Malin Group

G0005

Potential UK Fabrication Demand

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00	Initial Issue for Review and Comment	J. Brown	09/11/2022
01	Appendix A.1 – clarified assumptions	J. Brown	05/12/2022
02	Appendix A.7 – graph size increased	J. Brown	07/12/2022
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07	Addition of Executive Summary All graphs updated to improve clarity Section 2 – Updated wording of introduction Section 3, Appendix A.5 – National Flagship, Northern Lighthouse Board Buoy Laying Tender, four Transport Scotland Large Ferries removed Section 3.1, Section 3.3, Section 4.1, Section 4.3, Appendix A.2, Appendix A.6, Appendix A.7 – ML (UK) added	J. Brown	05/05/2023

Reference Documents		
Number	Document Number	Document Title / Description
[1]	CP605	National Shipbuilding Strategy
[2]	N/A	Initial Predictions for Offshore Wind Farms in the ScotWind Leasing Round

Documents referenced are applicable to the extent specified within this document.

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Abbreviations and Acronyms	
Term	Definition
FOW	Floating Offshore Wind
GRP	Glass Reinforced Plastic
INTOG	Innovation Targeted Oil and Gas
NSbS	National Shipbuilding Strategy
ORE	Offshore Renewable Energy
te	Tonnes
UK	United Kingdom

1. Executive Summary

Two exciting opportunities are facing the UK manufacturing sector: the National Shipbuilding Strategy (NSbS) and offshore wind development. With the growing interest in local content, these two opportunities offer the potential to rejuvenate the heavy, large-scale manufacturing sector in the UK.

To fully understand these opportunities, it is key to assess the current in-country capacity and the potential challenges that could be faced from the NSbS and offshore wind demands. This paper focuses on developing a demand forecast alongside an evaluation of the existing capacity to create an assessment of the NSbS and offshore wind demands separately.

These assessments outline a clear deficit in manufacturing capacity in country for both workstreams, with offshore wind, shown in Figure 2, dwarfing the NSbS demand stream shown in Figure 1.

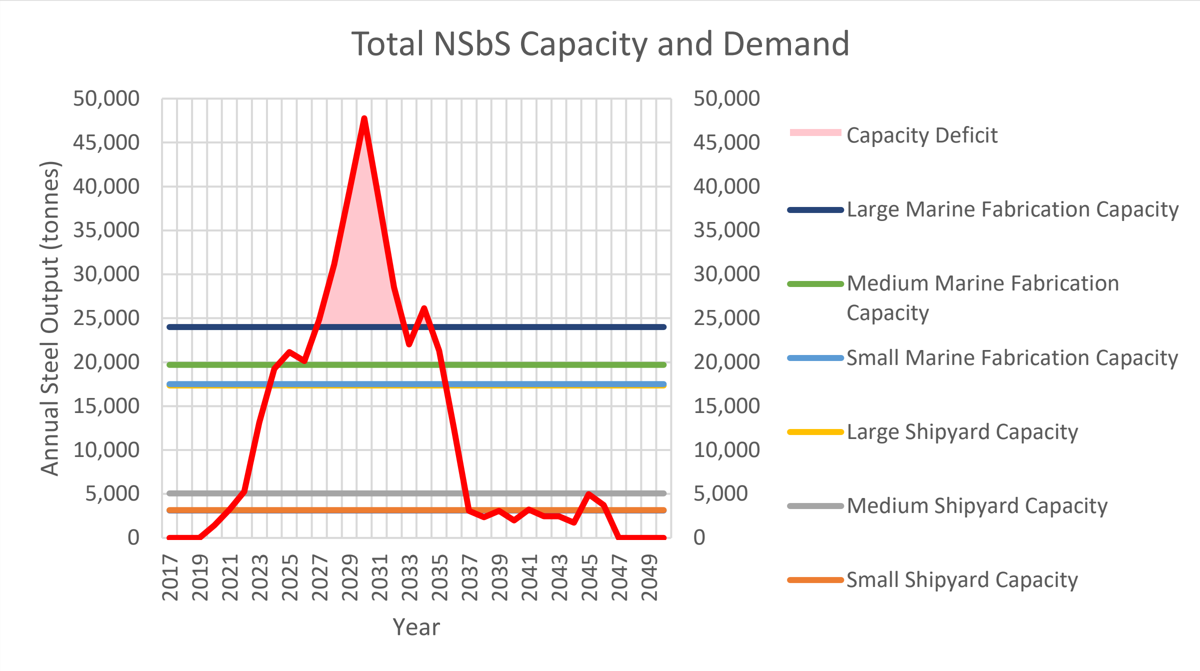

Figure 1: Total Steel Capacity and Demand for National Shipbuilding Strategy

The National Shipbuilding Strategy demand exceeds that of the available capacity for a total of seven years with a peak deficit of just under 23,800 tonnes in 2030. This steel work demand can be subdivided into primary and secondary steel, as outlined in Section 3.2 and Section 3.3, however the overall demand outlines the challenges facing the sector from this front.

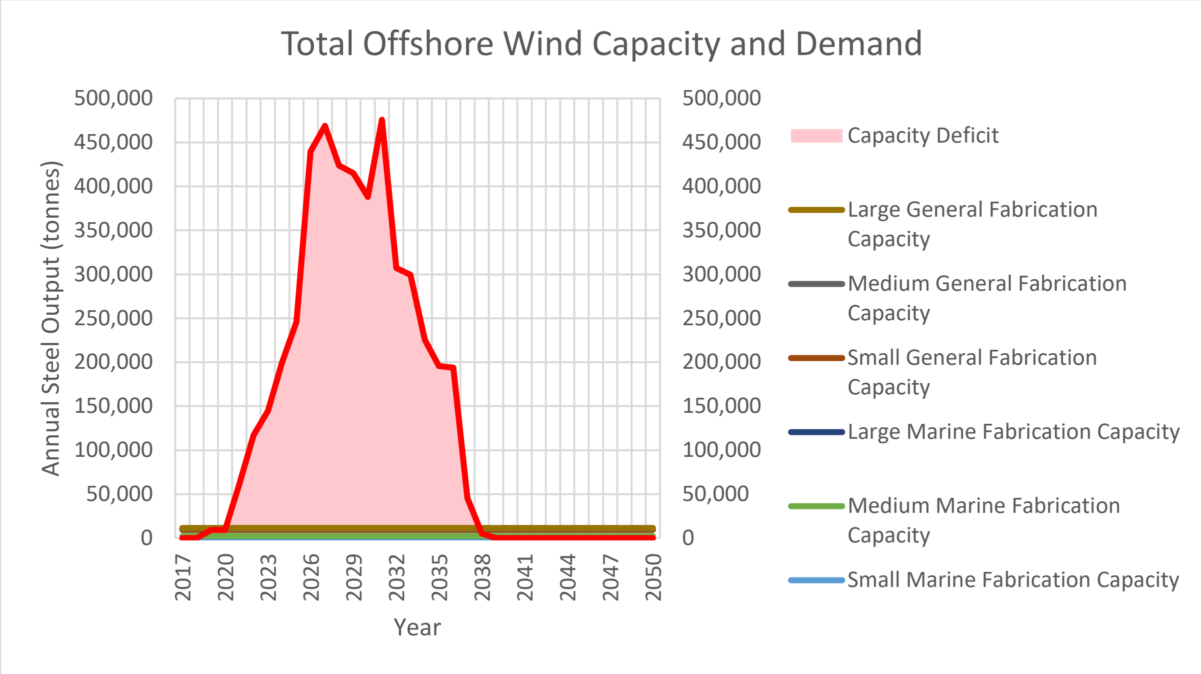

Figure 2: Total Steel Capacity and Demand for Offshore Wind

The offshore wind demand exceeds the available capacity for a total of 17 years with a peak of just over 464,000 tonnes in 2031, almost coinciding with the peak NSbS demand but with a significantly larger scale. Again, this has been subdivided into primary and secondary steelwork, outlined in Section 4.2 and Section 4.3, however the overall trend of this large deficit remains.

This assessment of the opportunities and the existing capability highlights the challenges that the industry is facing in the coming years to meeting the fabrication demand. However, this is also a massive opportunity for the sector to capture a significant revenue stream that would otherwise be exported. There is not a singular solution which will support the sector in this development, instead the industry will need to focus on scaling up facilities, improving productivity through implementation of advanced manufacturing technologies, and importantly attracting the next generation of talent to the fabrication sector.

Ultimately, the ability to meet this demand relies largely on the capital investment into the sector. Developing facilities or implementing new technologies requires significant investment, however the combination of public spending and local content mandates through the NSbS and offshore wind developments are clear reasons for both the industry and public sector to invest. Otherwise, there is a risk that these revenue streams will disappear alongside the manufacturing capabilities.

2. Introduction

The UK maritime sector, and the UK in general, are facing huge challenges from a variety of fronts, the most pressing of which are economic and environmental pressures.

Amongst the challenges, there are two notable opportunities: the National Shipbuilding Strategy (NSbS) and offshore wind development. These present exciting development opportunities throughout the sector and throughout the value chain, in particular for heavy, large-scale fabrication.

Recently, heavy and large-scale fabrication has been declining within the UK due to the lower cost markets in Europe and Asia, however recent trends show a growing interest for in-country content to stimulate these sectors. There are a range of improvements which could be made to the sector to improve competitiveness when compared with international markets however it is key to assess and understand the capacity requirements and challenges presented through increased demand.

This paper focuses on understanding the demand for the UK fabrication sector to address these opportunities compared to the current capacity within the UK. This has focused on the development of a model to calculate the available capacity. This model is still a work in progress and open to any input with suitable sources to correct assumptions or add further information.

The full model and assumptions are explained in Appendix A. The following sections will provide some analysis of the outcomes from the model, separated into the demand for the National Shipbuilding Strategy and that for offshore wind.

3. National Shipbuilding Strategy Demand

3.1 Total Steel Demand

The total steel demand for the National Shipbuilding Strategy can be visualised in Figure 1, larger graphs in Appendix A.7, compared against the capacity available from different facilities. Clearly, the required capacity to fulfil the NSbS exceeds the available capacity in country by just under 23,800 tonnes per year at its peak in 2030.

It is worth noting that the demand outlined does not include the full number of vessels outlined in the National Shipbuilding Strategy as some contracts have been awarded to non-UK yards, hence there will not be a significant steelwork demand. These include four large ferries for Transport Scotland and the Northern Lighthouse Board Buoy Laying Tender. The Fleet Solid Support Ships remain within the demand outlined as the split between UK and Spanish build has not yet been defined. The National Flagship has also been excluded as this project is no longer proceeding.

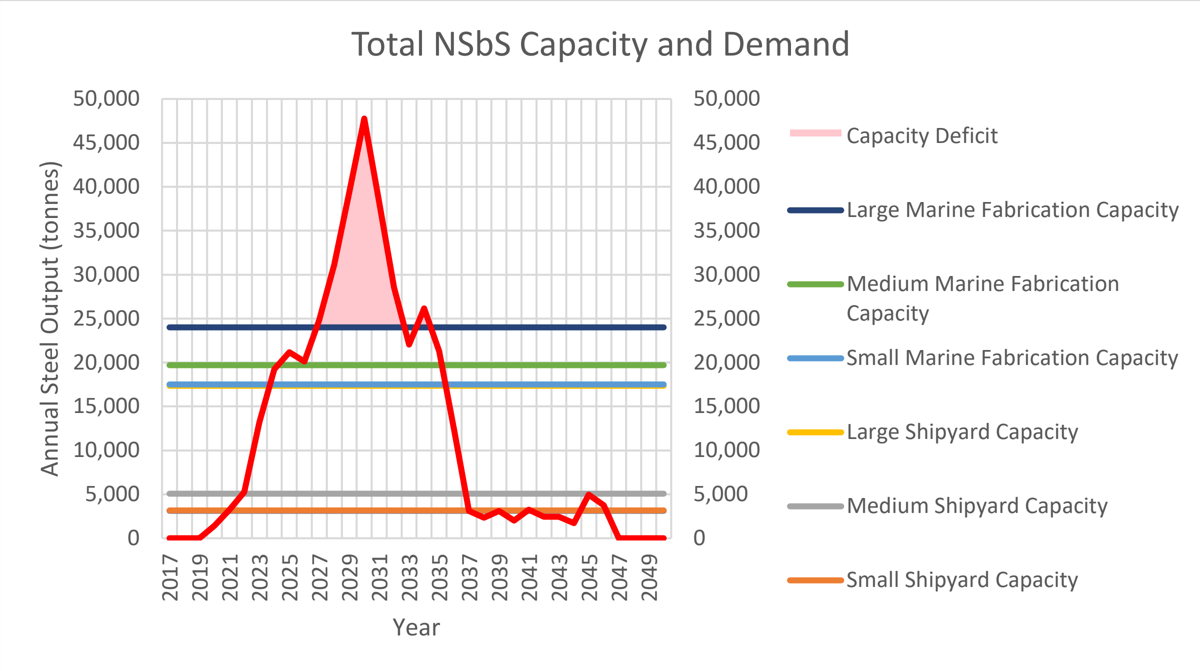

Figure 3: Total Steel Capacity and Demand for National Shipbuilding Strategy

Although it can be noted that for most of the years the capacity currently in country is sufficient, this does not provide the full picture. Shipbuilding can be broken into primary and secondary steel, with primary steel covering the main hull and primary structure that can only be catered for at shipyards while secondary steel covers more minor, smaller items which can be addressed at smaller or more generalised fabrication facilities. For example, marine fabrication facilities would likely not be capable of outputting a significant portion of primary steel and would not be capable of building and launching full vessels, however, could fabricate smaller items, such as superstructure blocks and machinery seats which could be integrated by a main shipyard.

