



SCOTTISH
DEVELOPMENT INTERNATIONAL

Offshore Wind Industry and Opportunities in Scotland 苏格兰的海上风电产业与机遇

Lily Zhao 赵莉

Scottish Development International

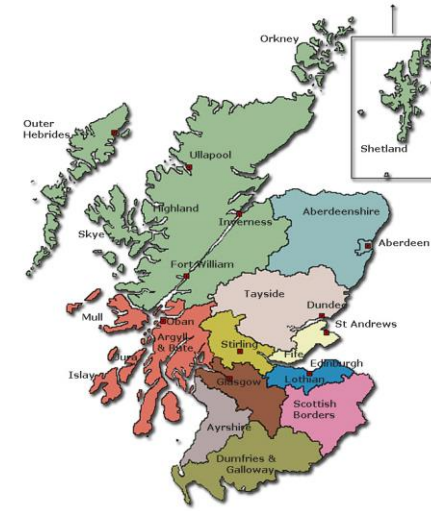
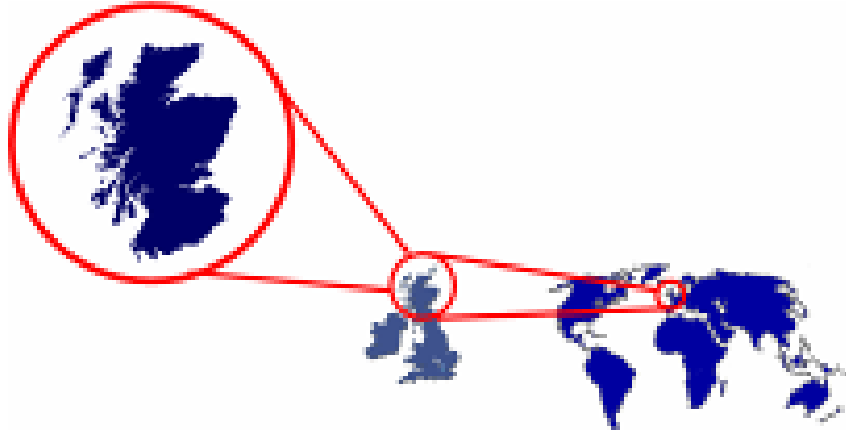
苏格兰国际发展局

14th October 2020

2020年10月14日

#SCOTLAND|SNOW

苏格兰国际发展局 (SDI)



Economic data

- Area: 77169 km² Population 5.4 million
- 356,550 private sector enterprise
- 2018 GDP US\$238 billion
- 2018 GDP growth year on year +1.4%
- GDP per capital US\$43,740
- Average weekly salary US\$740
- Q2 2019 unemployment rate 3.6%

经济数据

- 面积近8万平方公里，人口540万
- 356,550家私营企业
- 2018年GDP达2,380亿美元
- 2018年GDP同比增长+ 1.4%
- 人均国内生产总值43,740美元
- 平均每周工资 740美元
- 2019年第二季度失业率3.6%

苏格兰国际发展局:

- 苏格兰政府下属的贸易投资促进机构 - 非盈利的对外窗口
- 协助海外企业到苏格兰投资设立业务
- 协助苏格兰公司出口海外
- 提供一站式的服务



Contents 主要内容

- Energy industry in Scotland
苏格兰的能源产业
- Offshore wind industry in Scotland
苏格兰的海上风电产业
- Opportunities 商业机遇
 - ScotWind Leasing Round
Scotwind 海上风电租赁项目
 - Floating Wind 浮式风电
 - Supply chain 供应链

Energy Industry in Scotland

苏格兰的能源产业

Scotland's Net Zero Climate Targets

苏格兰零排放目标

Year	Scottish CO ₂ Reduction
2030	75%
2035	80%
2040	90%
2045	100%

The [CCC advises](#) combined use of renewables and CCS for rapid and effective carbon reduction



Scottish Energy Strategy Target and Progress

苏格兰能源战略的目标和进展

Renewable Electricity 可再生能源供电

- Equivalent of 100% of Scotland's electricity demand to be generated from renewable sources by **2020**:

至2020年苏格兰100%的电力需求完全可以由可再生能源满足

- 74.6% in 2018 - another record year for renewable electricity in Scotland.

