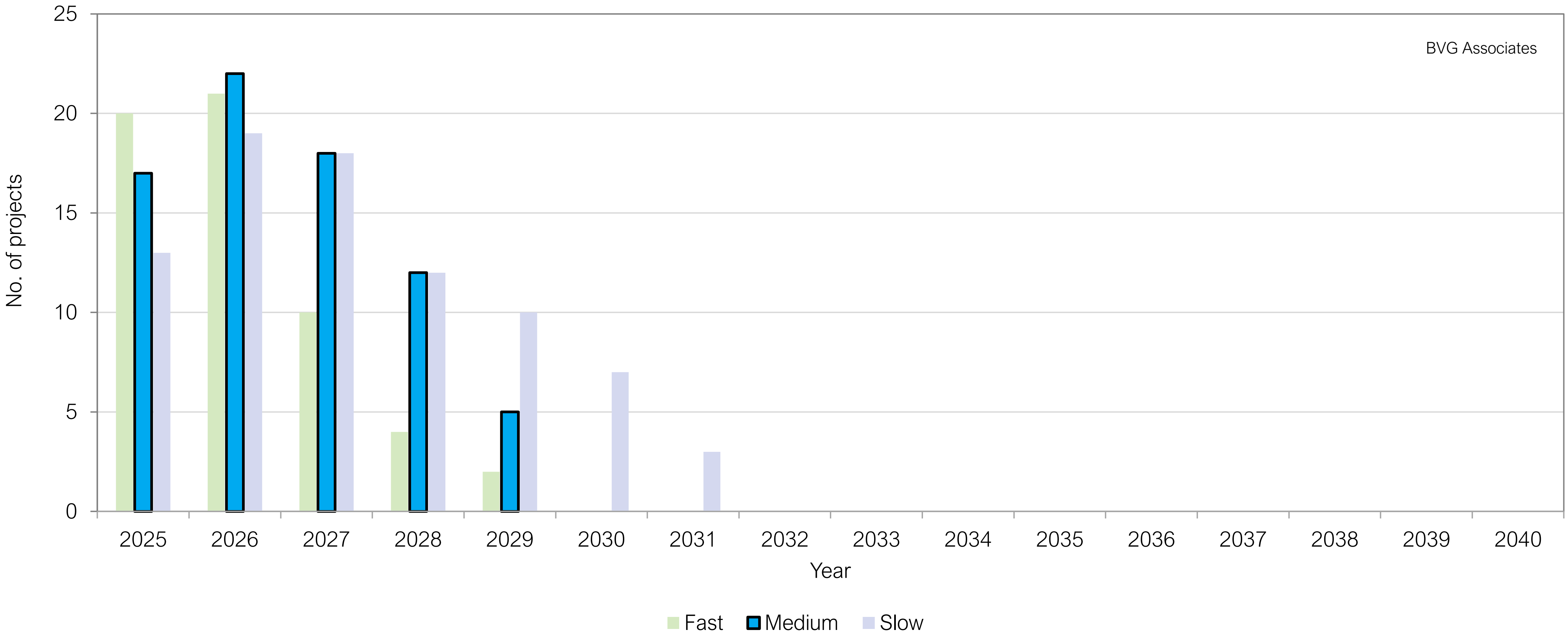
Considering the medium scenario, we estimate that between 2025 and 2028 there will be 10 or more Scottish offshore wind projects going through the planning process in any given year (peaking at 22 in 2026).

There will be an average of six consent decisions required annually between 2025 to 2029.

These numbers will be of interest to the Scottish Government Marine Directorate Licensing and Operations Team (MD-LOT) and other key stakeholders in the planning process (such as the statutory consultees) as it will help them assess their ability to resource these future demands and plan accordingly.

Reducing the time required to reach consent decisions is a key factor in reducing project risk and ultimately cost of energy from the wind farms. It is a critical lever that is within Scotland's control, and will help mitigate against other 3rd party risks (such as supply chain constraints and construction delays) inherent in building large scale offshore wind at volume and pace.

Projects in Planning (Not Yet Consented) - Scotland



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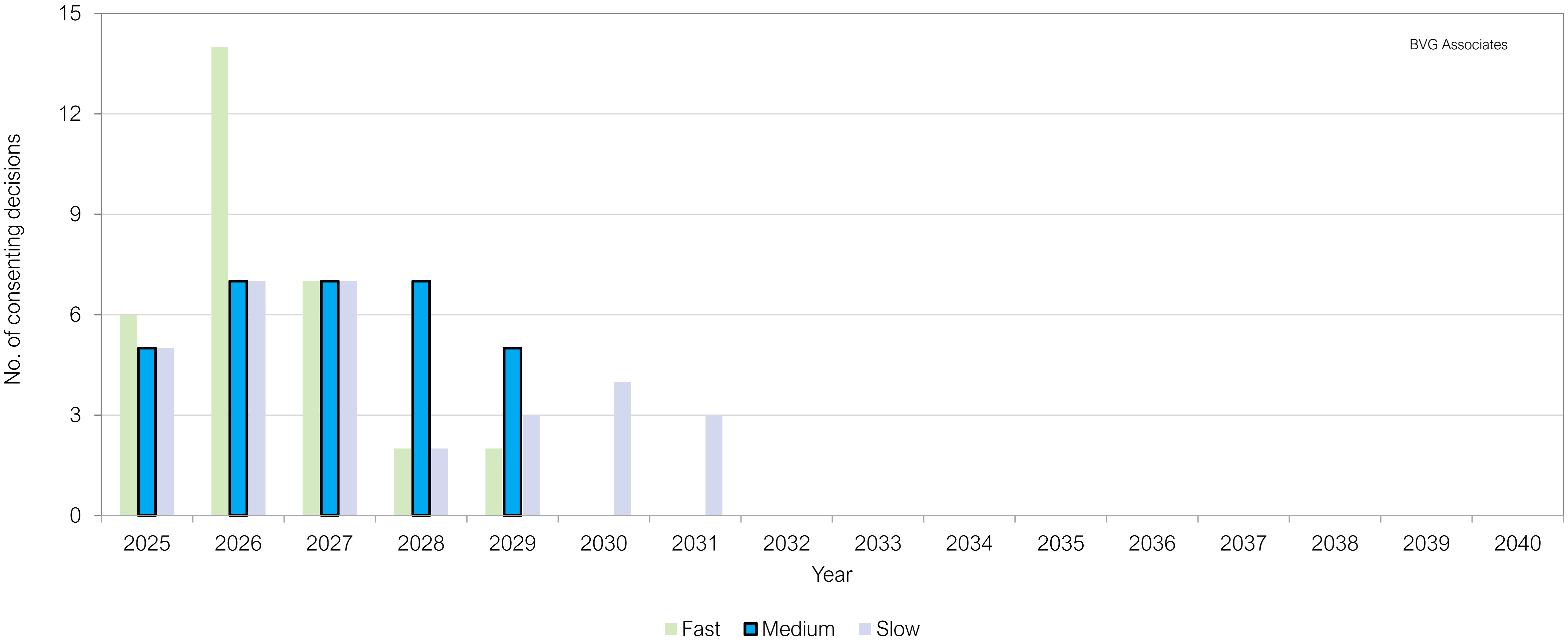
Projects in Planning – Expected Consent Decisions - Scotland



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Annual CfD Allocation

Eligible volume for future CfD allocation rounds (2025 to 2032)

Future CfD Allocation Rounds

If all projects in the pipeline are to use future CfD allocation rounds (AR) for their route to market then it is important to understand what the pot sizes will need to be to match the growth demands.

The following slides show the anticipated eligible capacity for each AR at a UK and Scotland level assuming that CfD allocation rounds continue to occur annually into the future. We have based eligibility purely on expected consent date, ignoring the impact and uncertainty of grid connection dates.

We have assumed that any project is able to enter a CfD allocation round will do so, and we have assumed that all projects will be successful. However, we note that having a consent does not necessarily mean developers will apply for the first round they are eligible for, and that not all projects will be successful in a given auction, with some projects potentially pursuing alternative routes to market or unsuccessful projects being further delayed.

Based on the recently released AR7 indicative timetable, we have assumed that the deadline for application will be 27 Aug 2025, and that all subsequent ARs will follow this pattern (i.e. AR8 will have a deadline of 27 Aug 2026). Any project with an expected consent date before this deadline, and which does not yet have a CfD, will be eligible for that AR.

