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Supergen Wind Hub

Sustainable Power Generation and Supply
- Wind Energy Technologies

D4.3: **Roadmap of UK based test facilities for wind technologies**

Delivered by:	Durham University		
Author(s):	Donatella Zappalá, Christopher J Crabtree, Simon Hogg		
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Durham University
Department of Engineering

Durham University
Department of Engineering

Directory of UK Based Test and Demonstration Facilities for Wind Technologies

Donatella Zappalá,
Christopher J Crabtree,
Simon Hogg.

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SUPERGEN WIND

Durham University
Lower Mountjoy
South Road
Durham DH1 3LE, UK

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Cover photo: Wind Turbines in Liverpool Bay
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Contents

1. Introduction

The UK's extensive wind resource and rich history in the energy industry have made the UK internationally leading in both academic understanding and technology development capability in the wind energy sector. The sector is continuously and dynamically evolving and facing new technological challenges. The testing at scale of onshore and offshore wind energy technology is a crucial under-pinning factor in innovation and commercialisation of new technologies. The UK has a large number of advanced facilities, with a variety of capabilities, to de-risk technology development both at the academic and industrial level, with some of the world's foremost testing assets.

This report gives an insight into the UK testing and demonstration facilities landscape for the wind energy sector used by the scientific and industrial communities. It provides an extensive directory of the facilities of use to the UK and European wind research and development community, identifying where cutting-edge facilities exist within the UK for validation testing of new developments across the full range of Technology Readiness Levels. By providing a comprehensive understanding of the available testing and demonstration services, this document is a source of information for energy researchers and industry, academia and government innovators who have interest in reducing technology development risk. It contains useful technical insights to support academic/business cases and is accessible to professionals across all sectors of the wind industry from early career researchers through to senior industrial project managers. The document has been designed to be used as a reference directory and is produced from a combination of publically available material and Durham University internal sources. The document also provides links to recommended resources and detailed information specific to individual facilities.

This report is organised in two sections:

- Section I provides an overview of the directory facilities, which are colour coded according to their typology. The information and location for each facility is given in Table 1, where the map numbers represent the facility unique reference numbers, corresponding to the overview map in Figure 1, and link to single page full descriptions in Section II.
- Section II includes detailed information on individual test and demonstration facilities. The details provided are: the organisation owning the facility, the facility location, the type of asset, the scale of operation, the facility description, the typical testing activities, expected or normal users and the website.

This directory is as accurate as possible given the publicly available information and will be regularly updated to include new test and demonstration facilities. Please contact Dr Zappalá (donatella.zappala@durham.ac.uk) or Dr Crabtree (c.j.crabtree@durham.ac.uk) if you have any updates and/or queries about existing database entries or if you would like to include new facilities.

2. Section I: Summary of the UK Test and Demonstration Facilities

Table 1: Directory of UK test and demonstration facilities for wind technologies.

Type of Facility	Organisation	Test Facility	Location	Map
Aeroelastic Testing	Imperial College of London	Load Control and Aeroelastics Lab	London	1
Blade Testing	Offshore Renewable Energy (ORE) Catapult	50m R&D Blade Test Facility	Blyth	2
	Offshore Renewable Energy (ORE) Catapult	100m Blade Test Facility	Blyth	3
	Offshore Renewable Energy (ORE) Catapult	Blade Rain Erosion Test Rig and Laboratory	Blyth	4
Cable Testing	Offshore Renewable Energy (ORE) Catapult	HV & Materials Laboratory	Blyth	5
	Offshore Renewable Energy (ORE) Catapult	Dynamic Cable Test Rig	Blyth	6
Demonstration Site	EDF Energy Renewables	Offshore Demonstrator Wind Farm	Blyth	7
	Offshore Renewable Energy (ORE) Catapult	7MW Demonstration Offshore Wind Turbine	Levenmouth	8
	Offshore Renewable Energy (ORE) Catapult	27m Turbine Training Tower	Blyth	9
	Science and Technology Facilities Council (STFC) Rutherford Appleton Laboratory - Energy Research Unit (ERU)	Britwind H15 Wind Turbine	Didcot	10
	Scottish and Southern Energy (SSE)	National Offshore Wind Turbine Test facility (NOWTTF)	Port of Hunterston	11
	TUV SUD NEL	National Wind Energy Centre	Myres Hill	12
	University of Cranfield	Wind Turbine Experimental Facility	Cranfield	13
	University of Exeter	Falmouth Bay Test Site (FaBTest)	Falmouth Harbour	14
	University of Exeter	South West Mooring Test Facility (SWMTF)	Falmouth Harbour	15
	Vattenfall, Technip and Aberdeen Renewable Energy Group (AREG)	European Offshore Wind Deployment Centre	Aberdeen Bay	16
	Wave Hub Ltd.	Wave Hub Test Site	16km offshore from Hayle	17

Drive Train/ Dynamometer Testing	Durham University	Energy Conversion and Drivetrain Research Laboratory	Durham	**18**
	Energy Technology Centre	Rotating Machinery Test Facility	Glasgow	**19**
	Offshore Renewable Energy (ORE) Catapult	1MW Powertrain Test Rig Facility	Blyth	**20**
	Offshore Renewable Energy (ORE) Catapult	3MW Powertrain Test Rig Facility	Blyth	**21**
	Offshore Renewable Energy (ORE) Catapult	15 MW Wind Turbine Nacelle Test Facility	Blyth	**22**
	University of Cardiff	Machines Lab	Cardiff	**23**
	University of Sheffield	Electrical Machines & Drives (EMD) Laboratory	Sheffield	**24**
	University of Strathclyde	Powertrain Testing Facilities	Glasgow	**25**
Electrical Systems Testing	Newcastle University	Power Electronics, Drives and Machines Lab	Newcastle	**26**
	Offshore Renewable Energy (ORE) Catapult	Grid Emulation (eGrid)	Blyth	**27**
	Parsons Peebles	Electric Motor & Generator Test Facility	Rosyth	**28**
	Scottish and Southern Energy (SSE)	UK HVDC Test Centre	Cumbernauld	**29**
	University of Cardiff	Power Electronic Lab	Cardiff	**30**
	University of Cranfield	Electrical Machine Test and Validation Platform	Cranfield	**31**
	University of Edinburgh	Electrical Machines and Power Electronics Test Laboratory	Edinburgh	**32**
	University of Exeter	Electrical Power Systems Laboratory	Penryn	**33**
	University of Manchester	Power Electronics, Machines and Drives Test Laboratory	Manchester	**34**
	University of Manchester	National Grid Power Systems Research Centre	Manchester	**35**
	University of Nottingham	Power Electronics, Machines and Control (PEMC) Testing Facilities	Nottingham	**36**
	University of Southampton	Tony Davies High Voltage Laboratory (TDHVL)	Southampton	**37**
	University of Strathclyde	Distribution Network & Protection Laboratory	Glasgow	**38**
	University of Strathclyde	High Voltage Technologies & Electrical Plant Diagnostics	Glasgow	**39**
	University of Strathclyde	Power Networks Demonstration Centre	Glasgow	**40**

Electrical Systems Testing	University of Warwick	Power Electronics Applications Lab	Coventry	**41**
Foundations	University of Dundee	Geotechnical Laboratory	Dundee	**42**
	University of Surrey	SAGE (Surrey Advanced Geotechnical Engineering) Lab	Guildford	**43**
Hydrodynamics	Heriot-Watt University	Wave Basin	Edinburgh	**44**
	HR Wallingford	Fast Flow Facility (F^3)	Wallingford	**45**
	Newcastle University	Hydrodynamics Laboratory	Newcastle	**46**
	University of Edinburgh	FloWave Ocean Energy Research Facility	Edinburgh	**47**
	University of Edinburgh	Curved Wave Tank	Edinburgh	**48**
	University of Liverpool	National Oceanography Centre	Liverpool	**49**
	University of Plymouth	Coastal, Ocean and Sediment Transport (COAST) Laboratory	Plymouth	**50**
	University of Strathclyde	Kelvin Hydrodynamics Laboratory	Glasgow	**51**
Icing Tunnel	University of Cranfield	Icing Tunnel	Cranfield	**52**
Marine Environment	Scottish Association for Marine Science (SAMS)	SAMS Research Services Ltd (SRSL)	Oban	**53**
	University of Cranfield	Marine Environment Experimental Field Site	Loch Ceann Traigh	**54**
	University of Hull	Total Environment Simulator (TES)	Hull	**55**
Material Testing	Doosan Power Systems Ltd	Materials, Corrosion and NDT Laboratories	Renfrew	**56**
	NPL	Composites, Adhesives and Polymeric Material Test Facilities	Teddington	**57**
	TWI	Materials and Corrosion Testing Laboratories	Cambridge	**58**
	University of Bristol	Bristol Composites Institute (ACCIS)	Bristol	**59**
	University of Cardiff	Morgan-Botti Lightning Laboratory	Cardiff	**60**
	University of Dundee	Scottish Marine And Renewables Test (SMART) Centre	Dundee	**61**
	University of Manchester	The National Composites Certification and Evaluation Facility (NCCEF)	Manchester	**62**
	University of Strathclyde	Advanced Forming Research Centre (AFRC)	Inchinnan	**63**

Mechanical Components Testing	Doosan Power Systems Ltd	Large Scale Component Testing Facility	Renfrew	**64**
	MacTaggart Scott	Gearbox Test Rig	Loanhead	**65**
	Newcastle University	Design Unit Test Rigs	Newcastle	**66**
	University of Exeter	Dynamic Marine Component Test Facility (DMaC)	Falmouth	**67**
Meteorology	Offshore Renewable Energy (ORE) Catapult	National Offshore Anemometry Hub (NOAH) Offshore Met Mast	3nm off Blyth	**68**
	Science and Technology Facilities Council (STFC) Rutherford Appleton Laboratory - Energy Research Unit (ERU)	Test Site Meteorology	Didcot	**69**
Radar	University College London (UCL)	NetRAD	London	**70**
Robotics	Heriot-Watt University & University of Edinburgh	Edinburgh Centre for Robotics	Edinburgh	**71**
	University of Bristol &Perceptual Robotics	Bristol Robotics Laboratory	Bristol	**72**
	University of Liverpool	Centre for Autonomous Systems Technology (CAST)	Liverpool	**73**
Smart Energy	Durham University	Smart Grid Laboratory	Durham	**74**
	Imperial College of London	Maurice Hancock Smart Energy Laboratory	London	**75**
	Keele University	Smart Energy Network Demonstrator (SEND)	Keele	**76**
	Newcastle University	Smart Grid Lab	Newcastle	**77**
	University of Birmingham	Smart Grid Lab	Birmingham	**78**
Structural Testing	Energy Technology Centre	Structural Test Laboratory	Glasgow	**79**
	TWI	Integrity Management Laboratories	Cambridge	**80**
	University of Cranfield	Structural Integrity Laboratory	Cranfield	**81**
	University of Sheffield	Structural Dynamics Laboratory for Verification and Validation (LVV)	Sheffield	**82**
Subsea Testing	JFD	National Hyperbaric Centre (NHC)	Aberdeen	**83**
	Newcastle University	Sensors, Electromagnetics and Acoustics Lab	Newcastle	**84**
	Newcastle University	Tyne Subsea - National Centre for Subsea and Offshore Engineering	Newcastle	**85**

Subsea Testing	Newcastle University	Neptune National Centre for Subsea and Offshore Engineering	Newcastle	**86**
	Offshore Renewable Energy (ORE) Catapult	Subsea Docks	Blyth	**87**
	University of Aberdeen	Oceanlab Sea Testing Facilities	Newburgh	**88**
Visualization Environment	University of Hull	Immersive Visualization Environment (HIVE)	Hull	**89**
Wind Tunnels	Building Research Establishment (BRE)	Wind Tunnels	Watford	**90**
	Durham University	Wind Tunnels	Durham	**91**
	Energy Technology Centre	Wind Tunnel	Glasgow	**92**
	Imperial College of London	Wind Tunnels	London	**93**
	Loughborough University	Wind Tunnels	Loughborough	**94**
	University of Bristol	Wind Tunnel Laboratory	Bristol	**95**
	University of Cranfield	Wind Tunnels	Cranfield	**96**
	University of Glasgow	Wind Tunnel Facilities	Glasgow	**97**
	University of Manchester	Wind Tunnels	Manchester	**98**
	University of Southampton	Wind Tunnels	Southampton	**99**
	University of Surrey	Enflo Laboratory	Guildford	**100**

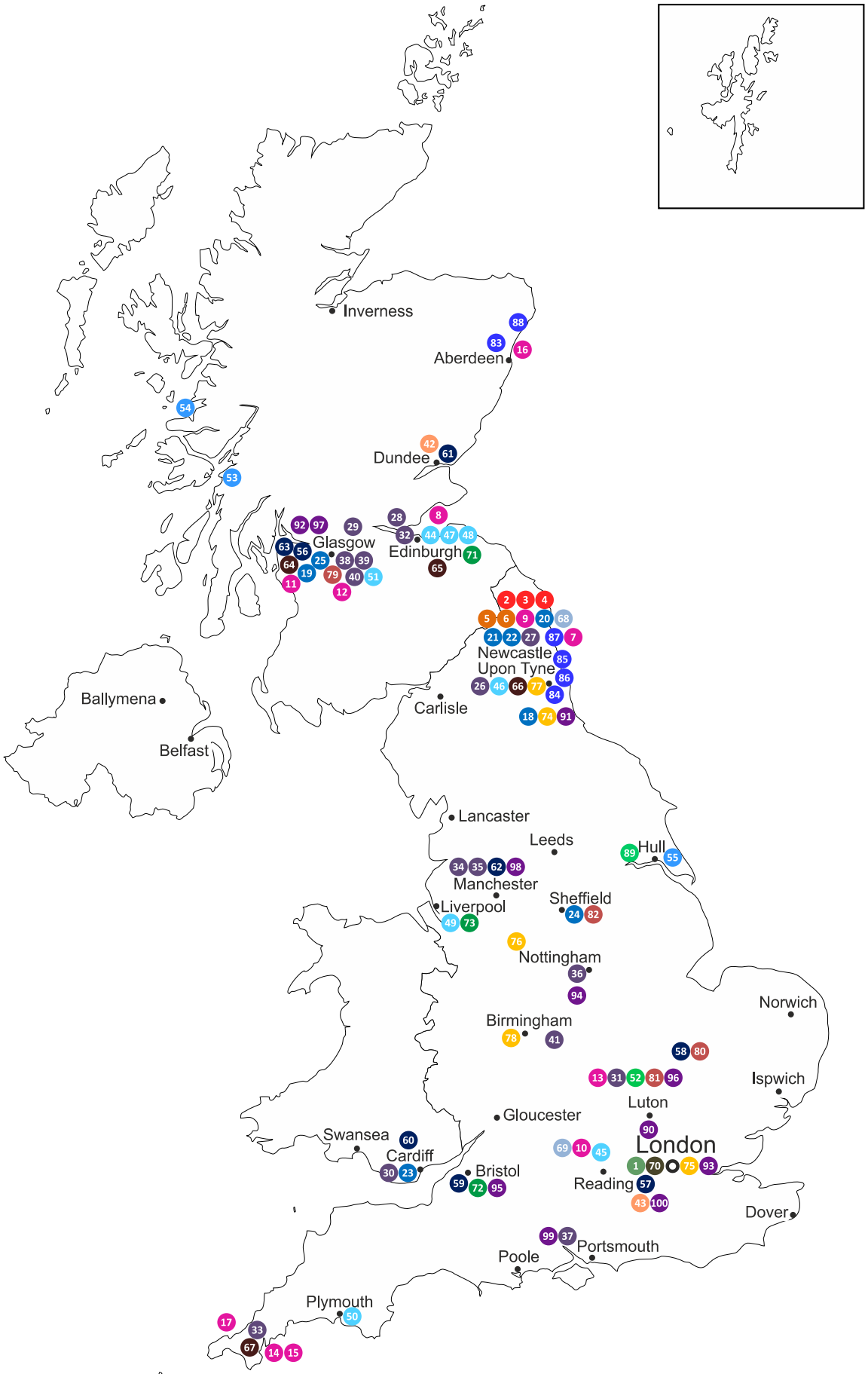

Figure 1: Map of the UK testing and demonstration facilities.