2018年可再生能源供电已达到74.6%

Renewable Heat 可再生能源供暖

- 11% of non-electrical heat demand to come from renewable sources by **2020**:

2020年11%的非电力供暖需求由可再生能源供应

- Scotland generated 5.9% of its non-electrical heat demand from renewable sources in 2017.

2017年非电力供暖中可再生能源供应占5.9%

Energy Consumption 能源消耗

- 12% reduction in the amount of energy consumed annually by **2020**: 至2020年每年能源消耗降低12%
- 13.9% reduction in 2017. 2017年的数据是13.9%

Energy Productivity 能源产能

- 30% increase by **2030**: 至2030年能源增长30%
- Energy productivity has increased by 0.3% between 2015 and 2017.
2015年至2017之间能源产能增加0.3%

All Renewable Energy target 综合可再生能源的目标

- 50% by **2030** 2030年达到50%
- 20% in 2017 2017是20%

Phase out new petrol and diesel cars by **2032** 2032年逐步减少汽油和柴油车

#SCOTLANDISNOW

2045 Net Zero 2045 实现完全零排放

WORLD FIRST RENEWABLES PROJECTS 世界领先的苏格兰可再生能源项目

Our pioneering energy sector continues to innovate, evolve and punch above its weight in delivering world first projects.

欧洲海洋能源中心-全球首个开放型波浪和潮汐能测试中心

EMEC (European Marine Energy Centre) – world's first open sea wave and tidal testing site

Eigg-全球首个离网可再生能源系统

Eigg – world's first off-grid renewable energy system

Shetland Tidal Array-全球首个社区所有的潮汐能阵列

Shetland Tidal Array – world's first community owned tidal array

MeyGen 1A-全球首个民用规模的潮汐能阵列

MeyGen 1A – world's first utility-scale tidal array

欧洲海上风电发展中心-全球首个安装在工业用吸力式筒型基础上的最大功率风机

EOWDC (European Offshore Wind Development Centre) – world's most powerful turbines installed on industry-first suction jacket foundations



Beatrice-全球首个深水风电项目

Pentland Firth & Orkney Waters-全球首个海风商用租赁竞标项目

Hywind Scotland-全球首个浮式风电项目

Surf'n'Turf-全球首个潮汐能氢电解质项目

Offshore Wind Industry in Scotland

苏格兰的海上风电产业

Offshore Wind Sector Deal 英国海上风电行业协议

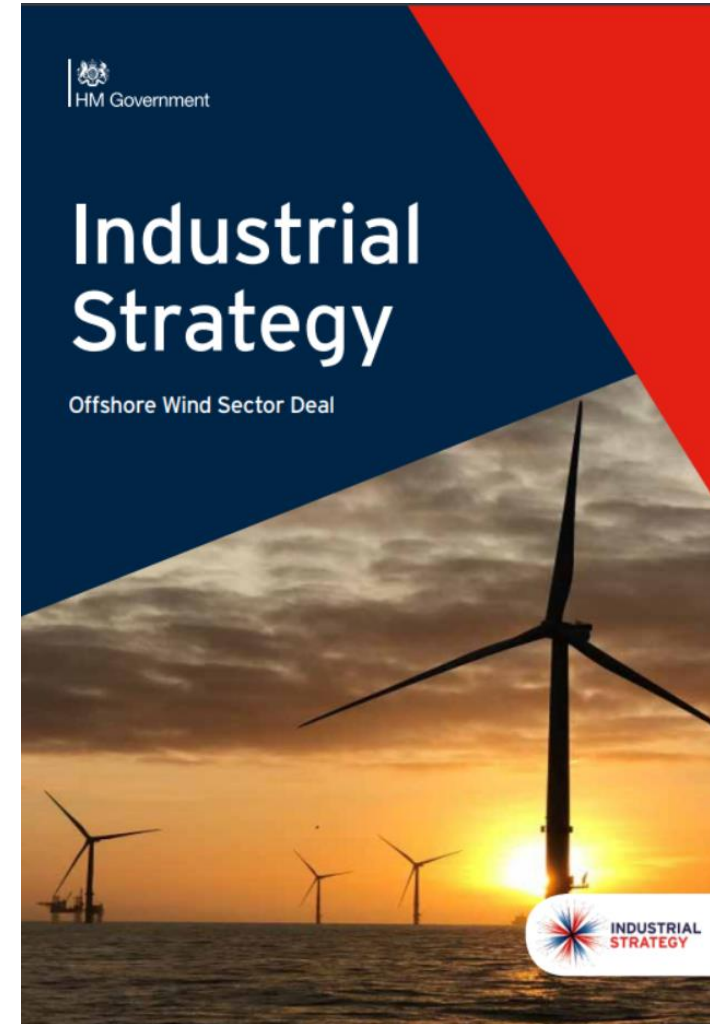
- **UK's 2019 Offshore Wind Sector Deal Theme**
Ideas (Innovation), Business Environment (Supply Chain), Infrastructure, People (Employment, Skills and Community), Place (Clusters)