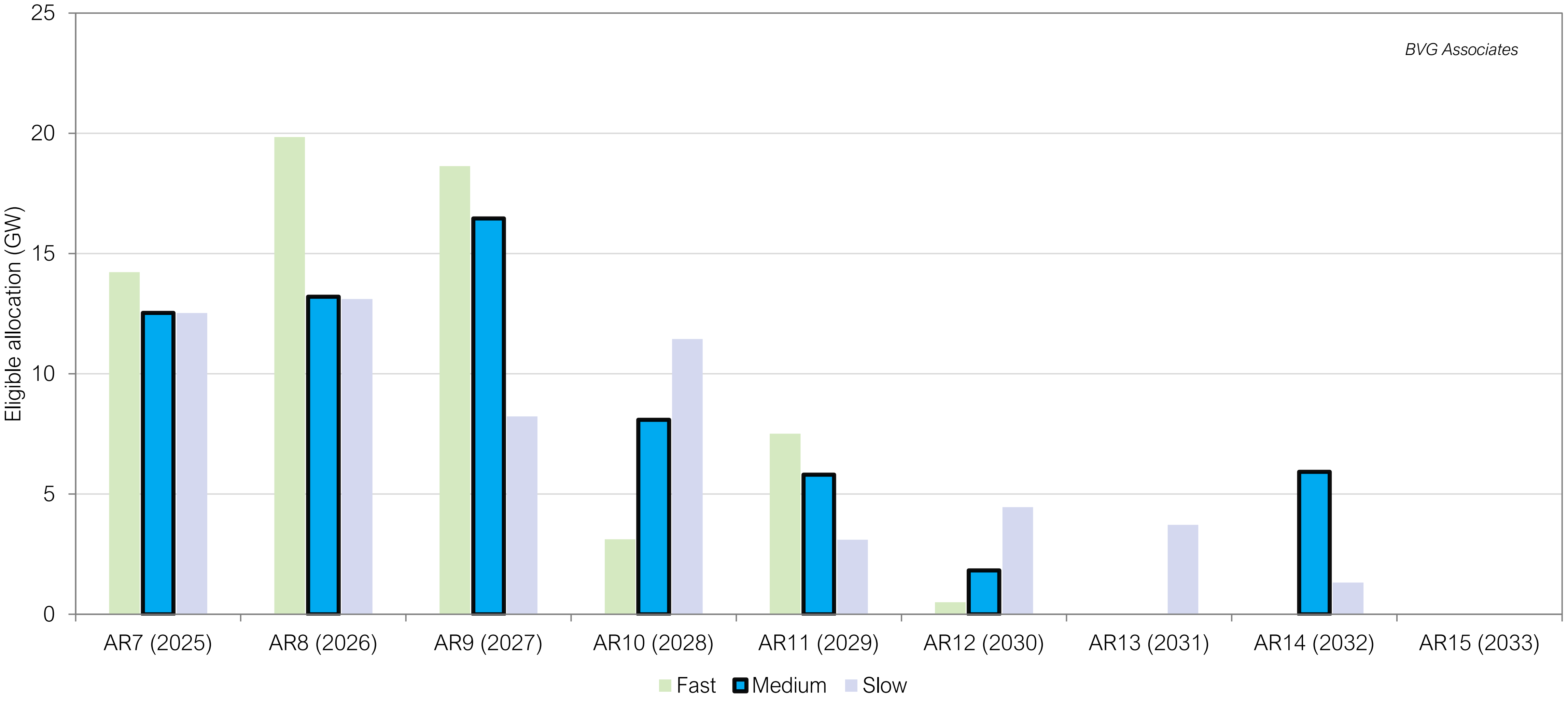
To accommodate the medium pace scenario, the next four ARs - AR7 (2025) to AR10 (2028) - will each need to allocate an average of 12.5 GW each at UK level, with Scotland contributing around two thirds of the capacity (34 out of 50 GW = 68%).

For context, AR6 in 2024 awarded CfD contracts to 5.3 GW of offshore wind.

We show the UK and Scotland totals, followed by the UK fixed and floating split, for each of the three scenarios.

The spike in AR14 (medium scenario) for floating relates to the Celtic Sea sites – they are estimated to be in AR11 in the fast scenario, and AR16 in the slow scenario.

CfD Eligibility (UK) – All Scenarios, All Foundation Types



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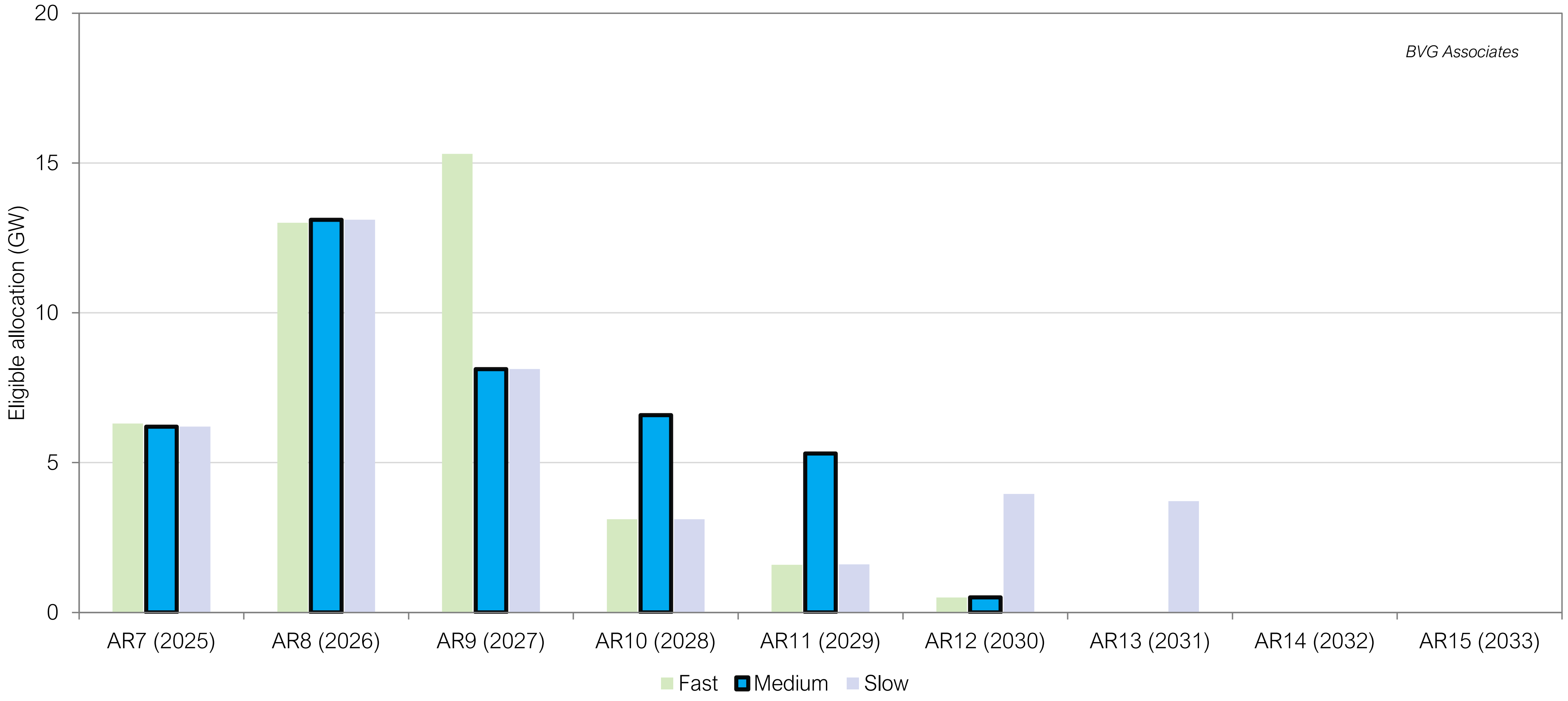
CfD Eligibility (Scotland) – All Scenarios, All Foundation Types