3. Section II: Facility Descriptions

Aeroelastic Testing		
Load Control and Aeroelastics Lab		**1**
Organisation	Imperial College of London	
Location	London	
Type of asset	Laboratory	
Scale of operation	Medium/Large	
Description	Investigation of numerical solutions and modelling strategies to address challenging engineering problems, such as the efficient stabilization of floating wind turbines. Computational simulation approach capable of handling the complex interactions between the local atmosphere, farm aerodynamics, and turbine response in offshore wind farms.	
Typical Testing Activities	- Assessment of aeroelastic effects in the very long (over 100m in diameter) flexible composite blades, in the integration of active load control mechanisms that improve performance and increase fatigue life. - High-fidelity optimization of array design and operation, tailored to a specific site and able to deal with realistic marine atmospheric boundary layer conditions, in particular the very slow dissipation of rotor wakes. - Aeroelastic analysis process for deformable aerofoils or blade sections, including attached and separated flow and dynamic stall phenomena.	
User	Academia/Industry	
Website	http://www.imperial.ac.uk/aeroelastics	

Blade Testing		
50m R&D Blade Test Facility		**2**
Organisation	Offshore Renewable Energy (ORE) Catapult	
Location	Blyth	
Type of asset	Laboratory	
Scale of operation	Medium	
Description	Facility for R&D blade test programmes and upscaling new and innovative blade technologies up to 50m in length.	
Typical Testing Activities	- Structural and mechanical testing of turbine blades. - Robust static and fatigue testing. - Bi-axial fatigue tests. - Blade model validation. - Testing, validation and de-risking of RAS technologies designed to inspect the surface and subsurface of wind turbine blades. - Testing the performance of wind turbine blade leading edge protection systems for blade erosion resistance. - Detailed materials testing analysis.	
User	Academia/Industry	
Website	https://ore.catapult.org.uk/testing-validation/facilities/blades/	

Blade Testing	
100m Blade Test Facility	**3**
Organisation	Offshore Renewable Energy (ORE) Catapult
Location	Blyth
Type of asset	Laboratory
Scale of operation	Large
Description	Capable of testing offshore wind rotor blades designed for +10MW turbine devices.
Typical Testing Activities	- Structural and mechanical testing of turbine blades. - Robust static and fatigue testing. - Bi-axial fatigue tests. - Blade model validation. - Testing, validation and de-risking of RAS technologies designed to inspect the surface and subsurface of wind turbine blades.
User	Academia/Industry
Website	https://ore.catapult.org.uk/testing-validation/facilities/blades/

Blade Testing	
Blade Rain Erosion Test Rig and Laboratory	**4**
Organisation	Offshore Renewable Energy (ORE) Catapult
Location	Blyth
Type of asset	Laboratory
Scale of operation	Medium/Large
Description	State-of-the-art facility for simulating and analysing erosion of wind turbine blades during operation.
Typical Testing Activities	- Testing the performance of wind turbine blade leading edge protection systems for blade erosion resistance. - Blade erosion research. - Detailed materials testing analysis.
User	Academia/Industry
Website	https://ore.catapult.org.uk/testing-validation/facilities/blades/

Cable Testing	
HV & Materials Laboratory	**5**
Organisation	Offshore Renewable Energy (ORE) Catapult
Location	Blyth
Type of asset	Laboratory
Scale of operation	Small/Medium/Large
Description	Open access, UKAS-accredited HV laboratories for electrical ageing and materials analysis. Forensic analysis of materials, including spectroscopic and microscopic suite also includes facilities for hot set testing: with the capabilities to analyse how a breakdown occurs, and take in the wider set of circumstances leading to cable failure. Capability to perform research into new cable materials – from basic analytical research through to new product developments in water-retardant insulation, self-repairing materials, etc.
Typical Testing Activities	- Type certification of HV cable systems, switchgear and other HV insulation systems. - HV insulation breakdown testing up to 6OOkV AC, 1MV DC. - Product development, testing and certification support. - HV bushing and transformer performance testing. - Highly-Accelerated Lifetime Testing (HALT) - Wet age testing. - Karl Fischer Titration testing. - Polymeric materials testing. - Environmental assessment and testing. - Temperature and process data telemetry. - Fault finding, failure investigation and diagnostics. - Static and fatigue mechanical testing.
User	Academia/Industry
Website	https://ore.catapult.org.uk/app/uploads/2017/10/Materials-Lab-Case-Study-Final.pdf

Cable Testing	
Dynamic Cable Test Rig	**6**
Organisation	Offshore Renewable Energy (ORE) Catapult
Location	Blyth
Type of asset	Laboratory
Scale of operation	Large
Description	15-tonne subsea cable bend fatigue test rig. Representative test bed for dynamic submarine cable development. Key features: testing to Cigre TB 623 standard; up to 10 bend cycles per minute over the full test; testing up to three samples simultaneously while fully submerged in seawater; free access to one or both sample ends for electrical testing; performing electrical and mechanical testing simultaneously, and testing within a UKAS-accredited laboratory.
Typical Testing Activities	- Fatigue testing of submarine dynamic floating wind and tidal cables. - Understand failure mechanisms of dynamic subsea cables. - Cable qualification for floating offshore wind and tidal connectors. - Operational research.
User	Academia/Industry
Website	https://ore.catapult.org.uk/press-releases/dynamic-cable-test-rig/

Demonstration Site	
Offshore Demonstrator Wind Farm	**7**
Organisation	EDF Energy Renewables
Location	Blyth
Type of asset	Offshore Technology Demonstration
Scale of operation	Large
Description	It comprises five MHI Vestas 8.3MW wind turbines, with a total generating capacity of 41.5MW, installed on hybrid gravity based foundations at around 6.5 kilometres off the coast of Blyth in approximately 40m water depth. The individual turbines have been connected to around 11 kilometres of buried 66kV offshore cables.
Typical Testing Activities	- Host of new offshore wind technologies designed to help bring down the cost of clean power. - Testing of float and submerge concrete gravity based foundations (GBFs). - First offshore wind project to using 66kV rated connection cables.
User	Industry
Website	https://www.edfenergy.com/media-centre/news-releases/blyth-offshore-wind-farm-project-hits-new-milestone

Demonstration Site	
7MW Demonstration Offshore Wind Turbine	**8**
Organisation	Offshore Renewable Energy (ORE) Catapult
Location	Levenmouth, Fife (Scotland)
Type of asset	Offshore Test Facility
Scale of operation	Large
Description	Open access offshore wind turbine dedicated to research and product validation. Platform for testing innovative technologies and operational settings, with open access to design information; it also offers complementary opportunities for training and development of skills vital for the future of the offshore wind industry. Key features: IEC Class IA/SB; 171.2m rotor diameter; 7MW capacity at grid side; 110.6m hub height; 83.5m blade length; 196m total height blade tip to sea level; medium voltage PMG (3.3kV); full power conversion; medium speed (400rpm); 50Hz rated frequency; 5.9 ~ 10.6rpm rotor speed; 3.5 ~ 25m/s wind speed; Level 1 (IEC 62305-1) lightning protection level; 25 years design life.
Typical Testing Activities	- Product validation of new concepts and technology. - Improve wind resource estimation and standardisation. - Holistic control system development, including control algorithm optimisation. - Prognostic condition monitoring system (CMS) development. - Measurement system development (DAQ, sensors). - Measure and compare real-life data against a controlled test programme. - Structural mechanics. - Aeroelastic and aerodynamic modelling. - Design and analysis tool evaluation. - Testig, validating and demonstrating aerial robotics, autonomous systems (RAS) technologies for remote turbine inspections and repairs, for example Unmanned Aerial Vehicles (UAVs).
User	Academia/Industry
Website	https://ore.catapult.org.uk/app/uploads/2018/01/Levenmouth-7MW-demonstration-offshore-wind-turbine.pdf

Demonstration Site		
27m Turbine Training Tower		9
Organisation	Offshore Renewable Energy (ORE) Catapult	
Location	Blyth	
Type of asset	Onshore Technology Demonstration	
Scale of operation	Medium	
Description	Open access facility, equipped with: a hexagonal working platform mounted over the main tower section designed to allow abseiling from various locations on the tower and a sloping section for rescue training; wind vane and anemometer fitted to the top of the tower; two internal ladders, two internal rest platforms and an internal 2 man power climb lift; anchor points at each platform level for securing personnel and on the upper platform to allow for abseiling, rescue and instruction.	
Typical Testing Activities	- Training programmes for technicians working in the wind industry and at height, both onshore and offshore. - Testing, validation and de-risking of RAS technologies designed to inspect the surface and subsurface of wind turbine blades	
User	Academia/Industry	
Website	http://www.narecde.co.uk/wp-content/uploads/2012/07/Wind-turbine-training-tower.pdf	

Demonstration Site		
Britwind H15 Wind Turbine		**10**
Organisation	Science and Technology Facilities Council (STFC) Rutherford Appleton Laboratory - Energy Research Unit (ERU)	
Location	Didcot	
Type of asset	Onshore Test Facility	
Scale of operation	Small	
Description	Class IV wind turbine erected at RAL in early 2018, and commissioned on the 22nd February by Britwind Ltd Key features: modern horizontal-axis up-wind machine with a tower height of 18m, a 3-bladed rotor with a 13.1m diameter, and rated power of 12kW. The blades are fixed pitch and the rotor operates at variable speed, optimising energy production at low wind speeds (cut-in wind speed: around 3 - 4 m/s, rated wind speed: about 12 m/s, the cut-out wind speed: about 14 m/s). The turbine has extensive instrumentation for the measurement of key parameters, such as power production, current, voltage.	
Typical Testing Activities	- Investigation of technical, integrative and control aspects of wind energy exploitation. - Energy storage projects. - Harwell Ammonia energy storage system demonstrator.	
User	Academia/Industry	
Website	http://www.eru.rl.ac.uk/testfacility_BritwindH15.html	

Demonstration Site	
National Offshore Wind Turbine Test facility (NOWTTF)	**11**
Organisation	Scottish and Southern Energy (SSE)
Location	Port of Hunterston, on the coast of North Ayrshire
Type of asset	Onshore Test Facility
Scale of operation	Large
Description	£20m investment to create an offshore wind turbine test centre capable of hosting three full scale wind turbines designed for offshore deployment. Hunterston's wind resource, which replicates offshore conditions, coupled with its existing grid connection, make it an ideal site for the testing facility. The advantage of testing turbines on land is that it permits the manufacturer 24-hour access to make modifications and repairs, which is critical, particularly for early series prototype turbines. Siemens tested the 6MW direct drive turbine (tip height of 177m with a rotor diameter of 154m) and Mitsubishi Heavy Industries tested the 7MW (tip height of 193.5m with a rotor diameter of 167m), SeaAngel hydraulic drive turbine (completed on July 2018).
Typical Testing Activities	The Siemens SWT 6.0 turbine at Hunterston was used for the turbine Type Certification by Siemens. Key aspects of the testing regime: - Power quality measurement campaign. - Low Voltage Ride Through (LVRT) testing to comply with UK grid compliance. - Single Convertor Operation Functionality (SCO). - Power Boost function testing. - High Temperature Ride Through to ensure that the turbine does not trip in periods of high temperature. Information obtained from the testing of the Siemens turbine at Hunterston has been used in the design of the Beatrice Offshore Wind Farm. Subject to successful verification testing at Hunterston (and Fukushima) MHI intends to supply the new hydraulic drive train to MHI Vestas Offshore Wind.
User	Industry
Website	http://sse.com/whatwedo/ourprojectsandassets/renewables/Hunterston/

Demonstration Site	
National Wind Energy Centre	12
Organisation	TUV SUD NEL
Location	Myres Hill (East Kilbride)
Type of asset	Onshore Test Facility
Scale of operation	Medium/Large
Description	The test site provides a comprehensive measurement and testing service for wind turbines and electrical energy storage systems. The facility is used by designers, manufacturers, researchers, technology developers and end users of all wind turbine systems. Site features: clean wind flow conditions allowing all operating modes to be tested; two 1 MW wind turbines used for R&D projects as well as generating power; test laboratory buildings available; unpopulated area permitting research and development and prototype testing; long-term annual mean wind speed of 7.7m/sat an elevation of 10m above ground; 20 test pads; 80m met mast with cup type and ultrasonic anemometers; the site is supplied with an 11 kV grid connection with a 2.3 MVA capacity.
Typical Testing Activities	- Wind turbine performance evaluation. - Wind speed measurement and site assessment. - Acoustic measurement. - Vibration measurement. - Strain measurement. - Power quality. - Electromagnetic compatibility. - Environmental exposure. - Load measurement. - Intercomparison of wind speed sensing: SODAR, LIDAR, cup, ultrasonic. - Condition monitoring of offshore towers & blades.
User	Academia/Industry
Website	https://www.tuv-sud.co.uk/nel/our-services/activities/calibration-testing/wind-energy-systems/wind-turbine-testing

Demonstration Site	
Wind Turbine Experimental Facility	**13**
Organisation	University of Cranfield
Location	Cranfield
Type of asset	Onshore Test Facility
Scale of operation	Small
Description	Mini wind farm equipped with two small scale wind turbines from Leading Edge (LE-600) and Future Energy (1 kW rated power) connected to a typical consumer energy storage setup based on the smart charging circuit and 24V battery. Both turbines are equipped with wireless sensory circuits powered directly from wind turbine and backed up with large capacity battery. In this configurations the measurements can be performed for a long periods of time. The sensor readings are transferred to control room wirelessly, where they acquired/processed using the corresponding hardware.
Typical Testing Activities	For use for students and research projects in the field of renewable energy generation.
User	Academia
Website	https://www.cranfield.ac.uk/facilities/wind-turbine-experimental-facility

Demonstration Site		
Falmouth Bay Test Site (FaBTest)		14
Organisation	University of Exeter	
Location	Falmouth Harbour	
Type of asset	Offshore Test Facility	
Scale of operation	Small/Medium	
Description	2.8km^2 test area for offshore renewable energy, sheltered from the extreme sea conditions, with easy access to the extensive port infrastructure. 20m-50m water depths, seabed types of rock, gravel and sand.	
Typical Testing Activities	Testing of marine energy technologies, device components, concepts or full-scale devices, moorings and deployment procedures in a moderate wave climate.	
User	Academia/Industry	
Website	http://emps.exeter.ac.uk/renewable-energy/facilities/	

emonstration Site	
South West Mooring Test Facility (SWMTF)	15
Organisation	University of Exeter
Location	Falmouth Harbour
Type of asset	Offshore Test Facility
Scale of operation	Medium/Large
Description	Tidal range (m): 4.7; water depth (m): 28; size of facility – width (m): 3, – length (m): 3; maximum lifting capacity (ton): 3; minimum wave period (s): 4; maximum wave height (m): 6. Data gathered from the test facility used to calibrate numerical models, enhance the physical understanding of the coupled behaviour and obtain understanding of component loading and deterioration.
Typical Testing Activities	Testing mooring systems for offshore renewable energy under real wave, wind, current and tidal conditions.
User	Academia/Industry
Website	http://emps.exeter.ac.uk/renewable-energy/facilities/

