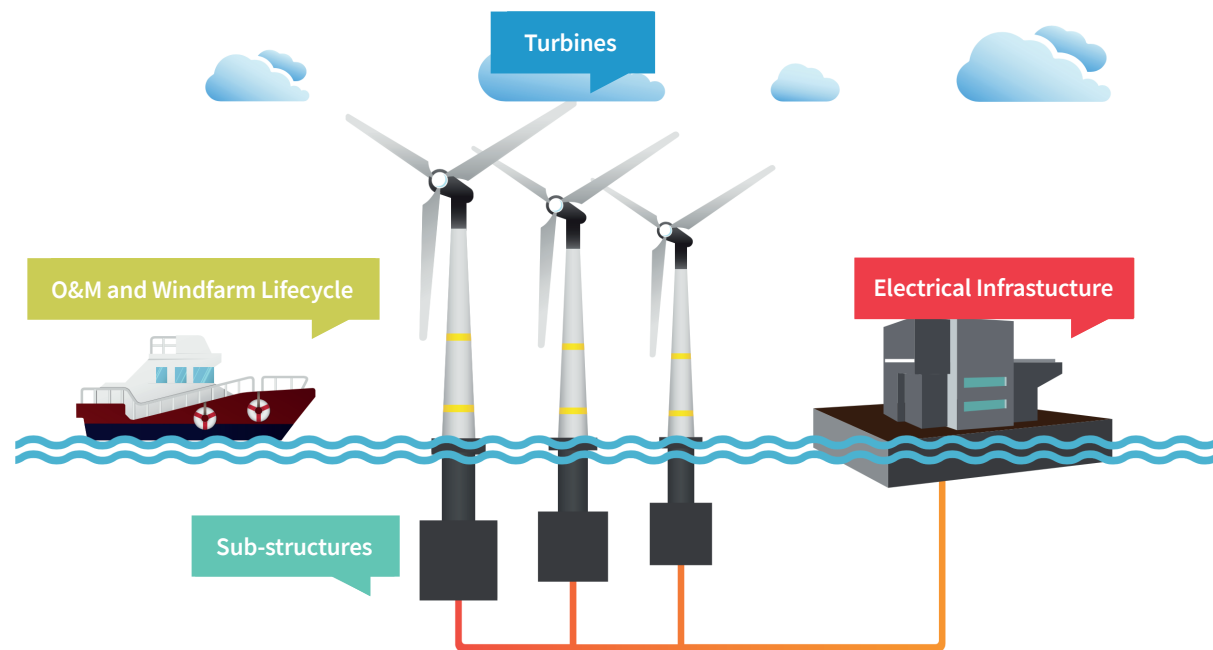




**Offshore Wind  
Innovation  
Hub**



INNOVATION  
ROADMAPS



## ABOUT US

Funded by the Department for Business, Energy and Industrial Strategy (BEIS) and delivered jointly by the Offshore Renewable Energy (ORE) Catapult and Innovate UK's Knowledge Transfer Network (KTN), the Offshore Wind Innovation Hub is the UK's primary coordinating body for innovation to reduce the cost of offshore wind energy and grow UK jobs in the sector. It coordinates with industry, supply chain and academia to provide Government and industry with an impartial, inclusive and trusted view of the innovation needs of the UK offshore wind sector, supply chain growth opportunities, and a comprehensive view of the funding landscape in offshore wind.

## INNOVATION ROADMAPS

**The UK offshore wind industry aims to supply one third of the country's electricity from offshore wind by 2030. This vision includes more than doubling the current generation capacity to reach 30GW by 2030 and has the potential to create 27,000 skilled jobs. In order to achieve this ambition, it is vital to understand the areas of offshore wind where there is a demand for innovation. The Offshore Wind Innovation Hub, in collaboration with industry and academia, has developed a set of technology innovation roadmaps. These are advanced prioritisation tools that identify the innovation needs of the offshore wind sector.**

### What do the Innovation Roadmaps do?

Provide government and industry with a single, validated source of information on the key challenges and innovation priorities within the UK offshore wind sector.

Identify to innovators and the supply chain where there are potential market opportunities within the UK offshore wind sector.

Provide funders and potential applicants with an evidence base for demonstrating the areas of the UK offshore wind sector that have a demand for innovation.

### How are they populated?

The roadmaps build on previous innovation prioritisation work undertaken in the sector, such as the Cost Reduction Monitoring Framework. Based on this foundation, the Hub created a series of roadmaps which were tested with industry and academia through the Hub's Technical Advisory Group.

### How often are they updated?

The roadmaps will be updated at least every six months to ensure they continue to accurately reflect the needs of the UK offshore wind sector.

The Offshore Wind Innovation Hub has created four roadmaps (Turbines, Substructures, Electrical Infrastructure, and O&M and Windfarm Lifecycle). This brochure gives an introduction to the four roadmaps and provides some examples of the innovation areas identified.