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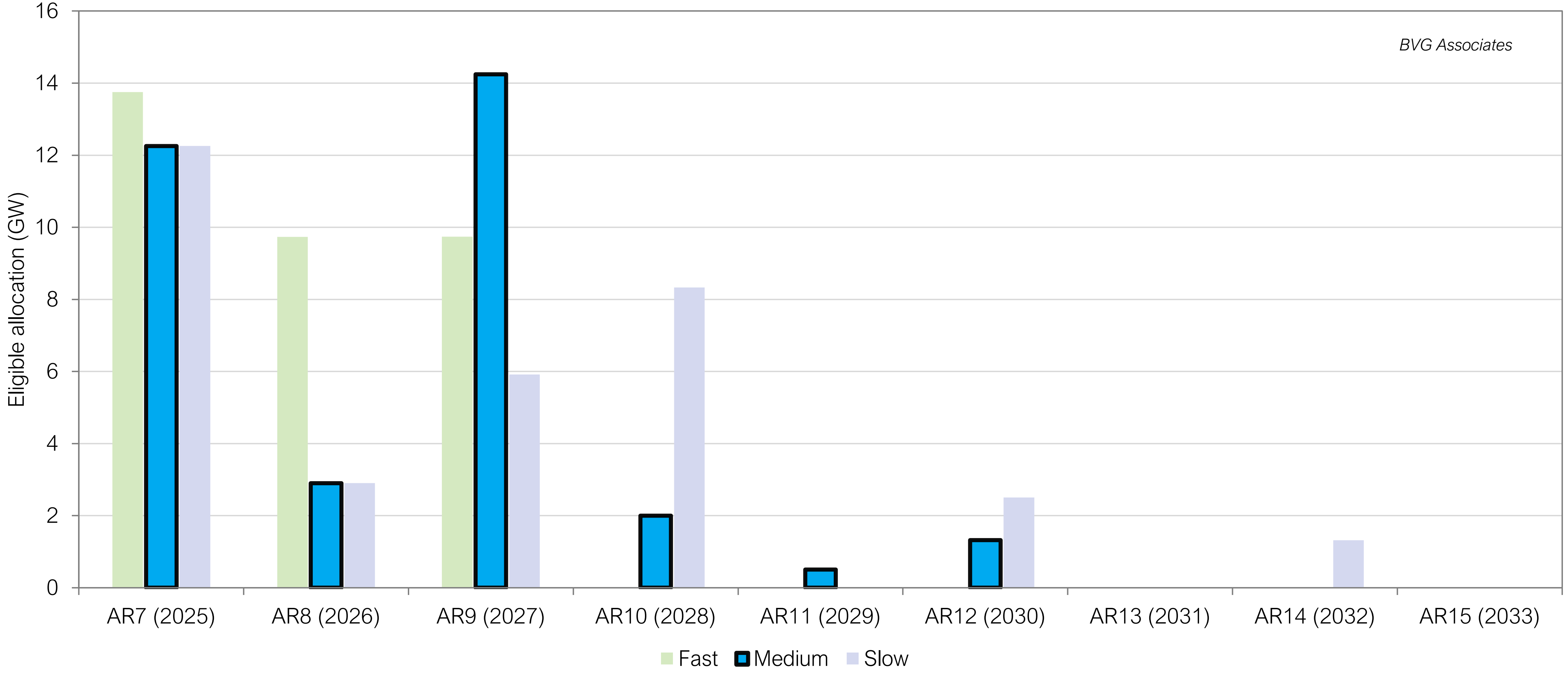
CfD Eligibility (UK) – All Scenarios, Fixed Foundations



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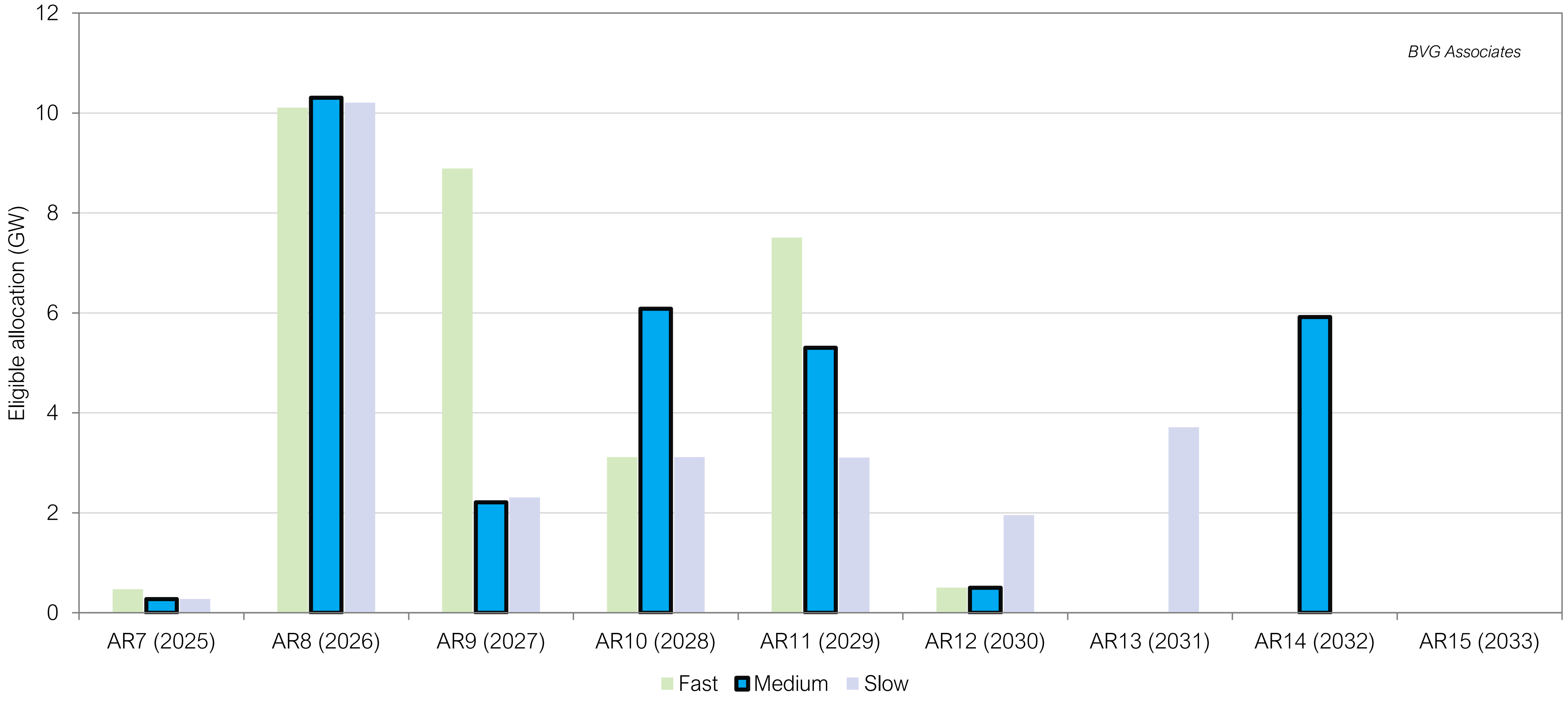
CfD Eligibility (UK) – All Scenarios, Floating Foundations



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Part 3: Supply Chain Considerations

Estimated demand on key parts of the offshore wind supply chain

Turbines and Foundations

The following graphs shows the number of turbines and associated fixed or floating foundations, based on the medium pace scenario.

We show this in two ways:

1. With the turbines for a project assigned to the year of first generation of that project, and
2. With the x-axis changed to show the year of installation, and the y-axis reflecting the annual volume expected to be in construction at any given time.

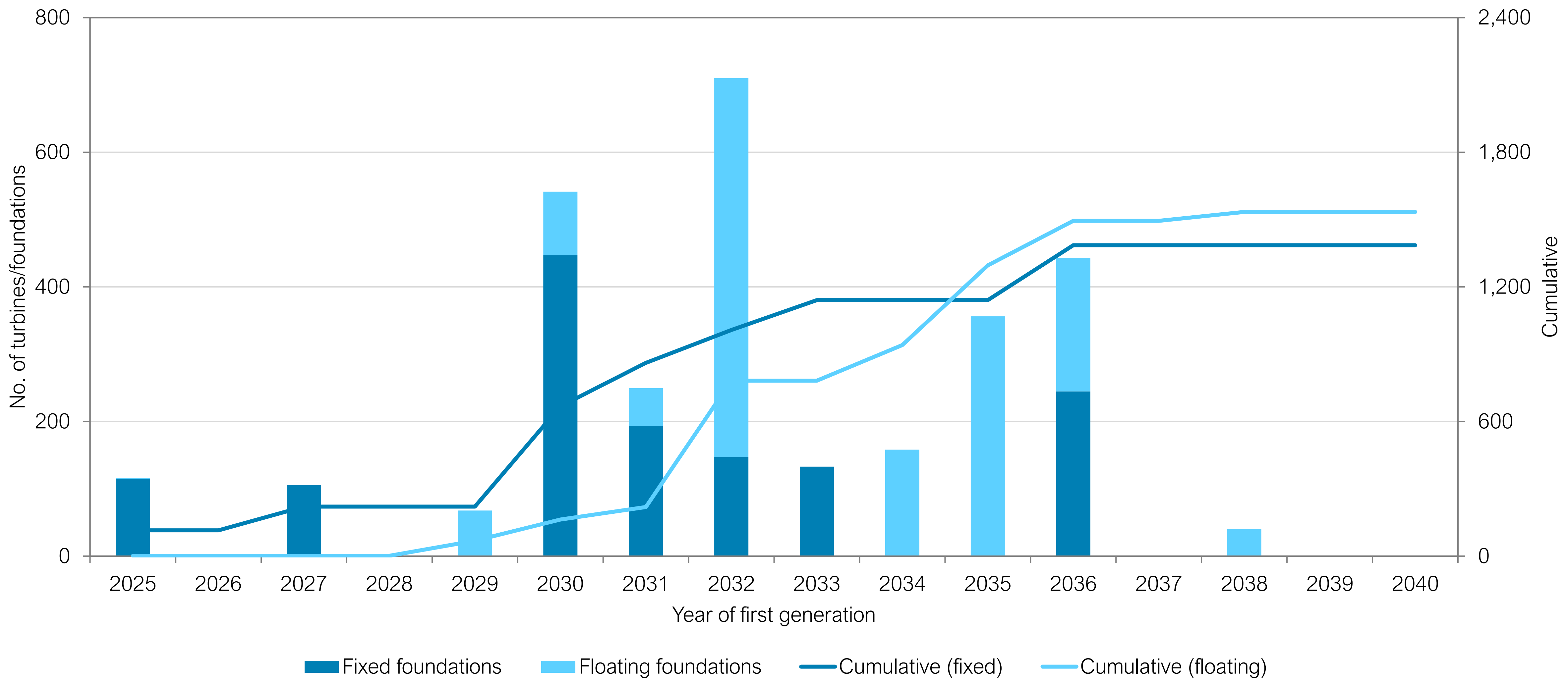
The first helps associate the turbines with particular projects, while the second visualises the practical implication of the installation process. The second graph also shows the smoothing effect of installing large numbers of turbines over a 2 to 3 year period per project.

