Summary

The offshore wind industry is demonstrating maturity by shifting its focus towards innovation and industrialisation. Reducing cost in the operational phase of the offshore wind farm lifecycle becomes increasingly important. Spare parts management is a critical element of the successful implementation of offshore wind farm operations and can therefore contribute to cost reductions. However, today there is variation in spare parts management practices across the industry and a lack of understanding of the value of the related data and information.

As offshore wind evolves, it would be prudent to look to similar but more mature industries for examples of good practice and lessons to be learned. This case study provides actionable advice for improving spare parts management in the offshore wind industry by drawing on good practice from the aerospace industry. The aerospace and offshore wind industries share common asset lifespans, international supply chains and related logistics challenges.

Key Findings

Over a 10-year period from 2007, Accenture employed data analytics, process innovation and enhanced supplier collaboration to overhaul the spare parts management strategy of a major aerospace client. Much of the knowledge and experience accumulated during this journey is applicable to the offshore wind sector.

Over the period, the tools and solutions developed by Accenture (on behalf of their client) has enabled it to realise some significant process improvement benefit across their operations. These improvements have strengthened commercial performance, and the quality and reliability of their products, within a highly competitive and increasingly price sensitive marketplace. Improvements have included a 35%-plus reduction in aircraft on-ground time (equivalent to unscheduled downtime), and a 20% reduction in the value of spare parts held in inventory per quarter, while improving spare part availability by more than 30%.

Recommendations

While aerospace is a mature industry, the supply chain management improvements delivered by Accenture provide the following recommendations that could be directly applied to the offshore wind industry as its focus shifts towards efficiency improvements in the operational lifecycle phase:

- Achieving a high-level O&M strategy goal (such as aircraft on ground for aerospace or availability for offshore wind) is not enough. Exploring the levers that drive the dynamics of the high-level target (such as spare parts management) can unlock meaningful cost reductions and performance improvements.
• Performance improvements can be made by optimising a spare parts management strategy but such an optimisation has dependencies including a data-driven approach to operations and effective collaboration between supply chain companies. There needs to be a staged approach to unlocking these gains, enabled by contractual relationships.
• Mine the data available to adjust and improve existing strategies. Once a data mining objective has been set, a statistical analysis of historic information will provide a baseline. A significant volume of data is required for data mining to effectively establish patterns and trends – Accenture recommends at least three years’ worth.
• Allow sufficient time to explore historic data and generate recommendations.
• Visualising supply chain data could drive better engagement with the supply chain. A standard dashboard should be made available to all parties to enable a common understanding of performance.
• Collaboration is key to unlocking performance gains. This includes better communication between operational functions and open communications with suppliers.
• Supply chain management is complex due to the volume of stakeholders involved. Therefore, an end-to-end process review is recommended.
• Automation of repeated, systematic tasks can have significant benefits.
• It is critical to monitor performance improvements using KPIs to influence behaviour.

Introduction

There is currently over 12GW of offshore wind installed globally and over 95% of this capacity has been installed in the past 10 years. The technology has come through a period of rapid growth that has established it as a mainstream generation source.

While projections are for this impressive growth rate to continue, there has been a noticeable maturing of the industry as the focus for key stakeholders moves away from environmental and construction issues and has shifted towards efficiency improvements and process innovation in the operational phase.

As offshore wind evolves, it would be prudent to look to similar but more mature industries for examples of good practice and lessons to be learned. Aerospace is an example of a similar industry where there is complex machinery to be operated and maintained in a safe yet time-critical manner.

Furthermore, the technology and components involved in the aerospace industry typically have a 20- to 30-year expected life span, therefore retaining the after-sales service market is critical. The larger players depend upon an international network of specialised suppliers and service providers to optimise and standardise their service model offering. This is strikingly similar to the offshore wind industry.

This case study focuses on how Accenture have optimised the spare parts management on behalf of an aerospace client, revealing how improving this aspect of operating and maintaining aircraft has had a significant impact on aircraft availability and client performance. The objective of this case study is to establish how this practice can be applied in an offshore wind context and to quantify the opportunity for offshore wind.
Spare Parts Management

There is now a significant global fleet of operational offshore wind turbines and balance of plant assets that must be operated and maintained efficiently. A critical element of the operations and maintenance (O&M) phase of the wind farm project lifecycle is spare parts management.

There are thousands of components in each wind turbine and there must be sufficient access to replacement parts and materials at all times to minimise any downtime.

