

Bill of Works

A review of UK offshore wind steel requirements

Phase One Executive Summary

Report to UK Steel: November 2024

Version Control

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A	Draft summary report for client	10/24
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The project utilises Everoze’s SCCA model¹ developed for OWIC & OWGP, updated to provide additional data on offshore wind steel requirements. The model is owned by OWIC/OWGP with rights given to Everoze re. utilisation, and was an input source into the UK Industrial Growth Plan.

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Executive Summary

The UK offshore wind pipeline is the second largest in the world and will require up to 25 million tonnes of steel (1 million tonnes per annum) between 2026 and 2050. This represents a potential £21 billion market for UK steel over the coming decades

The UK's offshore wind pipeline has an annual steel demand equivalent to 20% of annual UK steel production (5.6 million tonnes of steel in 2023).

However, while UK requires a significant volume of steel to build out its offshore wind pipeline, currently the vast majority of this steel is expected to be provided by non-UK mills that are better able to supply the volume and types of steel required. There are a number of reasons for this. Firstly, components for the UK's offshore wind pipeline are being fabricated abroad and then imported. We estimate that less than 2% of UK steel components (by weight) needed in the last five years were fabricated in the UK.

The UK has had some success securing some components fabrication, but activity in the UK is primarily for fit out and finishing of components using imported primary sub-components and secondary components.

Smulders has been operating out of Wallsend successfully for a number of years, importing primary components for jackets (both for turbines and substations) and transition pieces (TPs) for assembly and fit out, while nearby on the Teesworks site the new SeAH monopile factory (the world's largest) has now started steel rolling as part of pre-production work.

Smulders' Wallsend facility provides fabrication, assembly and finishing of jackets and transition pieces. Primary and secondary components are imported into the yard however, as non-UK providers are currently better able to meet the cost and quality requirements for this work. Steel plate and other steel types for these activities are sourced from non-UK mills. SeAH's new facility will ensure rolling of large plate

and fabrication of large monopiles is taking place within the UK. However, monopiles need some of the largest plate sizes available on the market, meaning that it is currently expected that SeAH will need to import all of its steel needs.

In Phase Two of this project, *Bill of Works* will assess in detail the specifications of different plate requirements in offshore wind and report on what percentage of UK plate steel needs UK mills can (a) currently provide and (b) could provide based on potential new investments in capacity.

However, from Phase One of this work a number of things are already clear.

Firstly the UK has existing capability and capacity to supply all or most of the steel requirements for rebar, tensioning strands and other steel types such as rolled and open sections. This means that the UK is well placed to (a) supply rebar and tensioning strands into the emerging market for concrete floating foundations, as well as gravity bases, and (b) the UK can supply a wide range of other steels and products mainly for secondary steel requirements as well as specialist components such as bolts, flux and welding materials. The UK also has existing expertise from oil and gas meaning it has comparative advantage in supply of anchors and moorings for floating offshore wind, including fabrication of steel elements.

Secondly, those components that are fabricated out of plate – monopiles, towers, transition pieces, semi-sub, TLPs, anchors – have different specification requirements.

That means that there are expected to be opportunities for supply of plate for components that need smaller plate sizes. This will be assessed in detail in Phase Two.

Thirdly, while UK plate supply is not generally well suited for supply into offshore wind, this is not a challenge unique to the UK. Offshore wind has demanding plate requirements meaning that there are few mills globally that can supply into this market, creating potential supply bottlenecks.

Given the size of the UK pipeline, this therefore offers an opportunity. In the short term, the UK needs to be an early mover into use of new welding technologies like laser welding and vacuum welding that enable high-quality rapid welds to be made, including the ability to join smaller plates together into larger sizes. Cambridge Vacuum Engineering has already proven this use in transition pieces with SIF and SSE Renewables on Dogger Bank.²

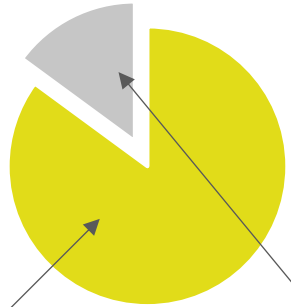
In the medium term, the UK needs to use the forthcoming Steel Strategy to focus in on investment opportunities for new caster and plate rolling capacity to supply plate into the offshore wind market (alongside other strategically important sectors such as defence). However, because offshore wind build out peaks in the early 2030s, the UK would need to move swiftly to build out new mill capacity to be ready to supply this market.