Due to this, the steel weight has been split out in primary and secondary steel, where primary steel represents the large structure and hull blocks, while secondary structure represents minor structure which can be handled easily be smaller fabrication facilities.

3.2 Primary Steel Demand

The primary steel demand, shown in Figure 2, shows a starker picture for the potential of the UK fabrication sector to meet the demand for the National Shipbuilding strategy.

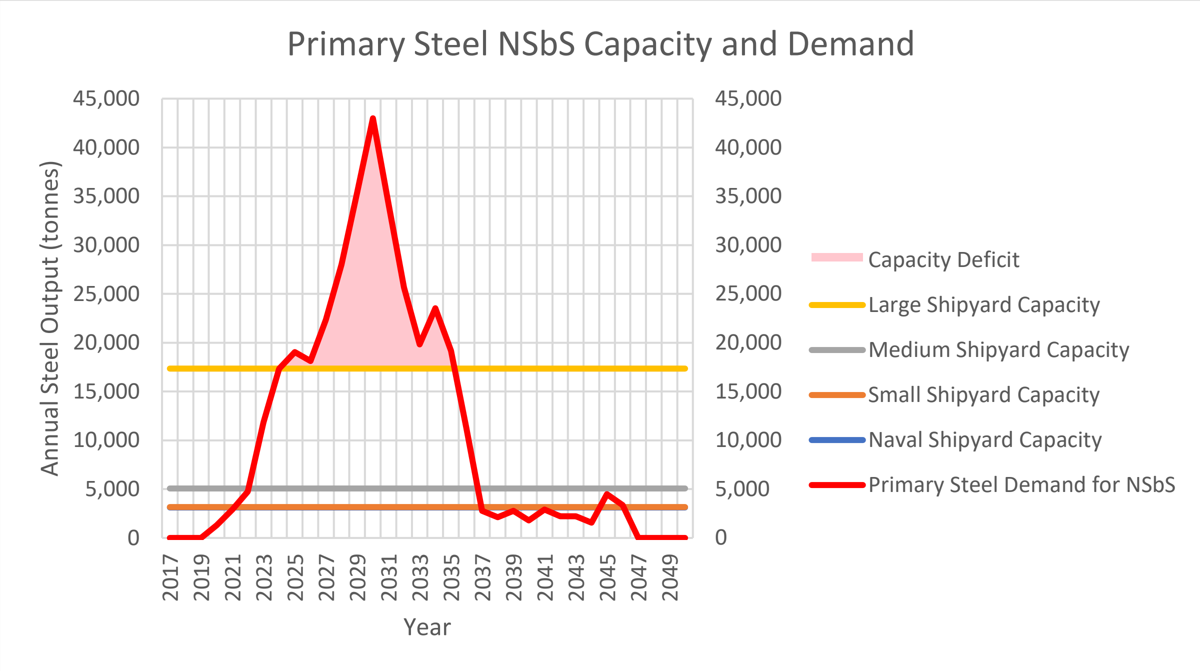

Figure 4: Primary Steel Capacity and Demand for National Shipbuilding Strategy

The capacity of shipyards is significantly less than that of the marine fabrication facilities, creating an output deficit of just over 25,600 tonnes at its peak in 2030, but with a period of 11 years in deficit compared to the three years previously shown. The initial deficit starts in 2025 and continues until the end of 2035 and it is worth acknowledging that the large drop in required capacity is likely due to the increasing uncertainty in required vessels as the pipeline reaches the end of the 30-year period.

To add some perspective to these deficits in terms of current facilities, the initial deficit in 2024 is around 1,700 tonnes which in ideal facility terms would equate to another Ferguson Marine solely dedicated to these projects rather than split between NSbS, offshore wind, and commercial projects. Using a similar comparison for the peak deficit in 2030, this relates to ten A&P Tyne equivalent facilities combined and solely dedicated to National Shipbuilding Strategy work.

The provides a clear emphasis of the lack of capable facilities to support the NSbS from a primary steel perspective but also provides an impression of what needs to change to meet these requirements. In the short term, there is the potential to develop some new facilities that could meet a portion of the deficit, however long term there is likely not the space or appetite to develop potentially ten large facilities. This emphasises the importance of investigating methods of improving output of existing facilities, making the most of those which already exist and optimising the fabrication process to create a greater chance to capitalise on the full opportunity.

3.3 Secondary Steel Demand

Secondary steel for the NSbS is not a driver in the capacity deficit which can be seen in Figure 3.

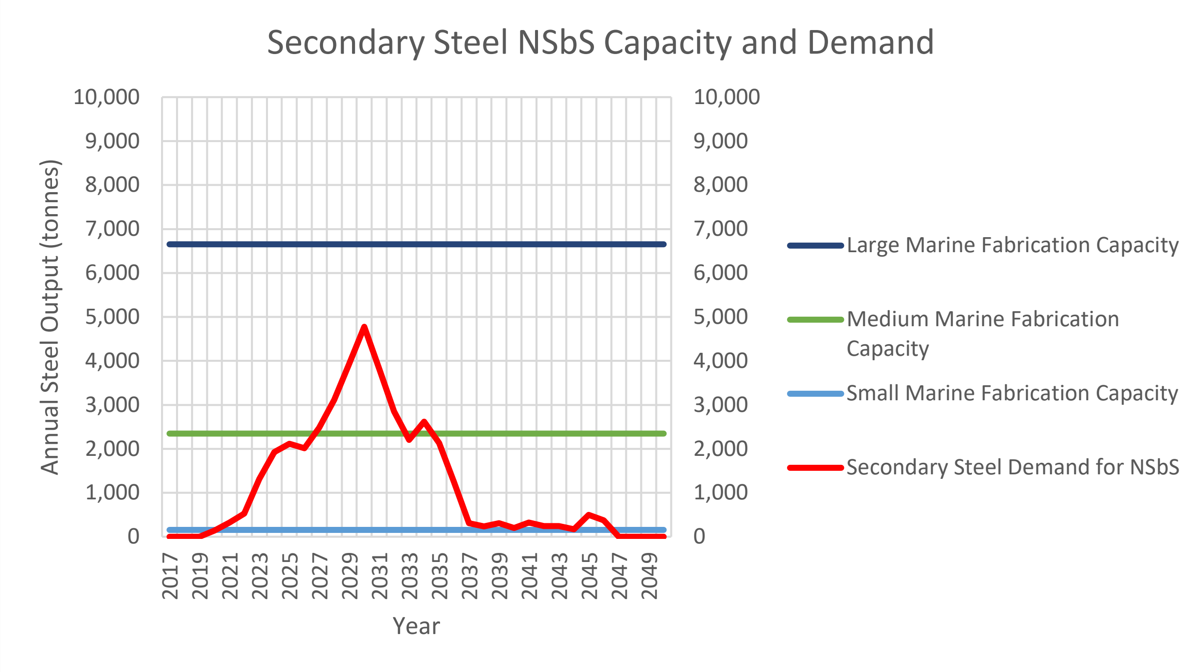

Figure 5: Secondary Steel Capacity and Demand for National Shipbuilding Strategy

The available small, medium, and large marine fabrication facilities provide more than sufficient capacity to supply secondary steel. At the peak of capacity requirements, there remains an excess of slightly more than 1,800 tonnes that could feed further capacity into the primary steel requirement. However, further work would be required here to determine the portion of primary steel that could be outsourced to medium and large marine fabricators and the logistics of moving larger units between facilities across the country to further support shipyards.

Additionally, it is worth acknowledging that even if the full capacity available was allocated across the projects, the total capacity would still not be sufficient to address the NSbS requirements, as outlined in Section 2.1 and shown in Figure 1.

4. Offshore Wind Demand

4.1 Total Steel Demand

The total steel demand for meeting the offshore wind opportunity are significantly higher compared to the National Shipbuilding Strategy due to the ambitious offshore wind targets and volume of steel in both fixed and floating foundations. The overall required capacity compared to that available from marine and general fabricators is shown in Figure 4, larger graphs in Appendix A.7,although it is worth acknowledging that the figures of available capacity are dwarfed by the required capacity due to the scale of the challenge, or opportunity.

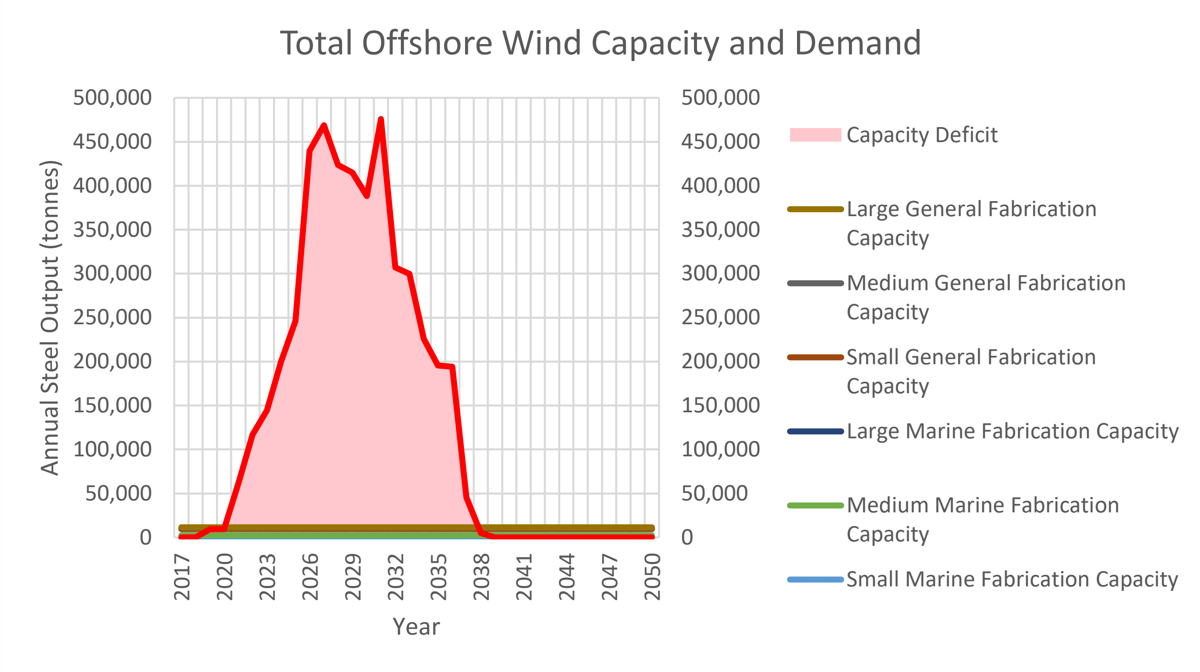

Figure 6: Total Steel Capacity and Demand for Offshore Wind

As can be seen in the above figure, the required capacity to meet the offshore wind fabrication massively overshadows the currently available capacity within the UK. It is also worth emphasising here that this does not represent the full fabrication scope of these projects but assumes a similar commitment made by ScotWind developers (approximately 57%) for all projects, suggesting there is still a huge volume of fabrication that would need to be imported.