Demonstration Site	
European Offshore Wind Deployment Centre	**16**
Organisation	Vattenfall, Technip and Aberdeen Renewable Energy Group (AREG)
Location	Aberdeen Bay
Type of asset	Offshore Test Facility
Scale of operation	Large
Description	Scotland's largest offshore wind test and demonstration facility. The scheme consists of 11 wind turbines (two V164-8.8MW turbines and nine V164-8.4MW turbines), paired with suction bucket jacket foundations, with a total installed capacity of 93.2MW. First power was generated in July 2018, with full commissioning following in September 2018. Power is exported via 66kV subsea cabling, first time that cabling of this capacity has been installed on a commercial offshore wind project in Scotland.
Typical Testing Activities	- Long term environmental monitoring. - Wind resource studies. - New technology testing in the offshore environment and training. - Associated research and scientific functions demonstration, certification, training and accreditation. - €3million scientific research programme to understand the environmental impacts of offshore wind. The programme supports in-depth scientific research and monitoring in a real-time environment and aims at providing insight into the lives of bottlenose dolphins, salmon, sea trouts, sea birds and the communities around the wind farm.
User	Industry
Website	https://corporate.vattenfall.co.uk/projects/operational-wind-farms/european-offshore-wind-deployment-centre/

Demonstration Site	
Wave Hub Test Site	**17**
Organisation	Wave Hub Ltd.
Location	16km offshore from Hayle, Cornwall
Type of asset	Offshore Test Facility
Scale of operation	Large
Description	Key features: four offshore cable connection points; purpose built and commissioned, grid connected infrastructure with a 30MW export capacity, upgradable to 48MW; grid connection at either 11kV or 33kV; fully consented testing environment with a 25 year seabed lease; water depths ranging from 51m - 57m; full range of robust baseline data; proximity to a variety of ports and associated infrastructure; a dedicated operational team.
Typical Testing Activities	- Testing large offshore renewable energy technology and subsea apparatus. - Wave climate monitoring and live wave data.
User	Academia/Industry
Website	https://www.wavehub.co.uk/wave-hub-site

Drive Train/Dynamometer Testing	
Energy Conversion and Drivetrain Research Laboratory	**18**
Organisation	Durham University
Location	Durham
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	Testing of novel machines, rotating systems and components (rotating and power-electronic) at an experimental and pre-industrial level. 75kW Dynamometer test rig to 13000rpm 250Nm – fully controlled load and test on dedicated and adaptable bedplate – four quadrant. 20kW Dynamometer test rig to 5000 rpm and 100Nm – fully controlled load and test on dedicated and adaptable bedplate – four quadrant. Real time power analysis packages, high sample rate to ratings 400A and 2kV. Various AC power supplies - variable frequency to 400Hz, 0 to 300V and 30A. Various DC power supplies – to 600V and 125A and 16kW continuous. Smaller (sub 5kW) drive train test rigs. State of the art measurement and data capture facilities for voltage, current, power, vibration, temperature and control signals.
Typical Testing Activities	- Testing of electrical machine and drive train prototypes to a power rating of 75kW. - Design, prototyping and validation testing of novel electrical generator and converter topologies, magnetic bearing technologies (including their control). - Development of novel condition monitoring approaches. - Drivetrain signature analysis. - Reliability study of electrical machines and drives. - Development of sensors and monitoring algorithms. - Optical torque monitoring. - High-frequency temperature sensing.
User	Academia/Industry
Website	https://www.dur.ac.uk/engineering/research/future-energy/

Drive Train/Dynamometer Testing	
Rotating Machinery Test Facility	**19**
Organisation	Energy Technology Centre
Location	Scottish Enterprise Technology Park Glasgow
Type of asset	Laboratory
Scale of operation	Small/Medium/Large
Description	Drivetrain Test Facility: highly configurable and flexible test rig; motor drive power: 75kW or 110kW, input drive speeds: up to 6000rpm, drive torque: up to 350Nm (expandable with gearbox), dynamometer power: 130kW, dynamometer speed: up to 10000rpm. Facility supported with high quality measurement and data acquisition systems for electrical and mechanical power, loads and related performance data. Supporting infrastructure is installed to absorb up to 285kW electric power. Motoring Dynamometer: power: 7.5kW, speed: 1,500rpm, torque:50 Nm.
Typical Testing Activities	- Testing of multiple drivetrain components including gearboxes, chains, bearings and generators. - Static, dynamic and cyclic loading test regimes. - Investigation of high torque loading on wind turbine drive shaft. - Testing and development of small scale rotating machinery. - Performance characterisation of small wind turbine generators.
User	Academia/Industry
Website	http://www.e-t-c.co.uk/test-facilities/

Drive Train/Dynamometer Testing	
1MW Powertrain Test Rig Facility	**20**
Organisation	Offshore Renewable Energy (ORE) Catapult
Location	Blyth
Type of asset	Laboratory
Scale of operation	Small
Description	Sub-megawatt powertrain and component testing facility for small-scale turbine powertrain systems. This facility allows to carry out reliability and performance appraisals in a controlled environment, helping to identify any potential design issues in a relatively short time period compared to field tests. This helps to reduce the financial risk and improve reliability for developers, before full demonstration. Key features: 1MW continuous shaft input power to test piece; 95kNm max torque; -2000 to 2000rpm speed range; 15 tonnes facility crane capacity; voltage at which power is re-circulated of 400V; 132 channels customer data acquisition; 35kW cooling power available (DUT); SINAMICS S150 variable speed drive.
Typical Testing Activities	- Structural and mechanical testing of turbine drivetrain. - Endurance and extreme load tests, including Highly Accelerated Lifetime Testing (HALT) with multi-axis loading. - System performance tests; including power curve and efficiency assessments and control system verification. - Design system verification and model validation. - Grid compliant testing. - Component validation and conformance testing (gearbox, generator and bearing). - New supplier validation test (major component). - Improvements to physical and numerical models, including condition monitoring validation. - Instrumentation validation and demonstration. -Tear down inspection for failure investigation.
User	Academia/Industry
Website	https://ore.catapult.org.uk/testing-validation/facilities/powertrains/

Drive Train/Dynamometer Testing	
3MW Powertrain Test Rig Facility	**21**
Organisation	Offshore Renewable Energy (ORE) Catapult
Location	Blyth
Type of asset	Laboratory
Scale of operation	Medium
Description	Horizontal axis testing facility, with 6 degrees of freedom Non-Toque Loading (NTL), able to simulate the environmental loads likely to be experienced by wind turbines in operation. It allows to carry out reliability and performance appraisals in a controlled environment, and to identify any potential design issues in a relatively short time period compared to field test, reducing the financial risk and improving reliability for developers, before full demonstration. Key features: 3MW continuous shaft input power to test piece; 5MNm max torque; 30rpm max speed; 14.3MNm max bending moment; 4MN max radial force; 4MN max axial thrust; 125 tonnes facility crane capacity; voltage at which power is re-circulated of 11kV; 400 channels customer data acquisition; 900kW cooling power available (DUT).
Typical Testing Activities	- Structural and mechanical testing of turbine drivetrain. - Endurance and extreme load tests, including Highly Accelerated Lifetime Testing (HALT) with multi-axis loading. - System performance tests; including power curve and efficiency assessments and control system verification. - Design system verification and model validation. - Grid compliant testing. - Component validation and conformance testing (gearbox, generator and bearing). - New supplier validation test (major component). - Improvements to physical and numerical models, including condition monitoring validation. - Instrumentation validation and demonstration. -Tear down inspection for failure investigation.
User	Academia/Industry
Website	https://ore.catapult.org.uk/testing-validation/facilities/powertrains/

Drive Train/Dynamometer Testing	
15 MW Wind Turbine Nacelle Test Facility	**22**
Organisation	Offshore Renewable Energy (ORE) Catapult
Location	Blyth
Type of asset	Laboratory
Scale of operation	Large
Description	Facility with 6 degrees of freedom Non-Torque Loading (NTL). capable of performing independent performance, validation, functionality, endurance and compressed life testing of components, sub-assemblies, sub-systems and full systems dynamically in a controlled onshore environment up to 15MW rating. Testing capability: dynamic torque, axial and radial force and bending moment application to emulate operational conditions, unbalanced rotor, brake emulations, condition monitoring and control system validation tests. Key features: 15MW continuous shaft input power to test piece; 14.3MNm max torque; 30rpm max speed; 56MNm max bending moment; 8MN max radial force; 4MN max axial thrust; voltage at which power is re-circulated of 11kV; 2x250 tonnes crane capacity; 800 channels customer data acquisition; 8.1m test rig shaft height.
Typical Testing Activities	- Structural and mechanical testing of turbine drivetrain. - Endurance and extreme load tests, including Highly Accelerated Lifetime Testing (HALT) with multi-axis loading. - System performance tests; including power curve and efficiency assessments and control system verification. - Design system verification and model validation. - Grid compliant testing. - Component validation and conformance testing (gearbox, generator and bearing). - New supplier validation test (major component). - Improvements to physical and numerical models, including condition monitoring validation. - Instrumentation validation and demonstration. -Tear down inspection for failure investigation.
User	Academia/Industry
Website	https://ore.catapult.org.uk/testing-validation/facilities/powertrains/

Drive Train/Dynamometer Testing		
Machines Lab		23
Organisation	University of Cardiff	
Location	Cardiff	
Type of asset	Laboratory	
Scale of operation	Small/Medium	
Description	Asynchronous wind mill (Turco), with control unit that could mimic the operation of a wind turbine. DFIG test rig (LUCAS NULLE) - the servo machine testing stand and the WindSim software allow to emulate down to precise detail the effect of wind force and the mechanical design of wind power stations. The control unit for the double-feed asynchronous machine permits user-friendly operation and visualisation during the experiments.	
Typical Testing Activities	- Investigation of self-exciting of an induction generator, principles of DC energy transfer using a 4-quadrent rectifier. - Investigation of the design and operation of modern wind power stations.	
User	Academia/Industry	
Website	https://www.cardiff.ac.uk/research-equipment/facilities/view/machines-lab	

Drive Train/Dynamometer Testing	
Electrical Machines & Drives (EMD) Laboratory	**24**
Organisation	University of Sheffield
Location	Sheffield
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	300kW Dynamometer (Control Techniques): 4-Quadrant, 3500rpm rated speed, 2800Nm rated torque, Lebow 5kN (In-Line) torque transducer. 12kW Dynamometer (IBAG Switzerland AG): 4-Quadrant, 42500rpm rated speed. 6.9kW Dynamometer (Lenze): 4-Quadrant, 5000rpm rated speed, 37Nm rated torque. 120kW (cont.) 150kW (1 min) Dynamometer (AVL LIST GmbH): 4-Quadrant, 20000rpm rated speed, 120Nm rated torque. 1kW Dynamometer (Vibrometer): 2-Quadrant, 70000rpm rated speed. Direct drive test rig. Prototype facility, lamination and magnet cutting for wind turbine generator prototypes: CNC Wire Eroder (EDM), Laser Welder, Magnetiser, CNC Lathe, CNC Milling Machine, CNC PCB Milling Machine, Vacuum Impregnation Chamber, Laser Ablation System. Range of ventilated, acoustically insulated test cells.
Typical Testing Activities	- Development of novel modular direct drive permanent magnet generators, converter topologies and control strategies. - Prototyping and testing of new generator topologies. - From design concept to final product operation. - Investigation of active and reactive power control. - Assessment of interference between grid and machines. - Influence of grid unbalance and machine/converter unbalance. - Fault detection and condition monitoring. - Acoustic noise and vibration.
User	Academia/Industry
Website	https://www.sheffield.ac.uk/eee/research/emd/emdfacilities

Drive Train/Dynamometer Testing	
Powertrain Testing Facilities	**25**
Organisation	University of Strathclyde
Location	Glasgow
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	Small 10kW test rig (1/100th scale): the prime mover is a 15kW induction machine (with a step down gearbox) supplied by a Control Techniques UniDrive SP unit, allowing for variable torque and speed input; torque and speed 'drive cycle' profiles can be pre-programmed using the SypTPRO drive software; low speed and high speed shaft torque meters, along with electrical power measurements from the drive unit, allow mechanical-to-mechanical and mechanical-to-electrical efficiency measurements to be performed. Large 100kW test rig (1/10th scale): devices under test are in a mechanical closed loop and rotation is unidirectional; torque and speed input into the gearboxes under test can be varied; modern control and data acquisition systems for capturing sensor data such as torque, speed, vibration, temperatures and oil quality. The test rigs include components that are found in turbine powertrains and other rotating plant.
Typical Testing Activities	- Testing of speed/torque converting assemblies and power generating equipment used in renewable energy device at a range of scales. - Testing of small wind turbine nacelles, gearboxes and generators in an electrical back-to-back configuration. - Testing of gearboxes (and their auxiliary systems) of a typical architecture found in modern multi-MW turbines. - Wind turbine drive train and rotating machines condition monitoring for diagnostics and prognostic. - Wind turbine drivetrain and generator design. - Sensors and sensor system design – condition monitoring hardware.
User	Academia/Industry
Website	https://www.strath.ac.uk/research/subjects/electronicelectricalengineering/instituteforenergyenvironment/windenergycontrol/

Electrical Systems Testing	
Power Electronics, Drives and Machines Lab	**26**
Organisation	Newcastle University
Location	Newcastle
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	Research using state-of-the-art equipment housed in a purpose-built research laboratory. Test rigs suitable for testing a large range of mechanical and electrical machines and drives for renewable applications: Torquemeters 100kW Dynamometer; Torquemeters 500kW Dynamometer; Magtrol Custom Motor Test System; Control Techniques 10kW Dynamometer; Control Techniques 15 kW Dynamometer. Environmental chambers used to test the effects of specific environmental conditions on electronic devices and components: Binder Environmental Simulation Chamber; Cosmotec Industrial Water Chiller; LOC Air Oil Cooler.
Typical Testing Activities	- Testing of power systems, drives and controls, machines, energy storage, hybrid electric aerospace equipment and power electronics. - Fault tolerance testing. - Condition monitoring.
User	Academia/Industry
Website	https://www.ncl.ac.uk/engineering/about/facilities/electricalelectronicengineering/

Electrical Systems Testing	
Grid Emulation (eGrid)	27
Organisation	Offshore Renewable Energy (ORE) Catapult
Location	Blyth
Type of asset	Laboratory
Scale of operation	Medium/Large
Description	18MVA system that allows to simultaneously test mechanical and electrical systems, in order to evaluate electrical performance, gain critical performance data and achieve grid-compliant assurance. It allows the testing of various wind turbine configurations. By emulating AC grid voltage, current, frequency and power balance, the system allows the simulation of abnormal conditions that wind and tidal turbines might experience in the field. The fully containerised Grid Emulation System can becused in the 15MW wind turbine nacelle/powertrain test facility and 3MW marine nacelle/powertrain test facility.
Typical Testing Activities	- Grid compliant testing. - Evaluate electrical performance. - Provide critical performance data. - Provide grid compliance assurance.
User	Academia/Industry
Website	https://ore.catapult.org.uk/stories/egrid/

Electrical Systems Testing	
Electric Motor & Generator Test Facility	**28**
Organisation	Parsons Peebles
Location	Rosyth
Type of asset	Test Centre
Scale of operation	Large
Description	High voltage test facility for full performance testing, including extensive facilities for both on-site and in-house testing to international specifications and standards. Factory Test Capacity: covering up to 13.8KV; induction motors-direct load testing up to 8 MW at 60 Hz and 7.5 MW at 50 Hz; generators- up to 35 MW, Zero PF, rated current, rated excitation, using state-of-the-art equipment. Induction motors can be tested at 50 or 60 Hertz to BS EN/IEC60034 with ratings up to 15000 kW. Synchronous Motors and Generators can be tested at 50 or 60 Hertz with ratings up to 40 MVA. Testing to IEEE (USA) requirements can also be undertaken. Full onsite analysis, repairs, site removal and installation of motors and generators.
Typical Testing Activities	- No load losses and magnetisation characterisation. - Temperature rise using direct loading or using the superposition or CVF methods. - Direct on line starting capability at both 50 and 60 Hz and Locked rotor tests including torque measurement. - Vibration measurement, recording analysis and noise testing. - Winding HV testing up to 33 kV with 100 kVA capacity. Purging and pressurising certification testing for hazardous areas.
User	Industry
Website	https://www.parsons-peebles.com/services/motor-generator-services/