Full details can be found at the Innovation Hub website  
[www.offshorewindinnovationhub.com](http://www.offshorewindinnovationhub.com)



## EXPLAINING THE ROADMAPS

For each one of the Roadmaps we are providing the following details:

### Title and description of the Innovation Area:

Technology Readiness Level at the start and end of the innovation area at in the timescales provided

### Forecast start and finish:

When the significant progress in this area of innovation is expected to start and finish

### Start and Target TRL:

Technology Readiness Level at the start and end of innovation area at timescales provided

### Enabler:

Target organisation likely to take a lead on this innovation area delivery e.g. Industry, Academia, Research Technical Organisations

### Beneficiary:

Part of the supply chain that would benefit from a solution in this innovation area

### Strategic Outcome:

One of 3 general strategic outcomes this innovation area can contribute to:

- enabling >10MW turbine platforms commercialised
- maximising operational performance from existing wind turbines
- enabling disruptive innovation

### Potential to Reduce LCoE:

Within the context of this specific roadmap what contribution could the specific innovation area make to reducing Levelised Cost of Energy

### UK Benefit:

How well placed is the UK to play a role in the development and maturing of the specific innovation area and benefit from the outcomes

### Case for Intervention:

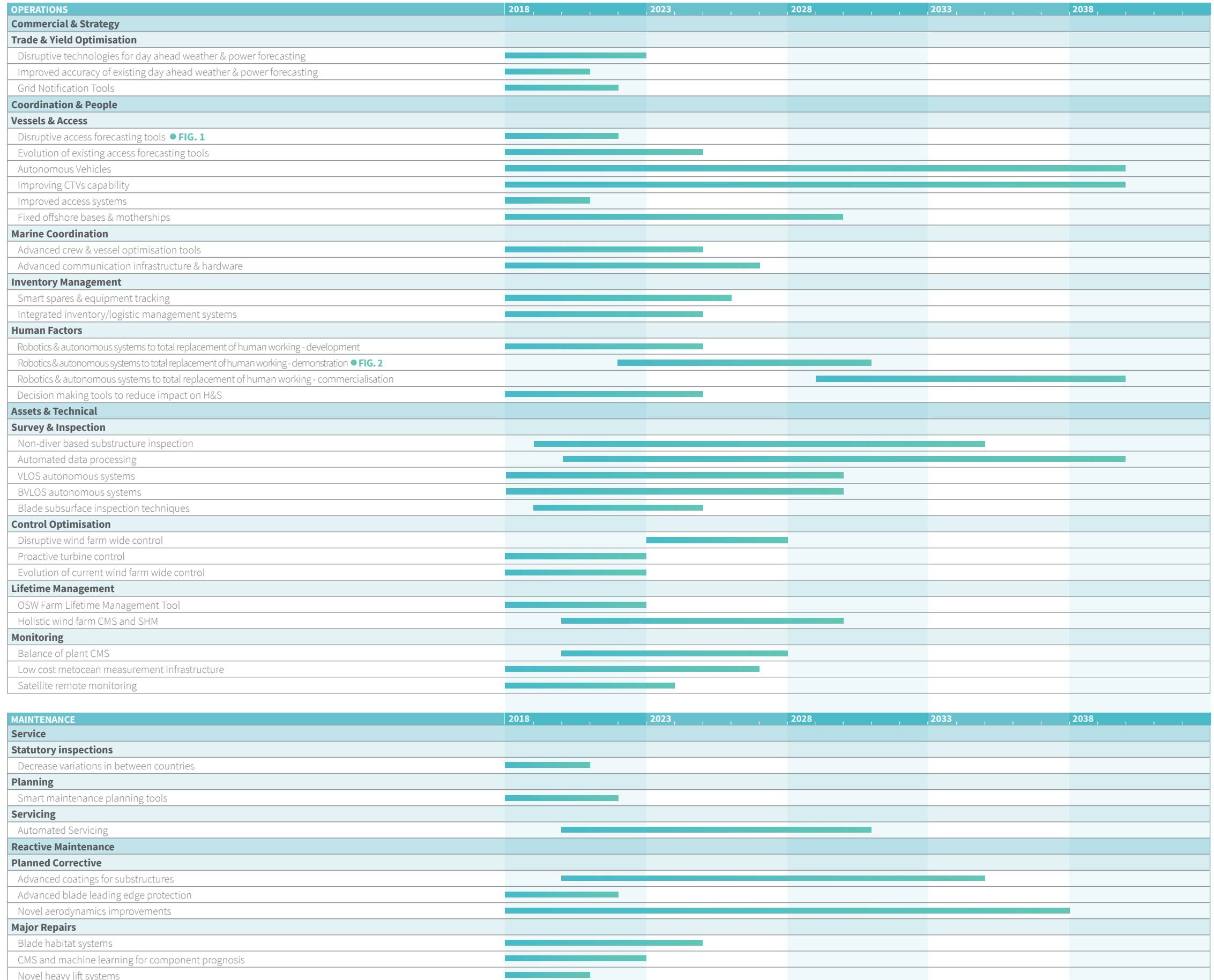
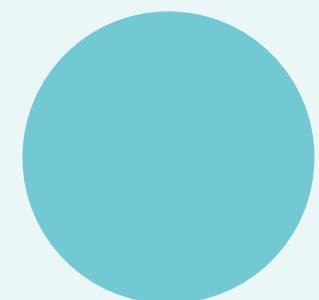
What is the probability that industry would not take this innovation area forward without additional support