The required fabrication capacity would run at a deficit from practically the start of fabrication for many of these projects, with a peak deficit of over 464,000 tonnes in 2031. It is worth noting that this is a year after the peak for the National Shipbuilding Strategy demand which will create two huge stresses on the fabrication industry going forward if no action is taken. The deficit continues for 17 years, and it is also worth noting that this deficit only stops due to the lack of information available on long term projects, not due to the capacity meeting the demand.

This presents a fairly worrying picture of the current ability of the UK to capitalise on this opportunity, but again this can be further expanded into primary and secondary steel to fully understand the driving factors in this lack of capacity.

4.2 Primary Steel Demand

The primary steel demand shown in Figure 5 outline a similar picture to the total capacity requirements. Due to the scale of these structures, the only facilities likely capable of managing these projects are large marine fabricators of which there are few, only eight in the fabricators list in Appendix A.2, with an annual throughput of just over 14,000 tonnes for offshore wind, not accounting for capacity available for the NSbS.

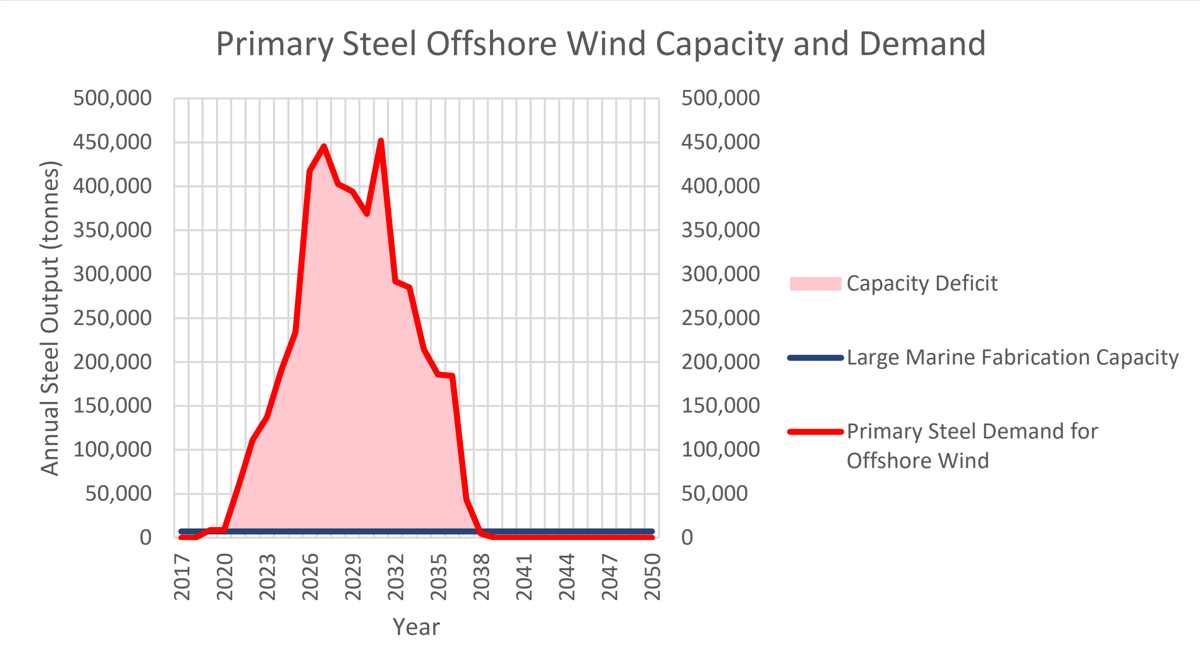

Figure 7: Primary Steel Capacity and Demand for Offshore Wind

The primary steel capacity shows a similar deficit with the total capacity, with a peak of just under 445,000 tonnes in 2031. For primary steel alone the period in which there is a deficit grows to 19 years compared to 17 years previously.

If this deficit is put in context of current facilities, all large marine fabricators have a total annual capacity of just under 14,500 tonnes and to meet the deficit highlighted above would require 30 times these eight facilities. It is worth acknowledging that some floating foundations are transitioning to concrete construction and would require less steel to be fabricated however the deficit would likely be of similar magnitude.

Again, this emphasises the challenges the industry faces and there is a clear requirement to upscale in this area to meet this demand in the future. However, it is clearly not possible to upscale the equivalent of 445,000 tonnes of annual steel output and hence a significant focus should be on improving the output from existing facilities by improving productivity and more efficient processes. Although it is likely that it will be extremely challenging to ever meet the deficit, it is likely that the figures will change as foundations and projects achieve more maturity.

4.3 Secondary Steel Demand

Secondary steel requirements are not as extensive as primary steel and, as shown in Figure 6, the deficit in capacity is nowhere near as significant as that of primary steel. However, there is still a deficit and for the UK, where secondary steel is likely one of the more suitable opportunities to capitalise on, this should indicate that further capacity is still required.

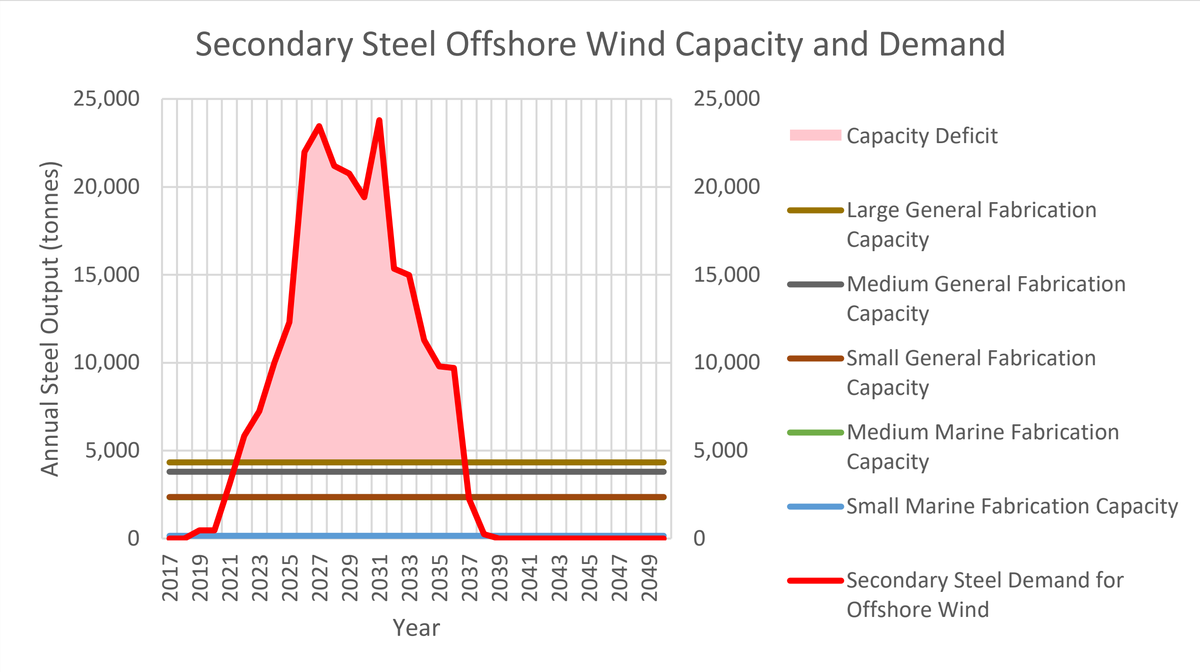

Figure 8: Secondary Steel Capacity and Demand for Offshore Wind

Secondary steel shows a peak production deficit of just under 19,500 tonnes in 2031 with a total of 15 years being over the current production capability. In the context of existing facilities, this would require facilities to be developed of similar size and capability to all the large marine, medium marine, and medium general fabrication facilities listed and be solely dedicated to secondary steel for offshore wind with no other contracts, NSbS, or commercial work.

Although the requirements still exceed the current capability, it is not as significant a challenge to address as that of primary steel but as mentioned the secondary steel opportunity is likely to be one of the best areas to capitalise on for the UK fabrication sector. Based on the level of deficit, this could, again, be a large target for improving existing facilities to address this need in the long-term.

5. Conclusions and Solutions

The capacity availability and requirements outlined above detail the challenges that the UK fabrication industry is facing in meeting demand in the coming years. However, this should be seen as a massive opportunity for the UK fabrication sector which if not captured will result in a significant revenue stream being outsourced and imported rather than serviced internally within the UK.

It is worth acknowledging that this model cannot be assumed to be 100% accurate or representative of the full fabrication environment at this time due to the complexity of the overall landscape. However, efforts have been made to ensure that sufficient detail and assumptions have been made to create a representation which can outline the scale of the challenges and opportunities facing the industry. An example of a potential omission or inaccuracy, as mentioned previously, is regarding that of offshore wind foundations transitioning from steel to concrete foundations. Concrete foundations are growing in market share which would reduce the tonnage of steel that would be required but there would still be a demand for fabrication services, likely more focused on secondary steel.

It would be easy to view this as an unsurmountable challenge which cannot be addressed, however this would be a defeatist view to a huge opportunity which could be addressed through a number of means. Ultimately though, the solution to addressing these challenges requires a significant scale up of capable facilities in the UK combined with improvements in efficiency to optimise the throughput of existing facilities. Many of these improvements, and the scale up of new facilities, could be enabled through the application of new fabrication technology and automation, to increase the output while maintaining, or even increasing, the number of workers focused on fabrication.

There are a number of different technologies which could be explored and are being implemented in some facilities. These include automated fabrication lines, welding cells, and additive manufacturing, all of which could increase output. The challenge with these technologies is the significant investment required, especially without any guaranteed contracts to utilise the technology. It is key to note that even with a huge increase in automation, something typically associated with a loss of jobs, the industry could maintain the existing workforce and it would still likely not be possible to meet the demand that is currently required.

The ability to meet this demand largely rests on the appetite for capital investment. Developing new facilities and investing in new fabrication methods requires significant investment and one which the fabrication industry is typically slow to make without commitment for extensive future orders. However, with a combination of the National Shipbuilding Strategy’s public spending and mandated local content requirements for offshore wind, there are clear reasons for both the industry and public sector to invest in this area, otherwise the risk these revenue streams will disappear alongside the fabrication capabilities.