英国政府2019年发布的海上风电行业协议主旨:

创新建议, 商业环境 (供应链), 基础设施, 人才, 集群

- **Ambitions: 协议目标**

- 40GW of offshore wind capacity by 2030
2030年实现40GW的海上装机容量
- £72bn investment in UK infrastructure
720亿英镑投资注入基础设施
- A fivefold increase in exports to **£2.6bn** p.a.
出口实现五倍增长至每年260亿英镑
- A **£2.4bn** reduction in electricity costs to consumers
消费者用电成本降低24亿英镑
- **27,000** skilled jobs (30-40% female) **创造 27,000个工作**



*increased from 30GW to 40GW in January 2020

Offshore Wind Industry in Scotland

苏格兰的海风产业

➤ UNRIVALLED NATURAL RESOURCES 丰富的自然资源

25% of Europe's entire offshore wind resources and a practical offshore wind resource of **169GW**
拥有欧洲**25%**的海上风电资源，可利用的海风资源达 **169GW**

➤ RECORD-BREAKING RESULTS 创纪录的成果

2019 was a record year for renewable electricity in Scotland - **90%** of our gross electricity consumption met by renewables

2019年是苏格兰可再生能源创新高的一年，**90%**苏格兰的电力消耗来源于可再生能源

➤ IMPRESSIVE PROJECT PIPELINE 卓越的项目资源

- **2.2GW** operational or under construction **2.2 GW** 已运营或在建的项目
- **7GW** in the pipeline **7GW** 已获批即将开发的项目
- up to **10GW** in current ScotWind leasing round **10GW**的新一轮海风租赁项目

➤ A TALENTED WORKFORCE 优秀的人才

- 46,500 people employed in the renewables and low carbon sector.
46,500 雇员从事可再生能源和低碳产业
- 101,400 people employed in oil & gas 101,400雇员从事油气产业

CENTRES OF EXCELLENCE

创新中心

➤ **Offshore Renewable Energy Catapult 英国海上风电能源加速器**

The UK's leading innovation centre for offshore renewable energy brings together industry and academia, enabling the scale-up of offshore renewable energy technologies.

➤ **Energy Technology Partnership (ETP) 能源技术合作中心**

The largest energy research partnership in Europe, with 250 academics and 600 researchers, ensures easy access to world-class capability, resources and collaboration.

➤ **Industrial Doctoral Centre in Offshore Renewable Energy (IDCORE) 海上可再生能源工业博士中心**

Multi-disciplinary center training engineers and scientists to tackle current and future offshore renewable energy challenges.

➤ **European Offshore Wind Deployment Centre (EOWDC) 欧洲海上风电中心**

Test & demonstration facilities for next generation technology, currently hosting some of the world's most powerful wind turbines.

➤ **The National HVDC Centre 英国HVDC中心**

The UK's only simulation and training facility supports all HVDC schemes connecting to the UK grid.

➤ **Power Networks Demonstration Centre (PNDC) 电力网络示范中心**

Enables highly realistic and accelerated technology testing alongside a rich portfolio of research programmes across the full Smart Grid domain.

➤ **Floating Offshore Wind Centre of Excellence 浮式海上风电创新中心**

Accelerates the development of next-generation offshore wind technologies.

OFFSHORE WIND CLUSTERS

海上风电产业集群

Scotland's offshore wind clusters are instrumental in connecting, supporting, promoting and accelerating the sector, by influencing government, driving forward supply chain opportunities and investing in skills and infrastructure.