Finally, the UK's rapid decarbonisation of its power sector, thanks in large part to offshore wind, offers a route to greener steel here in the UK.³ The UK's shift to electric arc furnaces powered by a low carbon power mix puts the UK towards the front of the pack in nations able to offer greener steel to the market. This opens up potential for a virtuous circle of offshore wind powering UK furnaces producing steel for UK fabricators producing components for wind farms here in the UK and globally.

Offshore wind has a steel demand almost 6x that of defence, highways, rail, nuclear and government buildings combined

However, between 2021-25 less than 2% of steel components used in UK wind farms were fabricated in the UK, and almost none using UK made steel. The UK steel demand is primarily for plate, as well as rebar, tensioning strands and other steel

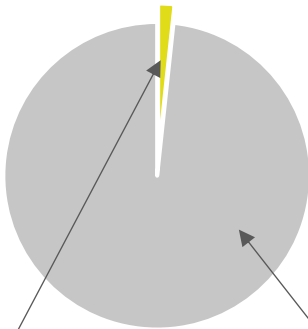
1 Relative size of UK pipeline



The UK offshore wind pipeline out to 2030 will need approx 6m tonnes of steel

This is almost 6x greater than steel demand for highways, rail, defence, nuclear and government buildings combined

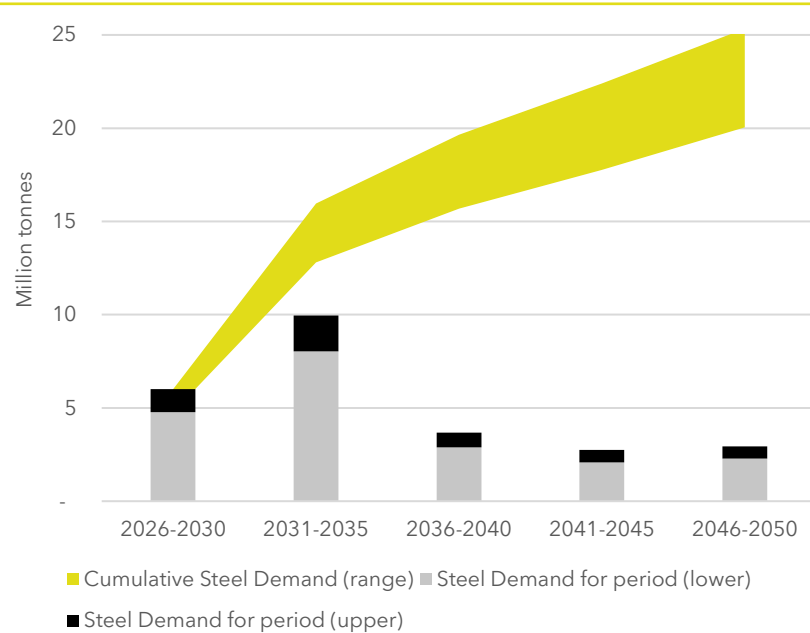
2 UK % of fabricated steel today



Between 2021-25 less than 2% (by weight) of steel used was fabricated in the UK

Of the imported components, 55% came from rest of Europe, 26% from Middle East or China and 18% was of unknown origin