The current Scottish pipeline will require a total of over 2,900 turbines to be installed over the next 15 years.

This consists of over 1,400 fixed foundations and around 1,500 floating foundations.

For context, by 2024 a total of 2,765 turbines had been installed in the UK, 378 of which were in Scotland.

Turbines Split by Foundation Type (Scotland, Medium Scenario)



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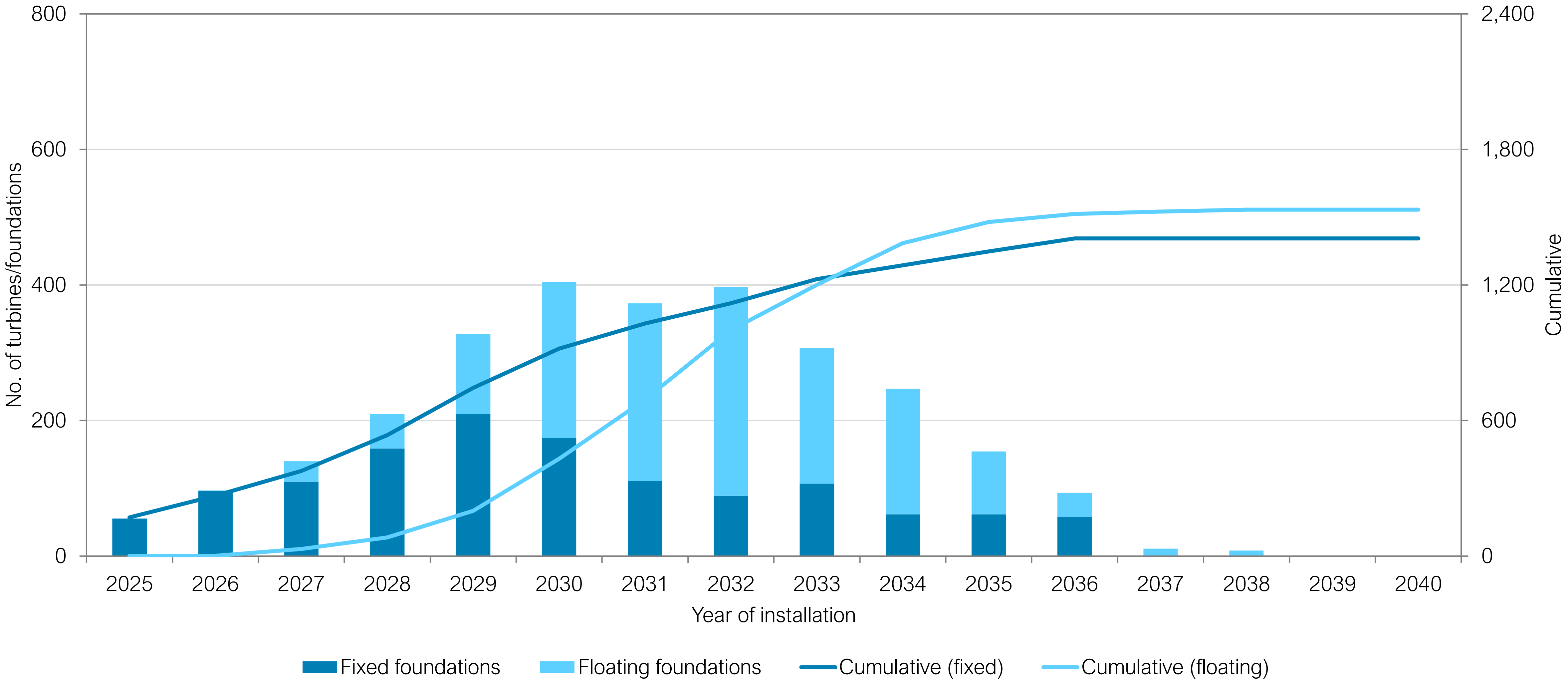
Turbines/Foundations Shown by Installation Year



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Cable and Substation Requirements

The following graphs show the length of offshore and onshore transmission cables associated with this capacity, and the number of offshore substations (OSS) required, based on the medium pace scenario.

Where data was not available, we have estimated based on the following:

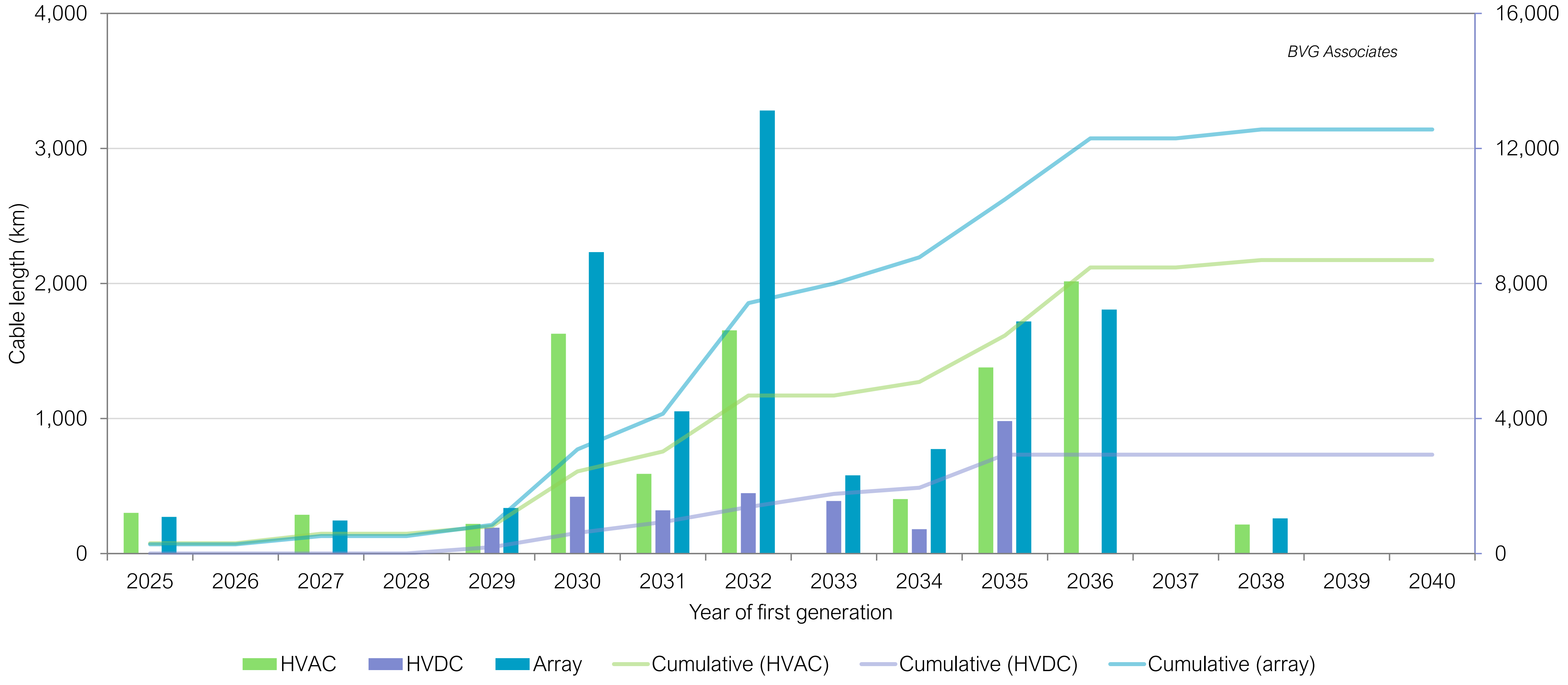
- Transmission distance is 2 x direct line to shore
- Offshore transmission uses HVDC if distance is >150 km
- There is one OSS per 500 MW for HVAC and one per 2,000 MW for HVDC, and
- Array cable length is 3.6 km per turbine, or 290 km per GW.