A recent study by DNV-GL\(^1\) suggested that turbine spare parts can account for between 8.3% and 16.7% of the total O&M costs for workboat-based offshore wind farms (i.e. Round 1 and Round 2-type sites with no helicopter or service offshore vessel). While this suggests that there is an opportunity to make significant cost reduction here, during the warranty period, it is normal for all spare parts to be sourced by the wind turbine original equipment manufacturer (OEM). Therefore, at an industry-wide level there has been a lack of innovation of this aspect of O&M. As turbine OEMs industrialise processes and project owners come out of warranty, it will become increasingly important to understand the value of good spare parts management practices and the related data and information.

The elements of spare parts management explored in this case study are illustrated in Figure 1.

---

Figure 1: Elements of supply chain management explored in this case study
Accenture

Accenture is a leading global professional services company, providing a broad range of services and solutions in strategy, consulting, digital, technology and operations. Combining unmatched experience and specialised skills across more than 40 industries and all business functions— and underpinned by the world's largest delivery network — Accenture works at the intersection of business and technology to help clients improve their performance and create sustainable value for their stakeholders.

One Accenture contract is with a large aerospace client. Accenture's role is to manage the supply chain on behalf of the client to confirm that the necessary parts for maintenance and repair are available when needed at a network of airports.

Through delivery of this contract and optimisation of the processes, Accenture has gained experience of how spare parts management can improve operational performance.

Aircraft Maintenance Landscape

The aircraft maintenance landscape is both large and complex; ICF International estimates that the industry accounts for a current spend of $65 billion. While a handful of OEMs dominate this market, they are serviced by an even more concentrated supplier base. Approximately 75% of the components and spare parts are manufactured by a small group of suppliers, resulting in extensive competition between OEMs to get the right attention from these suppliers. The complexity of the equipment and the long lead times further complicate this landscape, with aeroplanes consistently being delivered over three years late. Within this context, proactive management of the supply chain is critical and has been a core area of focus for industry players.

The Opportunity

Through optimisation of spare parts management, the Accenture team has helped its client achieve improvements of various KPIs. It is possible to establish analogies for the KPIs to the offshore wind sector. Table 1 outlines the comparable KPIs explored in the following case study.
The Approach

In 2007, Accenture was awarded a contract to provide supply chain management services to an aerospace client across both planned and unplanned activities. This included management of more than 350 suppliers and more than 20,000 active part numbers to support more than 1,800 operators and over 170 aircraft per month.
Over the following decade, Accenture identified and implemented various opportunities for innovation and today they provide a comprehensive service to their client which has demonstrated significantly improved performance for their client’s customers.

Scope of Accenture Contract

This section will outline the original scope and evolution of Accenture’s contract. The original scope of work was the execution of an existing supply chain management strategy. The main tasks involved were purchase requisition and purchase order creation, invoices and reconciliations.

The system uses multiple distribution centres globally to source the spares required at a network of airports to repair aero-engines. When a request for a part was raised by the client, the Accenture team was responsible for checking which of the distribution centres had the necessary spare parts and preparing the shipping plan to deliver the part to the relevant airport.

Per industry standards, the client needs to maintain an aircraft on ground time of no longer than 24 hours whenever an aircraft is grounded. When Accenture started the spare parts management service in 2007, the client was achieving the high-level aircraft on ground target, but at significant cost. The monthly average first order fill rate was low, however, and an investigation revealed that 40% of risks were classified as quality and supplier production issues, with more than half of delays the result of short notice notifications.

The analogy to offshore wind here is a turbine manufacturer’s or service provider’s target availability. Achieving this target every month could mask significant potential improvements to performance that they are not aware of or incentivised to seek out.

Figure 2: Development of the supply chain services provided by Accenture for this client.
Over the subsequent decade, Accenture would go on to implement significant improvements to the original supply chain management strategy. The development of the supply chain services provided by Accenture for this client is illustrated in Figure 2.

Data Mining and Investigation of Efficiencies

In 2010, Accenture proposed a series of investigations on behalf of the client, with the intention of identifying opportunities to adjust the existing spare parts management strategy to unlock potential performance gains.

With the four years of purchase order and work management history that had accrued since the original contract began, a team began mining this valuable data set to test whether the existing strategy was fit for purpose. The team also wanted to understand what components and materials they may have been holding too much of, and to assess where there are risks, uncertainties, issues and delays in the supply chain.