Electrical Systems Testing	
UK HVDC Test Centre	**29**
Organisation	Scottish and Southern Energy (SSE)
Location	Cumbernauld
Type of asset	Test Centre
Scale of operation	Large
Description	The technology centre, first of its kind in the UK, allows the energy industry to simulate real life conditions to test and de-risk the use of high voltage direct current (HVDC) on the electricity network in Great Britain. It provides an industry-wide collaborative testing facility for electricity Transmission Owners and Operators, suppliers, developers and academic institutions to simulate the use of HVDC technology on the GB electricity network. The Centre hosts control replicas from the Caithness–Moray HVDC scheme allowing extensive testing of its interactions with the rest of the UK system, especially other HVDC schemes and power electronic systems.
Typical Testing Activities	- Undertaking detailed studies on the operation of HVDC (and other power electronics), on GB's transmission network, focusing on real-time simulation (including innovation). - Computer simulators, which replicate the electricity network in real time, to allow engineers to study the impact the HVDC systems can have to identify and mitigate any risks in a safe test environment before the technology goes live on the network. - Advise on the design, development and operation of HVDC schemes. - Diagnosis of network issues. - Build operational and technical knowledge to reduce risks associated with HVDC deployment.
User	Academia/Industry
Website	https://www.hvdccentre.com/

Electrical Systems Testing	
Power Electronic Lab	**30**
Organisation	University of Cardiff
Location	Cardiff
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	Full power converter test rig, motor-generator unit with required power electronic circuitry. The system includes a digital signal processor to implement control algorithms and a higher level controller based on dSPACE to interface with the user. Multi-terminal High Voltage DC, Voltage Source Converter based multi-terminal DC system with three terminals. Two permanent magnetic synchronous generators generate controllable amount of electricity. Each converter is rated at 5.5 kW, 400 V.
Typical Testing Activities	- Investigation of wind turbine full power converters. - Investigation of wind farms and grid connections.
User	Academia/Industry
Website	https://www.cardiff.ac.uk/research-equipment/facilities/view/power-electronic-lab

Electrical Systems Testing	
Electrical Machine Test and Validation Platform	**31**
Organisation	University of Cranfield
Location	Cranfield
Type of asset	Laboratory
Scale of operation	Small
Description	This facility is equipped with a programmable loading dyno unit, high accuracy vibration and acoustic data acquisition modules, and in-house characterisation tools that incorporate other on-line data to generate efficiency maps, characteristic curves and other key performance indicators. The research platform has precise speed control of up to 3000rpm and programmable load output of up to 5kW. The system is further equipped with flexible shaft connector to alleviate vibrations caused by shaft misalignment and imprecise connections.
Typical Testing Activities	- Emulation of power network and micro smart grid system, servo drive system tests, and performance validation for different types of electrical machines and their controllers. - Analysis of the steady and transient performance of wind power machines.
User	Academia/Industry
Website	https://www.cranfield.ac.uk/facilities/electrical-machine-test-and-validation-platform

Electrical Systems Testing	
Electrical Machines and Power Electronics Test Laboratory	**32**
Organisation	University of Edinburgh
Location	Edinburgh
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	Extensive range of test facilities for power performance measurement of different electrical power generation equipment used in renewable and low carbon energy sectors. Key Features: 20 kW direct drive slow speed rotary motor generator test bed; 20 kW direct drive 4 pole rotary motor generator test bed; 20 KVA fully variable speed hybrid wind-diesel test system – network connected with power conversion; 15 kW wind turbine generator test platform, network connected with power conversion at Myres Hill; 50 kW linear machine test bed at NEL; wet linear test bed for flooded machines and bearings.
Typical Testing Activities	- Novel Generator Designs for Renewable Power Generation. - Thermal and Mechanical Analysis for Electrical Machines. - Power Conversion and Control for Renewable Energy Converters. - HVDC converters for offshore power transmission. - Hybrid Power Systems.
User	Academia/Industry
Website	https://www.eng.ed.ac.uk/research/themes/electrical-power-conversion

Electrical Systems Testing	
Electrical Power Systems Laboratory	**33**
Organisation	University of Exeter
Location	Penryn
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	The hardware includes Real time Simulator, Dspace 1103 Control unit, 11kW four quadrant dynamometer, 60k Grid connected inverters, a microgrid setup, Power analyser and scopes. The software includes Matlab, ETAP, PSCAD, LabView, JMAG, ANSYS, Plexim, Ansys. Additionally the laboratory has the capability of integrating small machine and for testing power conditioning systems.
Typical Testing Activities	- Emulation of electrical grid network and model of the impact of different electrical generators such as wind turbines on grid voltage and frequency. - Development of controllers for power electronics to integrate renewable energy sources to the grid.
User	Academia/Industry
Website	http://emps.exeter.ac.uk/renewable-energy/facilities/#tab1

Electrical Systems Testing	
Power Electronics, Machines and Drives Test Laboratory	**34**
Organisation	University of Manchester
Location	Manchester
Type of asset	Laboratory
Scale of operation	Small
Description	Key features: fully instrumented vector control 30kW DFIG (i.e. Type III wind turbine drive) facility; fully instrumented fully rated 5.5. kW PM test rig (i.e. Type IV wind turbine drive); fully instrumented 7.5kW extended slip Wound Round Induction Machine (WRIM) test bench.
Typical Testing Activities	- Measuring properties of electrical machines and power converter systems. - Replication of electrical and mechanical (bearings/misalignment) faults. - Replication of electrical and mechanical generator faults.
User	Academia
Website	https://www.eee.manchester.ac.uk/research/expertise/power-conversion/

Electrical Systems Testing	
National Grid Power Systems Research Centre	**35**
Organisation	University of Manchester
Location	Manchester
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	Key features: 2MV impulse generator; 800kV AC test set; 600kV DC test set; 20kVA high current source; salt fog and environmental test chambers; modern digital measurement equipment; material processing and characterisation equipment; RIV measurement systems; UV inspection facilities for corona monitoring; high voltage environment chambers for testing of equipment in harsh environments; anechoic chamber, with 200kV input for noise and corona measurements.
Typical Testing Activities	- High voltage testing of equipment used at all voltages of the power system. - Noise and corona analysis. - Insulation system development and testing. - Condition monitoring of high voltage plant (switch gear and transformers). - Assessment of new materials. - Forensic analysis.
User	Academia/Industry
Website	https://www.eee.manchester.ac.uk/research/facilities/high-voltage-lab/

Electrical Systems Testing	
Power Electronics, Machines and Control (PEMC) Testing Facilities	**36**
Organisation	University of Nottingham
Location	Nottingham
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	The PEMC has a variety of testing and demonstration facilities, including environmental chambers, dynamometers, X-ray tomography equipment, wire electrical discharge machining, power device packaging facilities and programmable ac sources (270kVA). Programmable electronic supplies (AC/DC) and loads. A number of test rigs are available for testing machines of different sizes, speeds and load ratings. A dedicated High Speed Area and High Power Area provide specialised testing capabilities with a Froude Hofmann 800kW dynamometer, and a remotely monitored High Speed Area allows safe testing at speeds up to 120,000rpm (Torquemeters 50 kW Dynamometer).
Typical Testing Activities	- Power electronic conversion systems. - Power electronic components (including reliability testing and thermal characterisation). - Motor drives and motor control. - Electrical machines testing. - Magnetic material characterisation.
User	Academia/Industry
Website	https://www.nottingham.ac.uk/research/groups/power-electronics-machines-and-control-group/facilities/facilities.aspx

Electrical Systems Testing	
Tony Davies High Voltage Laboratory (TDHVL)	**37**
Organisation	University of Southampton
Location	Southampton
Type of asset	Laboratory
Scale of operation	Small/Medium/Large
Description	State-of-the-art facilities, supported by a specialist HV engineering team. Key features: 2 main high voltage halls, 15 discrete high-voltage test areas, temperature and humidity controlled room 5-50oC, 10-80%RH, Faraday room, environmental/salt-fog chamber, Forensic Rooms (X-ray analysis, Raman microprobe and IR spectroscopy).
Typical Testing Activities	- Research into dielectric materials and insulation systems, as well as high voltage and related phenomena. - Condition monitoring of HV assets. - Electrical, thermal, mechanical and optical characterisation. - Partial discharge, capacitance and tan delta measurements.
User	Academia/Industry
Website	https://www.highvoltage.ecs.soton.ac.uk/facilities-and-testing-capabilities

Electrical Systems Testing	
Distribution Network & Protection Laboratory	**38**
Organisation	University of Strathclyde
Location	Glasgow
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	£1M experimental facility comprising a 100 kVA microgrid set with digital partial discharge (PD) detection equipment, hardware-in-the-loop capability, integrated with a real-time digital network simulator and protection injection laboratory, and incorporating induction machines, programmable load banks, various 1/3 phase inverters and a communications system simulator for testing of smart grid technologies. The facility can be used for hardware in the loop (HIL) simulation, preset scenario playback and demonstration of system behaviour in islanded mode. Different demonstrations and tests can be performed in each mode. It supports basic research, Rolls-Royce UTC activities, and engagement with European research organisations via the EU Distributed Energy Research Infrastructure (DERri) and Distributed Energy Resources Laboratories (DERLab) programmes.
Typical Testing Activities	- Testing of power system protection relays. - "Replaying" of fault events through protection relays and/or models of protection relays. - Development and testing of new/modified protection relay algorithms. - Modelling of anticipated protection relay responses under various scenarios. - Detailed power system and protection system modelling. - Real time system level testing of novel communications based protection schemes. - Testing of intelligent network management and control methods for future smart grid and microgrid applications.
User	Academia/Industry
Website	https://www.strath.ac.uk/research/subjects/electronicelectricalengineering/instituteforenergyenvironment/advancedelectricalsystems/

Electrical Systems Testing	
High Voltage Technologies & Electrical Plant Diagnostics	**39**
Organisation	University of Strathclyde
Location	Glasgow
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	Key facilities: David Tedford High Voltage Technologies Laboratory (20 × 12 × 10 m); Fully equipped interlocked test bays, high current and high voltage supplies and screened rooms with filtered power supplies; LDS-6 digital partial discharge (PD) test & measurement system; Marx impulse generators, GIS test rigs (including a 500 kV encapsulated transformer), vacuum test vessels and environmental chambers; Pulsed power components, systems and industrial applications of the technology; PD research capabilities (gaseous, liquid and solid insulation); High frequency diagnostics (UHF PD detection and location); UHF sensor design and calibration; PD detection and location in MV cable networks; Electromagnetic modelling, on-site testing and consultancy.
Typical Testing Activities	- PD monitoring in substations and power transformers. - Application of ultra-high frequency (UHF) techniques to locate defects in power transformers. - Development of multiple-defect location techniques. - Investigation of electromagnetic energy harvesting techniques for powering autonomous wireless sensors. - PD detection and location in HV distribution cables. - Fault location in cable networks. - EMC issues in substations. - Performance of non-conventional lightning protection systems.
User	Academia/Industry
Website	https://www.strath.ac.uk/research/subjects/electronicelectricalengineering/instituteforenergyenvironment/highvoltagetechnologieselectricalplantdiagnostics/

Electrical Systems Testing	
Power Networks Demonstration Centre	**40**
Organisation	University of Strathclyde
Location	Glasgow
Type of asset	Technology Demonstration
Scale of operation	Medium/Large
Description	13,000 sq. ft. facility comprising a real 11kV and LV network environment representative of various power networks, secure test bays, MW-scale Motor Generator (MG) Set, dedicated SCADA control room, electrical vehicle charging bay and real-time simulation suite. Key Features: both primary and secondary equipment connected together in a reconfigurable way (using HV and LV switchgear) to provide representation of typical urban, semi-urban and rural networks at 11kV and 400V. These can either be directly connected to the grid at HV or run in islanded mode using a motor-generator. Decoupling from the grid allows the operation of the network with variable frequency or voltage to replicate transients that can be pre-recorded or simulated in real time. The network is composed of typical cables and overhead lines, together with protection and automation schemes, to allow analysis of system behaviour under various load/generation profiles and disturbed conditions. The network has also the capability to apply resistive and earth faults at 11kV and 400V.
Typical Testing Activities	- Testing, demonstration and development work associated with smart grids and power network integration of renewables, electric vehicles and energy storage. - Testing and evaluation of new forms of generation, network components, control room tools, load management and storage systems. - Pre-commercial testing of HV and LV equipment and secondary control, protection and measurement systems. - Developing, accelerated testing and validation of new low carbon technologies under a range of challenging power system scenarios.
User	Academia/Industry
Website	https://www.pndc.co.uk/

Electrical Systems Testing	
Power Electronics Applications Lab	**41**
Organisation	University of Warwick
Location	Coventry
Type of asset	Laboratory
Scale of operation	Small
Description	Laboratory dedicated to electrical measurements on power semiconductor devices, allowing the testing of devices at voltages up to 8kV. Key features: Agilent B1500A semiconductor device analyser, Agilent E4980A LCR meter, Agilent spectrum analyser, Probe station, Mercury probe station. Power semiconductor device test rigs: Back-to-back inverter test rig, Inductive switching test rig, power cycling test rig.
Typical Testing Activities	- IGBT heat flux health monitoring for wind turbine power converters. - Condition monitoring of power electronic converters in offshore wind turbines. - Development of sensors/sensing for improved condition monitoring of wind turbine power electronics. - Investigation of degradation of power electronics during variable offshore wind turbine operation.
User	Academia/Industry
Website	https://warwick.ac.uk/fac/sci/eng/research/grouplist/electricalpower/powerelecapps/

Foundations	
Geotechnical Laboratory	42
Organisation	University of Dundee
Location	Dundee
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	Geotechnical centrifuge: 3.5m diameter, 150 g-tonne beam centrifuge (Actidyn C67-2), servo-hydraulic earthquake simulator capable of delivering seismic accelerations of any target waveform up to 0.8g, fault-rupture simulator, climate simulation chamber, 3-axis in-flight loading system (robot), high capacity combined vertical and rotational loading system, high capacity lateral loading system, multi direction monotonic and cyclic load capabilities, horizontal drag apparatus (ploughing, anchors), high resolution image capturing systems for soil deformation tracking and GeoPIV analysis, large stock of soil and structural mounted transducer/sensor arrays (e.g strain gauging, accelerometers, pore pressure transducers). Independent linear actuators and large 1g model development and testing facilities with manual and automated soils sample preparation systems (Large sample box 2.5 m×1.5 m×0.75 m plus multiple smaller simulation rigs). Instrumentation and mobile (modular) data acquisition. Cyclic and stress path controlled triaxial systems with strain measurement capabilities. Direct shear apparatus (conventional and large-volume/large-displacement). Oedometer cells (including constant rate of strain).
Typical Testing Activities	- Scaled physical modelling of new foundation and anchoring technologies. - Testing scale geotechnical/foundation models from 1:10-1:100th scale at full scale or prototype stresses. - Sustained acceleration life testing of individual components. - Soil characterisation. - Development of foundation and anchoring systems in a controllable and repeatable environment.
User	Academia/Industry
Website	https://www.dundee.ac.uk/engineering/facilities/details/geotechnical-laboratory.php