The transmission cable calculation assumes all projects have a radial connection back to shore. It does not accommodate any shared solutions that may affect multiple wind farms, such as energy islands, HVDC collector stations, or other co-ordinated solutions that may be considered under the Centralised Strategic Network Plan (CSNP).

Our estimations of demand and supply for both array and HVDC cables are similar to those estimated by ORE Catapult in [1].

The graphs show both cable and substation demand by year of first generation – this aligns with the first graph showing turbines/foundations. The cables will be quayside and ready for installation two to three years before this, with the shape and timing of the installation similar to the second graph of the turbines/foundations.

Cable Requirements (Scotland, Medium Scenario)



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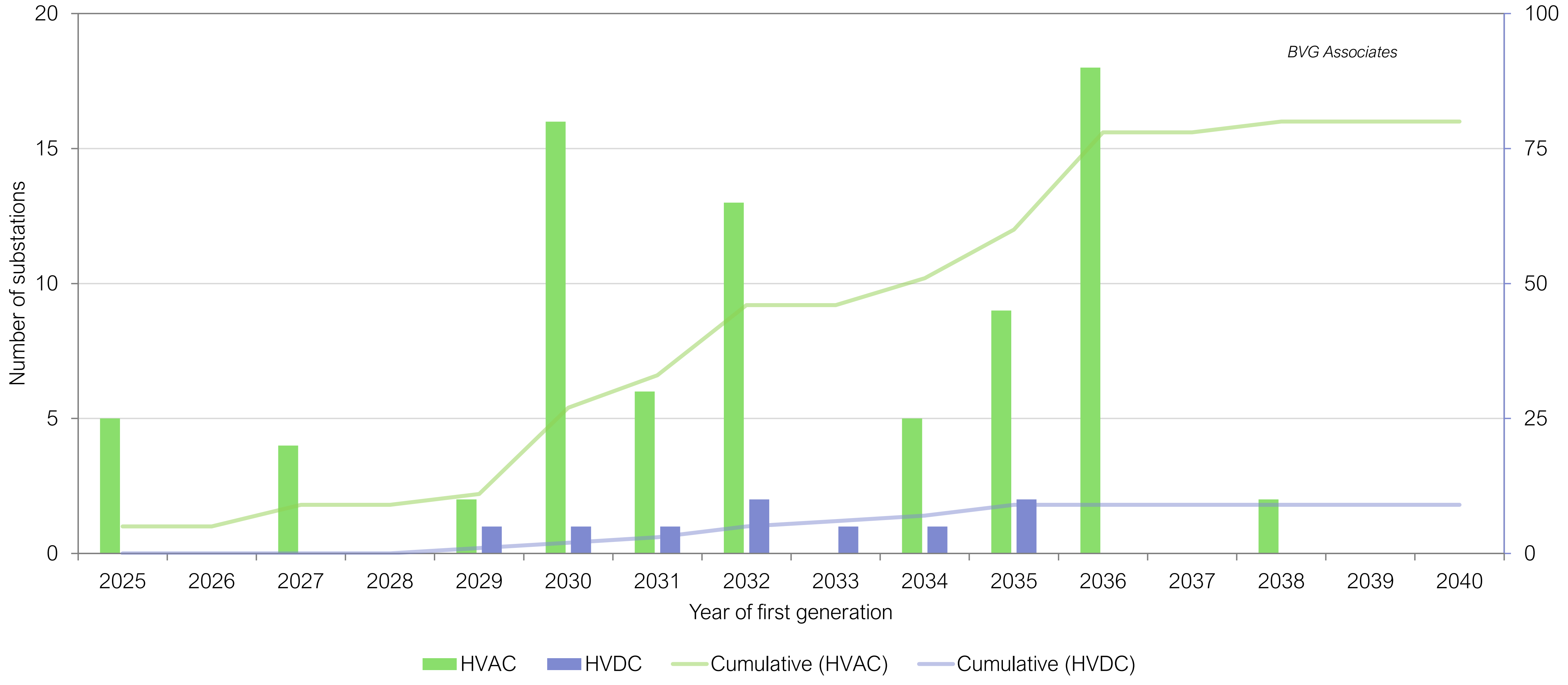
Offshore Substation Requirements (Scotland, Medium Scenario)



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Cable Length Estimates

We estimate that over 11,600 km of new offshore transmission cable will be required to connect all Scottish projects in the pipeline. Around 3,000 km of this we expect will be HVDC. We estimate a further 12,600 km of array cable to be required. This will require 80 HVAC and 9 HVDC OSS.

The total cable requirement (24,200 km) is over half the circumference of the earth.

For the seven years between 2030 to 2036 inclusive, the average annual demand is 1,096 km/yr of HVAC, 391 km/yr of HVDC, and 1,635 km/yr of array cables. For context, the JDR cable factory in Blyth is expected to have an initial annual output of 660 km/yr of array cable ramping up to 2,640 km/yr, or 120 km/yr of HVAC ramping up to 480 km/yr. Sumitomo in Nigg is expected to have lower volume but will be able to produce HVDC cables (production rate unknown). So, in very general terms, the array cable requirements for the whole of the Scottish offshore wind projects could theoretically support several JDR–sized factories for a period of six-plus years from the late 2020s.

The dates above are associated with the year of first generation. Cables will need to be quayside for the start of installation, which, for the medium scenario, will be two to three years earlier than the dates shown on the graph – the graph of installation will be offset and smoothed similar to the one shown for turbines and foundations. Cables with first generation in 2031 will be required to be quayside by 2028 and will likely be contracted in 2025/26 – so the factories expected to supply this cable will either need to exist already or be starting construction imminently. Cable supply is both a significant opportunity for Scotland but also a significant risk to deployment.

Economic Benefits

High level FTE and GVA estimates

Economic Benefits

Using the medium scenario, we estimated the economic benefits from the Scottish offshore wind projects. This is shown in the following two slides using the following metrics:

- Full Time Equivalent (FTE) years required by offshore wind projects within the pipeline, and
- Gross Value Add (GVA) to Scotland from the offshore wind projects in the pipeline per year.

These numbers were estimated using our internal BVGA model. We used a simplified approach aimed at producing a high-level estimation of the value inherent in the pipeline. For ease of comparison with other studies, we included both direct and indirect jobs, and excluded the value associated with the maintenance of the transmission assets (which is typically also both high in value and high in local content).

In particular, we used the assumption that the Scottish supply chain will grow "in line" with the demand over the next 10 to 15 years, meaning that the percentage of project spend that is spent in Scotland remains constant through the analysis period.

We used the following project details and have not accommodated for changes in either costs or percentage of local content over time. The FTE and GVA profiles created by our model for these project definitions were applied regardless of when a project in the pipeline became operational.

Foundation: Jacket/Semi-sub (steel)