Appendix A Full Model Breakdown

A.1 Model Assumptions

Significant assumptions were made to develop the model covering aspects such as steel weight percentage, outfitting periods, time between service dates, facility utilisation and build times. All of these assumptions are listed below:

Applicability	Assumption
Steel Weight Assumptions	
Large Complex Warships Steel Weight	Steel weight in large complex warships (>4000te) is 53% of the total weight
Small Complex Warships Steel Weight	Steel weight in small complex warships (<4000te) is 49% of the total weight
Non-Complex Warship Steel Weight	Steel weight in non-complex warships is 65% of the total weight
Offshore Service Vessel Steel Weight	Steel weight in offshore service vessels is 50% of the total weight
Small Ferry Steel Weight	Steel weight in small ferries (<40m) is 66% of the total weight
Medium Ferry Steel Weight	Steel weight in small ferries (>40m and <70m) is 61% of the total weight
Large Ferry Steel Weight	Steel weight in small ferries (>70m) is 54% of the total weight
Research Vessel Steel Weight	Steel weight in research vessels is 50% of the total weight
Coastal Protection Vessel Steel Weight	Steel weight in coastal protection vessels is 0% of the total weight as assumed to be of GRP construction
Tug Steel Weight	Steel weight in tugs is 50% of the total weight
Workboat Steel Weight	Steel weight in workboats is 75% of the total weight
Barge Steel Weight	Steel weight in barges is 80% of the total weight
Passenger Vessel Steel Weight	Steel weight in passenger vessels is 50% of the total weight
Pilot Vessel Steel Weight	Steel weight in pilot vessels is 0% of the total weight as assumed to be GRP construction
Small Submarine Steel Weight	Steel weight in small submarines is 50% of the total weight
Large Submarine Steel Weight	Steel weight in large submarines is 50% of the total weight
Offshore Wind Secondary Steel Weight	Secondary steel for offshore wind projects is assumed to be 5% of total steel weight
Offshore Wind Primary Steel Weight	Primary steel for offshore wind projects is assumed to be 95% of total steel weight
Shipbuilding Secondary Steel Weight	Secondary steel for shipbuilding projects is assumed to be 10% of total steel weight
Shipbuilding Primary Steel Weight	Primary steel for shipbuilding projects is assumed to be 90% of total steel weight
Steel Build Times	
Large Complex Warship Steel Build Time	The build time of a large complex warship is 5 years
Non-Complex Warship Steel Build Time	The build time of a non-complex warship is 2 years
Small Complex Warship Steel Build Time	The build time of a small complex warship is 2 years

Research Vessel Steel Build Time	The build time of a research vessel is 2 years
Tug Steel Build Time	The build time of a tug is 1 year
Pilot Vessel Steel Build Time	The build time of a pilot vessel is 1 year
Passenger Vessel Steel Build Time	The build time of a passenger vessel is 1 year
Workboat Steel Build Time	The build time of a workboat is 1 year
Barge Steel Build Time	The build time of a barge is 2 years
Coastal Protection Vessel Steel Build Time	The build time of a coastal protection vessel is 1 year
Offshore Service Vessel Steel Build Time	The build time of an offshore service vessel is 2 years
Small Ferry Steel Build Time	The build time of a small ferry is 1 year
Medium Ferry Steel Build Time	The build time of a medium ferry is 1 year
Large Ferry Steel Build Time	The build time of a large ferry is 2 years
Small Submarine Steel Build Time	The build time of a small submarine is 8 years
Large Submarine Steel Build Time	The build time of a large submarine is 10 years
Service Dates	
Type 26 Frigate Service Dates	Time between deliveries of Type 26 frigates is assumed to be 2 years
Future Anti-Submarine Warfare Service Dates	Time between deliveries of Future Anti-Submarine Warfare is assumed to be 2 years
Future Anti-Air Warfare Service Dates	Time between deliveries of Future Anti-Air Warfare is assumed to be 2 years
Type 31 Frigate Service Dates	Time between deliveries of Type 31 frigates is assumed to be 1 year
Type 32 Frigate Service Dates	Time between deliveries of Type 32 frigates is assumed to be 1 year
Multi Role Support Ship Service Dates	Time between deliveries of Multi Role Support Ships is assumed to be 1 year
Fleet Solid Support Service Dates	Time between deliveries of Fleet Solid Support is assumed to be 1 year
Future Offshore Patrol Vessels Service Dates	Time between deliveries of Future Offshore Support Vessels is assumed to be 1 year
Future Sealift Service Dates	Time between deliveries of Future Sealift is assumed to be 1 year
Bollard Pull Tug Service Dates	Bollard Pull Tugs are delivered at a pace of 2 per year
Pilot Vessel Service Dates	Pilot Vessels are delivered at a pace of 2 per year
Passenger Vessel Service Dates	Passenger Vessels are delivered at a pace of 2 per year
Barge Mounted Crane Service Dates	Time between deliveries of Barge Mounted Cranes is assumed to be 1 year
Naval Ammunition Lighters Service Dates	Naval Ammunition Lighters are delivered at a pace of 2 per year

Product Barge Service Dates	Product Barges are delivered at a pace of 2 per year
Border Force Seagoing and Coastal Patrol Vessels Service Dates	Border Force Seagoing and Coastal Patrol Vessels are delivered at a pace of 2 per year
Marine Scotland Marine Protection Vessel Service Dates	Time between deliveries of Marine Scotland Marine Protection Vessels is assumed to be 1 year
Marine Scotland Marine Research Vessel Service Dates	Time between deliveries of Marine Scotland Marine Research Vessels is assumed to be 1 year
Transport Scotland Small Ferry Service Dates	Transport Scotland Small Ferries are delivered at a pace of 2 per year
Transport Scotland Medium Ferry Service Dates	Transport Scotland Medium Ferries are delivered at a pace of 2 per year
Transport Scotland Large Ferry Service Dates	Transport Scotland Large Ferries are delivered at a pace of 2 per year
Small Submarine Service Dates	Time between deliveries of Small Submarines is assumed to be 3 years
Large Submarine Service Dates	Time between deliveries of Small Submarines is assumed to be 3 years
Outfitting Period Assumptions	
Large Complex Warships Outfitting Period	Outfitting period for large complex warship (>4000te) is 3 years
Small Complex Warships Outfitting Period	Outfitting period for small complex warship (<4000te) is 2 years
Non-Complex Warship Outfitting Period	Outfitting period for non-complex warship is 2 years
Small Ferry Outfitting Period	Outfitting period for a small ferry is 6 months
Medium Ferry Outfitting Period	Outfitting period for a medium ferry is 9 months
Large Ferry Outfitting Period	Outfitting period for a large ferry is 1 year
Offshore Service Vessel Outfitting Period	Outfitting period for an offshore service vessel is 1 year
Research Vessel Outfitting Period	Outfitting period for a research vessel is 2 years
Coastal Protection Vessel Outfitting Period	Outfitting period for a coastal protection vessel is 6 months
Tug Outfitting Period	Outfitting period for a tug is one year
Workboat Outfitting Period	Outfitting period for a workboat is 3 months
Barge Outfitting Period	Outfitting period for a barge is 3 months
Passenger Vessel Outfitting Period	Outfitting period for a passenger vessel is 6 months
Pilot Vessel Outfitting Period	Outfitting period for a pilot vessel is 3 months
Small Submarine Outfitting Period	Outfitting period for a small submarine is 3 years

Large Submarine Outfitting Period	Outfitting period for a large submarine is 3 years
Facility Sizes	
Small Facilities	Small Facilities are assumed to be those less than 1000m^2
Medium Facilities	Medium Facilities are assumed to be those more than 1000m^2 but less than 10000m^2
Large Facilities	Large Facilities are assumed to be those more than 10000m^2
Facility Utilisation	
Small General Fabrication NSbS Utilisation	Small General Fabrication facilities are assumed to not contribute to NSbS workload
Small General Fabrication Offshore Wind Utilisation	Small General Fabrication facilities are assumed to contribute 20% to Offshore Wind workload
Small General Fabrication Unspecified Commercial Utilisation	Small General Fabrication facilities are assumed to contribute 80% to Unspecified Commercial
Medium General Fabrication NSbS Utilisation	Medium General Fabrication facilities are assumed to not contribute to NSbS workload
Medium General Fabrication Offshore Wind Utilisation	Medium General Fabrication facilities are assumed to contribute 40% to Offshore Wind workload
Medium General Fabrication Unspecified Commercial Utilisation	Medium General Fabrication facilities are assumed to contribute 60% to Unspecified Commercial
Large General Fabrication NSbS Utilisation	Large General Fabrication facilities are assumed to not contribute to NSbS workload
Large General Fabrication Offshore Wind Utilisation	Large General Fabrication facilities are assumed to contribute 50% to Offshore Wind workload
Large General Fabrication Unspecified Commercial Utilisation	Large General Fabrication facilities are assumed to contribute 50% to Unspecified Commercial
Small Marine Fabrication NSbS Utilisation	Small Marine Fabrication facilities are assumed to contribute 25% of their capacity to NSbS workload in a support role
Small Marine Fabrication Offshore Wind Utilisation	Small Marine Fabrication facilities are assumed to contribute 25% of their capacity to Offshore Wind workload in a support role
Small Marine Fabrication Unspecified Commercial Utilisation	Small Marine Fabrication facilities are assumed to contribute 50% of their capacity to Unspecified Commercial workload in a support role
Medium Marine Fabrication NSbS Utilisation	Medium Marine Fabrication facilities are assumed to contribute 30% of their capacity to NSbS workload in a support role
Medium Marine Fabrication Offshore Wind Utilisation	Medium Marine Fabrication facilities are assumed to contribute 30% of their capacity to Offshore Wind workload in a support role

Medium Marine Fabrication Unspecified Commercial Utilisation	Medium Marine Fabrication facilities are assumed to contribute 40% of their capacity to Unspecified Commercial workload in a support role
Large Marine Fabrication NSbS Utilisation	Large Marine Fabrication facilities are assumed to contribute 30% of their capacity to NSbS workload in a support role
Large Marine Fabrication Offshore Wind Utilisation	Large Marine Fabrication facilities are assumed to contribute 50% of their capacity to Offshore Wind workload in a support role
Large Marine Fabrication Unspecified Commercial Utilisation	Large Marine Fabrication facilities are assumed to contribute 20% of their capacity to Unspecified Commercial workload in a support role
Small Shipyard NSbS Utilisation	Small Shipyard facilities are assumed to contribute 25% of their capacity to NSbS workload
Small Shipyard Offshore Wind Utilisation	Small Shipyard facilities are assumed to contribute 0% of their capacity to Offshore Wind workload
Small Shipyard Unspecified Commercial Utilisation	Small Shipyard facilities are assumed to contribute 75% of their capacity to Unspecified Commercial workload
Medium Shipyard NSbS Utilisation	Medium Shipyard facilities are assumed to contribute 50% of their capacity to NSbS workload
Medium Shipyard Offshore Wind Utilisation	Medium Shipyard facilities are assumed to contribute 0% of their capacity to Offshore Wind workload
Medium Shipyard Unspecified Commercial Utilisation	Medium Shipyard facilities are assumed to contribute 50% of their capacity to Unspecified Commercial workload
Large Shipyard NSbS Utilisation	Large Shipyard facilities are assumed to contribute 75% of their capacity to NSbS workload
Large Shipyard Offshore Wind Utilisation	Large Shipyard facilities are assumed to contribute 0% of their capacity to Offshore Wind workload
Large Shipyard Unspecified Commercial Utilisation	Large Shipyard facilities are assumed to contribute 25% of their capacity to Unspecified Commercial workload
Naval Shipyard NSbS Utilisation	Naval Shipyard facilities are assumed to contribute 100% of their capacity to NSbS workload
Naval Shipyard Offshore Wind Utilisation	Naval Shipyard facilities are assumed to contribute 100% of their capacity to Offshore Wind workload
Naval Shipyard Unspecified Commercial Utilisation	Naval Shipyard facilities are assumed to contribute 100% of their capacity to Unspecified Commercial workload
Offshore Wind Secondary Steel Fabrication	Facilities capable of Offshore Wind Secondary Steel are Small Marine Fabrication, Medium Marine Fabrication, Small General Fabrication, Medium General Fabrication, Large General Fabrication

Offshore Wind Primary Steel Fabrication	Facilities capable of Offshore Wind Secondary Steel are Large Marine Fabrication
Shipbuilding Secondary Steel Fabrication	Facilities capable of Shipbuilding Secondary Steel are Small Marine Fabrication, Medium Marine Fabrication, Large Marine Fabrication
Shipbuilding Primary Steel Fabrication	Facilities capable of Shipbuilding Primary Steel are Naval Shipyard, Small Shipyard, Medium Shipyard, Large Shipyard
Misc Assumptions	
Large Complex Warship Construction Facilities	Large Complex Warships can only be constructed in Naval Shipyards
Small Complex Warship Construction Facilities	Small Complex Warships can only be constructed in Naval Shipyards
Offshore Wind Assumptions	
Commissioning Date	If no commissioning date specified, 10 years from start date is assumed
Steel Start Date	Steel start date is assumed to be 1 year after Project Start Date
Steel End Date	Steel end date is assumed to be 2 years before Commissioning Date
Jacket Foundation Steel Weight	Steel weight of jacket foundations is assumed to be 900 tonnes
Monopile Foundation Steel Weight	Steel weight of monopile foundations is assumed to be 600 tonnes
Monopile/Gravity/Suction Foundation Steel Weight	Steel weight of monopile/gravity/suction foundations is assumed to be 600 tonnes
Floating Foundation Steel Weight	Steel weight of floating foundations is assumed to be 3000 tonnes
Mixed Foundation Steel Weight	Steel weight of mixed foundations is assumed to be 900 tonnes
Grounded Foundation Steel Weight	Steel weight of grounded foundations is assumed to be 600 tonnes
Articulated Wind Column Foundation Steel Weight	Steel weight of articulated wind column foundations is assumed to be 900 tonnes
Floating - Saipem Hexafloat Foundation Steel Weight	Steel weight of Saipem Hexafloat foundations is assumed to be 1380 tonnes
Floating - Principle Power Windfloat Foundation Steel Weight	Steel weight of Principle Power Windfloat foundations is assumed to be 2500 tonnes
Floating - Cerulean Foundation Steel Weight	Steel weight of Cerulean foundations is assumed to be 4500 tonnes
Unknown Foundation Steel Weight	Steel weight of unknown foundations is assumed to be 900 tonnes
Proportion of Steel Weight in UK	The proportion of steel weight captured within the UK is based on ScotWind commitments (57%)

Table 1: Model Assumptions

The majority of these assumptions were made as educated approximations. The following assumptions were based on historic information:

- Large Complex Warships Steel Weight
- Small Complex Warships Steel Weight
- Non-Complex Warship Steel Weight
- Small Ferry Steel Weight
- Medium Ferry Steel Weight
- Large Ferry Steel Weight
- Tug Steel Weight
- Small Ferry Outfitting Period
- Medium Ferry Outfitting Period
- Large Ferry Outfitting Period
- Tug Outfitting Period

The following assumptions were based on open-source information:

- Large Complex Warship Steel Build Time
- Small Complex Warship Steel Build Time
- Non-Complex Warship Steel Build Time
- Small Submarine Steel Build Time
- Large Submarine Steel Build Time
- Large Complex Warship Outfitting Period
- Small Complex Warship Outfitting Period
- Non-Complex Warship Outfitting Period
- Small Submarine Outfitting Period
- Large Submarine Outfitting Period

All other parameters not mentioned above were based on educated assumptions, however all parameters are open to further input to refine and improve the overall model.