苏格兰海风产业集群主要职能是通过影响政府，引导供应链机遇与投资人才和基础设施来支持，推广和加速苏格兰的整个海风产业



苏格兰深海风电协会（北部）



苏格兰Forth & Tay海上风电协会 (东部)

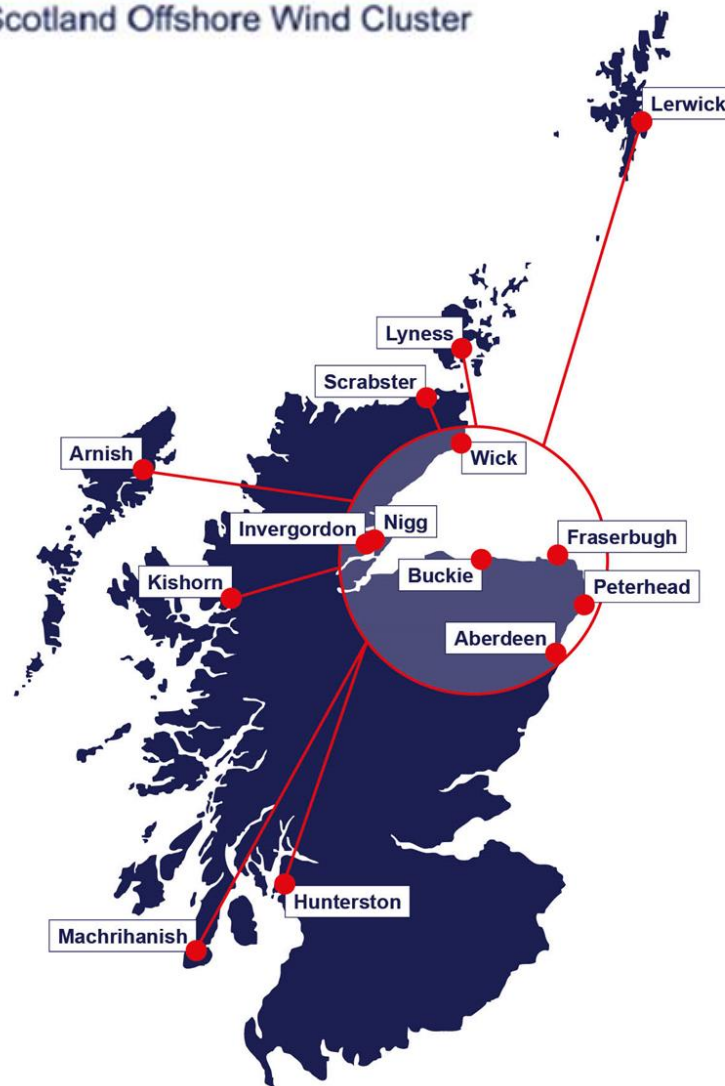


苏格兰海上风电能源协会

The DeepWind Cluster 苏格兰深海风电协会 (北部)



- Active from May 2019 2019年5月正式成立
- Lead cluster in the UK for floating wind 英国浮式风电的领先集群
- Strong subsea focus 专注于海底
- 452 members 目前452个会员
- Membership Includes 成员包括:
 - 22 Offshore Wind Developers 22家海风开发商
 - 1 OEM Turbine Manufacturer 1家风机OEM厂商
 - 6 Councils (Local Government) 6家当地政府协会
 - 4 Universities and 4 Colleges 4所大学和4所学院
 - 25 ports and harbours 25个港口
 - 3 Associations- AREG, Decom North Sea and Subsea UK 3家产业协会
 - 375 supply chain companies from micro SMEs to multi-national companies 375个供应链公司, 包括跨国企业和中小企业



Developer Group -22 Companies

22家开发商





The Forth & Tay Offshore Cluster 苏格兰Forth & Tay海上风电协会 (东部)

- Drives the growth of offshore energy on the east coast of Scotland, focused around the Seagreen, Neart na Gaoithe and Inch Cape projects.
促进苏格兰东海岸的海上能源发展，尤其是三个主要的海上风电项目：
Seagreen, Neart na Gaoithe 和Inch Cape
- Represents offshore wind developers, public sector organizations, further & higher education institutions and supply chain businesses from across Scotland.
代表了苏格兰的海风开发商，政府机构，教育研发机构和供应链公司
- Supported by SSE, EDF Renewables and SDIC Red Rock Power, with the full database of supply chain members publicly available.
主要由SSE, EDF Renewable 和 国投电力的子公司红石能源支持