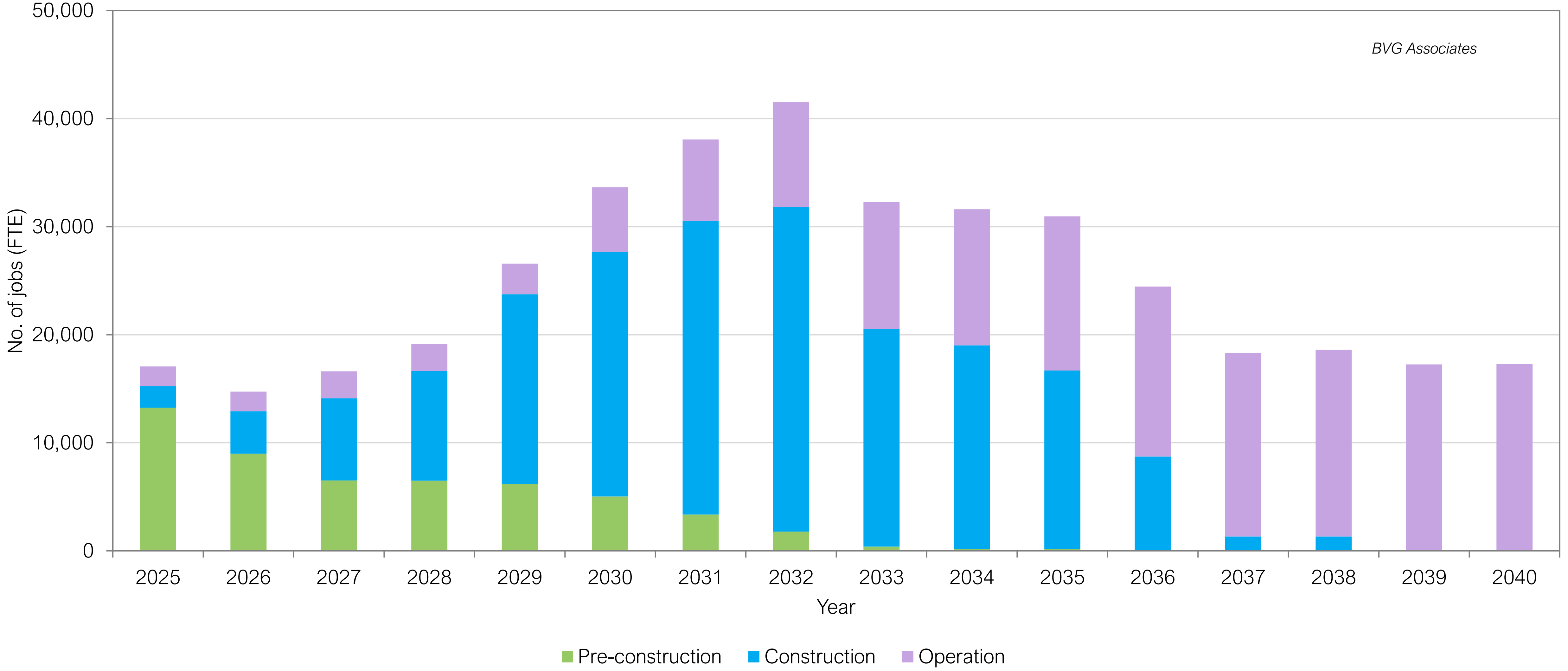
Project: 1.2 GW, 80 x 15 GW turbines

Transmission: HVAC, two offshore substations

Year of first operation: 2030 [a]

[a] Estimated costs vary with COD. We chose 2030 as it reflects the approximate mid-point of the medium scenario and is aligned with the size of project and turbine choice.

Jobs (FTE) - Scotland (Direct and Indirect)



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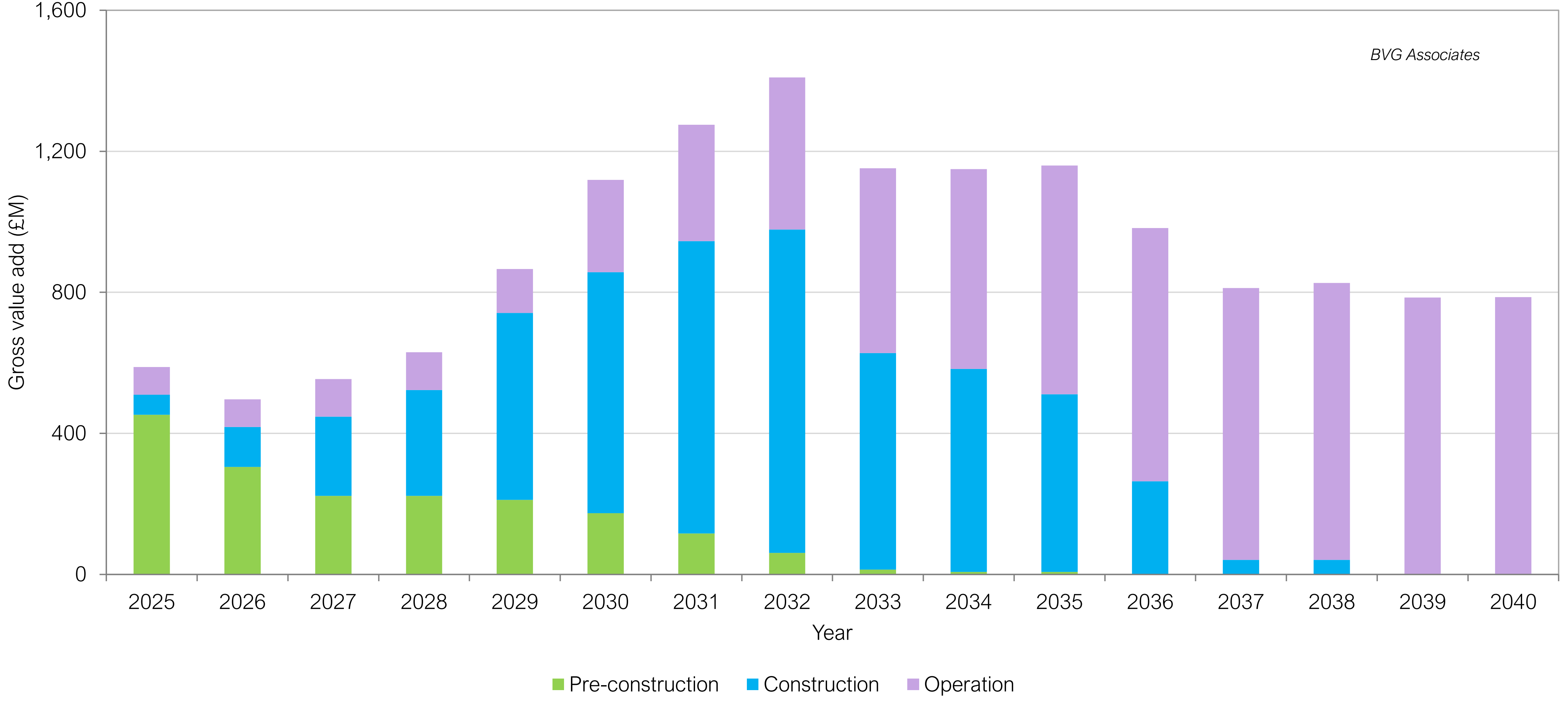
Gross Value Add - Scotland (Direct and Indirect)



Economic Benefits

We used a conservative approach to the modelling to avoid the need for complexity and the associated justification. We assumed that the services already deliverable from the Scottish supply chain do not change, but they do grow in line with the available market – that is, there is no investment assumed that will provide a step-change increase in the Scottish content.

This “constant local content” approach still provides very significant additions to the Scottish economy – from £497 million (14,700 FTE) in 2026 to a peak of £1,410 million (41,500 FTE) in 2032.

Investment will be required into the Scottish supply chain just to maintain the current levels of local content obtained. Further investment enabling a greater range of skills and services would help provide both increased opportunity for Scottish companies to export and increased protection from the competitive demands of other offshore wind markets

The steady state contributions from around 2039 onward are due solely to the wind farm related operational services. These include:

- Wind farm operations
- Turbine maintenance and servicing, and
- Balance of plant operations, maintenance and servicing.

Economic Benefits

Our simplified analysis estimates a peak of around 41,500 FTE per year for direct and indirect jobs created by Scottish offshore wind projects. This equates to a peak annual GVA of around £1.4 billion to the Scottish economy – or a total of around £8.1 billion between 2029 to 2035 inclusive (the primary construction years).

It can be misleading to compare examples of social and economic benefits as so much depends on the methods used in each case. For this reason, this slide is not a comparison of offshore wind with other industries/examples. Nevertheless, it is helpful to provide some level of context for the FTE and GVA figures provided.

Spend (or cost) is not the same as GVA – so the following reference points are not directly comparable to the GVA figures reported in this analysis – but they do help to provide some level of context in relation to project scale:

- The total cost of the Queensferry road bridge is estimated at £1.4 billion, and [14]
- The total spend on all infrastructure-related projects in Scotland in 2024 was estimated to be £4.5 billion. [15]
  This figure covers spend on water, sewerage, electricity, gas, communications, air transport, railways, harbours and roads.

By way of comparison, the total capital expenditure (CAPEX) for the reference 1.2 GW fixed foundation project is around £2.8 billion and around £3.5 billion for a 1.2 GW floating project. With the current pipeline and assuming the medium scenario, that would equate to an annual average of £4.6 billion per year CAPEX over the next 15 years for Scottish offshore wind.

Port Capacity Requirements

Estimations of quayside laydown and wet storage requirements

Port Capacity Requirements

The following slides show key metrics for the demand on port infrastructure during the construction phase:

- All turbines:
  - Quayside laydown area
- Fixed foundations:
  - Quayside laydown area
- Floating foundations:
  - Wet storage/inshore anchorage area (foundations only)
  - Staging/mating area (with turbine and rotors)

These graphs use “year of installation” for the x-axis and are all based on medium scenario. They follow the pattern shape and timing of the second graph of turbine installation (slide 41).