A.2 Fabrication Facilities

A list of fabrication facilities was developed using existing knowledge and basic research into shipyards, marine focused fabrication facilities, and general steel fabrication facilities throughout the UK.

Each of the facilities was classified into either shipyard, which is heavily marine focused with either dry docks or slipways, marine fabrication, which is a focused facility and, in many cases, located at a quayside, or general fabrication, which is not specialist. All were also allocated a size classifier of small, medium, or large based on their size which, if not publicly available, was taken from Google Earth measurements. The only facilities that were separate to these outlined above were naval shipyards which solely focus on military vessels and will likely not explore commercial shipbuilding or offshore wind opportunities.

Weekly throughput in terms of steel tonnage was also applied against all facilities. Tonnage rates were only available for a small number of facilities and hence rates were applied across similar facilities to complete missing information.

The list of facilities currently used within the model is included below. It is recognised that this list is not comprehensive, and some facilities may not have been included.

Yard	Yard Classifier	Area (m^2)	Weekly Throughput (te)
A&P Falmouth	Medium Shipyard	4109	8.646
A&P Tees	Medium Shipyard	3705	7.796
A&P Tyne	Large Shipyard	20759	49.374
ABLE UK Middlesbrough	Large Marine Fabrication	16170	29.678
ABLE UK Seaton	Medium Marine Fabrication	7250	14.317
Adey Steel	Medium General Fabrication	9290	10.323
AFS GB Lowestoft	Small Marine Fabrication	480	0.948
Alexander Noble and Sons	Medium Shipyard	1470	3.093
Allerton Steel	Medium General Fabrication	6950	7.722
Ardmaleish Boat Building	Medium Shipyard	1960	4.124
Babcock International Group	Naval Shipyard	56000	26.799
BAE Systems Barrow	Naval Shipyard	89755	9.794
BAE Systems Glasgow	Naval Shipyard	54025	25.854
Blackrow Group	Medium General Fabrication	9000	10.000
Brook Welding	Small Marine Fabrication	750	1.481
Burntisland Facilities	Large Marine Fabrication	16120	29.587
Cairnhill Structures	Large General Fabrication	11148	12.387
Cammell Laird	Large Shipyard	28998	104.167
Carver Engineering	Medium General Fabrication	8000	8.889
Coastal Workboats	Medium Shipyard	3000	6.313
CTL Seal	Medium General Fabrication	3252	3.613
D Hughes Welding and Fabrication	Small Marine Fabrication	860	1.698
Dales Engineering Services	Medium Marine Fabrication	2130	4.206
Dales Marine Aberdeen	Medium Shipyard	1055	2.083
Dales Marine Grangemouth	Small Marine Fabrication	420	0.829
Dales Marine Greenock	Medium Marine Fabrication	1230	2.429
Dales Marine Leith	Small Marine Fabrication	500	0.987
Dales Marine Troon	Small Marine Fabrication	365	0.721

Diverse Marine	Medium Shipyard	4200	8.838
Ferguson Marine	Large Shipyard	10498	26.750
Forsyths Aberdeen	Medium Marine Fabrication	1676	3.310
Forsyths Buckie I	Medium Marine Fabrication	1900	3.752
Forsyths Buckie II	Small Marine Fabrication	800	1.580
Forsyths Buckie III	Small Marine Fabrication	620	1.224
Forsyths Caithness	Medium Marine Fabrication	3500	6.912
Forsyths Rothes	Medium Marine Fabrication	1500	2.962
Francis Brown Limited	Medium General Fabrication	4500	5.000
Fraserburgh Engineering	Medium Marine Fabrication	1240	2.449
Gael Force Boatbuilding	Medium Shipyard	1260	2.651
Global Energy Group Invergordon Port	Large Marine Fabrication	12550	23.034
Global Energy Group Nigg	Large Marine Fabrication	36000	66.074
Global Energy Group Nord Centre	Medium Marine Fabrication	2918	5.762
Gray Fabrication	Medium Marine Fabrication	4100	8.096
Harland and Wolff Appledore	Large Shipyard	18859	17.227
Harland and Wolff Arnish	Large Marine Fabrication	13500	24.778
Harland and Wolff Belfast	Large Shipyard	52846	130.000
Harland and Wolff Methil	Large Marine Fabrication	13088	24.022
Harper UK	Medium General Fabrication	1858	2.065
Hartwell Manufacturing	Medium General Fabrication	7432	8.258
Holyhead Marine	Medium Shipyard	1591	3.348
Hutchison Engineering	Large General Fabrication	8000	8.889
Hydrus Group	Medium Marine Fabrication	1161	2.293
I Knibb & Son	Small General Fabrication	929	1.032
Intermarine UK	Medium Marine Fabrication	2400	4.739
JBS Fabrication	Medium Marine Fabrication	2405	4.749
Lycett Fabrications	Medium General Fabrication	2225	2.472
MacDuff Shipyards Buckie	Medium Shipyard	1575	3.314
MacDuff Shipyards Fraserburgh	Small Shipyard	300	0.302
MacDuff Shipyards MacDuff	Medium Shipyard	1235	2.599
Mainstay Marine	Medium Shipyard	2586	5.442
Malin Fabrication	Large Marine Fabrication	13969	25.639
Manor Marine	Small Shipyard	3102	3.125
McEvoy Engineering	Medium General Fabrication	4041	4.490
Mech-Tool Engineering	Medium Marine Fabrication	4000	7.899
Meercat Boats	Medium Shipyard	8500	17.886
MJ Engineering	Small General Fabrication	395	0.439
ML (UK)	Small Marine Fabrication	480	0.948
MMS Ship Repair	Medium Marine Fabrication	7820	15.442
Mount Vernon Engineering	Medium General Fabrication	1394	1.548
Penzance Drydock	Small Marine Fabrication	440	0.869
RB Ross Steel Fabrications	Medium General Fabrication	2700	3.000
Smulders Projects UK	Large Marine Fabrication	35000	64.239

Sparrows Aberdeen	Medium Marine Fabrication	1995	3.940
Texo Engineering & Fabrication Dundee	Medium Marine Fabrication	3489	6.890
Texo Port Services Blyth	Medium Marine Fabrication	1100	2.172
UK Docks Mashfords	Medium Marine Fabrication	6000	11.848
UK Docks Teesside	Small Marine Fabrication	600	1.185
Walker Engineering	Medium General Fabrication	1115	1.239
WD Close	Medium Marine Fabrication	6500	12.836
WEC Fabrication	Medium General Fabrication	2940	3.267
Whittaker Engineering	Medium Marine Fabrication	1134	2.239
Wilton Engineering Services	Medium Marine Fabrication	8514	16.813

Table 2: List of Facilities

A.3 National Shipbuilding Strategy Outlook

The tonnage required for the National Shipbuilding Strategy was based on the 30 Year Shipbuilding Pipeline outlined in the strategy document.

The Pipeline can be seen below in the following figures:

Figure 9: 30 Year Shipbuilding Pipeline

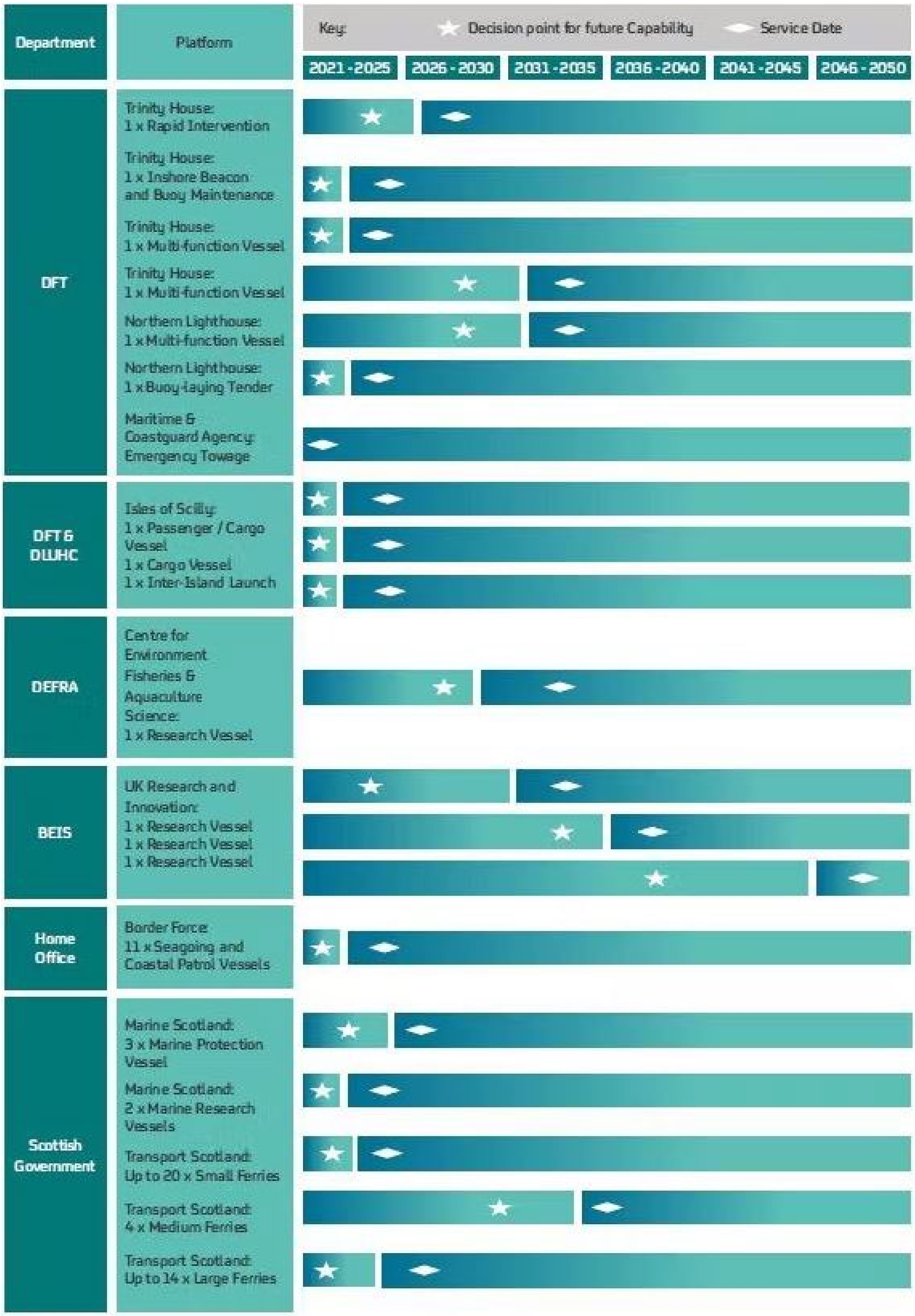

Figure 10: 30 Year Shipbuilding Pipeline

Figure 11: 30 Year Shipbuilding Pipeline

It is worth noting that the model considers the 30 Year Shipbuilding Pipeline as it was published and does not account for any changes that may have been expressed since its publication.