SCOTTISH OFFSHORE WIND ENERGY COUNCIL (SOWEC)

苏格兰海上风电能源协会

- SOWEC is a powerful partnership between the Scottish Government and the offshore wind industry
- 苏格兰政府和企业联合成立的机构
- Working directly with the DeepWind and Forth & Tay Offshore clusters, it aims to create a competitive, commercially-attractive offshore wind sector in Scotland which can deliver both domestically and globally.
- 与其它两个产业集群协作以创造富有竞争力和吸引力的产业来促进苏格兰和全球的海风市场
- Focus on project development, deeper water capability and innovative technology solutions - aims to develop a sustainable, world-class supply chain in Scotland.
- 主要职能是项目开发，和发展深水技术来促进苏格兰的供应链

Scotland's Offshore Wind Opportunities

苏格兰海上风电的商业机遇

- Offshore wind leasing rounds -Scotwind Leasing
Scotwind海上风电海床租赁竞标项目
- Floating Wind
浮式风电
- Supply Chain Opportunities
供应链

Scotwind Leasing Round

Scotwind海上风电海床租赁竞标项目



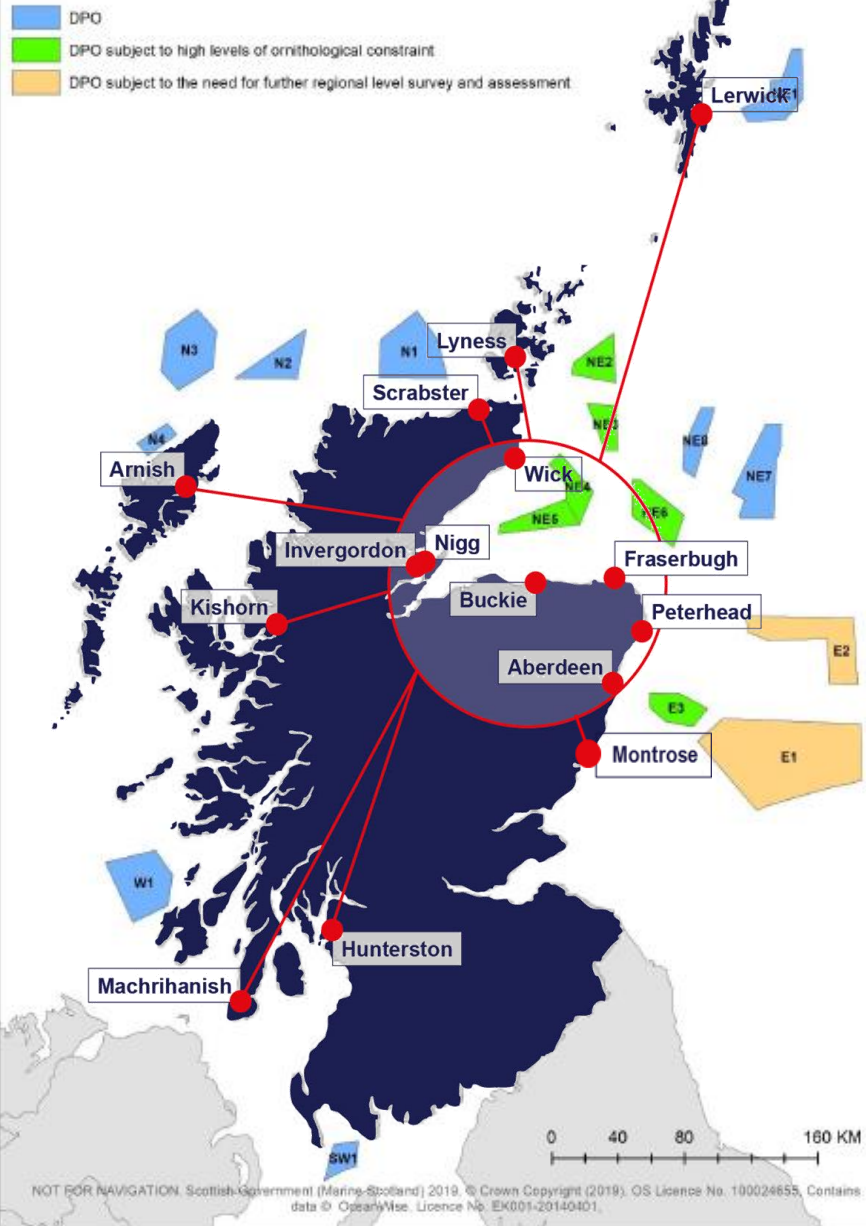
Crown Estate Scotland are the seabed manager. Crown Estate Scotland grants a lease of the seabed only when the consents and other required permissions are in place
苏格兰皇家资产局是苏格兰海床的管辖机构。负责条件成熟符合规定的海床租赁。