Foundations	
SAGE (Surrey Advanced Geotechnical Engineering) Lab	**43**
Organisation	University of Surrey
Location	Guildford
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	Geotechnical testing facility within the Department of Civil and Environmental Engineering at the University of Surrey. Key facilities: Cyclic Triaxial Apparatus, Resonant Column Apparatus, Dynamic Simple Shear Apparatus, Triaxial with Local Measurement (Bender Element), Large Calibration Chamber (2.4m × 1.4m × 2.6m) with a transparent front for shaking table tests, Small Calibration Chamber (450mm × 200mm × 400mm) with a transparent front for 1-g and shaking table tests.
Typical Testing Activities	- Geomechanics research. - Advanced soil testing, including element testing of soil to understand the cyclic behaviour including liquefaction susceptibility and also multi-stage test and construction of bespoke p-y curves (Winkler Springs for pile-soil analysis); shear modulus and damping characterisation of soils; simple shear tests on soils applying hundreds of thousands of cycles. - Scaled model tests for different geotechnical problems, such as the behaviour of offshore wind turbines under cyclic and dynamic loading, behaviour of pipelines crossing a fault, and other Dynamic Soil-Structure Interaction (DSSI) issues. - Vibration monitoring of small scale models using non-contact devices, shaking table tests for small scale models and development of customized sensors (e.g. water proof MEMS accelerometers).
User	Academia/Industry
Website	https://www.surrey.ac.uk/department-civil-environmental-engineering/research/geomechanics-group

Hydrodynamics		
Wave Basin		44
Organisation	Heriot-Watt University	
Location	Edinburgh	
Type of asset	Laboratory	
Scale of operation	Small/Medium	
Description	Key Features: 12m x 12.4m wave basin with a working water depth of 3m and a deep pit of 5m in depth; wave making system of electro-mechanical flap-type wave makers across the width of the tank at one end; parabolic mesh beach at the other end of the tank to dissipate most of the wave energy; both long-crested and short-crested waves can be produced by 24 wave paddles, each 0.5m wide and independently controlled; regular and random waves in the frequency range of 0.2 – 2.5Hz.	
Typical Testing Activities	- Simulation of any sea condition. - Experimentation and development of offshore devices and structures.	
User	Academia/Industry	
Website	https://www.hw.ac.uk/schools/energy-geoscience-infrastructure-society/about/facilities/built-environment-testing-facilities.htm	

Hydrodynamics		
Fast Flow Facility (F3)		45
Organisation	HR Wallingford	
Location	Wallingford	
Type of asset	Laboratory	
Scale of operation	Medium/Large	
Description	Dual-channel, race track shaped flume with waves, fast tidal currents and sediment capabilities. Key features: working channel size of 57m by 4m (main) and 50m by 2.6m (secondary), water depth range 0.8m to 2m, 1m deep (16 m^3) test pit for sediment or subsurface studies, hinge flap type multi-element wavemaker with active wave absorption, wave heights up to 0.5m and maximum wave height 1.0m, reversible pumps to simulate unidirectional or tidal currents, with discharge capacity to generate flows of over 2m/s.	
Typical Testing Activities	- Wave-current-sediment-structure studies. - Foundation stability and scour protection. - Seabed-structure interaction. - Wave-current interaction. - Sediment transport under flows, waves and currents. - Floating structures.	
User	Industry	
Website	http://www.hrwallingford.com/facilities/fast-flow-facility	

Hydrodynamics	
Hydrodynamics Laboratory	46
Organisation	Newcastle University
Location	Newcastle
Type of asset	Laboratory
Scale of operation	Small
Description	The combined Wind Wave Current Tank was designed to allow the three sea-states of wind, waves and current to be applied individually, or in combination with equal emphasis. The Wind Wave Current Tank was designed for small scale model testing for renewable energy devices. Key features: 1.8m Width; 1m Normal water depth; 1m Air clearance; 3m Central measurement section; 1m/s Maximum water velocity; 20m/s Maximum wind velocity. Wave Capability: Pierson-Moskowitz JONSWAP Bretschneider Neumann Spectra; 0.8 – 4sec Period range; 0.02 – 0.12m (period dependent) Wave height.
Typical Testing Activities	- Resistance testing in calm water and waves. - Seakeeping of vessels and floating structures. - Wave resistance of offshore structures using regular, irregular and focused waves. - Transportation and deployment of offshore structures. - Proof of concept testing. - Development and validation of computational modelling. - Flow visualisation. - Combined interaction as well as individual effects of wind, waves and current.
User	Academia/Industry
Website	https://www.ncl.ac.uk/media/wwwnclacuk/marinescienceandtechnology/files/hydrodynamics-brochure.pdf

Hydrodynamics	
FloWave Ocean Energy Research Facility	**47**
Organisation	University of Edinburgh
Location	Edinburgh
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	30m circular concrete basin containing the 25m diameter, 5m deep wave and current tank. Containing more than 2.4 million litres of water the test tank is divided into upper and lower volumes, separated by a 1m thick moveable floor. The 2m deep upper test volume is circumferentially ringed by 168 absorbing wave makers, whilst the lower volume contains the twenty-eight flow-drive units that can simultaneously and independently drive current across the upper test volume in any relative direction, with maximum current velocities of 1.6 metres per second. The rising tank floor and 5t overhead crane enable quick and easy installation of individual devices, or arrays, and the typically 3 minute settle time between tests combine to enable very efficient, effective and data-intensive test campaigns.
Typical Testing Activities	- Testing of impact of current on offshore devices in a controlled environment, prior to field Testing and commercial deployment. - Physical validation of computational layout models of small arrays of devices.
User	Academia/Industry
Website	https://www.flowavett.co.uk/

Hydrodynamics	
Curved Wave Tank	48
Organisation	University of Edinburgh
Location	Edinburgh
Type of asset	Laboratory
Scale of operation	Small
Description	Key features: water depth 1.2m, paddle depth 0.7m; deep water facility, offer testing scale of c. 1:70 - 1:100; 48 wavemakers in a 9m arc, whose incline angle is just over 90 degrees; absorbing wavemaker paddles and force control based on strain-gauge; Edinburgh Designs technology for control systems; Edinburgh Design conductivity wave gauge (2 x WG8), up to 16 locations, automated wave gauge calibration; 1 optical wave gauge; video motion tracking device providing real time displacement information, 6 degrees of freedom, accurate positioning of markers.
Typical Testing Activities	- Testing small-scale models of wave energy devices and other marine technologies in multi-directional seas. - Uni and multi-directional sea state. - Wave/Sea state measurement. - Compile sea state measurements.
User	Academia/Industry
Website	https://www.eng.ed.ac.uk/research/facilities-and-resources/small-research-facilities/curved-wave-tank

Hydrodynamics		
National Oceanography Centre		49
Organisation	University of Liverpool	
Location	Liverpool	
Type of asset	Laboratory	
Scale of operation	Small/Medium	
Description	Key features: Systems reliability lab with freshwater and saltwater ballasting tanks; environmental test chamber with shaker; pressure testing facility, including two hyperbaric pressure testing facilities and an immersion test tank; salt spray test chamber; co-ordinate measuring machine room; battery testing facility; calibration laboratory; communication aerial mast; waterfront launching capability.	
Typical Testing Activities	Testing of marine autonomous vehicles.	
User	Academia/Industry	
Website	https://www.noc.ac.uk/facilities/laboratories-workshops-testing-facilities	

ydrodynamics	
Coastal, Ocean And Sediment Transport (COAST) Laboratory	**50**
Organisation	University of Plymouth
Location	Plymouth
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	Flexible facility with the capability to generate short and long-crested waves in combination with currents at any relative direction, sediment dynamics, tidal effects and wind. Ocean Wave Basin: 35m long by 15.5m wide with a moveable floor that allows different operating depths of up to 3m; creation of unidirectional and directional wave fields, regular waves, wave spectra and currents in three dimensions. Coastal Basin: 15.5m long by 10m wide with a maximum operating depth of 0.5m; creation of regular waves with a peak wave height of 0.32m; wave synthesising software allows long and short-crested spectral sea states to be generated, as well as special wave effects. Sediment Flume (35m long with a working section of 0.6m wide and a maximum still water depth of 0.8m) and Tilting Flume (20m long with a working section of 0.6m wide by 0.6m deep) with the capability to be tilted, enabling smooth current to be modelled without disturbing the wave signal.
Typical Testing Activities	- Physical model testing with combined waves, currents and wind, offered at scales appropriate for device testing, array testing, environmental modelling and coastal engineering. - Study of sediment transport and coastal structures at scale in a controlled environment. - Controlled study of wave-current interaction and wave-current-device interaction. - Coastal and ocean engineering research.
User	Academia/Industry
Website	https://www.plymouth.ac.uk/research/institutes/marine-institute/coast-laboratory

Hydrodynamics	
Kelvin Hydrodynamics Laboratory	**51**
Organisation	University of Strathclyde
Location	Glasgow
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	Hydrodynamic test tank, providing state-of-art conditions for measuring forces and motions on fixed and floating bodies in wave and current environments under highly repeatable and controllable conditions. Key Features: Tank dimensions - 76 m (L) x 4.6 m (W) x 2.5 m (D). Carriage - Computer-controlled digital drive: max speed 5 m/s, equipped with digitally-controlled sub-carriage. Wavemaker - Variable-water-depth computer-controlled four-flap active-absorbing wavemaker generating regular and irregular waves over 0.5 m height (subject to water depth). Beach - Variable-water-depth sloping beach; reflection typically < 5%. Instrumentation - A range of state-of-art instrumentation including real-time non-contact motion capture, force and pressure measurement, non-intrusive and traditional wave measurement, and PIV flow measurement, allied to sophisticated data acquisition.
Typical Testing Activities	- Investigation of the operational performance and survivability of floating structures/foundations and support vessels. - Testing the performance of marine renewable energy devices at the design stage prior to prototype testing, including operational and survival performance, device installation, maintainability and survivability. - Ship resistance and sea-keeping. - Unsteady motion of ships and floating bodies. - Hydrodynamics of towed surface-piercing and submerged bodies. - Ocean engineering studies including vortex-induced vibration and vortex-induced motion. - Wave impact and slamming studies.
User	Academia/Industry
Website	https://www.strath.ac.uk/engineering/navalarchitectureoceanmarineengineering/ourfacilities/kelvinhydrodynamicslaboratory/

Icing Tunnel	
Icing Tunnel	52
Organisation	University of Cranfield
Location	Cranfield
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	The Icing tunnel is equipped with a multi-channel video monitoring and surveillance system and a National Instruments Field Point based flexible 16 bit signal monitoring and recording installation for temperatures, pressures and electrical signals. Key features: main tunnel mass flow rate, 80 kg per second; cooling capacity, 450kW; usual working section size, 761mm x 761mm; mach 0.1 to 0.5; total air temperature range from - 30 to + 30degC; liquid water concentrations from 0.05 to 3g/m^3; two independent sources of anti-icing air with a combined capacity150kW; droplet size 15 to 80 microns. The Cooled Vertical Droplet Tunnel, approximately 8 meters long, allows watching singular water droplets strike a surface at speeds. It is capable of generating and accelerating droplets in the diameter range from 10 to 1000 microns to speeds of up to 120m/s. It may be operated with air temperatures from +30 to – 20degC.
Typical Testing Activities	- Investigation of the growth, structure and shedding behaviour of ice on structures, at a component level, right down to the impact of an individual water droplet. - Testing new ice protection equipment. - Development of ice accretion modelling tools. - Validating design tools for simulating ice growth and ice Response to ice protection measures. - Basic studies of ice growth & behaviour to support the Development of new ice prediction methods. - Examining the potential role of ice phobic surface coatings. - Demonstration of novel ice protection concepts.
User	Academia/Industry
Website	https://www.cranfield.ac.uk/facilities/icing-tunnel

Marine Environment	
SAMS Research Services Ltd (SRSL)	**53**
Organisation	Scottish Association for Marine Science (SAMS)
Location	Oban
Type of asset	Research Centre
Scale of operation	Medium/Large
Description	SRSL provides a range of surveys for baseline assessments and monitoring programmes, as well as stand-alone studies of the marine environment. These may include: bathymetric surveys, sediment sampling, habitat mapping, metocean surveys, water-column profiling. Surveys are undertaken using a range of platforms, such as autonomous underwater vehicles (AUVs) and unmanned aerial vehicles (UAVs), in addition to conventional vessel-based surveys. All data is analysed, interpreted and reported to rigorous standards. Survey outputs can be supported by GIS mapping, hydrodynamic or environmental modelling where appropriate.
Typical Testing Activities	- Environmental impact assessment. - Underwater noise surveys and acoustic impact assessments for marine mammals. - Sediment and water quality sampling and analysis. - Benthic and intertidal ecological surveys. - Fish population surveys.
User	Industry
Website	https://www.srsl.com/industries/marine-renewables/

Marine Environment	
Marine Environment Experimental Field Site	**54**
Organisation	University of Cranfield
Location	Loch Ceann Traigh, Sound of Arisaig, near Ardtoe, west of Scotland
Type of asset	Offshore Test Facility
Scale of operation	Small/Medium
Description	The site is approximately 100m from the shore, not overly exposed. The leased area is a rectangle shape approx. 600m x 150m. The principle aim is to undertake robust, field scale experimental studies relating to marine organisms' and human activities in the marine environment. The site has moorings for fixing subsea or surface structures, two electrical cables buried in the seabed, two sunken 40m diameter fish pens in 10-15m of water. Navigation hazard warning buoys delineate the site which is accessed by boat from across the loch.
Typical Testing Activities	- Investigation of the potential effects of EMFs generated by offshore wind farm sub-sea power cables on electrically and magnetically sensitive marine organisms. - Effects of pile-driving noise on the behaviour of marine fish. - Response of marine organisms to non-physcial environmental stimuli. - Consequences to marine structures of exposure to the marine environment. - Organism colonisation. - Corrosion.
User	Academia/Industry
Website	https://www.cranfield.ac.uk/facilities/marine-environment-experimental-field-site

Marine Environment	
Total Environment Simulator (TES)	**55**
Organisation	University of Hull
Location	Deep aquarium Hull
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	Hydraulic infrastructure, with environmental control and flexibility to change boundary conditions, for environmental, hydraulic and morphological research. Modelling capabilities include: turbulent boundary layers up to 1m deep; transport of homogeneous and heterogeneous sediment mixtures; variable channel widths and planform configurations; normal and oblique wave directions with regular or irregular wave forms; spatially distributed rainfall from an array of 50 nozzles; modelling of estuarine and coastal ecology using natural and surrogate vegetation.
Typical Testing Activities	- Physical modelling of flow processes and sediment transport dynamics across a range of scales, including estuarine and coastal environments. - Application of laser and acoustic flow measurement techniques. - Physical modelling of ecohydraulics. - Ecological research and modelling of aquatic system responses to climate adaptation. - Modelling environmental impacts on the seabed associated with offshore wind energy.
User	Academia/Industry
Website	https://hydralab.eu/facilities--instruments/facilities-in-hydralab/Environmental-hydraulics-facilities/Total-Environment-Simulator/

Material Testing	
Materials, Corrosion and NDT Laboratories	**56**
Organisation	Doosan Power Systems Ltd
Location	Renfrew
Type of asset	Test Centre
Scale of operation	Large
Description	Creep testing laboratory – largest in the UK with over 100 test points and capable of testing from 300 degC to 1200 degC and at loads up to 5 tonnes. Corrosion testing, metallurgical and failure investigation laboratories. Advanced non-destructive testing and remote monitoring development laboratories. Equipment for both manually and robotically deployed inspections.
Typical Testing Activities	- Materials testing. - Failure investigations. - Non-destructive testing.
User	Industry
Website	http://www.doosanbabcock.com/en/service/inspectionsolutions/