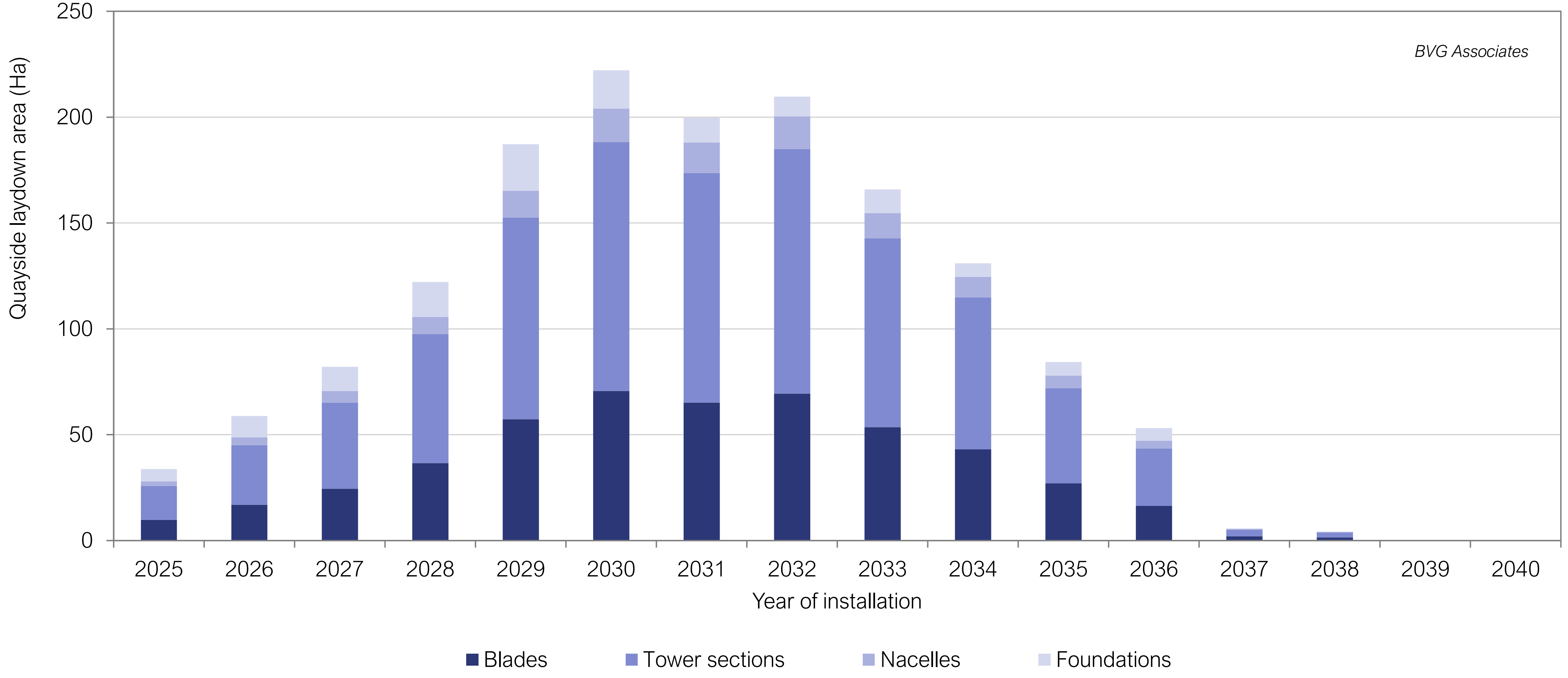
The area required per year for each of the metrics was calculated by the following footprints:

- Turbine: 0.2 Ha
- Fixed foundation: 0.1 Ha
- Floating foundation (no turbine): 7 Ha
- Floating foundation (with turbine): 28 Ha

Additionally, we assumed that:

- Quayside laydown areas are “set aside” for the full year, regardless of how long individual components were stored.
- Floating foundations without turbines are stored in wet storage/inshore anchorage (prior to turbine mating) for eight weeks.
- Floating foundations with turbines are stored in staging areas for four weeks.

Quayside Laydown Area



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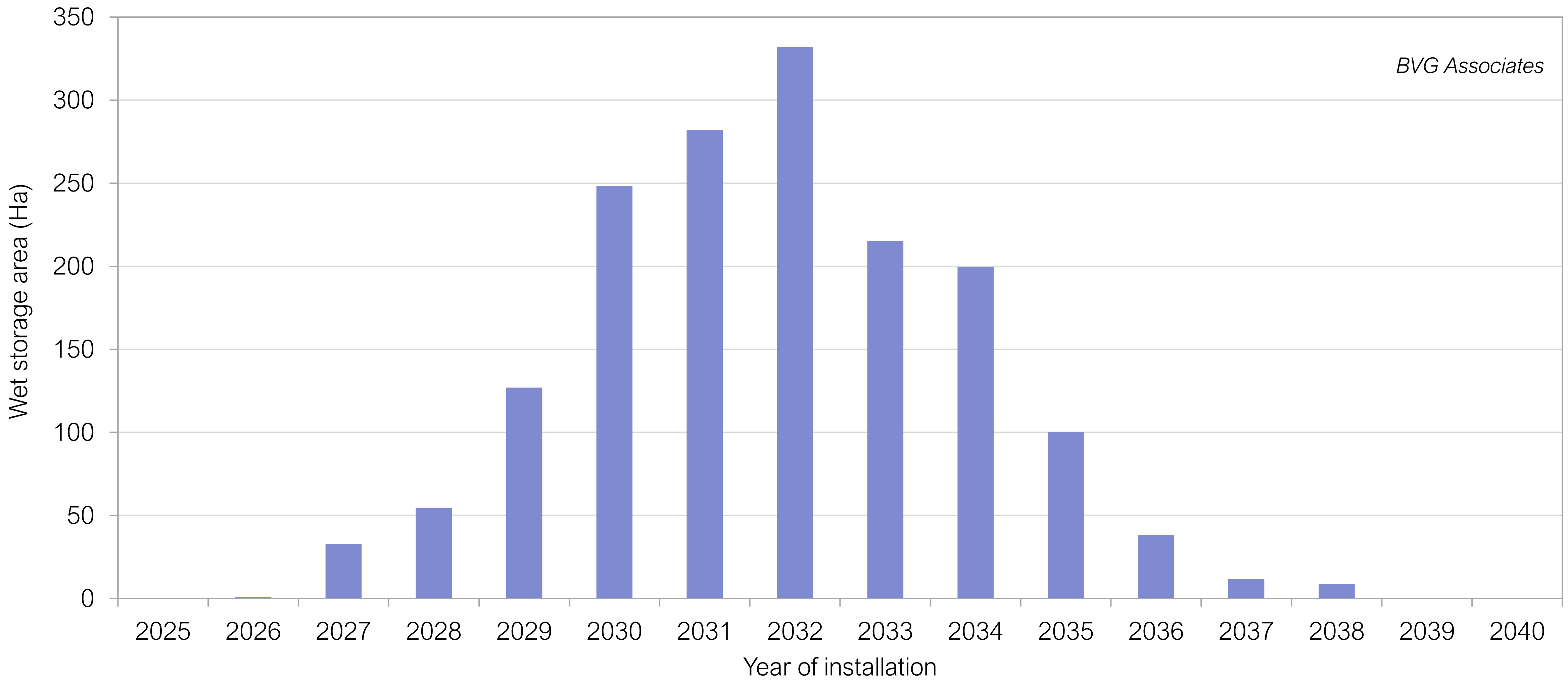
Wet Storage/Inshore Anchorage Area for Floating Foundations



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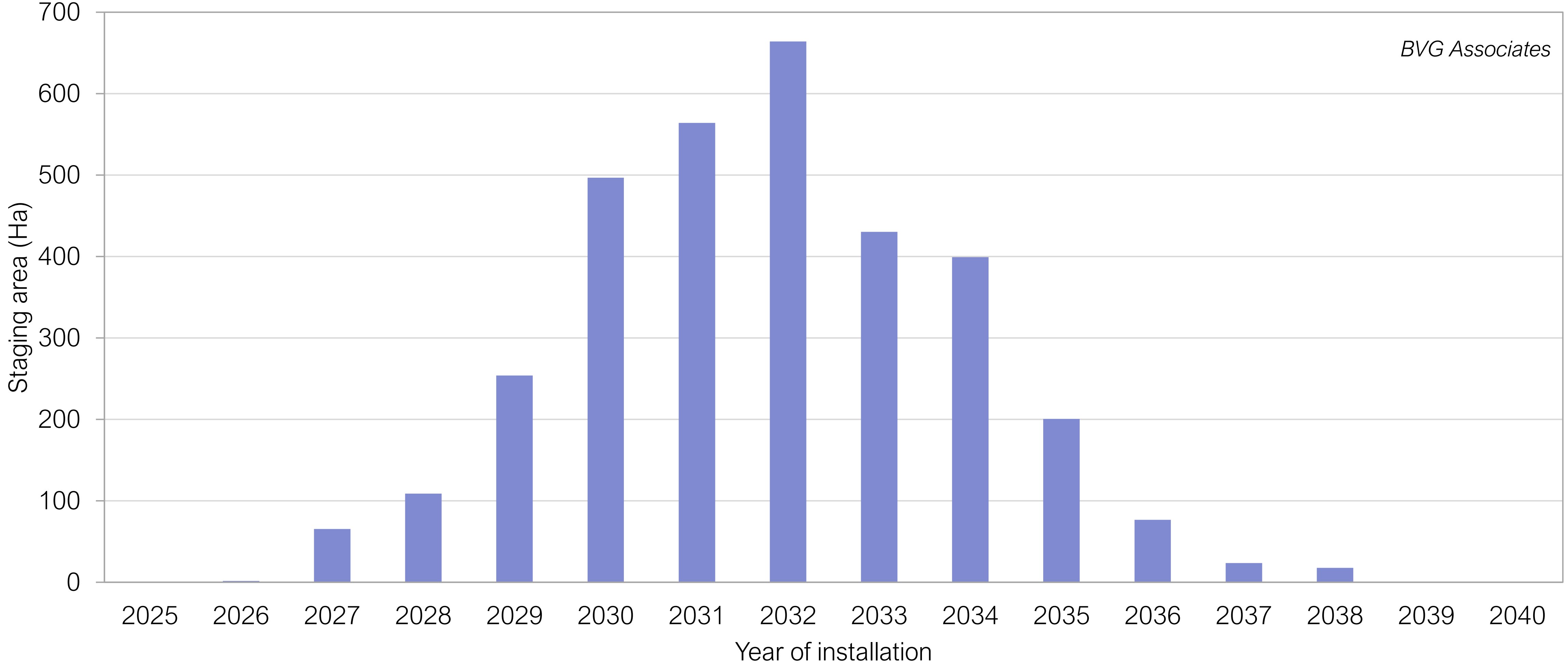
Staging Area for Floating Foundations With Turbine