This 30 Year Pipeline was broken down into a detailed timeline for each individual vessel, along with researching estimated sizes and tonnage to feed into the overall model.

Based on the assumed service dates and outfitting periods, the steel build period was estimated by subtracting the outfitting period from the service date. This is a rough approximation as the outfitting would overlap the steel build, but in this case the outfitting period is that dedicated solely to outfitting once steel is completed.

Using the assumed proportion of steel weight and the number of years for steel build, the steel output per year to meet each vessel contract can be calculated. This is then used to produce the full outlook year-to-year for the steel fabrication capacity that is required.

A.4 Offshore Wind Outlook

The offshore wind outlook was more difficult to develop and largely required basic research and collation of all the active and proposed projects around the UK in the near future.

This also included the new ScotWind leasing round along with wind projects awarded through the Innovation and Targeted Oil and Gas (INTOG) leasing round. Each of these projects was given a project start date and a commissioning date based on either publicly available information or assumed dates based on the current project status. The above assumptions for steel start and end dates were applied to provide the steel fabrication window for the outlook.

Foundation types for each project were also based on publicly available information for the individual projects with assumed weights for each type. In the case of ScotWind, project areas were further subdivided into foundation types based on the paper Initial Predictions for Offshore Wind Farms in the ScotWind Leasing Round by Offshore Renewable Energy (ORE) Catapult [2].

The list of offshore wind projects can be seen in the following table. Again, this list is not comprehensive, and some projects may not have been included.

Project Name	Type
East Anglia TWO	Jacket
East Anglia THREE	Jacket
East Anglia ONE North	Jacket
Hornsea Project 3	Monopile/Gravity/Suction
Hornsea Project 4	Monopile/Gravity/Suction
Neart Na Gaoithe	Jacket
Sofia Offshore Wind Farm Phase 1	Monopile
Doggerbank A	Monopile
Doggerbank B	Monopile
Doggerbank C	Monopile
Seagreen	Jacket
Forthwind	Monopile
Moray West	Jacket
Isle of Man	Unknown
Blyth Offshore Wind Demonstrator Phase 2	Floating
Inch Cape	Jacket
Twinhub	Floating
Pentland FOW	Floating
Berwick Bank	Jacket
Salamander FOW	Floating

North Falls	Monopile
Llyr 1	Floating
Llyr 2	Floating
Project White Cross	Floating
Norfolk Vanguard	Monopile
Norfolk Boreas	Monopile
Awel y Mor	Monopile
Rampion 2	Monopile
Five Estuaries	Monopile
Dudgeon Extension	Monopile
Sheringham Shoal Extension	Monopile
Morecambe	Monopile
RWE Dogger Bank 1	Monopile
RWE Dogger Bank 2	Monopile
bp/EnBW North Welsh	Monopile
bp/EnBW North East Anglesey	Monopile
GIG/Total Lincolnshire	Monopile
ScotWind - E1	Jacket
ScotWind - E1	Floating
ScotWind - E2	Jacket
ScotWind - E2	Floating
ScotWind - E3	Jacket
ScotWind - E3	Floating
ScotWind - NE1	Floating
ScotWind - NE2	Floating
ScotWind - NE3	Floating
ScotWind - NE4	Monopile
ScotWind - NE4	Jacket
ScotWind - NE4	Floating
ScotWind - NE6	Jacket
ScotWind - NE6	Floating
ScotWind - NE7	Floating
ScotWind - NE8	Floating
ScotWind - N1	Jacket
ScotWind - N1	Floating
ScotWind - N2	Floating
ScotWind - N3	Jacket
ScotWind - N3	Floating
ScotWind - N4	Monopile
ScotWind - N4	Jacket
ScotWind - W1	Monopile
ScotWind - W1	Jacket
ScotWind - W2	Floating
Cerulean Winds Area 1	Floating - Cerulean

Cerulean Winds Area 2	Floating - Cerulean
Cerulean Winds Area 3	Floating - Cerulean
ANIAR Offshore Array - phase 1	Monopile
ANIAR Offshore Array - phase 2	Floating
Arklow Bank - phase 2	Monopile
Atlantic Marine Energy Test Site	Floating
Blackwater	Floating
Cailleach	Monopile
Clarus	Floating
Clogher Head	Monopile
Codling	Monopile
Cooley Point	Monopile
Dublin Array	Monopile
Emerald (Commercial)	Floating
Emerald (Demonstration)	Floating
Greystones	Monopile
Ilen	Floating
Inis Ealga Marine Energy Park	Floating
Inis East 1	Grounded
Inis East 2	Grounded
Inis South	Mixed
Inis West 1	Mixed
Inis West 2	Mixed
Kilmichael Point	Monopile
Latitude 52	Monopile
Moneypoint Offshore One	Floating
Moneypoint Offshore Two	Floating
North Celtic Sea	Monopile
North Irish Sea Array	Monopile
Oriel	Monopile
Sceirde (Skerd) Rocks	Monopile
Sea Stacks	Monopile
Shelmalere	Monopile
South Irish Sea	Monopile
SSE Renewables Braymore Point	Monopile
SSE Renewables Celtic Sea	Floating
Urban Sea	Articulated Wind Column
AFLOWT (Accelerating market uptake of Floating Offshore Wind Technology)	Floating - Saipem Hexafloat
Atlantic Marine Energy Test Site	Floating
Dolphyn Project - commercial	Floating
Dolphyn Project - pre-commercial	Floating
Draig y Môr	Floating
Erebus (Demonstration)	Floating - Principle Power Windfloat

Kincardine - DOLPHYN - 2 MW demo	Floating
Pembrokeshire Demonstration Zone	Floating
Pentland	Floating
Pentland Floating Offshore Wind Demonstrator	Floating
Valorous	Floating - Principle Power Windfloat
Nomadic	Floating
Western Star - Phase 1	Floating
Western Star - Phase 2	Floating

Table 3: List of Offshore Wind Projects

A.5 Resultant Outlook

Using the above list of projects and assumptions, an overall outlook for the National Shipbuilding requirements and offshore wind requirements, with subdivisions for primary and secondary steel based on the assumptions detailed in Appendix A.1.

Year	NSbS Demand			Offshore Wind Demand		
	Total Steel Demand for NSbS	Primary Steel Demand for NSbS	Secondary Steel Demand for NSbS	Total Steel Demand for Offshore Wind	Primary Steel Demand for Offshore Wind	Secondary Steel Demand for Offshore Wind
2017	0	0	0	0	0	0
2018	0	0	0	0	0	0
2019	0	0	0	9250	8788	463
2020	1436	1292	144	9250	8788	463
2021	3243	2918	324	61839	58747	3092
2022	5257	4731	526	116892	111047	5845
2023	13152	11836	1315	144693	137458	7235
2024	19250	17325	1925	199872	189878	9994
2025	21156	19040	2116	246095	233790	12305
2026	20122	18109	2012	439586	417607	21979
2027	24821	22339	2482	468886	445442	23444
2028	31133	28020	3113	423704	402519	21185
2029	39362	35426	3936	414981	394232	20749
2030	47767	42990	4777	388151	368743	19408
2031	38152	34337	3815	475841	452049	23792
2032	28513	25662	2851	307108	291753	15355
2033	22045	19841	2205	299685	284701	14984
2034	26152	23537	2615	225703	214418	11285
2035	21298	19168	2130	195670	185887	9784
2036	12481	11233	1248	193987	184287	9699
2037	3086	2777	309	45442	43170	2272
2038	2344	2110	234	5055	4802	253

2039	3086	2777	309	0	0	0
2040	1999	1799	200	0	0	0
2041	3231	2908	323	0	0	0
2042	2464	2218	246	0	0	0
2043	2464	2218	246	0	0	0
2044	1722	1550	172	0	0	0
2045	4972	4475	497	0	0	0
2046	3740	3366	374	0	0	0
2047	0	0	0	0	0	0
2048	0	0	0	0	0	0
2049	0	0	0	0	0	0
2050	0	0	0	0	0	0

Table 4: Steel Demand Outlook

These outlook figures allow the following graphical representations to be developed to show the comparison of the demand compared to that available in the current facilities. The horizontal lines represent cumulative available capacity subdivided into the facility categories specified previously. The variable lines are the required capacity either total, primary steel, or secondary steel. These variable lines represent the figures shown previously in Table 4.

A.6 Available Capacity

Based on the assumptions and capacity allocations, the following values can be obtained for the available capacity for the National Shipbuilding Strategy and offshore wind, along with a delta between the available and required capacities.

Year	NSbS Available Capacities						Offshore Wind Required Capacities					
	Total Available Capacity for NSbS	Total Delta	Primary Steel Available Capacity for NSbS	Primary Steel Delta	Secondary Steel Available Capacity for NSbS	Secondary Steel Delta	Total Available Capacity for Offshore Wind	Total Delta	Primary Steel Available Capacity for Offshore Wind	Primary Steel Delta	Secondary Steel Available Capacity for Offshore Wind	Secondary Steel Delta
2017	24003	24003	17350	17350	6652	6652	11507	11507	7176	7176	4331	4331
2018	24003	24003	17350	17350	6652	6652	11507	11507	7176	7176	4331	4331
2019	24003	24003	17350	17350	6652	6652	11507	2257	7176	-1611	4331	3869
2020	24003	22567	17350	16058	6652	6509	11507	2257	7176	-1611	4331	3869
2021	24003	20760	17350	14432	6652	6328	11507	-50332	7176	-51571	4331	1239
2022	24003	18746	17350	12619	6652	6127	11507	-105385	7176	-103871	4331	-1514
2023	24003	10851	17350	5514	6652	5337	11507	-133185	7176	-130282	4331	-2904
2024	24003	4753	17350	25	6652	4727	11507	-188365	7176	-182702	4331	-5663
2025	24003	2847	17350	-1690	6652	4537	11507	-234588	7176	-226614	4331	-7974
2026	24003	3881	17350	-759	6652	4640	11507	-428079	7176	-410430	4331	-17648
2027	24003	-818	17350	-4988	6652	4170	11507	-457379	7176	-438265	4331	-19113
2028	24003	-7130	17350	-10670	6652	3539	11507	-412197	7176	-395343	4331	-16854
2029	24003	-15359	17350	-18076	6652	2716	11507	-403474	7176	-387056	4331	-16418
2030	24003	-23764	17350	-25640	6652	1876	11507	-376644	7176	-361567	4331	-15077
2031	24003	-14149	17350	-16986	6652	2837	11507	-464334	7176	-444873	4331	-19461
2032	24003	-4510	17350	-8311	6652	3801	11507	-295601	7176	-284577	4331	-11024
2033	24003	1958	17350	-2490	6652	4448	11507	-288178	7176	-277525	4331	-10653
2034	24003	-2149	17350	-6186	6652	4037	11507	-214196	7176	-207242	4331	-6954
2035	24003	2705	17350	-1818	6652	4523	11507	-184163	7176	-178710	4331	-5452
2036	24003	11522	17350	6118	6652	5404	11507	-182479	7176	-177111	4331	-5368

2037	24003	20917	17350	14573	6652	6344	11507	-33934	7176	-35993	4331	2059
2038	24003	21659	17350	15241	6652	6418	11507	6452	7176	2374	4331	4078
2039	24003	20917	17350	14573	6652	6344	11507	11507	7176	7176	4331	4331
2040	24003	22004	17350	15551	6652	6453	11507	11507	7176	7176	4331	4331
2041	24003	20772	17350	14442	6652	6329	11507	11507	7176	7176	4331	4331
2042	24003	21539	17350	15133	6652	6406	11507	11507	7176	7176	4331	4331
2043	24003	21539	17350	15133	6652	6406	11507	11507	7176	7176	4331	4331
2044	24003	22281	17350	15801	6652	6480	11507	11507	7176	7176	4331	4331
2045	24003	19031	17350	12876	6652	6155	11507	11507	7176	7176	4331	4331
2046	24003	20263	17350	13984	6652	6278	11507	11507	7176	7176	4331	4331
2047	24003	24003	17350	17350	6652	6652	11507	11507	7176	7176	4331	4331
2048	24003	24003	17350	17350	6652	6652	11507	11507	7176	7176	4331	4331
2049	24003	24003	17350	17350	6652	6652	11507	11507	7176	7176	4331	4331
2050	24003	24003	17350	17350	6652	6652	11507	11507	7176	7176	4331	4331

Table 5: Available Capacity and Differences

A.7 Demand and Capacity Comparison

The below figures provide a graphical representation of the numerical values outlined above.