Material Testing	
Composites, Adhesives and Polymeric material test facilities	**57**
Organisation	NPL
Location	Teddington
Type of asset	Test Centre
Scale of operation	Medium/Large
Description	Key Equipment: Static (±500kN, -150°C to 350°C), Cyclic fatigue (±100kN, 0.002 to 50Hz), Multiaxial testing (static and cyclic, ±50kN, 0 to 25Hz), Biaxial testing of polymers, High rate (1 to 2m/s, -150°C to 350°C), Drop weight impact (0 to 4 metres, 0 to 900J, -55 C to 200°C), Creep of composites (±500kN, 23°C to 350°C), Tensile creep of polymers (0 to 750N, 0 to 100°C), Slow rate strain testing (liquids and gas exposure, 4.5 x 10-7m/s),Environmental stress cracking (tension and flexure, all liquids, 0 to 1kN), Creep rupture (tension and flexure, 0 to 50kN), Tension, compression, shear, flexure and fracture toughness, Through-thickness tension, compression and shear, Open hole tension (OHT), open hole compression (OHC) and pin-bearing tests, Bonded and bolted joints, and sandwich structure testing.
Typical Testing Activities	- Mechanical characterisation of polymeric materials and composites. - Standardised and non-standard testing. - Continuous monitoring of specimen degradation during fatigue. - Dynamic mechanical analysis measurements (DMA) and stress wave (or acoustic) emission.
User	Academia/Industry
Website	http://www.npl.co.uk/science-technology/composites-adhesives-and-polymeric-materials/

Material Testing	
Materials and Corrosion Testing Laboratories	**58**
Organisation	TWI
Location	Cambridge
Type of asset	Test Centre
Scale of operation	Medium/Large
Description	Main test facilities: Functional Coatings and Resin Laboratory, Corrosion Laboratory, Aggressive Environments (Trevor Gooch) Laboratory (including enhanced high-pressure, high-temperature sour testing facility, full-scale sour testing rig and permeation testing facility), Ultrasonic immersion tank.
Typical Testing Activities	- Development of novel hybrid materials and functional coatings for harsh corrosive environments. - Non-toxic, small-scale, aqueous corrosion testing in different environments, including fresh water and seawater. - Failure investigation and analysis of corroded materials. - Large-scale failure investigation. - Fracture toughness, tensile and pressure testing under aggressive environment conditions. - Cyclic immersion testing.
User	Industry
Website	https://www.twi-global.com/capabilities/laboratories/

Material Testing	
Bristol Composites Institute (ACCIS)	**59**
Organisation	University of Bristol
Location	Bristol
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	ACCIS comprises a wide range of composites-specific equipment, with additional large scale equipment. Key pieces of equipment: Alicona Microscope; High Speed Cameras; Autoclave; Tensile Testing Machine and Environmental Chamber; Ultrasound Scanner; Impact Tower; Digital Image Correlation (DIC); Scanning Electron Microscope (SEM); Video Gauge System; Ultra High Speed Video.
Typical Testing Activities	- Research in advanced composite development, manufacturing and testing. - Investigation of blade materials and manufacturing technology, blade integrity, blade design and performance.
User	Academia/Industry
Website	http://www.bristol.ac.uk/composites/facilities/

Material Testing	
Morgan-Botti Lightning Laboratory	**60**
Organisation	University of Cardiff
Location	Cardiff
Type of asset	Laboratory
Scale of operation	Medium/Large
Description	Laboratory capable of generating controlled lightning up to 200,000A. Flexible facility boasting a number of bespoke current generators that can be sequenced and adjusted to suit particular test requirements. Large test objects can be accommodated inside the laboratory's light-tight acoustically shielded test chamber. Capable of generating the full range of lightning direct effect test current waveforms, and combinations thereof, as defined in EUROCAE ED84-A and SAE ARP 5412.
Typical Testing Activities	- Understanding of lightning effects on materials. - Lightning interactions with and protection of the current and next generation of composite materials and structures.
User	Academia/Industry
Website	http://lightning.engineering.cf.ac.uk/testing.html

Material Testing	
Scottish Marine And Renewables Test (SMART) Centre	**61**
Organisation	University of Dundee
Location	Dundee
Type of asset	Test Centre
Scale of operation	Small/Medium
Description	Equipment and facilities: X-Ray micro CT imaging facility; High-speed imaging system (up to 6000 fps) X-Ray diffraction; Cyclic Instron Load Frame; High speed stress-path triaxial apparatus with bender elements; Variable Direction Cyclic Simple Shear (VDCSS) apparatus; Large displacement Interface shear test device (IST); Dynamic direct shear for partially-saturated geomaterials; Micro-impact rig.
Typical Testing Activities	- Testing of marine renewable construction materials. - Testing facilities optimised for seabed geomaterials (soils and rocks), structural materials (e.g. reinforced concrete), and the interfaces between them.
User	Academia/Industry
Website	https://uod.app.box.com/v/Uni-of-Dundee-SMART-Centre

Material Testing	
The National Composites Certification and Evaluation Facility (NCCEF)	**62**
Organisation	University of Manchester
Location	Manchester
Type of asset	Test Centre
Scale of operation	Small/Medium/Large
Description	Operating across the spectrum of Technology Readiness Levels, from applied research to routine production testing, the NCCEF facilitates a two way flow of knowledge between industry and academia. Key capabilities: carbon fibre weaving and braiding for complex 3D structures; low cost out-of-autoclave processing; extensive non-destructive evaluation (NDE) and mechanical testing suites. Key facilities: Instron mechanical testing laboratory; processing laboratory; thermal analysis laboratory; processing equipment for the fabrication of composites via both lamination of prepreg materials and resin infusion of dry fibre preforms; ply cutting room; dedicated lay up room; test sample preparation workshop; inspection and measurement lab; ballistics laboratory.
Typical Testing Activities	- Investigation of the use of composite materials for turbine blades. - Testing of tensile strength/stiffness, compressive strength/stiffness, flexural properties and impact tolerance, under quasi-static and fatigue conditions at sub-zero or elevated temperatures. - Non-destructive Testing ranging from large state-of-the-art X-ray equipment with ultra-high defect resolution to small hand held ultrasonic equipment for detecting delaminations in composite components. - Investigation of reaction kinetics, degree of cure, glass transition temperature and viscoelastic properties.
User	Academia/Industry
Website	http://www.nccef.manchester.ac.uk/facilities/

Material Testing	
Advanced Forming Research Centre (AFRC)	**63**
Organisation	University of Strathclyde
Location	Inchinnan, Renfrewshire
Type of asset	Test Centre
Scale of operation	Small/Medium/Large
Description	Research facility supporting fundamental and applied research in high forming and forging, covering the entire product development cycle, from material testing and characterisation through to industry standard manufacturing trials and product tests. The AFRC houses over £25M-worth of equipment, in eight lab areas and three workshops, built to industry's specifications. There are seven key areas of equipment: hot forging & forming cold forming, materials characterisation, metallography, metrology, finances and machining.
Typical Testing Activities	- Testing and characterisation of materials: mechanical testing, residual stress measurement, sheet metal (BUP) testing, microstructural evaluation. - Metrology and inspection: 3D contact measurement, 3D non-contact measurement, Surface form & roughness measurement, thermal imaging & temperature measurement. - Wind turbine blade inspection using remote inspection techniques. - Development of automated technologies to assess blade structural integrity. - Investigation of ways to integrate remote blade inspection with a repair application. - Evaluation of the technical feasibility of novel sub-sea modular assembly concept cost for offshore wind. - Reliability modelling.
User	Academia/Industry
Website	https://www.strath.ac.uk/research/advancedformingresearchcentre/

Mechanical Components Testing	
Large Scale Component Testing Facility	**64**
Organisation	Doosan Power Systems Ltd
Location	Renfrew
Type of asset	Test Centre
Scale of operation	Large
Description	Extensive laboratories and major testing facilities to support internal R&D programmes and external customers; test bay totalling 3150m^2 serviced by two 10-tonne cranes, multi-axis load control for structural component testing, large scale four-point bend testing up to 6MNm, fatigue testing up to 50Hz, up to 30MN loading in compression and 20MN in tension, pressure testing in underground and reinforced concrete test cells.
Typical Testing Activities	- Large Scale Component Testing for wind, marine, oil & gas Structures. -Simulated Service Tests: 300BarG and 220DegC. - Tensile Tests: 20MN. - Compressive Tests: 30MN. - Reeling Tests: 2MNm. - Cyclic Testing: 8MN. - Low Cycle Fatigue Tests. - Creep/Fatigue Tests 650°C.
User	Industry
Website	http://www.doosanbabcock.com/en/service/componenttesting/

Mechanical Components Testing		
Gearbox Test Rig		**65**
Organisation	MacTaggart Scott	
Location	Loanhead	
Type of asset	Test Centre	
Scale of operation	Large	
Description	Capability to back-to-back test wind-turbine gearboxes with gearboxes up to 150kNm torque, 30 rpm input speed, and 3MW power. Wide range of cranes available on-site to lift the gearboxes onto the dedicated test rig. High Torque Test Rig: instrumented to endurance test gearboxes and motors automatically 24 hours a day. Scale of Investment (Capex and Opex) in the Facility: £1.0 - £5m	
Typical Testing Activities	Various parameters can be tested and analysed, including vibration levels, bearing temperature, oil pressure and oil cleanliness. These tests are configured using PC-based control. Oil cooling and flushing are available and can be performed concurrently with gearbox testing.	
User	Industry	
Website	http://www.mactag.com/119_GearboxTestRigs.html	

Mechanical Components Testing	
Design Unit Test Rigs	**66**
Organisation	Newcastle University
Location	Newcastle
Type of asset	Laboratory
Scale of operation	Small/Medium/Large
Description	Contact fatigue testing of gears carried out on back-to-back, or 'power recirculating' test rigs. Two test gearboxes of identical gear ratio and centre distance are joined by torsionally compliant shafts (torsion bars), with a servo-hydraulic torque actuator in one shaft. This rotates the shafts to induce equal and opposite torques in the test gears at each end. A small variable speed motor drives both gearboxes, the power required being only equal to the total mesh friction, windage and churning losses of the gears. Such an arrangement is relatively inexpensive to run, and can be used economically to test gearing at any speed and power. All Design Unit rigs are characterised by: servo-hydraulic control of test torque, which can be varied while the test rig is running; test gear geometries that can be optimised for maximum performance (not to generate failure); Spray lubrication with large oil tanks, operating temperature controllable to ± 2°C between 50°C and 90°C, oil filtration to 10µm; the ability to test helical gears; two test gearboxes rather than a slave and test gearbox.
Typical Testing Activities	- Research into gear surface fatigue. - Life testing (including fatigue testing of belt and chain drives). - Efficiency measurements (including power losses in high speed gearing and chain drives). - Wear testing (including low speed, high temperature gear testing). - Noise and vibration measurements (including an 8MW back to back rig for investigating tooth contact excitation in marine size gears). - Lube oil studies (including efficiency comparisons and investigating the effects of additives). - Coupling performance.
User	Academia/Industry
Website	https://www.ncl.ac.uk/gears/services/test/index.htm

Mechanical Components Testing	
Dynamic Marine Component Test Facility (DMaC)	**67**
Organisation	University of Exeter
Location	Falmouth
Type of asset	Laboratory
Scale of operation	Medium/Large
Description	The test rig comprises of a linear hydraulic cylinder, used to replicate any pulling (tension) and pushing (compression) force representative of dynamic loadings, pre-loadings, etc. At the other end of the rig the moving headstock with three degrees of freedom, namely pitch, roll and yaw, representative of x- and y-bending or torsion allows to replicate the movement and forces induced through the motion of a floating body. Max tensile forces of 30 tonnes in dynamic and 45 tonnes in static operation, maximum bending angle at the headstock of ±30º for x- and y-bending. The rig can test specimens up to a length of 6m.
Typical Testing Activities	- Dynamic testing of components in large scale under controlled environment applying realistic motion characteristics. - Replicate the forces and motions that components are subjected to in offshore applications. - Investigating reliability in harsh dynamic offshore environments.
User	Academia/Industry
Website	https://emps.exeter.ac.uk/renewable-energy/facilities/dmac/

Meteorology		
National Offshore Anemometry Hub (NOAH) Offshore Met Mast		68
Organisation	Offshore Renewable Energy (ORE) Catapult	
Location	North Sea, 3nm off Blyth	
Type of asset	Offshore Technology Demonstration	
Scale of operation	Medium/Large	
Description	NOAH enables clients to test, calibrate and validate remotes sensor technologies in a representative Round 3 environment. Clients can prove reliability, data availability and performance, as well as evaluate environmental conditions, observe marine conditions and collect wildlife data for R&D purposes. Wind instrumentation: Class 1 anemometers, calibrated to MEASNET procedures; Height of vanes and anemometers - 35m, 52m, 69m, 86m and 103m AMSL; Anemometry mast compliant to IEC 61400-12; Lidar system validated to NORSEWInD criteria. Environment: Temperature and humidity; Atmospheric pressure; Air quality monitoring; Present weather system; Data logging; Redundant system, backed up onshore and offshore. Environmental instrumentation: Sea state by Doppler Current Profiler; Marine mammal acoustic detector; Bat monitoring; Avian RADAR; Vessel RADAR with AIS; Turbidity monitoring.	
Typical Testing Activities	- Resource Assessment. - Hosting floating lidar trials. - Data licensing for wind and ocean conditions. - Consenting and permitting. - SME product development support. - Hosting instrumentation and monitoring of new equipment. - Marine Robotics & Autonomous Systems Testing (e.g. subsea inspection of the met mast foundation and survey of the surrounding seabed using AUVs).	
User	Academia/Industry	
Website	https://s3-eu-west-1.amazonaws.com/media.newore.catapult/app/uploads/2018/09/19095535/Catapult-Spec-Sheet-NOAH.pdf	

Meteorology	
Test Site Meteorology	69
Organisation	Science and Technology Facilities Council (STFC) Rutherford Appleton Laboratory - Energy Research Unit (ERU)
Location	Didcot
Type of asset	Onshore Test Facility
Scale of operation	Small/Medium
Description	Wind speed, wind direction, temperature, pressure, rainfall, relative humidity, and insolation are measured minute-by-minute on the ERU test site. Data are archived since 1987 and are available for research. Current data are available in real time at www.elm.eru.rl.ac.uk. The met station uses Minimet instruments and a DataHog logger supplied by Skye Instruments. The met logger is permanently connected to a PC running a Matlab program which generates graphs updated at one minute intervals, and stores data on an STFC server. The screen is refreshed at two minute intervals. Measurements of wind speed and direction are made using instruments on a met tower (Twr 4) at 18m above ground level; while solar irradiance, atmospheric pressure, relative humidity, temperature and rainfall are measured near to ground level.
Typical Testing Activities	- Wind resource estimation. - Aid research into wind energy, in particular the optimisation of wind turbine design and operation. - Scientific use, including ISIS Health and Safety, Diamond Light Source Ltd, and UKAEA.
User	Academia/Industry
Website	http://www.elm.eru.rl.ac.uk/

Radar	
NetRAD	**70**
Organisation	University College London (UCL)
Location	London
Type of asset	Test Equipment
Scale of operation	Small/Medium/Large
Description	Networked radar system with simultaneous monostatic and bistatic recording capabilities. It is an active S-band, coherent, pulse-Doppler radar, operating at a carrier frequency of 2.4GHz with three distinct but essentially identical nodes, one of which is used as a monostatic transceiver (node 3) and the other two as receive-only nodes (nodes 1 and 2).
Typical Testing Activities	- Characterization of radar signatures of wind turbines and wind farms. - Wind farm clutter characterisation. - Development and analysis of target detection algorithms.
User	Academia/Industry
Website	https://collab.ee.ucl.ac.uk/radar-research/lib/exe/fetch.php?media=Takayuki_Shimizu.pdf