Marine Scotland are the regulator and responsible for strategic marine planning—Marine Scotland grants consents for projects
苏格兰海事局是监管机构，负责苏格兰海事的战略性规划，审批相关项目。

- **ScotWind Leasing – 1st round** of offshore wind leasing in Scottish waters for **10 years**
– **8 billion GBP** investment opportunity
Scotwind Leasing – 苏格兰海域租期**10年**的第一轮海上风电海床租赁业务, 近**80亿**的投资机会。
- Companies at the cutting edge of offshore renewables are invited to help build Scotland's new generation of offshore wind farms, with a potential capacity of up to **10GW** over **17 new sites**.
邀请领先的可再生能源公司在苏格兰近**17个海域**共同建造装机容量约**10GW**的新一代海上风电厂。

Draft Plan Options - Options subject to ornithological mitigation measures



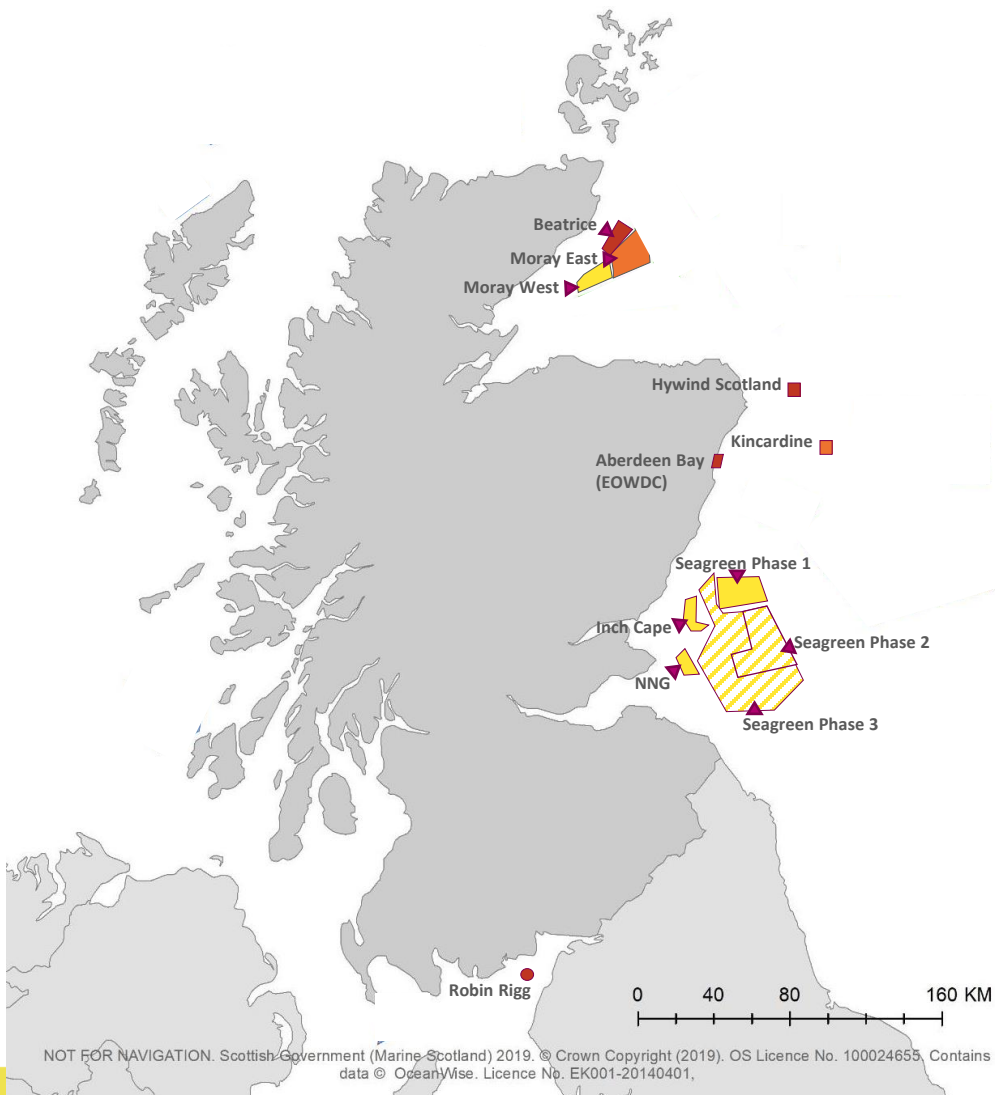
ScotWind Leasing Round 海上风电海床租赁竞标项目

- launched on 10th June in 2020
2020年6月10日正式开始招标
- Registration now open until 5th August 2020
投标公司注册时间截止2020年8月5日
- Earliest date for closing applications is October 2020
2020年10月申请结束
- Crown Estate Scotland's ambition is for a further 8-10GW
苏格兰皇家资产局的目标：8-10GW的装机容量
- Successful lease bidders will be announced in Q1-Q2 2021
2021年第一或二季度公布招标结果
- This could more than double Scotland's existing 7.6GW pipeline (only 1GW built so far)