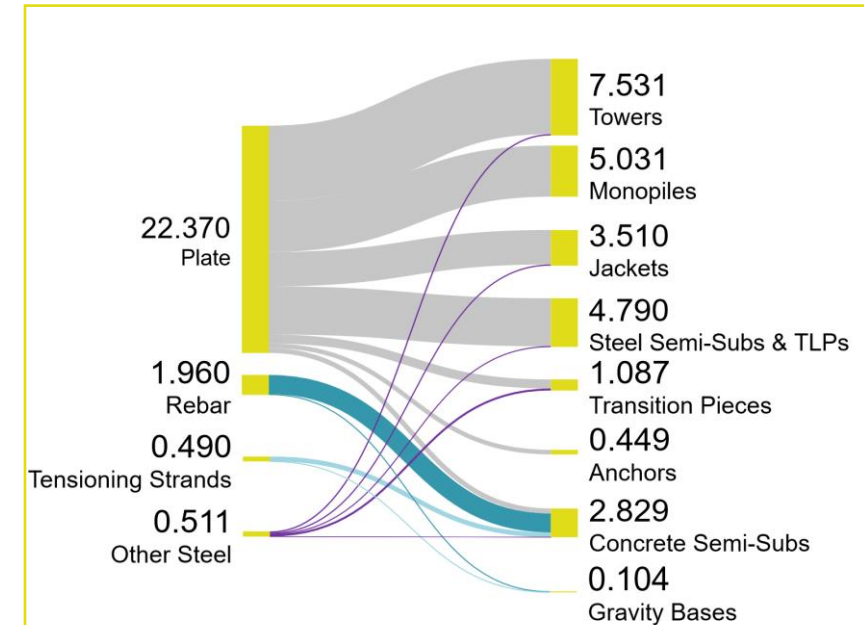
3 Cumulative & annual demand out to 2050



Top Centre: the UK has cumulative steel needs of between 20 and 25 million tonnes of steel. This represents a potential £21 billion market for UK steel over the coming decades

On average, annual demand is 1 million tonnes per annum (mtpa). Minimum demand is 0.4mtpa, and at peak is 2mtpa. Demand grows rapidly from the mid 2020s until mid 2030s, peaking in the early 2030s. However, in the fifteen-year period from 2036 to 2050 demand remains between 0.4 and 0.7mtpa, presenting a long-term opportunity for steel component fabrication and steel supply. For comparison, we estimate steel use between 2021-25 was approx. 0.3mtpa.

4 Demand by steel type out to 2050 (mt)



Top Right: the UK offshore wind sector's largest demand is for plate steel. Between 2026 and 2050 it will need up to 22 million tonnes of plate for a wide range of components.

In addition, it will need almost 2.5 million tonnes of rebar and tensioning strands to supply demand for concrete foundations.

As well as this the sector also needs 0.5 million tonnes of other steel types such as tubular steel, section steel, welding material, bolts etc. This other steel use is generally for supply into secondary steel components.

UK Offshore wind *Bill of Works*: pipeline steel requirements

Between 2026 & 2050, the UK's offshore wind pipeline will require a range of primary and secondary components. Overall tonnages forecast are shown below.



Towers

4.4m-8.4m tonnes steel required

Rolled Plate required for primary steel works, but also secondary steel opportunities

IGP priority? Yes

Opportunity? Investment in additional UK tubular steel rolling would enable tower manufacturing in UK and build capacity ready for floating offshore wind.

Plate size requirements high, so need to assess in more detail to what sizes UK mills can provide, and options for plate joining.



Monopiles

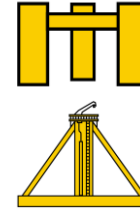
4.7m-6.2m tonnes steel required

Rolled Plate required for primary steel works. No secondary steel unless TP-less monopiles specified

IGP priority? Yes

Opportunity? Monopiles require some of largest plate sizes produced globally. Can potentially be addressed through (a) innovation in plate joining and (b) investment in medium term in larger casters and plate mill.

UK focus on TP-less monopiles could build on UK monopile expertise and open up secondary steel opportunities.



Steel Semi-Subs & TLPs

4.3m-4.8m tonnes steel required

Rolled Plate and other steels required for primary steel works, but also secondary steel opportunities

IGP priority? Yes

Opportunity? Most designs require smaller sizes plate sizes that can be potentially met from existing capability. Clarity re. platform specs needed to underpin investments.

UK must focus on establishing primary production of primary sub-components to secure value and open up secondary steel and mill supply opportunities.



Anchors

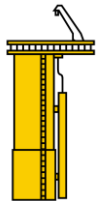
0.3m-0.5m tonnes steel required

Plate required for primary steel. UK has existing supply chain based around oil and gas

IGP priority? Yes

Opportunity? UK has high existing capability in anchor fabrication, and this is a significant export opportunity to supply global FLOW market.

Range of anchor types such as drag and pile anchors can be supplied by UK fabricators, and plate sizes tend to be smaller than for other components.