Within this period, the team conducted initial statistical analysis of historical demand patterns, parts segmentation and stock levels to compute the optimal levels of inventory. With this initial analysis, Accenture was able to achieve a 25% improvement in first order fill rate by 2011. This sets the groundwork for the development of a full optimisation tool that will be explained in the Process Innovation section of this case study.

This analysis took one-and-a-half years and led to the formation of actionable recommendations. The subsequent sections will go on to describe the impact of their implementation.

Process Innovation

Accenture began to act on the identified recommendations in 2011. Over the following year, a phase of process innovation was delivered that improved the spare parts management strategy. There had been no standard reporting, and the client was finding it difficult to manage issues due to a lack of understanding of the criticality of the spare parts. Therefore the team configured their materials demand forecaster to visualise critical information as a dashboard for both the client and the supply chain.
The Accenture team had also identified a lack of collaboration between the client and its suppliers. As previously noted, 40% of spare part issues were classified as quality and supplier production issues and more than half of delays were reported within three weeks of the delivery date, providing insufficient time to react and mitigate delays. In response to the supply chain engagement issues, the delivery phase visibility tool – a web-enabled portal that enables open communications with suppliers – was implemented. One of its key elements was the visualisation of the various stages of a component or spare part journey, which provides transparency on supply chain delays and dependencies so tasks can be reprioritised.

In addition to the implementation of a series of tools and visualisations, the wider process innovation phase incorporated an entire end-to-end process review with the intention of rationalising processes and minimising interfaces.

Following these process improvements, the first order fill rate had increased by an additional 10% in 2012 and the short notice notification decreased by more than half.

Together, these process innovations allowed the team to not only provide the basic spare parts replenishment service – they could now rapidly adjust for demand/supply issues and proactively mitigate demand/supply risks. This enabled improved business performance with appropriate, actionable and timely data and information.

**Optimisation and Automation**

With a streamlined process map in place by 2012, the team went on to optimise the spare parts management strategy and automate key processes involved.

Building on the initial data mining and statistical analysis previously described, Accenture configured and deployed an advanced inventory management tool. The objective was to calculate optimum inventory levels across the network of spare part distribution centres. The details of this tool are provided in section 3.2.

When informed by the organisation’s target performance and trained by historical invoice and work management system data, the tool has the ability to recommend a suite of options regarding what parts and material to stock and where to stock them.

This tool aligned stocking and ordering processes with business goals and monitored business KPIs, which enabled significant improvements in the stocking strategy. The optimised inventory mix was 60% smaller in terms of actual stock levels. This enabled a 20% reduction in quarterly inventory.
holding costs.

Despite holding less stock in real terms, the first order fill rate increased beyond the earlier improvements by a further 10% in Q4 of 2012. So, while less stock was being held, the correct parts were available when required more of the time.

In addition to optimising the strategy, Accenture was able to automate a key process. Having streamlined the end-to-end processes, it was identified that there were too many manual activities and high volumes of purchase orders for spare parts.

Accenture deployed a mini-bot tool with logical flow to automate the purchase order creation process, reducing creation time by more than 70%. Figure 3 describes the opportunity and benefits for deploying such a tool.

The coupling of a streamlined process involving minimal manual interventions and automation of one of the key processes led to a significant improvement in the response time. Turnaround time – the time from the point that the diagnostics/prognostics identifies a spare part issue to the point where spare parts are en route – was reduced from 30 to 15 minutes.
The inventory optimisation and process automation together improved the speed and quality of decision making.

**Opportunities for Improvement in Supply Chain Management**

This section will provide further details of opportunities for improvements in supply chain management. Tools configured and developed by Accenture are provided as examples of good practice in supply chain and material management.

**Criticality of Spare Parts**

A crucial element of effective spare parts management is to have a good understanding of the criticality of spare parts. This includes knowledge of how spare parts will be used, the likely demand on the parts, where there is redundancy, and the impact of delays to accessing parts in time. Accenture implemented a tool called the materials demand forecaster, which not only acts as a valuable knowledge base for spare parts criticality but also effectively shares and visualises this vital information with Accenture’s team and the client.

The tool provides insight about how a part will ultimately be used, which improves communications throughout the whole supply chain.

A screenshot of the generic Accenture tool is reproduced in Figure 4, showing that the primary use case is forecasting and visualising consumer demand behaviour. A combination of categorised statistics is visualised as a dashboard and in qualitative key findings: together, this information can inform decision makers. The screenshot below specifically highlights the items of greatest consumption – and therefore largest impact – on inventory and service levels, equipping decision makers to develop and implement informed supply chain strategies.
Accenture configured this tool to suit the needs of the aerospace client. This provided inventory forecasts by material, supplier and location and presented them as a dashboard, which significantly improved the efficiency of seeking out spares in response to requests from the client.