此项目将会让苏格兰目前7.6GW的装机容量翻倍
(目前只有1GW的在建项目)
- With a 15-17GW project pipeline Scotland would become a world top ten offshore wind market
此项目建成后苏格兰将成为全球海上风电装机容量 (15-17GW) 前十名的市场之一

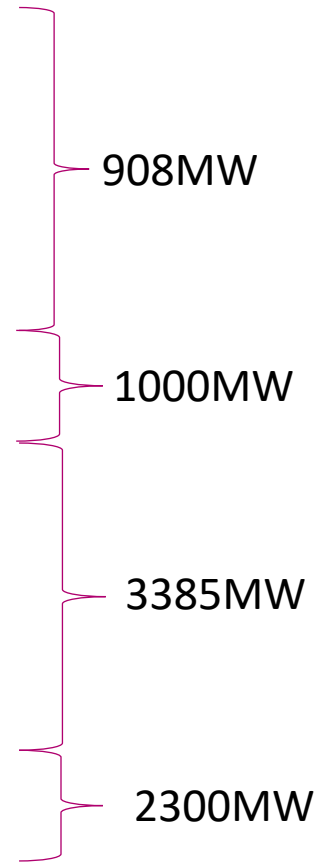
ScotWind Leasing Round ScotWind海上风电租赁项目

Draft Plan Options 规划草案选项 (8-10GW)

- DPO 规划草案选项
- DPO subject to high levels of ornithological constraint 因鸟类高频率出现受限的选项
- DPO subject to need for further level survey and assessment 需要进一步调查和评估的选项



SITE 地点	DEVELOPER 开发商	CAPACITY 容量
Robin Rigg	E.ON	180MW
Hywind Scotland	Equinor	30MW
Aberdeen Bay	Vattenfall	93MW
Beatrice Demo	SSE	10MW
Levenmouth	ORE Catapult	7MW
Beatrice	SSE/Red Rock Power	588MW
Kincardine	Cobra	50MW
Moray East	EDPR/Engie	950MW
Inch Cape	Red Rock Power	1000MW
Seagreen	SSE	1075MW (454MW CfD)
NNG	EDF Renewables/ESB	448MW (CfD)
Moray West	EDPR/Engie	850MW
ForthWind	Cierco	12MW (CfD)
Seagreen (2)	SSE	1400MW
Seagreen (3)	SSE	900MW



Current Wind Farms 现有风电场 (7.6GW)

By status 以运营状态分类

- Operational 运营中
- Under construction 建设中
- Consented 已批准
- Planned 计划中

NOT FOR NAVIGATION. Scottish Government (Marine Scotland) 2019. © Crown Copyright (2019). OS Licence No. 100024655. Contains data © OceanWise. Licence No. EK001-20140401.