Transition Pieces

1.0m-1.4m tonnes steel required

Rolled Plate required for primary steel works, but also relatively high secondary steel opportunities

IGP priority? Yes

Opportunity? UK has secondary and fit out capability but relies on import of primary components. UK should prioritise TP primary fabrication or encourage TP-less approach that supports existing UK supply chain.

TJs now certified for use with plate-joining of smaller plate, potentially opening up supply opportunity for UK mills.



Jackets

2.8m-4.4m tonnes steel required

Rolled Plate required for primary steel works, but also secondary steel opportunities including other steels

IGP priority? Yes

Opportunity? Next generation of larger jackets, and OSS jackets will need larger plate sizes.

UK has expertise in jacket assembly, but needs to investigate options for supply of primary and secondary fabrication, plus supply of steel into European supply chain.



Concrete foundations

2.6m-2.9m tonnes steel required

Significant rebar requirements, as well as some plate and other steels

IGP priority? Yes

Opportunity? UK has strong rebar and tension strand capacity to supply concrete floating platforms and gravity base market.

Gravity bases offer further supply opportunity for TP primary and secondary steel supply.

UK support around construction and civil engineering will help open-up this opportunity to UK rebar suppliers.

Defining UK steel & fabricator capability

In **Phase Two** of *Bill of Works* we will review in detail the plate requirements of the different steel components. Our evidence base shows us already that the UK has capability for rebar, tensioning strands and other steel types.

We will map this steel capability alongside capability of UK fabricators to highlight the biggest opportunities for UK supply.

Main Findings

The UK's offshore wind pipeline will need to source between 21m and 25m tonnes of steel between 2026 and 2050