Accenture has demonstrated the importance of not only understanding and interpreting spare parts criticality, but also presenting the resulting data to facilitate better decision making. Such a tool is valuable to inform the team, the client and the supply chain.

**Spare Parts Criticality in Offshore Wind**

In the offshore wind industry, a significant barrier to improving spare parts criticality (and hence demand on parts) is a lack of knowledge of failure modes and effect criticality analysis (FMECA). There is uncertainty around failure rates in the offshore wind industry that could be addressed with better data sharing. Furthermore, the engineering knowledge of failure modes and effect analysis is lacking. This inhibits root cause analysis of failures, which issues should be prioritised, and understanding of which spare parts are required to repair specific failure modes.

This barrier is further complicated by the rate at which new technology is being designed, developed and implemented in the field.

**Supply Chain Engagement and Relationship Management**

The supply chain for an industry involving complex rotating and electric machinery with high volumes of components will inevitably involve a multifaceted network of suppliers and service providers and generate vast amounts of data. Effective communication and collaboration can be a challenge.

Accenture implemented the delivery phase visibility tool: a good example of how spare parts delivery
assurance can be improved by engaging in better communication with suppliers. Performance can be improved by rapidly adjusting for demand/supply issues and proactively mitigating demand/supply risks.

The tool is a web-enabled portal which informs suppliers about what has been ordered and expected delivery dates. Furthermore, it incorporates supplier reviews, which incentivises good behaviour by offering an opportunity for a supplier to improve their reputation.

This portal also visualised the various stages of a component or spare part journey in the delivery phase, which facilitated efficiency improvements. The client, Accenture, and the supply chain can log in to find out if a part has been dispatched and where it is. This stopped time being wasted on responding to requests about the status of deliveries.

An escalation mechanism enables assurance of delivery dates. In the aerospace example, suppliers are contacted eight weeks before delivery date and if there are any issues or non-response, escalation levels begin. The team used this tool to actively manage demand and drive prioritisation of what to order and what issues to escalate.

Effectively, such a system could facilitate open communication with suppliers and provide transparency on supply chain dependencies so tasks can be reprioritised.

**Optimisation of Inventory Mix**

Selecting an inventory mix is a multidimensional optimisation problem aiming to minimise excess inventory while maintaining the ability to have spare parts available at site when they are required. In the offshore wind industry, this task can have many unknowns, not least demand on spares.

Accenture drew upon existing financial and work management data to carry out basic statistical analysis of the inventory mix in 2010. This laid the groundwork for the configuration of an inventory management tool in 2012, an advanced inventory optimisation tool used to calculate optimum inventory levels across spare parts distribution centres. The tool considers historical data and a target performance to suggest the optimal inventory levels using the best fit distribution and user parameters for demand and cost segments.

The tool was implemented as a more comprehensive and repeatable approach to the initial data mining analysis, which adapted the inventory strategy based on statistical analysis of the historic records of spare parts supply and demand. The inputs for the tool are:

- spare parts supply and demand history in the form of invoices and work management system records.
- part criticality engineering input.
- assumptions on costs of parts and supply chain lead times.
- a high-level target for performance that must be achieved by any proposed inventory strategy.
The tool then outputs a range of inventory strategy options describing what parts to order and how often to replenish for each of the distribution centres. Each strategy option (or scenario) suggested will achieve the target performance, but all strategies will differ in terms of lower-level measures of performance such as overall service level and projected fill rate. An example of this scenario-based output is provided in Figure 5.

![Scenario Analysis](image)

**Figure 5: Scenario-based output generated by Accenture’s in-house Inventory Management Tool**

This example highlights the criticality of modelling inventory strategy scenarios on a service level versus average inventory curve. Understanding the quantitative impacts of the qualitative inventory strategies makes for more informed and business outcome-focused decisions.

The key benefits here are that the optimisation task has become codified, so it is repeatable, and that when more information becomes available the calculation can be replicated and the resulting strategy adjusted. Furthermore, supply chain management involves many dependencies and complexities and the scenario-based output offers a degree of flexibility – a range of strategies are recommended, and the materials manager can select the option that best suits the supply chain conditions.
The Results

This case study has demonstrated that spare parts management analytics and process innovation can drive significant performance improvements. Table 2, below, summarises the improvements achieved by Accenture, the associated key drivers, and the opportunities available to offshore wind through the application of similar tools.