# O&M AND WIND FARM LIFECYCLE

Innovative services and products that improve Offshore Wind Farm Operations and Maintenance (O&M) over a project lifecycle, including evolution and optimisation of existing methods and development of disruptive solutions that address industry needs.

Innovation areas in Operations are grouped by: Commercial & Strategy, Coordination & People and Assets & Technical.

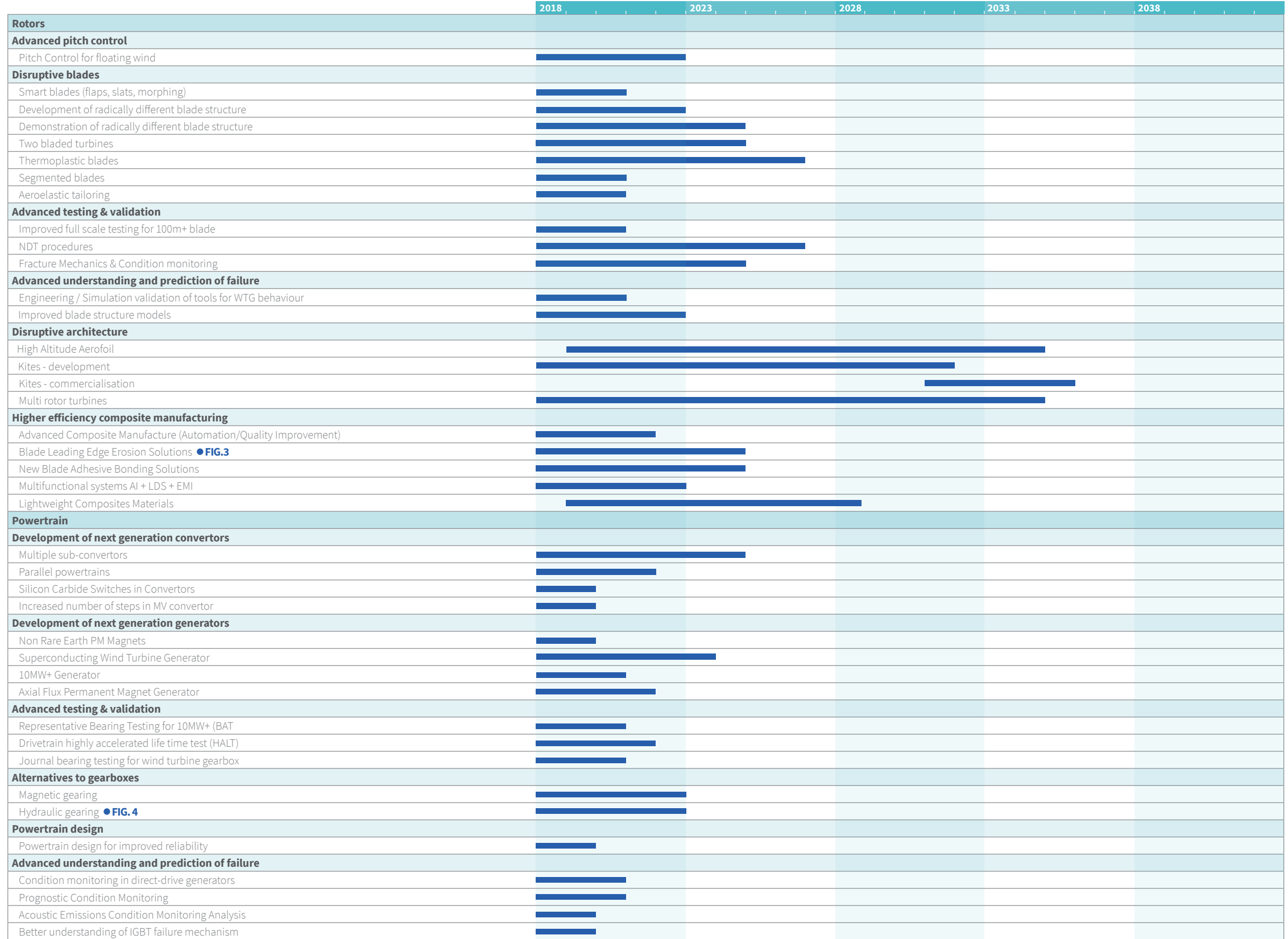
Innovation areas for Maintenance are grouped by: Service and Reactive Maintenance.