Robotics	
Edinburgh Centre for Robotics	**71**
Organisation	Heriot-Watt University & University of Edinburgh
Location	Edinburgh
Type of asset	Laboratory
Scale of operation	Small/Medium/Large
Description	Field Robotics Laboratories: including mock-ups for the offshore environment infrastructure asset inspection sector (e.g. ANYmal quadruped robot and mobile Husky robot with multi arm manipulators). Interaction Laboratory: developing intelligent interactive systems to collaborate effectively and adaptively with humans. Ocean Systems Laboratory: autonomous systems, sensor modelling and processing, and underwater acoustic system theory/design; tank facilities and vehicles (Offshore Hyball, Remus, PAIV, Nessie auv's). Smart Systems Laboratory: design, manufacture and characterisation of transformative Smart Systems. Virtual Reality Laboratory: 3D real-time motion sensing and tracking capabilities. ROBOTARIUM: four integrated and interconnected components (Interaction Spaces, Field Robotic Systems, MOBOTARIUM and Enabling Facilities) for exploring collaborative interaction between remote teams of human, robots and their environments at all levels.
Typical Testing Activities	- Environment Interactions: physical interactions between a robot and the environment, including studies of contact dynamics, sensor performance/processing and active sensing. - Multi-Robot Interactions: autonomous sensing and decision making for collaborative interactions between multiple, decentralised robotic systems. - People Interactions: interactions between robots and people in smart spaces. - Self Interactions: robotic introspection for condition monitoring, prognostics and health management. - Enablers: architectural system design.
User	Academia/Industry
Website	https://www.edinburgh-robotics.org/

Robotics		
Bristol Robotics Laboratory		**72**
Organisation	University of Bristol & Perceptual Robotics	
Location	Bristol	
Type of asset	Test Equipment	
Scale of operation	Medium/Large	
Description	Dhalion is an intelligent Unmanned Aerial Vehicle (UAV) developed to provide existing inspection engineers with a new, cost effective inspection tool that increases quality, whilst minimising inspection time and health and safety risks. This allows wind turbine owners to maintain optimal performance at a reduced cost.	
Typical Testing Activities	Development of automated methods for inspecting and maintaining turbines, based on drones fitted with cameras.	
User	Academia/Industry	
Website	https://www.perceptual-robotics.com/	

Robotics	
Centre for Autonomous Systems Technology (CAST)	**73**
Organisation	University of Liverpool
Location	Liverpool
Type of asset	Laboratory
Scale of operation	Small/Medium/Large
Description	Range of facilities and labs related to the Centre, such as the Virtual Engineering Simulation Lab (VESL) and Robotic Autonomy Simulation Laboratory (RASL) at the Virtual Engineering Centre, providing high-fidelity simulation and analysis frameworks for autonomous systems.
Typical Testing Activities	Development, analysis, enhancement and deployment of autonomous systems.
User	Academia/Industry
Website	http://www.virtualengineeringcentre.com/media/1255/autonomous-systems-brochure_v01.pdf

Smart Energy	
Smart Grid Laboratory	74
Organisation	Durham University
Location	Durham
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	The laboratory hosts a low-voltage network and a wide range of low carbon technologies. The laboratory has been designed to enable research on the solutions to resolve network constraints driven by the transition to a low carbon economy. It consists of a flexible low voltage distribution network, a Real Time Digital Simulator (RTDS) system which connects to the experimental network via 3-phase Power Amplifier, a PV Emulator, a Wind Generation Emulator, an Electrical Energy Storage (EES), an Electric Vehicle (EV), an Air Source Heat Pump (ASHP) and a few Smart Meters. The system is fully instrumented with precise measurement boards, integrated with high-speed data communication network, and human-machine interface.
Typical Testing Activities	- ICT-Power System Integration (development of scalable ICT networks to handle massive quantities of smart grid data). - Renewable Generation Integration. - Energy Storage Systems. - Big Data Analysis. - Power Electronics (investigation of the ability of local DC networks to improve the overall reliability and flexibility of future power networks). - Demand side management and demand response.
User	Academia
Website	https://www.dur.ac.uk/resources/dei/DEICapabilitiesinsertsmartgrid2017.pdf

Smart Energy	
Maurice Hancock Smart Energy Laboratory	**75**
Organisation	Imperial College of London
Location	London
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	The Smart Energy Lab has both its own hardware experimental facilities and data gathering from external real networks. The internal hardware comprises a flexible set of network connections and a programmable voltage source connected to PV, batteries and other inverter-based distributed energy resources plus active and passive loads. The inverters have rapid prototyping control systems that allow verification of smart grid control schemes. The Lab has a data to the network centre controlling the London area for analysis of smart metering and smart grid trials. The hardware is designed to be easily customised, offering a 'plug and play' approach that allows researchers to conduct complex experiments without spending time on building the basic infrastructure needed for the work.
Typical Testing Activities	-Investigation of how new forms of high voltage DC electrical grids can be used to connect offshore wind farms to national networks and link national networks together in a cross-border 'super grid'. - Configured to represent a variety of network scenarios as technical demonstrator for decentralised control schemes, such as agent-based control, and of demand-side network services. - Evaluation platform for the analysis of data from field trials of smart metering and smart grid technologies and control practices. Used to analyse the technical and economic effectiveness of using distributed generation and controllable loads to manage the network and satisfy customer expectations.
User	Academia/Industry
Website	http://www.imperial.ac.uk/electrical-engineering/research/control-and-power/

Smart Energy	
Smart Energy Network Demonstrator (SEND)	**76**
Organisation	Keele University
Location	Keele
Type of asset	Technology Demonstration
Scale of operation	Medium/Large
Description	Europe's largest smart energy living facility for at-scale living laboratory research, testing new energy efficient technologies in a real world environment. Siemens will digitalise 24 substations, install 1,500 smart meters, and integrate 5MW of renewable energy as part of phase 1 of the project.
Typical Testing Activities	Testing new technologies related to: - Security of energy supply. - Carbon reduction. - Network demand side management. - Energy generation performance monitoring.
User	Academia/Industry
Website	https://equipment.lboro.ac.uk/facility/877/wind-tunnel.html

Smart Energy	
Smart Grid Lab	77
Organisation	Newcastle University
Location	Newcastle Helix
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	A real-time network simulator (RTNS) allows for detailed real-time simulation of networks using sophisticated models that can interact with the physical laboratory environment. The RTNS and the control systems platform are fully integrated with the LV (low voltage) network of the laboratory. This flexible AC system can be fully controllable in terms of amplitude, frequency, harmonic content, and independent control of phase angle. This reconfigurable LV network also features flexible line impedances, which can enable evaluation of networks with different X/R ratios. It can be operated de-coupled from the grid or even with soft open points between different areas of the LV network using a flexible power converter. Emulated PV and other distributed generators are also integrated into the laboratory system, as well as a set of controllable real and reactive load banks.
Typical Testing Activities	- Simulation of distribution networks under future scenarios. - Dynamically evaluate the impact of low carbon technology such as PV, wind, EVs and future load scenarios on networks in hardware. - Investigate the impact that the dynamic power flow fluctuations of future networks, featuring large concentrations of clustered renewable generation,an other low carbon load, will have on these systems. - Evaluate the capability of future smart active network management systems to maintain networks within their technical and operational limits in future low carbon network scenarios. -Investigate the operation of new smart grid technology and control schemes.
User	Academia/Industry
Website	https://www.ncl.ac.uk/media/wwwnclacuk/instituteforsustainability/files/Smart%20Energy%20Labs%20Online.pdf

Smart Energy	
Smart Grid Lab	78
Organisation	University of Birmingham
Location	Birmingham
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	The power & control group consists of two laboratories, namely, real-time power grid simulation, control and protection lab, and micro smart grid lab. These two labs provide the facilities for the efficient operation and control of Smart Grids with distributed power generation or large renewable generation. Key pieces of equipment: a smart power grid and real-time simulator that provides the capability to realistically simulate smart power grids with the integration of distributed power generation including wind, wave and fuel cell generation systems; monitoring and control capability as well as real-time information integration, monitoring, protection and closed-loop control functions; novel VSC HVDC simulations and control.
Typical Testing Activities	- Operation and control methods for power grids. - Control techniques for distributed energy generation and interconnection. - Controllers and protection devices and algorithms for individual components. - Investigation of technical barriers to the integration of renewable energy generated from distributed sources in to the power grid.
User	Academia/Industry
Website	https://www.birmingham.ac.uk/research/activity/eese/power-control/power-control.aspx

Structural Testing	
Structural Test Laboratory	**79**
Organisation	Energy Technology Centre
Location	ScottishEnterprise Technology Park Glasgow
Type of asset	Laboratory
Scale of operation	Medium/Large
Description	Versatile facility with a range of key assets, hydraulic power pack: 170 kW (expandable), range of actuators: up to 2 m stroke, hydraulic shaker table: 500 mm stroke, 50 Hz, electrodynamic shaker tables.
Typical Testing Activities	- Mechanical testing at system and subsystem level. - Linear generator testing of marine energy devices. - Component testing for novel multi-megawatt drivetrain systems. - Fatigue testing of marine energy components.
User	Academia/Industry
Website	http://www.e-t-c.co.uk/test-facilities/

Structural Testing	
Integrity Management Laboratories	**80**
Organisation	TWI
Location	Cambridge
Type of asset	Test Centre
Scale of operation	Medium/Large
Description	Main test facilities: Corrosion Fatigue Testing Laboratory, Fatigue Testing Laboratory (including 2500kN servo-hydraulic fatigue test machine), Fracture and Mechanical Testing Laboratory (including 750 joule Charpy impact testing machine and high-rate servo-hydraulic test machine), Condition Monitoring Laboratory (including 3D laser scanning vibrometer, acoustic emission measurement system and air-cooled vibration testing facility), Non-Destructive Testing Inspection and Assessment Laboratories (including 3D X-ray microscope, laser-ultrasonic system and seven-axis ultrasonic immersion tank), Resonance Testing Laboratory, Validation Testing Laboratory.
Typical Testing Activities	- High and low-cycle fatigue testing of parent material. - Endurance testing of weldments under constant and variable amplitude loading. -Full-scale testing and fatigue crack growth rate testing of parent metal, weld metal and heat affected zone. - Fracture toughness, tensile and large-scale and pressure testing. - Mechanical testing in a seawater environment. - Material validation and integrity assessment. - Acoustic emission testing, vibration monitoring and risk analysis, wireless condition monitoring.
User	Industry
Website	https://www.twi-global.com/capabilities/laboratories/

Structural Testing	
Structural Integrity Laboratory	**81**
Organisation	University of Cranfield
Location	Cranfield
Type of asset	Laboratory
Scale of operation	Small/Medium/Large
Description	The laboratory allows examination of the conditions and parameters that effect material strength and durability due to stress, fatigue, fracture and corrosion, using destructive and non-destructive methods. Key features: Servo Hydraulic Fatigue Testing Machines all using the latest 8600 Instron Controllers; Charpy Impact Test Machine; Corrosion Testing; Environmental Chamber; Hopkinson Bar Facility; Pipeline Repair Rig; Non Destructive Testing.
Typical Testing Activities	- Fatigue and fracture mechanics. - Structural reliability analysis. - Design of structures and components. - Composite materials. - Corrosion analysis. - Offshore wind structural health monitoring.
User	Academia/Industry
Website	https://www.cranfield.ac.uk/facilities/structural-integrity-laboratory

Structural Testing	
Structural Dynamics Laboratory for Verification and Validation (LVV)	**82**
Organisation	University of Sheffield
Location	Sheffield
Type of asset	Laboratory
Scale of operation	Small/Medium/Large
Description	Acoustics and vibration testing facility for verification and validation of engineering models across test scales and in all environments. Key Features: Three individual climatic test rooms (one with an integrated Multi Axis Shaker Table (MAST)) for simulation of temperature, humidity, wind and rainfall effects. Precision glass-sided wave tank with double flap wave generator (12m long, 1.5m deep) for simulation of deep water conditions. A strong floor (16m long x 3.5m wide) and wall (3m tall x 3.5m wide) enabling testing of large components and structures in a range of mounting configurations. Flexible laboratory space suitable for a broad range of dynamic testing at ambient temperatures (approx. 12m x 12m).
Typical Testing Activities	- Research into vibrations, dynamics of structures and wave propagation, with a wide range of engineering applications including aerospace, energy generation, automotive and infrastructure. - Structural health and condition monitoring. - System identification. - Damping and structural control. - Nonlinear structural dynamics. - Acoustics.
User	Academia/Industry
Website	https://lvv.ac.uk/

Subsea Testing	
National Hyperbaric Centre (NHC)	**83**
Organisation	JFD
Location	Aberdeen
Type of asset	Test Centre
Scale of operation	Medium/Large
Description	The NHC has deep water simulation facilities, with interface flexibility allowing a variety of habitat welding techniques, capable of both manned and unmanned testing. Large work chamber adaptable for a variety of welding situations, attached to a full saturation diving system furnished for up to 16 divers to live in during saturation. A variety of hyperbaric pressure test vessels can be utilised to create depths of up to 8000m. Internal filtration system ensuring the maintenance of good visibility during dry and wet welding operations, in fresh water, seawater or mixed gas environments. Full video and communication system to monitor and record the dives to ensure a controlled and safe environment.
Typical Testing Activities	- Testing of dry and wet hyperbaric welding procedures. - Development of projects on subsea welding and robotics developing systems for the repair of underwater pipelines and structures. - Component hydrostatic and gas pressure testing. - Cylinder hydraulic pressure testing & refurbishment. - Testing of wind turbine umbilicals.
User	Industry
Website	https://www.jfdglobal.com/services/testing-services/hyperbaric-welding/

Subsea Testing		
Sensors, Electromagnetics and Acoustics Lab		**84**
Organisation	Newcastle University	
Location	Newcastle	
Type of asset	Laboratory	
Scale of operation	Small/Medium	
Description	The facility includes: a large (3m x 2m x 2m) tank which is filled with fresh or saline water; anechoic-lined tank to produce the ideal conditions for acoustic experiments and calibration; steel-walled enclosure positioned next to the tank to provide water-steel-air transmission paths; design tools for the development of experimental prototypes and production designs; remote operated vehicles to enable flexible underwater deployment of sensors or communication hardware; underwater cameras for easy inspection of submerged installations; portable EM instrumentation to identify interference sources; heavy duty IP67 portable computers for field trials of new products; survey-grade GPS unit to enable precise positioning and tracking in communication trials.	
Typical Testing Activities	- Controlled experiments on acoustic and electromagnetic transmission through various mediums. - Through-hull communications and sub-sea to air communications. - Low-cost sonar imaging.	
User	Academia/Industry	
Website	https://www.ncl.ac.uk/engineering/about/facilities/electricalelectronicengineering/sensors-electromagnetics-acoustics-lab/	

Subsea Testing	
Tyne Subsea - National Centre for Subsea and Offshore Engineering	**85**
Organisation	Newcastle University
Location	Killingworth, Newcastle
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	Purpose built pressure testing facility focusing on providing pressure testing, hyperbaric certification and subsea research for deep water equipment in a variety of sectors. These services are conducted in six specialist hyperbaric chambers, 4 vertical and 2 horizontal, having various capabilities and differ in pressure rating, orientation, diameter, length, temperature, bespoke penetrations.
Typical Testing Activities	- Hyperbaric testing and certification. - Independent pressure testing. - Autonomous robots for the subsea sector.
User	Academia/Industry
Website	https://www.tynesubsea.com/