<table>
<thead>
<tr>
<th>Aerospace KPI</th>
<th>Improvement</th>
<th>Key Drivers</th>
<th>Opportunity for Offshore Wind</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aircraft on ground</td>
<td>Improvement of more than 35%</td>
<td>This can be thought of as the high-level target that has many underlying factors driving the dynamics. Aircraft on ground is a good KPI to monitor but the underlying dynamics are the levers that can be managed to actively impact performance. The principle motivation for deploying an advanced spares management strategy is to minimise the aircraft on ground time.</td>
<td>Significantly reducing the duration of unscheduled downtime.</td>
</tr>
<tr>
<td>First order fill rate</td>
<td>Overall improvement of almost 60%</td>
<td>The main driver of this improvement was the optimisation of inventory levels. The initial data mining and subsequent inventory management optimisations both were carried out specifically to decide what should be stocked and where. The improvements in first order fill rate effectively demonstrates that the updated inventory mix was much better suited to what was needed.</td>
<td>More requests for spare parts being realised on time</td>
</tr>
<tr>
<td>Actual stock levels</td>
<td>Reduction by 60%</td>
<td>The holding of slow-moving, high-cost spares at distribution centres has reduced significantly (with high velocity items staying regionally) because of the data-driven approach and improved communication, facilitating collectively holding spares across the network of distribution centres coupled with the optimisation of the inventory mix. A critical element of this was the implementation of spare parts demand forecasting. Adjustments in the inventory mix unlocked a remarkable 20% reduction in quarterly costs. In addition to these cost reductions, and despite reduced physical stock levels, the first order fill rate KPI demonstrates that the spare parts strategy improved.</td>
<td>Significant reduction in inventory holdings in warehouses, freeing up working capital.</td>
</tr>
</tbody>
</table>
Aerospace KPI | Improvement | Key Drivers | Opportunity for Offshore Wind
--- | --- | --- | ---
Turnaround time | Reduction from 30 minutes to 15 minutes | The main driver for this improvement was the streamlining of processes. A clear objective to minimise interfaces and manual processes has delivered a 50% reduction in response time.
Automation of the creation of purchase orders was a key component of reducing manual processes. Accenture deployed a mini-bot tool which reduced the length of time taken to create a purchase order by more than 70%.
Facilitates reprioritisation of turbine maintenance in response to known delays when waiting for parts to be delivered, eliminates abortive work. | Automation of the process from the point that the diagnostics/prognostics identifies spare part issue to spare parts en route along with 50% less time waiting for spare parts.

Short notice notification | Reduced by more than 50% | This KPI was significantly reduced through the implementation of the delivery phase visibility tool, which provides all stakeholders with a dashboard to visualise critical information and incentivises improvement in supplier behaviour.
Accenture’s improvements in relationship management provided much better visibility on delays and facilitated the ability to reprioritise maintenance activity. Ultimately the proportion of short notice notifications was reduced by more than 50%. | Facilitates reprioritisation of turbine maintenance in response to known delays when waiting for parts to be delivered, eliminates abortive work.

**Recommendations**

Aerospace is a more mature industry, but from the supply chain management enhancements delivered by Accenture we can extract the following useful recommendations for the offshore wind industry, as its focus shifts towards efficiency improvements in the operational lifecycle phase.

- Achieving a high-level O&M strategy goal (such as aircraft on ground for aerospace or availability for offshore wind) is not enough. The improvements unlocked by exploring the levers that drive the dynamics of the high-level target (such as spare parts management) can be meaningful.
- Performance improvements can be made by optimising a spare parts management strategy, but such an optimisation has dependencies including a data-driven approach to operations and effective collaboration between the supply chain. There needs to be a staged approach to unlocking these gains. The main elements are to confirm relevant data is collected and accessible, visualise and share data (collaborate) throughout the supply chain, invest time to derive insight and recommendations, and implement and monitor improvement using well defined KPIs.
- Mine the data available to adjust and improve existing strategies. The very first step must be to ensure there is a clearly articulated primary objective, such as assessing whether the existing inventory strategy is fit for purpose.
- Once a data mining objective has been set, a statistical analysis of historic information will provide a baseline. Accenture recommends three years of operational history to be sufficient. Subsequently,
variables such as inventory levels can be adjusted to optimise strategies.

- Allow sufficient time to explore historic data and generate recommendations. Accenture invested 1.5 years in this phase, however the ultimate performance gains has led to data driven spare parts management becoming standard practice for the client.