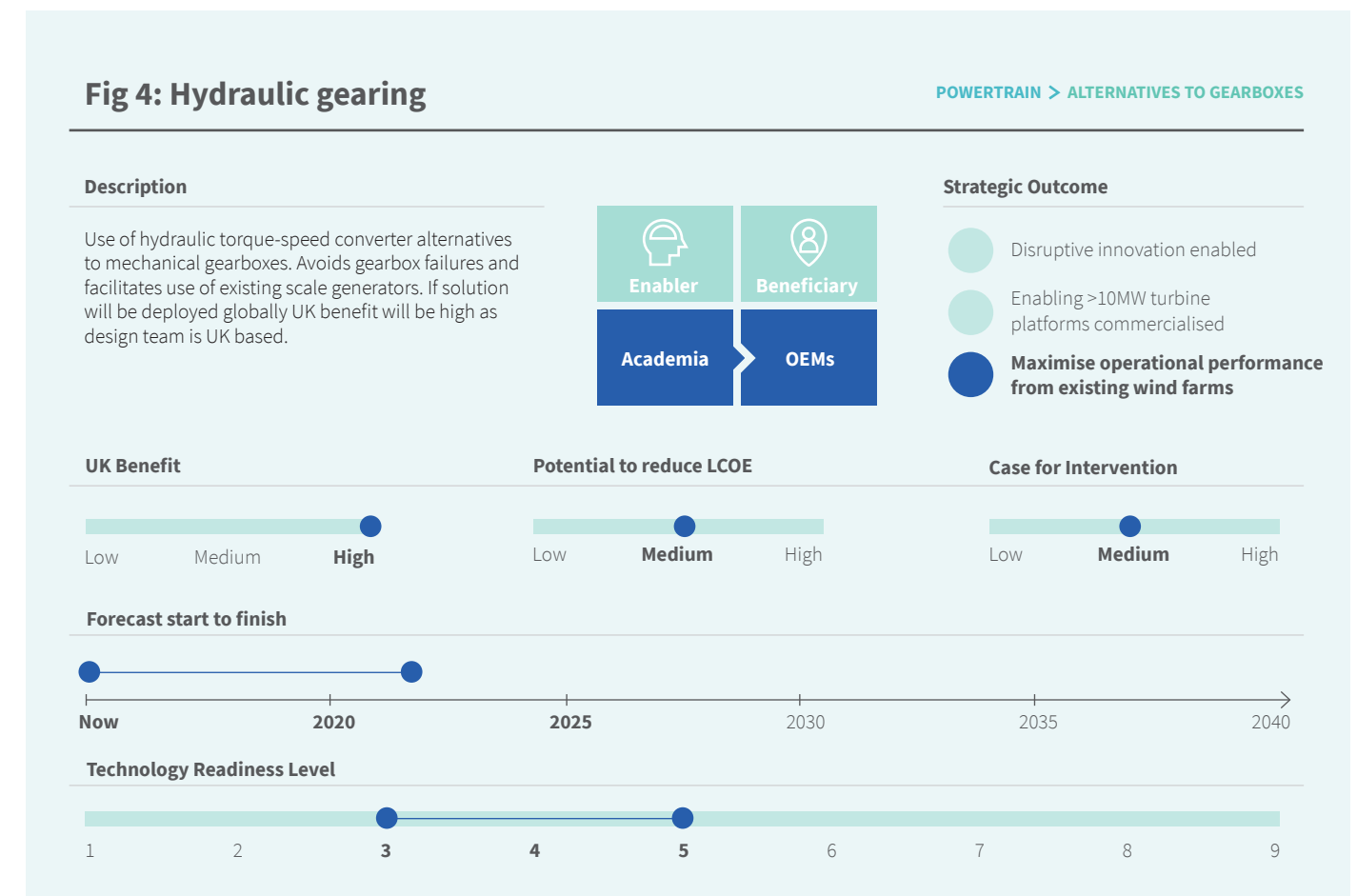