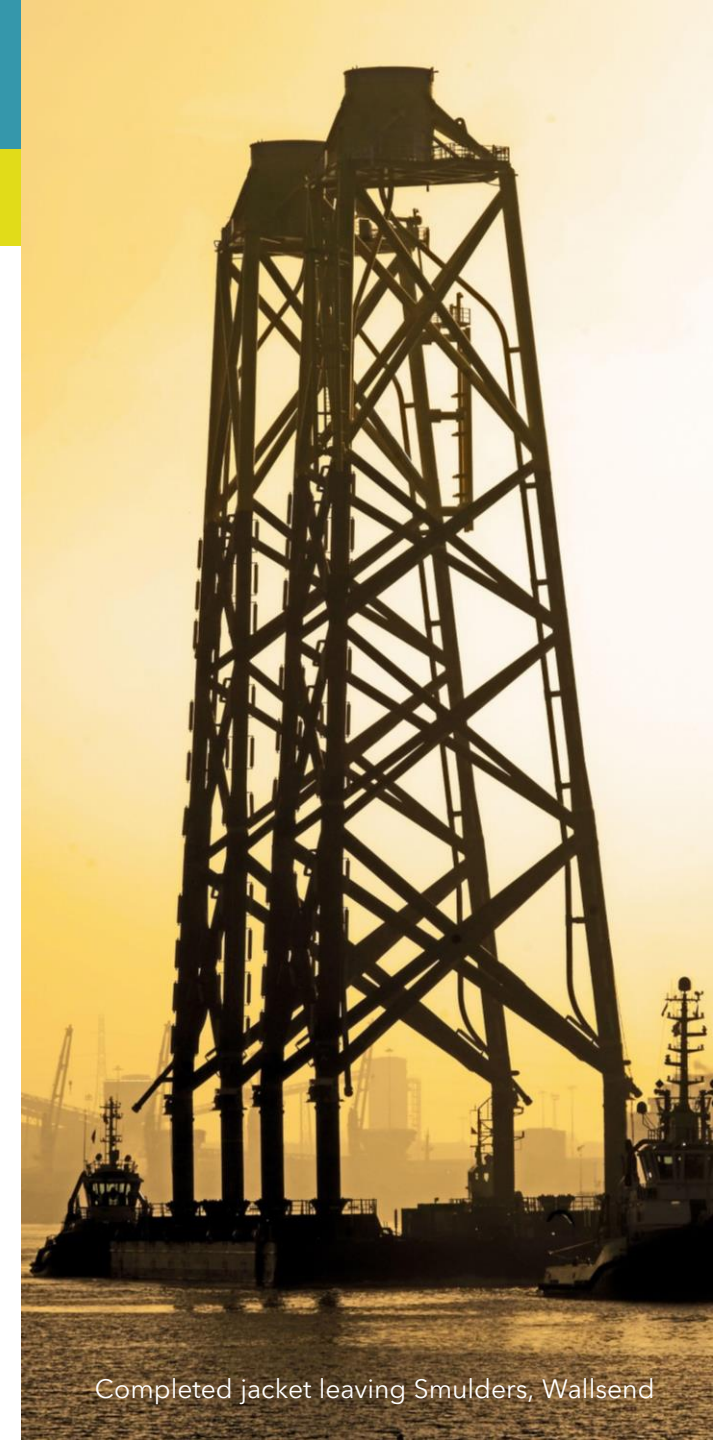
1. Between 2026 and 2050 the UK offshore wind pipeline will require between 20 and 25 million tonnes of steel. This represents a potential £21 billion market for UK steel over the coming decades.
2. On average, annual demand is 1 million tonnes per annum (mtpa). Minimum demand is 0.4mtpa, and at peak is 2mtpa. Demand grows rapidly from the mid 2020s until mid 2030s, peaking in the early 2030s. However, in the fifteen-year period from 2036 to 2050 demand remains between 0.4 and 0.7mtpa, presenting a long-term opportunity for steel component fabrication and steel supply. For comparison, we estimate steel use between 2021-25 was approx. 0.3mtpa.
3. The size of the UK offshore wind pipeline's steel requirement is significant compared to other sectors. Steel use in offshore wind is 5.7 x greater than that required by other UK pipelines such as defence, highways, rail and government buildings combined.
4. The main requirement for steel from the UK offshore wind pipeline is plate steel. 88% of steel (22.3 mtpa) required for offshore wind components needs to come from plate mills. This plate is needed in a range of sizes, though growth in turbine sizes as well as the use of fixed foundations in deeper and deeper waters, has pushed further upward the already large plate sizes required by industry. As offshore wind sizes continue to grow, the proportion of plate sizes that the UK can supply will fall. Phase Two of *Bill of Works* will look in detail about where the threshold is for UK supply of plate into offshore wind.
5. After steel plate, the UK needs significant tonnages of rebar and tensioning strands for use in concrete semi-submersibles and barges, as well as gravity base foundations. The UK will need between 2.2m and 2.5m tonnes of rebar and tensioning strands between 2026 and 2050. The UK also has opportunities to innovate in supply of rebar – for example supplying higher grades of steel of higher value but lower volume, and better-quality localised steel recycling as a new source of rebar steel supply.
6. As well as plate, rebar and tensioning strands, the UK offshore wind pipeline needs a range of other steel types, including rolled open sections, hollow sections, castings, welding materials and flux and bolts. Supporting UK suppliers of these higher value steel types and products should be a part of UK efforts to grow UK supply chain value.
7. The UK's main strengths in steel fabrication are currently focused at the secondary steel level. This market is better suited to small and medium sized companies able to take on the types of contract packages on offer. However, secondary steel makes up less than 2% of UK offshore wind steel needs by volume.
8. The UK has strong capability for high grade steel production and castings due to expertise of companies like Sheffield Forgemasters. The market may evolve to utilise more castings for nodes to enable stronger faster connections to be used in floating designs and also larger jacket designs. However, the size and scope of this market is not clear, though the UK could seek to position itself as a supplier in this market via IGP action on deep water foundations.
9. While the Industrial Growth Plan (IGP)⁴ lists UK transition piece (TP) fabrication as a UK strength to defend, at present the UK capacity is limited to fit out (Smulders and previously Wiltons) rather than primary or secondary steel supply. TPs have the highest secondary steel content of components analysed and require smaller plate sizes than monopiles and towers, meaning that they represent a strong opportunity for existing secondary steel providers and UK steel mills. The UK needs to build UK TP capability and/or explore routes to encourage uptake of TP-less monopiles.
10. It is also worth highlighting that the UK pipeline of floating offshore wind projects is of global significance.⁵ The UK is part of a larger global market expected to deliver 2,000 GW of fixed and floating offshore wind by 2050. If the UK can find a route to supply the quality, volume and well-priced steel and fabrication, there is a route to compete with other European steel mills and fabricators in Holland, Germany, Poland etc. that have invested in modern plants and have been able to retain market share in the face of competition from yards and steel mills in Asia.