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Port Storage Requirements

Between 2028 and 2034 we estimate that, based on the medium scenario, the average annual requirement for quayside laydown area will be around 180 Ha/yr. This increases to an average of 209 Ha/yr during the peak years of 2029 to 2032.

This is equivalent to around 250 to 290 football pitches.

We estimate this by assuming a project "sets aside" all required laydown area for the duration of construction - this technically overstates the space requirement, as there will be periods when the space is not used, but it does reflect the reality of how port space is currently managed.

For context, previous work by BVGA estimated the total quayside laydown area across nine major Scottish ports to be around 330 Ha. However, comparing 209 Ha (demand) vs 330 Ha (supply) does not take into account restrictions such as the technical suitability (e.g. bearing capacity) or existing use (the demand calculated here is for construction activities only). It also does not accommodate the practicalities of serving multiple projects, such as matching the location of the ports to the projects or the need to share port space between projects.

Considering the above, and as concluded in other studies, we expect that existing port laydown capacities will likely lead to significant bottlenecks during construction and therefore the likelihood of delays to the pipeline. [6]

We have not produced a detailed analysis of the supply vs demand for floating storage space. Floating storage is being considered in greater detail through other workstreams and reports such as [8] and [10].

Summary (1 of 5)

Whilst it is not possible to predict precise timing of future offshore wind deployment, this report highlights its scale and potential significance to Scotland's economy and supply chain, and the importance of ensuring it is enabled with appropriate policy, regulation and support.

The report emphasises the scale of the floating offshore wind opportunity in Scotland which will be a key element of both Scotland's and the UK's clean energy transition supporting thousands of jobs and adding hundreds of thousands of pounds to the economy annually.

The work highlights the significance and critical requirement of Scottish offshore wind to support UK-wide energy security and clean energy ambitions such as in the UK 2030 net zero action plan, NESO Future energy scenarios for deployment beyond 2030, and the Climate Change Committee anticipated requirements for UK to achieve net zero by 2050.

Summary (2 of 5)

We have created a pipeline model for offshore wind in Scotland, and the wider UK, which enables the user to understand the impact of future assumptions on a range of key practical metrics. Where possible this model is based on project timeline information provided directly to us by the developers of Scottish projects, otherwise a range of scenarios have been applied. These metrics are currently designed to estimate the demand in areas of specific interest – such as planning resources, port capacities and CfD allocations rounds. The model is designed to enable further metrics to be easily added in the future.

For simplicity of both modelling and messaging, we have made numerous assumptions in this work:

1. Due to the ongoing grid connection review, we have excluded publicly accessible grid connection dates from the timelines – though we have shown the effect these are likely to have.
2. We have assumed that ALL projects in the current pipeline will proceed to COD.
3. For the purpose of the CfD analysis, we have based eligibility on the expected consent date of a project, with a project eligible for the first available allocation round following their planning approval.
4. The size of a project has not influenced the duration between project milestones.
5. During installation, a turbine and its major components, including the foundation, are delivered, stored and installed in the same calendar year. The installation process itself is spread across multiple years, with the turbines installed pro-rata across the period.

The majority of the analysis is based on the medium scenario. We use the results from the slow and fast scenarios to provide an indication of the uncertainty inherent in the future deployment of the current offshore wind pipeline.

Summary (3 of 5)

The important messages from this work are:

1. For projects where we did not have milestone dates provided by the developer, we modelled three scenarios regarding the speed of development and construction. The medium pace scenario shows capacity growth at the UK level which is less than the rates expected by the UK's Clean Power 2030 (CP2030) report (39 GW compared with 43 to 51 GW by 2030). The medium scenario forecast for Scotland is however currently in line with the CP2030 report. For clarity, we removed Hornsea 4 (2.4 GW) from the UK forecast for the purpose of this analysis.
2. The medium pace scenario shows new capacity in Scotland connecting at a rate of around 4 to 8 GW per year in the first half of the 2030s, with most of that new capacity having connection agreements in place at the time of writing. A simplistic modelling of connection dates suggests a delay of the medium scenario of at least one to two years is likely with the connection queue in its current form.
3. We expect this new Scottish capacity to require over 11,600 km of offshore transmission cable (with 3,000 km of this to be HVDC) to be installed before 2035, and over 12,600 km of array cable. Depending on the development timelines, most of this will need to be installed before 2035 or sooner. Due to the duration of construction timelines and procurement lead times, commercial contracts for cable supply typically need to be in place around four years before a project's first generation.
4. Based on the medium scenario, the MD-LOT and other key stakeholders in the planning process should expect to make an average of six consent decisions annually between 2025 and 2029 to accommodate Scottish projects. There will be an average of around 16 projects going through the planning process at any given time during the early part of this period.

Summary (4 of 5)

4. UK CfD allocations for rounds 7 (2025) to 10 (2028) will each need to accommodate an average of 12.5 GW of offshore wind in order to achieve the medium pace scenario. This assumes all projects use CfD as their route to market and is based on projects bidding for CfDs as soon as they have planning consent. We recommend the "up-front" loading of these Allocation Rounds as this would help de-risk the projects affected and therefore increase the likelihood of the medium scenario being achieved.
5. We estimate an annual average CAPEX of £4.6 billion per year over the next 15 years on Scottish offshore wind – a value similar in scale to the total spend on all infrastructure-related projects in Scotland in 2024 as estimated by the ONS.
6. Using conservative assumptions (specifically, no significant change to the Scottish supply chain other than growth aligned with the increasing market size), we estimate that Scottish offshore wind projects will provide almost 34,000 FTE/yr annually on average during the peak construction years 2029 to 2035. These peak construction years contribute an annual average of just under £1.2 billion/yr GVA to the Scottish economy.
7. We estimate an average annual demand of around 180 Ha/yr of quayside storage for offshore projects in Scotland (for construction purposes only) between 2029 to 2034. We expect that the availability of suitable quayside laydown area will likely prove to be a bottleneck during this period if not before.
8. We estimate an annual demand of 130 to 330 Ha of wet storage/inshore anchoring for floating foundations, plus a further 260 to 660 Ha for staging/mating, during the early 2030s.

Summary (5 of 5)

Between 2025 and 2040, the current Scottish offshore wind pipeline is estimated to provide:

- Almost 43 GW of new offshore wind capacity
- Around 2,900 turbines:
  - 1,400 with fixed foundations, and
  - 1,500 with floating foundations.
- 11,600 km of transmission cable:
  - 8,600 km of HVAC, and
  - 3,000 km of HVDC.
- 12,600 km of array cable.
- 89 offshore substations (80 HVAC and 9 HVDC)

Other notable numbers:

- 8,700 blades totalling just over 1,000 km end to end (the distance by road between Cardiff and Wick) [a]
- Almost three million tonnes of steel for towers [b]
- Over three million tonnes of steel for fixed foundations (including transition pieces (TPs)) [c]
- Almost eight million tonnes of steel for floating foundations + TPs [d]
- Over 5,700 km of anchor chains - roughly the distance from Gibraltar to Moscow - with a total mass of almost five million tonnes. [e]

Assumptions:

[a] 116 m per blade

[b] 800 tonnes per tower (fixed), 1,200 tonnes per tower (floating)

[e] Jacket with 15 MW turbine in 60 m depth

[d] Semi-sub (steel) with 15 MW turbine

[e] Catenary style steel chains in 400 m depth

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