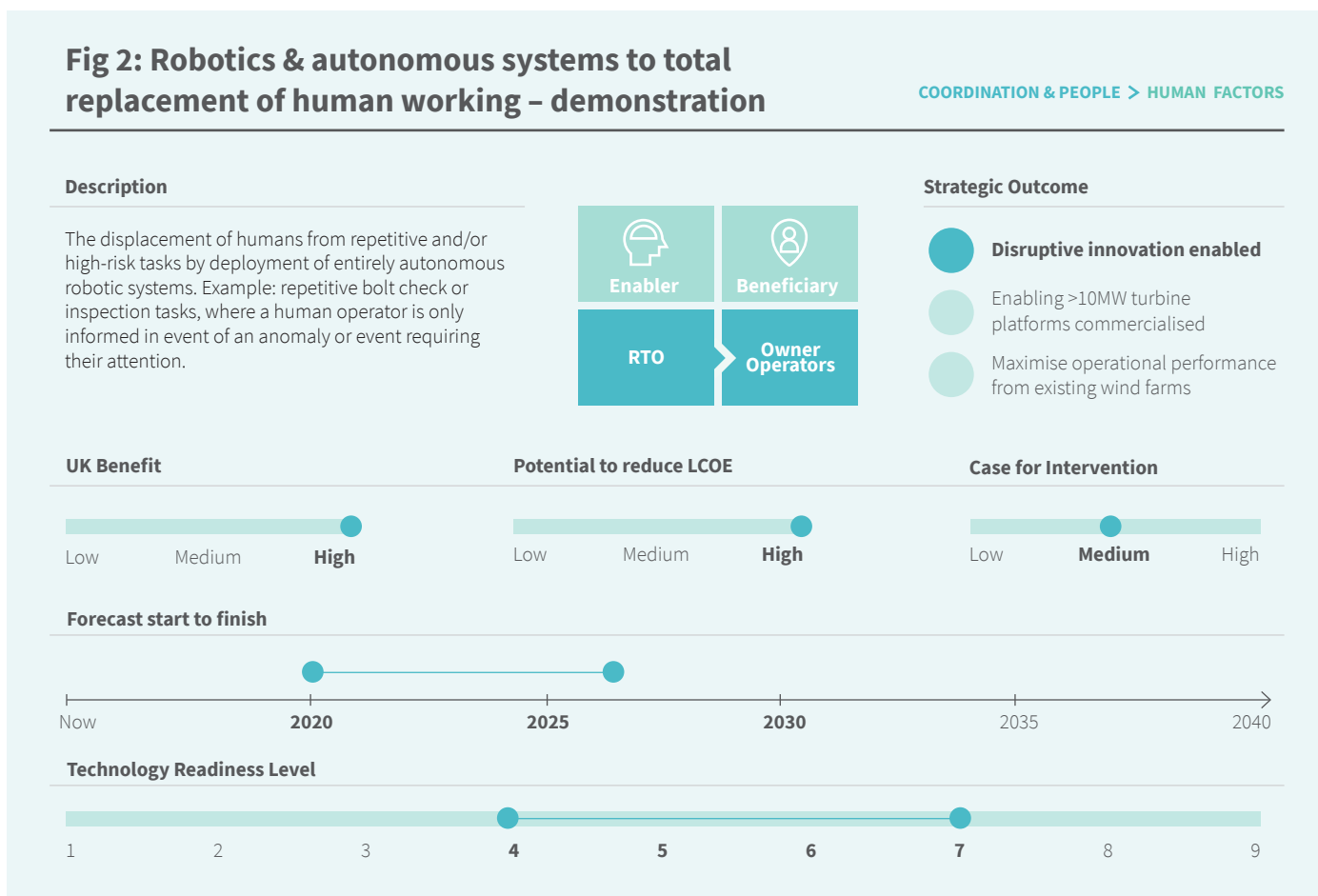
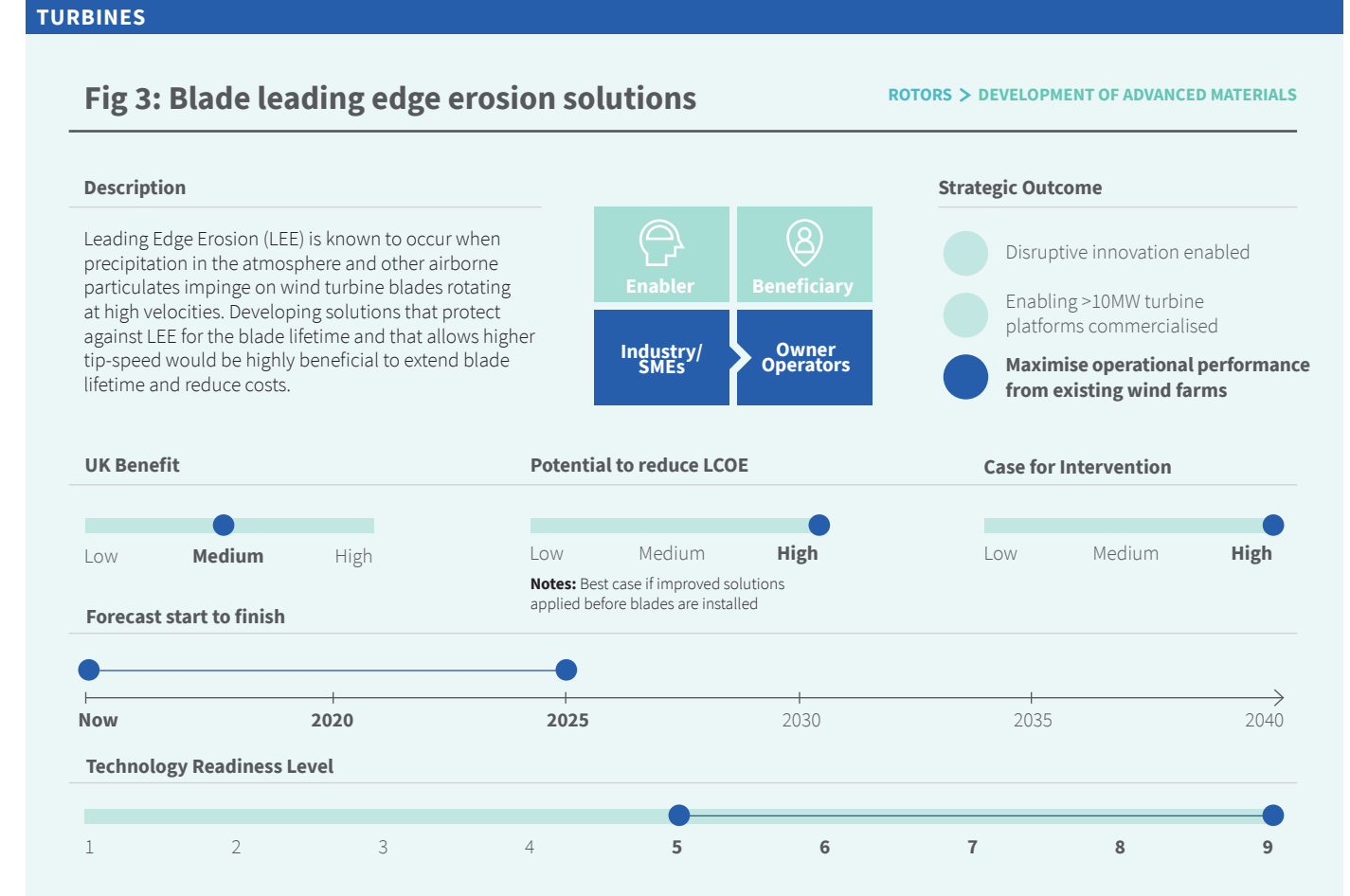