Subsea Testing	
Neptune National Centre for Subsea and Offshore Engineering	**86**
Organisation	Newcastle University
Location	Newcastle
Type of asset	Labortory/Offshore Technology Demonstration
Scale of operation	Small/Medium/Large
Description	National centre for the development of new materials and technologies to explore the world's oceans. World-class engineering research facility, first of its kind in the UK, bringing together industry and academia.
Typical Testing Activities	Research opportunities in high pressure materials, extreme environment electronics, underwater communications and pipeline engineering. It incorporates a manufacturing cluster of established companies such as GE Oil and Gas and Bridon International.
User	Academia/Industry
Website	https://www.ncl.ac.uk/press/articles/archive/2013/03/7mextremeengineeringcentreannounced.html

Subsea Testing	
Subsea Docks	**87**
Organisation	Offshore Renewable Energy (ORE) Catapult
Location	Blyth
Type of asset	Offshore Technology Demonstration
Scale of operation	Medium/Large
Description	Three subsea docks for both wet and dry conditions, including a replica seabed, for controlled subsea testing.
Typical Testing Activities	- Condition monitoring. - Controlled dry or wet testing of subsea systems and technologies. - Prototype subsea system deployment. - Subsea survey/inspection equipment. - Foundation testing, including piling, noise mitigation and anchoring. - Hydrodynamic stability analysis and testing.
User	Academia/Industry
Website	https://ore.catapult.org.uk/testing-validation/facilities/subsea/

Subsea Testing	
Oceanlab Sea Testing Facilities	**88**
Organisation	University of Aberdeen
Location	Newburgh
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	Two 1100 m^2 buildings with facilities available on a commercial basis including: 2.5T overhead X/Y crane; comprehensive suite of test equipment for subsea testing; 1800mm x 750mm, 700bar hydrostatic pressure vessel; Software driven vibration table; Software driven environmental chambers; Indoor test tanks (including seawater) max 5m^3; Immersion tank; Benthic laboratories and controlled environments.
Typical Testing Activities	- Assessment of the reliability of offshore components and assemblies. - Simulation of temperature and humidity profiles. - Simulation of deep ocean temperatures. - Automatic swept-sine resonance searching with programmable trigger level and dwell time for design evaluation for shocks or mechanical resonances. - Accelerated-life and shock testing. - Testing of subsea inspection equipment, ROVs and other subsea test simulations.
User	Academia/Industry
Website	https://www.abdn.ac.uk/oceanlab/about/index.php

Visualization Environment	
Immersive Visualization Environment (HIVE)	**89**
Organisation	University of Hull
Location	Hull
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	Array of advanced visualization, motion capture and computer graphics technology, including a virtual reality immersive cube, VR theatre and gigapixel wall facilities, 3D virtual reality 'cave' for offshore wind visualisation and simulation, and wearable devices.
Typical Testing Activities	- Virtual reality offshore wind environment training service for offshore wind farm engineers. - Simulation of crew transfer to an offshore platform via specialist vessel. - Training technicians for working at height in an offshore wind farm, experiencing very hostile environments. - Simulation of different weather conditions and sea states in a controlled space. - Improving health and safety in the offshore wind industry.
User	Academia/Industry
Website	https://www.hull.ac.uk/faculties/fse/engineering-and-computer-science/more/research.aspx

Wind Tunnels	
Wind Tunnels	**90**
Organisation	Building Research Establishment (BRE)
Location	Watford
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	Two atmospheric boundary layer wind tunnels where natural wind can be simulated for environments ranging from open country to city centres. Modelling of the building-mounted micro-wind turbines and surrounding area, typically at a scale of 1:200 to 1:300.
Typical Testing Activities	- Testing on best positioning of wind turbines on the roofs of tall buildings to maximise their potential for wind power generation. - Characterisation of wind conditions over a range of building heights from 15m to 80m. - Development of models that can be used by building owners and developers for siting micro-wind turbines on building roofs to optimise power generation.
User	Industry
Website	https://bregroup.com/services/testing/wind-load-testing/

Wind Tunnels	
Wind Tunnels	**91**
Organisation	Durham University
Location	Durham
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	2m Wind Tunnel: ¾ open jet, open return (Eiffel) wind tunnel with a nozzle area of 2m^2, featuring a turbulence generation system capable of producing repeatable unsteady flow events. The tunnel operates either with a wide-belt moving ground with the model supported from overhead, or in fixed ground with turntable and balance below the test section floor. 1m Wind Tunnel: open return wind tunnel, with a closed test section of 0.3m^2, capable of 45m/s. Three smaller open return wind tunnels, featuring either a closed or open jet configuration, with a test section of 0.2m^2, and a maximum speed of 20m/s. 'Durham Cascade': linear cascade of gas turbine blades for fundamental research on turbomachinery flow structures.
Typical Testing Activities	- Commercial testing of small-scale wind turbines. - Testing of horizontal and vertical axis turbines aerodynamics. - Wind turbine start-up, energy yield, aerodynamics. - Assessment of marine turbine diffuser cowling. - Assessment of skin friction drag of different aerospace coatings. - Assessment of aerofoil performance. - Active boundary layer control using plasma actuation. - Blade aerodynamic testing. - Aerodynamic Unsteadiness. - Wind Turbine wakes and interactions.
User	Academia/Industry
Website	https://www.dur.ac.uk/engineering/undergraduate/facilities/

Wind Tunnels	
Wind Tunnel	**92**
Organisation	Energy Technology Centre
Location	Scottish Enterprise Technology Park Glasgow
Type of asset	Laboratory
Scale of operation	Small
Description	Developed for small wind turbine development, working section: 3.2m x 3.2m, maximum wind speed: 17m/s, fan power: 200kW, completed with essential supporting infrastructure including power analysers, resistor load banks, wind speed measurement and load measurement.
Typical Testing Activities	Testing a wide range of small and micro wind turbines, including conventional horizontal axis wind turbines, novel ducted wind turbines and vertical axis Savonius rotors.
User	Academia/Industry
Website	http://www.e-t-c.co.uk/test-facilities/

Wind Tunnels	
Wind Tunnels	**93**
Organisation	Imperial College of London
Location	London
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	The Aeronautics department has a comprehensive series of wind tunnels, covering speeds from a few metres per second to Mach 9. There are 5 general purpose low speed tunnels with working sections from 0.4 to 4.5m^2. The 10x5 low speed wind tunnel has two large test sections and the lower section is fitted with a moving floor. It is also fitted with equipment to simulate the atmospheric Boundary Layer for wind engineering of buildings and other structures (1:200 scale and upwards). The lower test section is 3m x 1.5m x 20m long and the upper section 5.7m x 2.8m x 18m long. Wind shear and turbulence of the atmospheric environment can be simulated. The tunnel has a sophisticated 3-axis probe traversing mechanism, non-intrusive particle image velocimetry (PIV) equipment and the control and data processing are fully computerised.
Typical Testing Activities	- Aerodynamic testing of wind turbines. - Design and optimization of next-generation wind turbines.
User	Academia/Industry
Website	https://www.imperial.ac.uk/aeronautics/facilities/

Wind Tunnels	
Wind Tunnels	**94**
Organisation	Loughborough University
Location	Loughborough
Type of asset	Laboratory
Scale of operation	Medium/Large
Description	AAE Low Turbulence Windtunnel: Open return closed section tunnel. 3-component underfloor balance. Additional equipment includes Lavision PIV system FoV 100x100mm, Dantec Constant Temperature Anemometer, 2x64 channel Chell MicroHD Pressure Scanner, 6-component internal balance, Traverse mounted Pitot tube / hotwire. Turbulence Intensity = 1.0%. AAE Large Windtunnel: Open return closed section tunnel vented to atmosphere. 6-component virtual center high accuracy (+/- 0.015% FS) underfloor balance. Additional equipment includes Lavitvon stereo PIV system FoV 800x400mm, Dantec Constant Temperature Anemometer, 2x64 channel Chell MicroHD Pressure Scanner, 6-component internal balance, 5-component balance with integral spin motor.
Typical Testing Activities	- Aerodynamic testing of wind turbines. - Design and optimization of next-generation wind turbines.
User	Academia/Industry
Website	https://www.keele.ac.uk/business/newsandevents/ournews/2018/july/workbeginsoneuropeslargestsmartenergynetworkdemonstratoratkeeleuniversity/work-begins-on-europes-largest-smart-energy-network-demonstrator-at-keele-university.php

Wind Tunnels	
Wind Tunnel Laboratory	**95**
Organisation	University of Bristol
Location	Bristol
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	Large Low Speed Wind Tunnel: 2.1m x 1.5m octagonal section; maximum speed 60 m/s; return section 5.5m x 2.6m, maximum speed 12m/s. Low Turbulence Wind Tunnel: 0.8m x 0.6m octagonal section; maximum speed 100 m/s; turbulence level 0.05%. Open Jet Wind Tunnel: 1.1 m diameter; maximum speed 40m/s. DANTEC 3D Laser Doppler Anemometer: Fibre-optic linked 5W argon-ion laser, 600mm or 1600mm focal length; high precision 3-axis traverse; processing by 3 Burst Spectrum Analysers.
Typical Testing Activities	- Aerodynamics of wind turbines. - Rotor studies. - Fundamental fluid mechanics and aerodynamics. - Aerofoil characteristics, vibration and oscillation studies.
User	Academia/Industry
Website	http://www.bristol.ac.uk/aerodynamics-research/facilities/

Wind Tunnels	
Wind Tunnels	**96**
Organisation	University of Cranfield
Location	Cranfield
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	8x4 Atmospheric Boundary Layer Wind Tunnel: for simulation of flow fields associated with atmospheric winds, 2.4 x 1.2m working section, 15m flow development section, closed working section open return circuit, 0.5m/s to 16m/s flow speed, interchangeable turbulence grids and surface roughness elements, computer controlled three axis over-head traverse system, floor mounted 360˚ rotating turntable, six component dynamic force/moment balance. 8x6 Wind Tunnel: closed return design with very low freestream turbulence, configurable with a fixed or moving ground plane, 2.4 x 1.8m working section, closed test section, low turbulence flow, <0.1%, 5m/s to 50 m/s wind speed, six axis under-floor strain gauged balance, six axis internal strain gauged balance. Weybridge Wind Tunnel: open section closed return wind tunnel, model can be mounted from overhead or under working section struts, configurable with an automated pitching and yawing crescent, circular jet, 1.067m diameter, up to 38m/s flow speed, Reynolds Number 2.7 x106/m, computer controlled two axis traverse system, floor mounted 360˚ rotating turntable, six component force/moment balance.
Typical Testing Activities	- Aerodynamic testing of wind turbines. - Design and optimization of next-generation wind turbines. - Airflow characteristics around buildings and structures. - Surface pressure measurements for wind loading. - UAV testing. - 2D aerofoil testing. - Static and dynamic testing of small models, component testing, calibration and demonstrations. - Transient model studies for dynamic stall studies on vertical axis wind turbine aerofoils.
User	Academia/Industry
Website	https://www.cranfield.ac.uk/facilities/cranfield-wind-tunnels

Wind Tunnels	
Wind Tunnel Facilities	**97**
Organisation	University of Glasgow
Location	Glasgow
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	De-Havilland Wind Tunnel: 2.65m x 2.04m closed return wind tunnel with a max operating wind speed of 70m/s, 6-component sting balance and pitch/ roll/ yaw model positioning system. The settling chamber is 5 times the size of the working section and suitable for low speed testing on a large scale. Handley-Page Wind Tunnel: 2.13m x 1.61m closed return facility with a max operating speed of 60m/s. Low Speed Wind Tunnel: 1.15m x 0.95m closed-return facility with a max operating speed of 30m/s. Flow Visualisation Wind Tunnel: 0.9m x 0.9m purpose built wind tunnel has a max operating speed of 5m/s.
Typical Testing Activities	- Testing of a novel Vertical Axis Wind Turbine. - Foil testing and dynamic stall modelling. - Unsteady aerodynamics research.
User	Academia/Industry
Website	https://www.gla.ac.uk/schools/engineering/research/divisions/aerospace/researchfacilities/windtunnelfacilities/

Wind Tunnels	
Wind Tunnels	**98**
Organisation	University of Manchester
Location	Manchester
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	Key equipment: hypersonic wind tunnel with a run time of 7sec (Mach 4, 5 and 6) and 6" diameter circular test section; trisonic wind tunnel 0.15mx0.3m (Mach 0 to 0.8, 1.8); 1.2m x 0.3m x 5m open-circuit boundary layer tunnel, max speed 40m/s; 0.9m x 0.9m x 5m open-circuit wind tunnel, max speed 25m/s; 1.2m x 0.9m x 2m open-circuit wind tunnel, max speed 50m/s; 0.5m x 0.5m x 1m open-circuit wind tunnel, max speed 40m/s; 0.5m x 0.5m x 2m closed-circuit water tunnel, max speed 2m/s; 0.5m x 0.3m x 5m tilting flume, max speed 1m/s.
Typical Testing Activities	- Both force, and high-quality point, surface, and field measurements. - Wind turbine aerodynamics studies. - Investigation of the influence of atmospheric turbulence on unsteady loads and turbine performance.
User	Academia/Industry
Website	http://www.mace.manchester.ac.uk/our-research/facilities/wind-tunnels/

Wind Tunnels	
Wind Tunnels	**99**
Organisation	University of Southampton
Location	Southampton
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	3' x 2' tunnel: open circuit facility, with a closed 0.9m x 0.6m x 4.5m working section, equipped with a 3D computer controlled probe traversing system and dynamometer, and laser safety arrangements; maximum wind speed of 30m/s. 7’ x 5’ tunnel: closed circuit wind tunnel with a 2.1m x 1.5m working section, wind speeds of up to 45m/s, a moving ground for ground-effect aerodynamic work, and a 4.6m x 3.7m low speed section. R.J. Mitchell tunnel: large and extensively equipped low-speed wind tunnel with a 3.5m x 2.4m working section, with moving ground and a maximum wind speed of 40m/s, also equipped with a Nutem overhead 6-component balance, surface pressure scanning and PIV system for optical measurements.
Typical Testing Activities	- Aerodynamics performance testing of renewable energy devices. - Calibration of instrumentation. - Flow visualisation studies. - Wind engineering studies. - Vehicle aerodynamics. - Optical measurements of the airflow. - Flow simulation on underwater bodies.
User	Academia/Industry
Website	https://www.southampton.ac.uk/windtunnels/index.page

Wind Tunnels	
EnFlo Laboratory	**100**
Organisation	University of Surrey
Location	Guildford
Type of asset	Laboratory
Scale of operation	Small/Medium
Description	The EnFlo meteorological wind tunnel features comprehensive inlet flow and surface heating and cooling systems for generation of neutral, stable and unstable boundary layers and neutral and stable free flows, two three dimensional, computer controlled traversing gears, tracer supply systems, calibration facilities, a turntable and extensive condition monitoring. The tunnel and all associated capabilities operate under full computer control, enabling prolonged unmanned operation. Key features: thermally stratified, twin fans, suck through, working section: 20L x 3.5W x 1.5H m, overall length: 27.2m, air speed range: 0.3 to 3.0m/s, 15 layers at 0.1 spacing, 3 heating zones at 0.5m.
Typical Testing Activities	- Wind-tunnel simulation of neutral, stable and convective atmospheric boundary layer flows. - Wind turbine wakes, wake-wake and wake turbine interactions. - Structure of complex turbulent flows, boundary layers, separated flows and wakes. - Aerodynamic and bluff body flows, wind power aerodynamics.
User	Academia/Industry
Website	https://www.surrey.ac.uk/aerodynamics-environmental-flow-group/environmental-flow-research-centre/facilities

Department of Engineering
Durham University
Lower Mountjoy
South Road
Durham
DH1 3LE
UK

Tel: +44 (0) 191 334 1700

https://www.dur.ac.uk/engineering/

SUPERGEN Wind
Royal College Building
204 George St
Glasgow
Scotland
G1 1XW
UK

Tel: +44(0)141 548 2378

https://www.supergen-wind.org.uk/