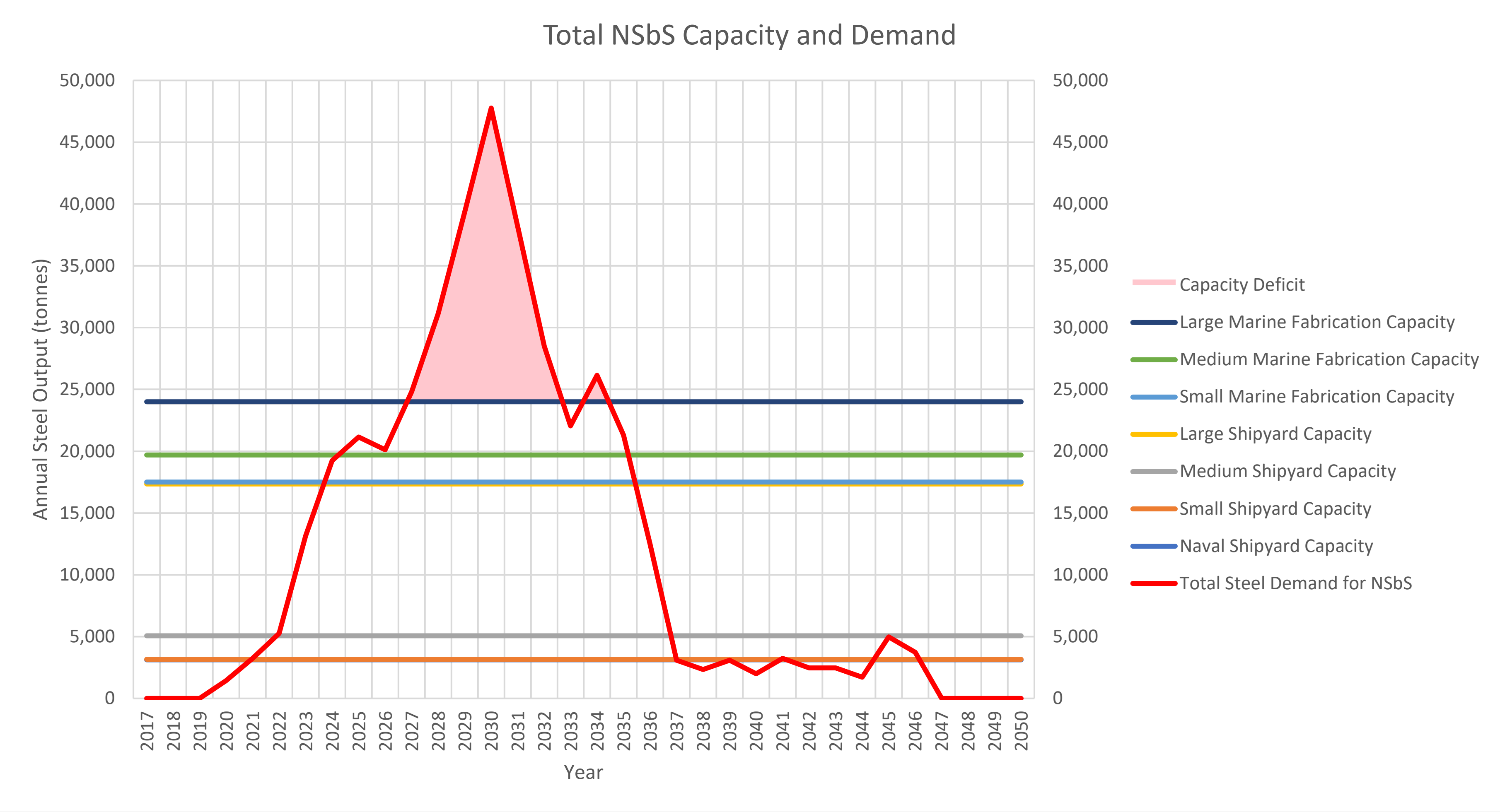

Figure 12: Total Steel Capacity and Demand for National Shipbuilding Strategy

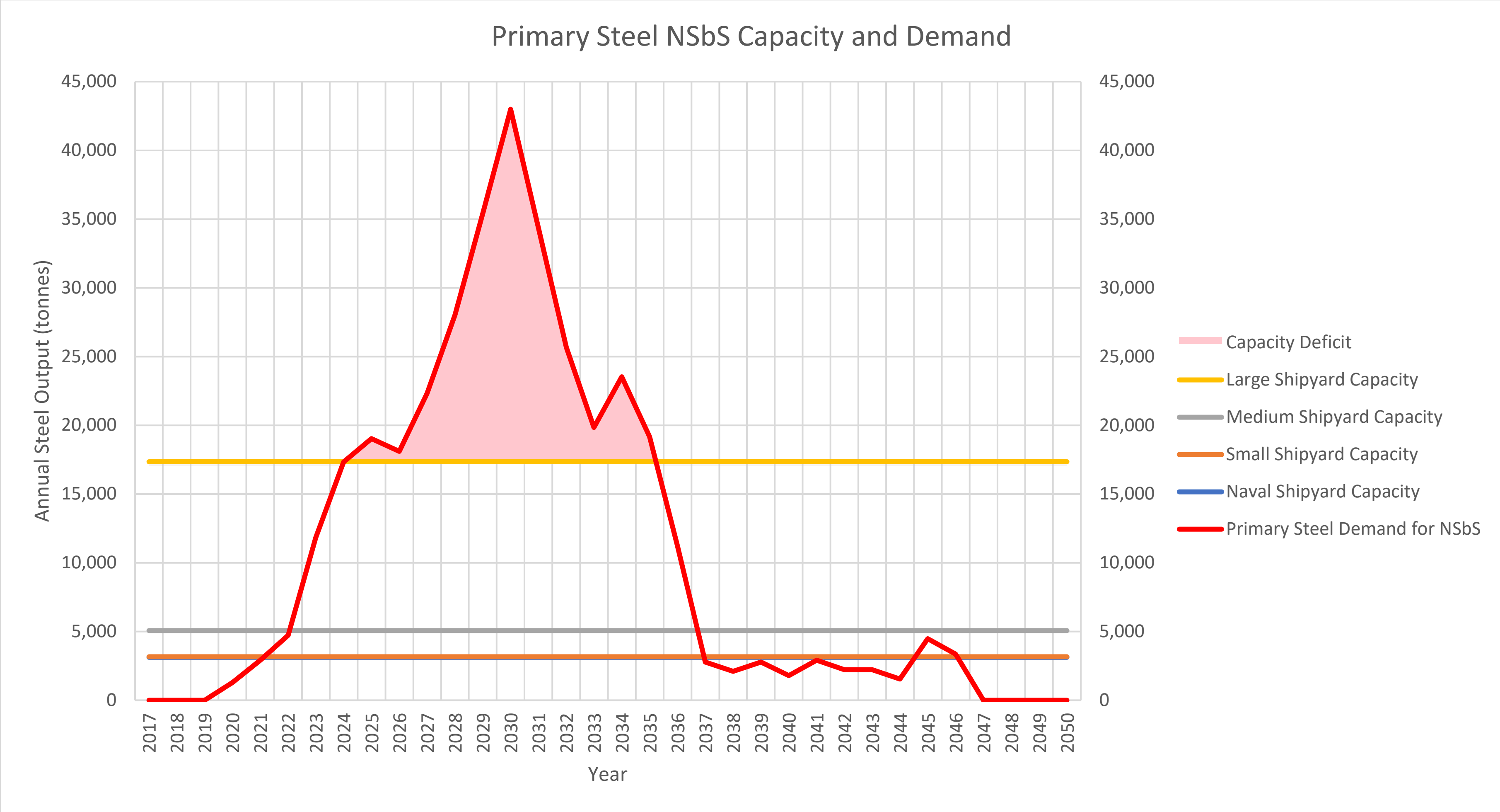

Figure 13: Primary Steel Capacity and Demand for National Shipbuilding Strategy

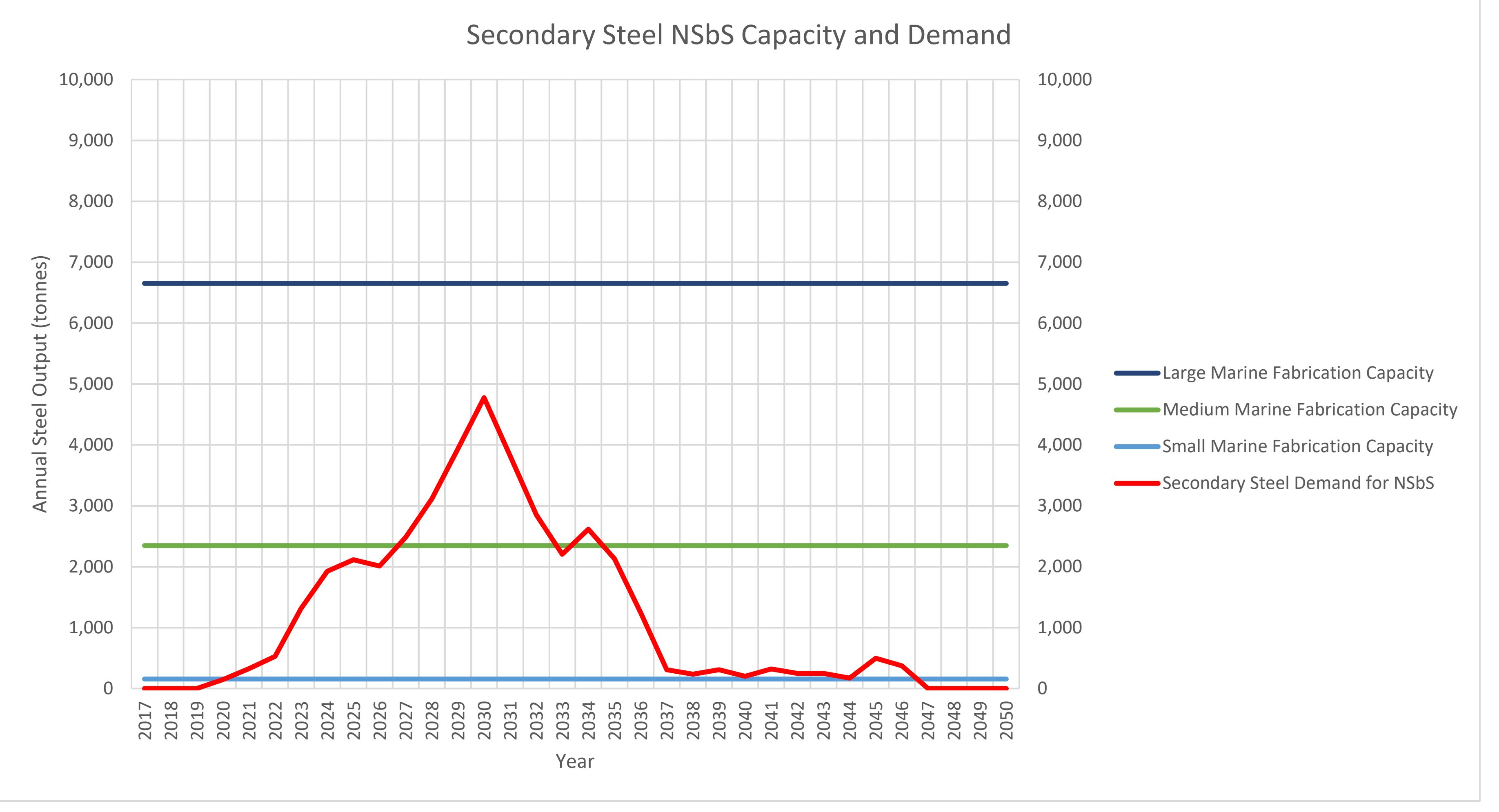

Figure 14: Secondary Steel Capacity and Demand for National Shipbuilding Strategy