- Visualising supply chain data will drive better engagement with the supply chain. A standard dashboard should be made available to all stakeholders to inform discussions with supply chain, supports decision making such as reprioritising maintenance tasks and drive behavioural improvements of suppliers.

- Collaboration is central to unlocking performance gains. Better communications between warehouses could enable optimised collective stock holdings and open communications with suppliers is critical to provide transparency on delays and support active management of spare parts supply and demand.

- Supply chain management is complex due to the volume of stakeholders involved. Therefore, an end-to-end process review is recommended. The aim should be to minimise interfaces, handovers and manual interventions. It is good practice to physically present the resulting streamlined process map. This clarifies bottlenecks and shares the process flow with the whole organisation.

- Automation of repeated, systematic tasks can have significant benefits. Offshore wind has the potential to leapfrog other industries by considering the potential to automate tasks (such as purchase order creation) in the early stages of the industry.

- It is critical to monitor performance improvements using KPIs. This will confirm that analytics-enabled insights are turned into both actions and measurable outcomes that drive higher performance. It will be difficult to quantify the impact of operational improvements without well-defined KPIs.

Lessons Learned

The Accenture team involved in this work pointed out the following lessons learned:

- Begin supply chain activities by understanding industry challenges, current issues, and desired outcomes. Identify relevant KPIs early and continuously monitor them to drive ongoing performance improvements.

- Start with data and analytics first. Use the data available to you to define and test strategies as early as possible to inform plans for supply execution and prioritise supply chain activities based on impact of delays, etc., on performance to optimise KPIs.

- Drive shared outcomes through open collaboration with supply chain partners early and often, and as informed by your data and analytics. Knowing which materials and suppliers have the biggest impact on your work will focus effort on areas of greatest criticality and value.
Appendices

References


Author Profiles

Dr Conaill Soraghan is a Project Engineer, O&M Systems at the Offshore Renewable Energy Catapult. He has a background in applied mathematics and completed a PhD in wind turbine design. Conaill’s main area of interest is the management and optimisation of operational assets and he has extensive experience in the design and development of benchmarking systems and data/knowledge sharing for the offshore wind industry.

Andy Lewin heads up a team of project managers delivering collaborative industry projects including key testing, demonstration, technology development and R&D activities. A project manager with over 10 years of experience in renewable energy sector, Andy has considerable project and commercial management experience, having spent eight years at Scottish Power Renewables delivering wind farm projects and strategic business programmes. Most recently Andy has worked within major joint venture teams delivering project development and overseeing construction activities for UK offshore wind farms.

Contributors

Melissa Stark, Managing Director, Accenture Energy and Utilities

Melissa has over 22 years of experience working across all sectors of the energy industry and focuses on R&D/technology, investment and decision support and supply chain, having worked on projects in U.S, Europe, Middle East, Africa, Asia and Latin America. Melissa led the development of Accenture’s Clean Energy and Unconventional practices and is now focused on renewable generation and natural gas.

Melissa has a MBA with Distinction (Honours) in Transportation Management from Northwestern University where she was the recipient of the Transportation Management Top Student Award. She also
has a BSc (Honours) in Finance from the Haas School at the University of California at Berkeley where she was the recipient of the Finance Award. Melissa has served as Assistant Chair of Technology for the US National Petroleum Council study, Advancing Technology for America's Transportation Future. She is currently part of the IGU's (International Gas Union) Triennial Work Programme Study team.

**Tushar Narsana, Managing Director and Global Lead of Accenture's Supply Chain Business Process Services**

Tushar has over 18 years of experience in management consulting and business process outsourcing with deep expertise in supply chain management, operational improvement, M&A, and process and organizational design. Prior to Accenture, he worked at Bridge Strategy Group, Mitchell Madison Group, and Tata Consultancy Services. Tushar has an MBA from the University of Michigan and BE (Computer Science) from the University of Pune, India.

**About the O&M Case Studies series**

This is one in a series of offshore wind O&M-focused case studies, supported by ORE Catapult’s O&M forum and funded by The Crown Estate and the Offshore Wind Programme Board. These studies aim to highlight game-changing O&M projects, and promote the dissemination of knowledge among the offshore wind O&M community.

**Disclaimer**

While the information contained in this report has been prepared and collated in good faith, ORE Catapult makes no representation or warranty (express or implied) as to the accuracy or completeness of the information contained herein nor shall be liable for any loss or damage resultant from reliance on same.