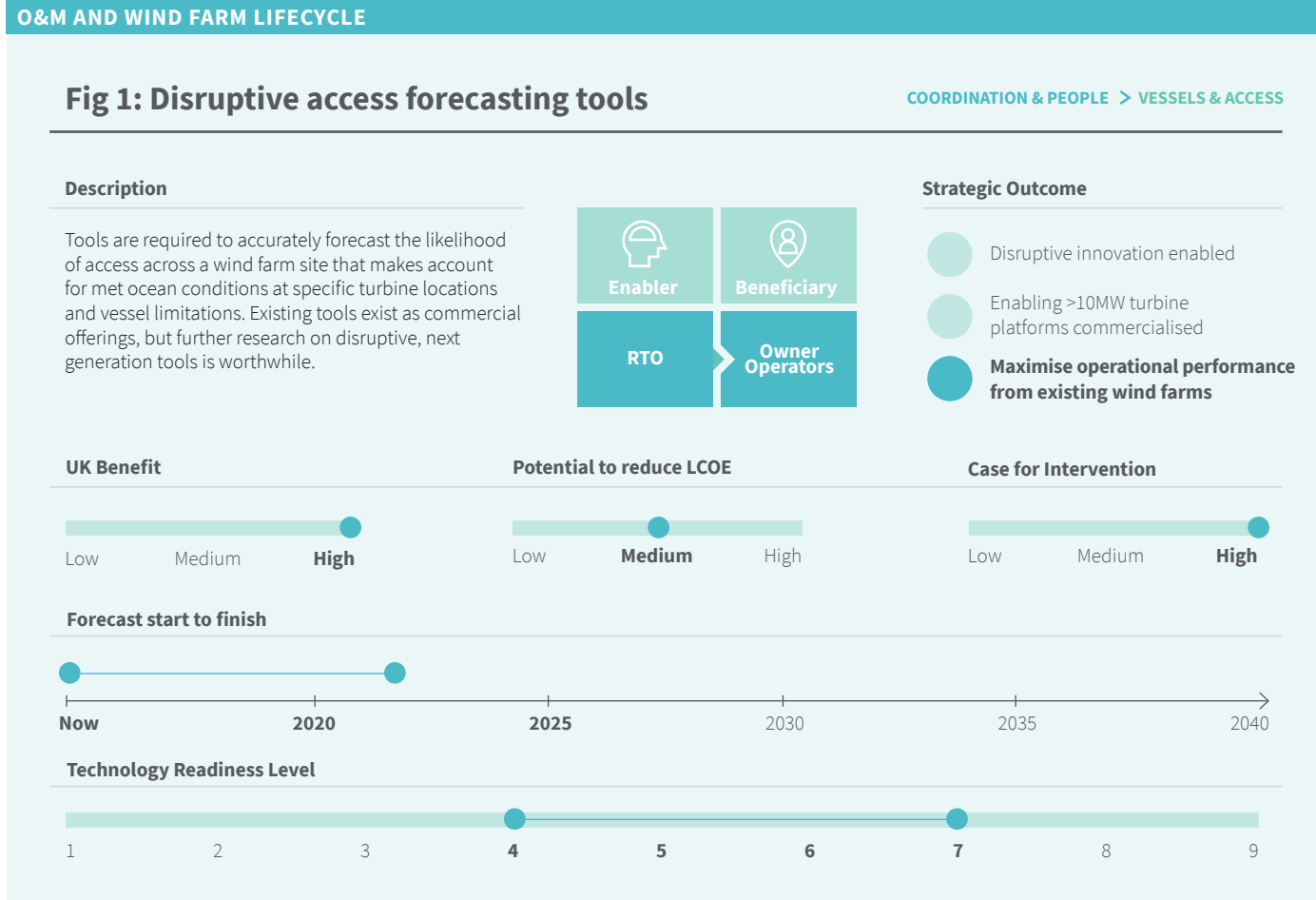
# TURBINES