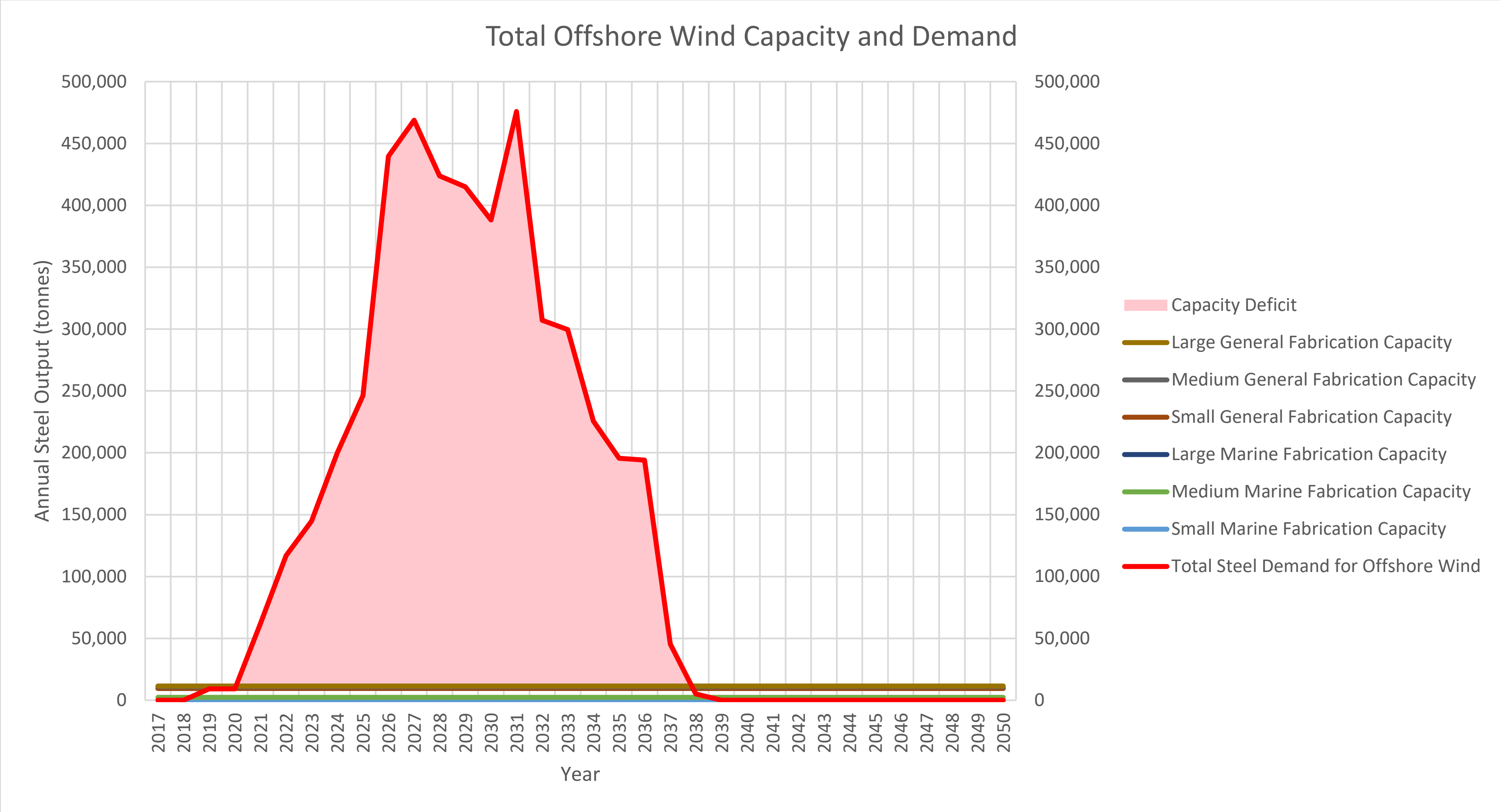

Figure 15: Total Steel Capacity and Demand for Offshore Wind

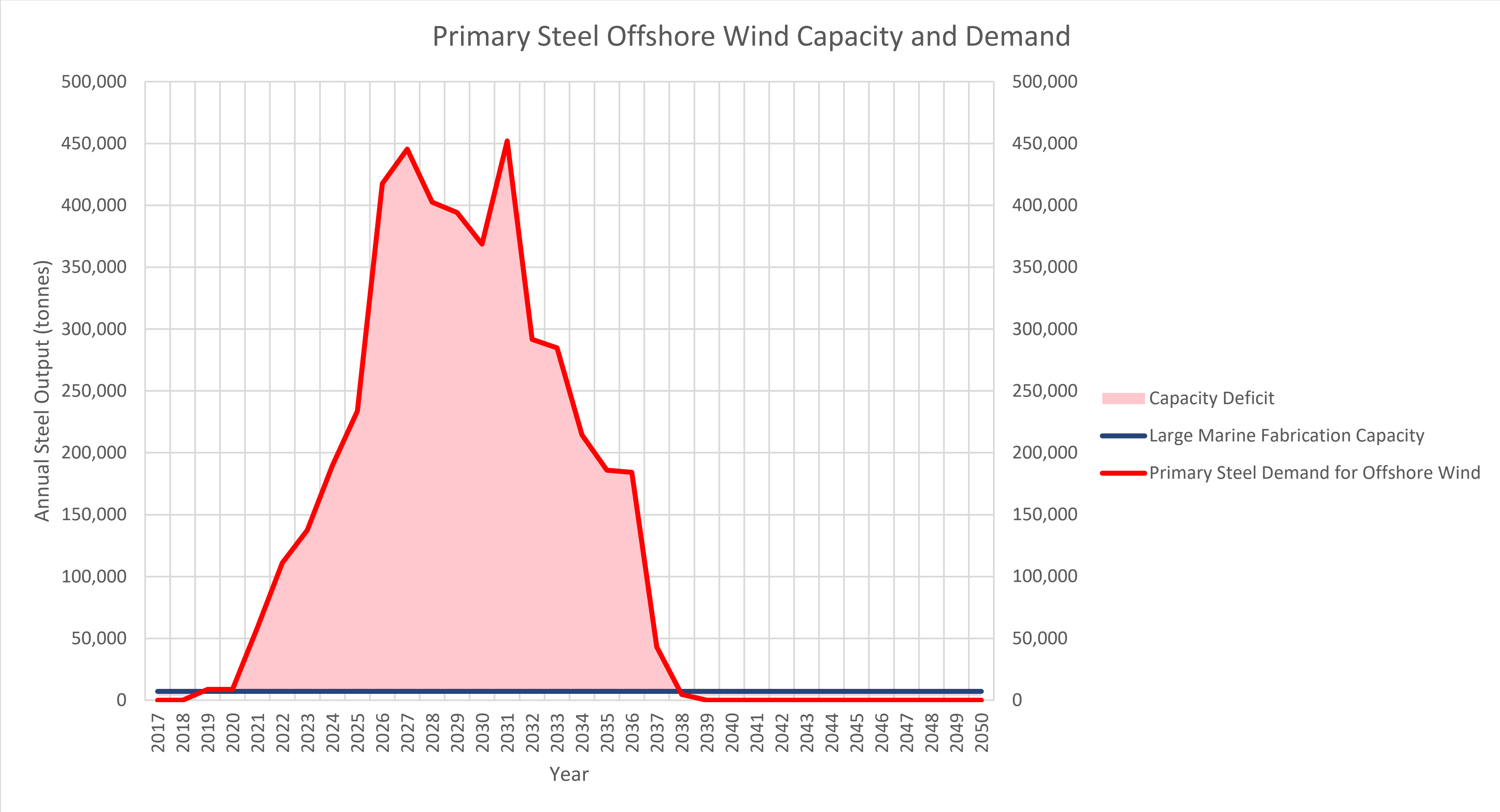

Figure 16: Primary Steel Capacity and Demand for Offshore Wind

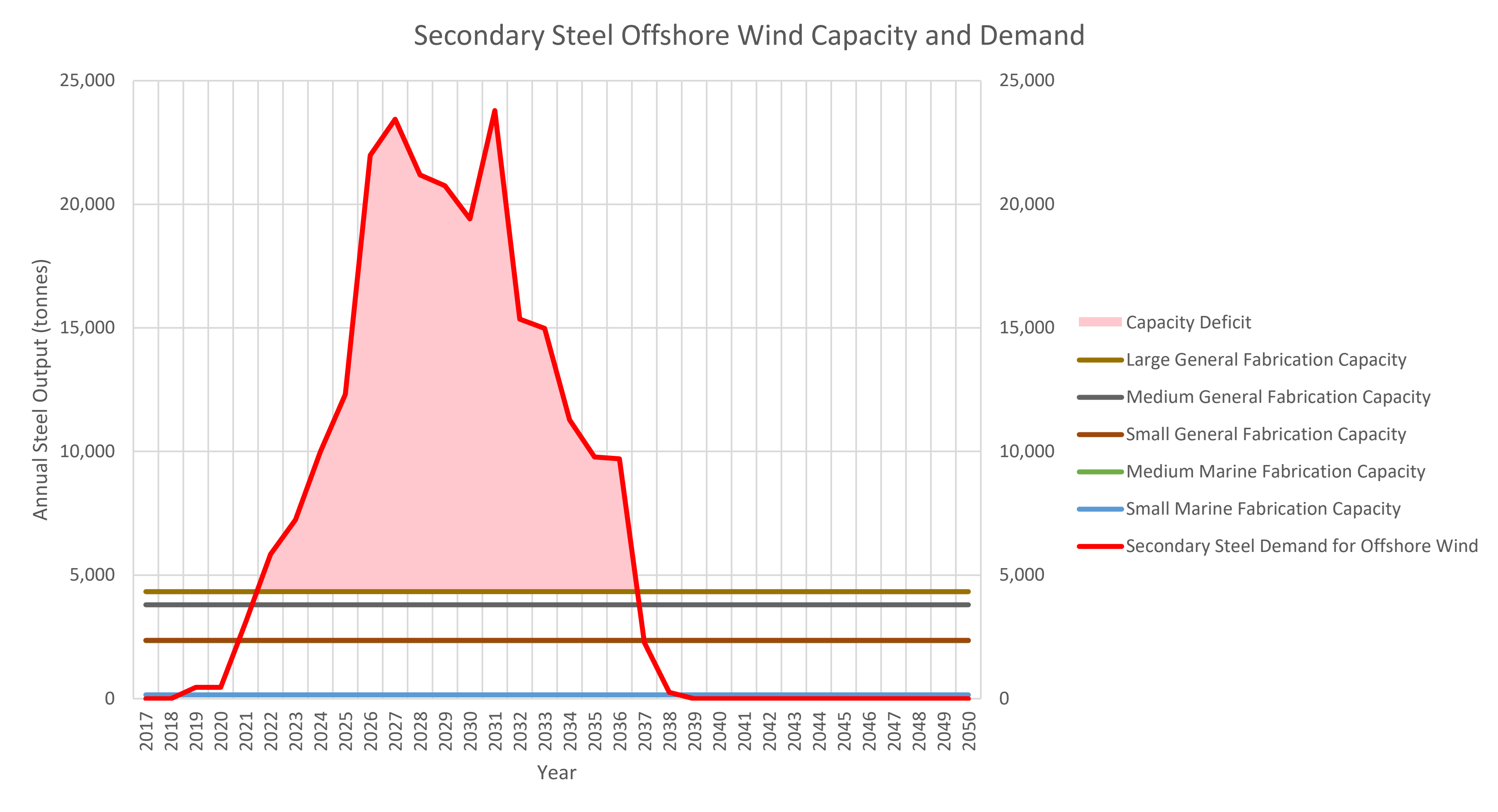

Figure 17: Secondary Steel Capacity and Demand for Offshore Wind