Recommendations

The Bill of Works project aims to set out a common evidence base for the steel sector, offshore wind industry and UK fabricators. The data in the report also highlights a number of issues that are worth drawing out.

Data analysis from the *Bill of Works* project identifies a number of challenges and opportunities for the UK, leading to the following recommendations:

1. The UK's IGP identifies towers and deep-water foundations as UK opportunities. UK success in defending and growing UK fabrication value of these major components represents the best route for growing UK primary fabrication. Investment in additional tubular rolling capacity will be necessary for tower production as well as supply into floating offshore wind.
2. The UK's biggest opportunity for steel supply will come from supply of plate. It will be important to understand in detail what size of plate UK mills can supply up to, how early adoption of technologies such as laser welding and electron beam welding to help match existing UK plate with offshore wind needs and what investment in new plate rolling and casting capacity is required.
3. The UK pipeline of floating offshore wind projects is of global significance. Everoze & LumenEE made a number of recommendations to the UK Floating Offshore Wind Taskforce, including use of a Collaborative Framework on platforms that would fit well with taking this Bill of Works forward.⁶ A critical point is that the UK needs to take seriously securing primary fabrication of floating steel components and concrete foundation expertise to increase value to the UK while protecting UK expertise in anchors and moorings.
 - a. We have modelled steel needs for some of the market leading platform designs we are aware of. However, clarity re. designs used in UK waters will enable better supply chain planning and successful establishment of primary component production.
 - b. The UK already has high capacity and capability to supply rebar and tensioning strands for concrete semi-sub and barges as well as gravity base foundations. Support to build a UK based concrete supply chain will be critical to help UK suppliers such as Celsa effectively access the market.
4. The UK also needs to consider how to align fabrication and steel supply into offshore wind with other critical energy supply chains such as onshore wind, electricity grid infrastructure (e.g. pylons), Onshore wind will require smaller plate sizes than offshore, as well as increase demand for UK rebar. The methodology developed here can be adapted to quantify use in these similar sectors.
5. Existing UK fabricators see markets such as defence as better priorities than offshore wind, despite their smaller size. There are opportunities to better align supply into these markets so that fabricators are able to pursue multiple markets to build more resilience into their future pipeline. Fabricators and steel mills will need confidence in demand across these multiple sectors before they seek to invest into the UK.
6. Finally, it is important to emphasise the importance of coordination between UK offshore wind developers, OEMs, fabricators and UK steel providers to align the forthcoming Steel Strategy with the existing Industrial Growth Plan. *Bill of Works* provided a shared evidence base to build on. It demonstrates the size of the opportunity that could be landed through cross sector working to build UK fabricator and mill capacity and help lock in the mutual benefits of supply of low-cost low-carbon electricity from offshore wind into UK steel manufacturing.



Completed jacket leaving Smulders, Wallsend

Glossary & References

Term	Definition
BCSA	British Construction Steel Association
CIB	Clean Industry Bonus
DBT	Department for Business & Trade
DESNZ	Department for Energy Security and Net Zero
EAF	Electric Arc Furnace
GOES	Grain-oriented electrical steel
IGP	Industrial Growth Plan
mt	Million tonnes
mtpa	Million tonnes steel per annum
NGOES	Non-grain-oriented electrical steel
OSS	Offshore Substation
SCCA	Supply Chain Capability Analysis
TLP	Tension Leg Platform
TP	Transition Piece

References

1. OWIC & OWGP (2023) [Supply Chain Capability Analysis – summary report](#)
2. Energy Industry Review (2023) [EbfloTM, First Electron Beam Welding of Wind Turbine Monopile](#)
3. See also Green Finance Institute (2024) [National Wealth Fund Taskforce](#), for a discussion about UK opportunities around green steel.
4. OWIC (2024) [2024 Offshore Wind Industrial Growth Plan](#)
5. UK Floating Offshore Wind Task Force (2024) [Floating Wind: Anchoring the next generation offshore](#)
6. Everoze (2024) [Tilt the balance: how the UK can capture opportunities in floating wind](#) – report to the Floating Wind Taskforce



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