Developing the next generation of offshore wind turbines, enhancing reliability and availability, enabling bigger systems and greater energy capture from the wind. These innovation areas incorporate all the technology that forms the structural and operational elements of the wind turbine generator.

Innovation areas in Turbines are grouped by:  
Rotors and Powertrains



# SOME KEY ELEMENTS IN DETAIL

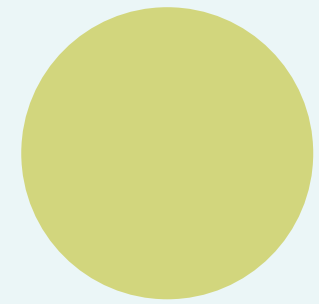




# SUBSTRUCTURES

Innovation areas with the potential to reduce costs through the optimisation of the design, manufacture, installation, or service life of substructures. This includes optimisation of existing designs and potential disruptive concepts to the towers, foundations and transition pieces.

Innovation areas in Sub-Structures are grouped by: Materials, Foundations, Transition Pieces, Floating Wind, Design, and Towers.



	2018	2023	2028	2033	2038
<b>Materials</b>					
<b>Materials Protection</b>					
Corrosion Protection	██████████	██████████			
SACP Gas evolution	██████████	██████████			
<b>New Materials</b>					
Self healing materials	██████████	██████████	██████████	██████████	
Lighter and stronger materials	██████████	██████████	██████████	██████████	
<b>Foundations</b>					
<b>Novel fixed foundations</b>					
Novel fixed foundations	██████████	██████████	██████████		
<b>Self-installing foundations</b>					
Barge based GBF Fabrication		██████████			
Gravity Base Foundations (GBFs)	██████████				
<b>Monopiles</b>					
Monopile lifetime assessment - establishing methodology ● FIG. 7	██████████	██████████			
Monopile lifetime assessment - establishing technology		██████████	██████████		
Standardisation of monopile monitoring + SHM	██████████	██████████			
Monopiles lower fabrication cost	██████████				
Pile installation noise reduction	██████████				
XL monopiles	██████████	██████████			
<b>Optimizing jacket manufacturing</b>					
Increased welding automation	██████████	██████████			
Industry-wide standardisation of nodes	██████████	██████████			
Real time weld inspection	██████████	██████████	██████████		
<b>Transition Piece</b>					
Incorporating TP into Foundations	██████████	██████████	██████████		
<b>Floating Wind</b>					
<b>Achieve cost equivalent of fixed</b>					
Achieve cost equivalent of fixed	██████████	██████████	██████████	██████████	
Port facilities for serial production		██████████	██████████	██████████	
Substructures optimised to wind turbine OEM requirements (eg loads, control)		██████████	██████████	██████████	
Access and egress for O&M	██████████	██████████	██████████		
<b>Standardisation of concepts</b>					
Optimised/standardised power transmission (dynamic cables and connectors)	██████████	██████████	██████████		
Consolidation in the number of designs		██████████	██████████	██████████	
<b>Design</b>					
<b>Design standards</b>					
Updated standards review	██████████				
<b>Integration of design</b>					
Total integrated design ● FIG. 8	██████████	██████████	██████████		
Combined WEC/WTG floating foundations	██████████	██████████			
Integrated installation of TP, foundations and tower	██████████	██████████	██████████		
<b>Tower</b>					
<b>New towers constructions</b>					
Concrete towers	██████████				
Lattice Towers	██████████				
<b>Reduce mass of towers</b>					
Reduce mass of tower	██████████				

# SOME KEY ELEMENTS IN DETAIL

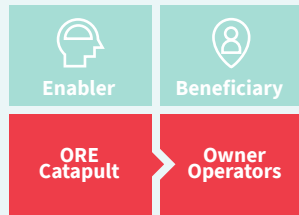
## ELECTRICAL INFRASTRUCTURE

**Fig 5: Understanding loading & failure of cables**

COMPONENT RELIABILITY IMPROVEMENT > CABLES

**Description**

Tools are required to accurately forecast the likelihood of access across a wind farm site that makes account for met ocean conditions at specific turbine locations and vessel limitations. Existing tools exist as commercial offerings, but further research on disruptive, next generation tools is worthwhile.



**Strategic Outcome**

- Disruptive innovation enabled
- Enabling >10MW turbine platforms commercialised
- Maximise operational performance from existing wind farms

**UK Benefit**



**Potential to reduce LCOE**



**Case for Intervention**



**Forecast start to finish**



**Technology Readiness Level**

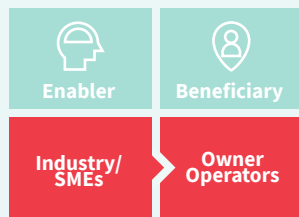


**Fig 6: Smart energy systems**

FLEXIBLE OFFSHORE WIND SOLUTIONS > NEW REVENUE STREAMS AND MWH OPTIMISATION

**Description**

Cyber Security and Network Automation Solutions for offshore wind. Develop standards, demonstration, etc. Pre-cursor to smart systems, and facilitator for new business models and commercial arrangements. Potential to reduce LCOE is Medium-High.



**Strategic Outcome**

- Disruptive innovation enabled
- Enabling >10MW turbine platforms commercialised
- Maximise operational performance from existing wind farms

**UK Benefit**



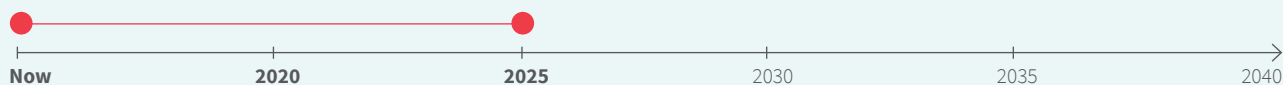
**Potential to reduce LCOE**



**Case for Intervention**



**Forecast start to finish**



**Technology Readiness Level**



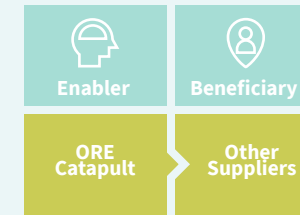
## SUBSTRUCTURES

**Fig 7: Monopile lifetime assessment – establishing methodology**

FOUNDATIONS > MONOPILES

**Description**

There are currently no standard methods for the assessment of remaining life of monopile foundations in the offshore wind industry. Such a method would enable a standardised and agreed approach for asset owners to make informed analysis as to the potential remaining operating life of the foundation and also enable the potential for life extension justification.



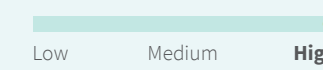
**Strategic Outcome**

- Disruptive innovation enabled
- Enabling >10MW turbine platforms commercialised
- Maximise operational performance from existing wind farms

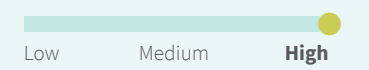
**UK Benefit**



**Potential to reduce LCOE**



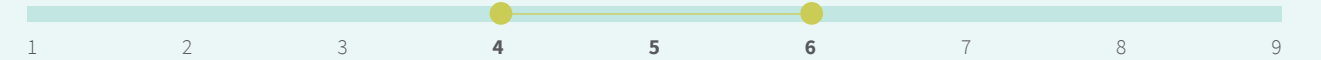
**Case for Intervention**



**Forecast start to finish**



**Technology Readiness Level**

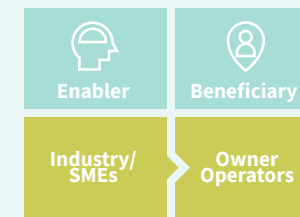


**Fig 8: Total integrated design**

DESIGN > INTEGRATION OF DESIGN

**Description**

Offshore wind turbines (fixed or floating) are coupled systems, however to date these have often been designed as two independent systems (a foundation and a wind turbine). This has resulted in suboptimal designs of foundations. A more open relationship between foundation designers and wind turbine OEMs can improve foundation designs, ultimately lowering the LCOE of offshore wind.



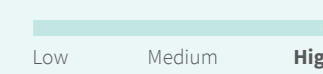
**Strategic Outcome**

- Disruptive innovation enabled
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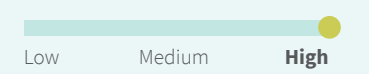
**UK Benefit**



**Potential to reduce LCOE**



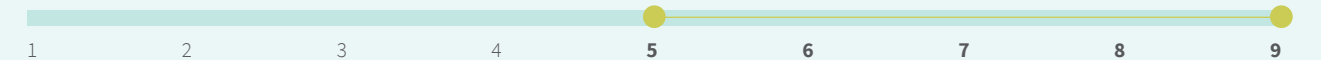
**Case for Intervention**



**Forecast start to finish**



**Technology Readiness Level**



**Notes:** Optimised structure in terms of steel, construction, installation, O&M and decommissioning

**Notes:** Currently there exists a barrier between OEMs





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## CONTACT

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