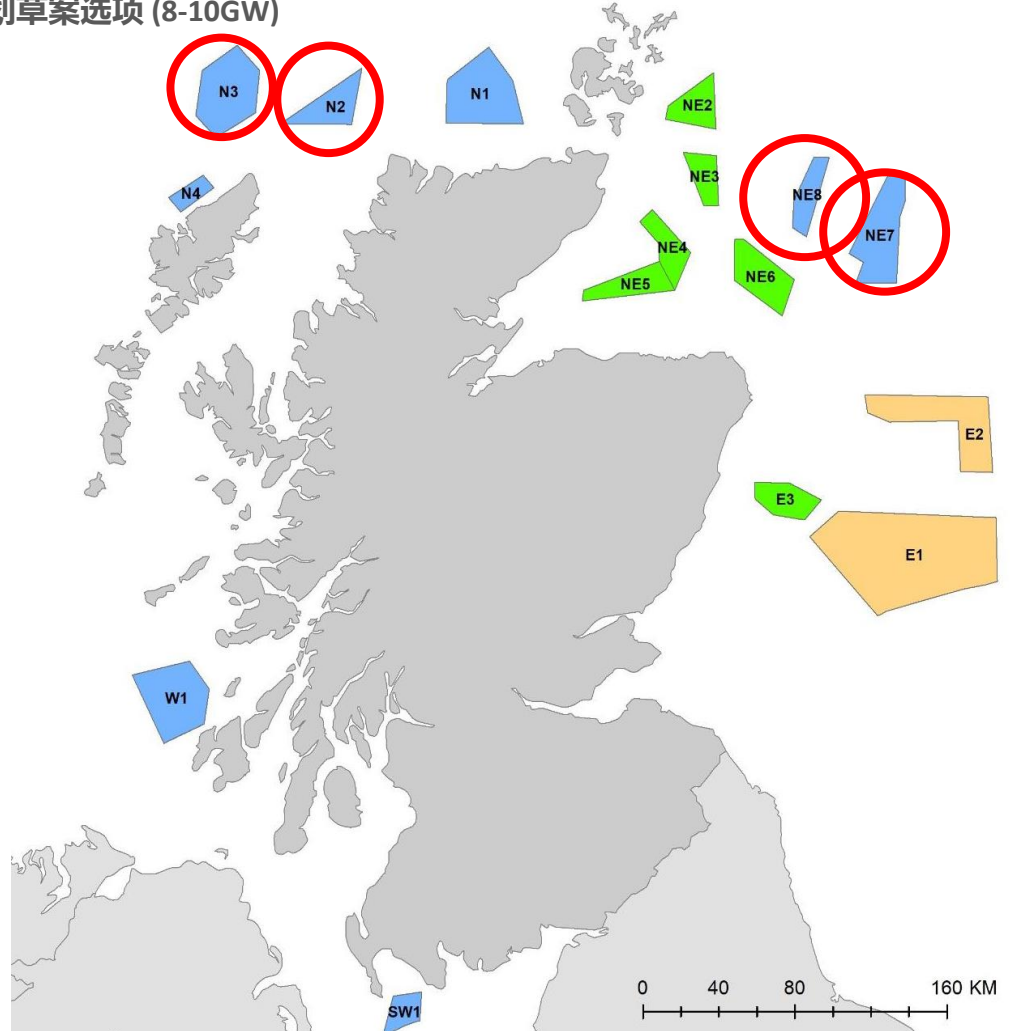
Indicative Capacity and Occupancy of Draft Plan Option Areas
规划草案备选区域的指示容量和占用率

Region 地区	DPO	Area 面积 (km ²)	Potential installed capacity 潜在安装容量 (GW)	Realistic maximum development scenario for DPO 规划选项的现实最大开发场景 (GW)
East 东部	E1	3816	19.1	3
	E2	1287	6.4	2
	E3	474	2.4	1
Subtotal 小计		5577	27.9	6
North East 东北	NE1	776	3.9	2
	NE2	464	2.3	1
	NE3	339	1.7	1
	NE4	440	2.2	1
	NE5	496	2.5	1
	NE6	699	3.5	2
	NE7	1027	5.1	3
	NE8	401	2	1
Subtotal 小计		4642	23.2	12
North 北部	N1	1163	5.8	2
	N2	560	2.8	2
	N3	1106	5.5	2
	N4	200	1	1
Subtotal 小计		3029	15.1	7
West 西部	W1	1107	5.5	2
Subtotal 小计		1107	5.5	2
South West 西北	SW1	292	1.5	1
Subtotal 小计		292	1.5	1
Total 合计		14647	73.2	28

- DPO 规划草案选项
- DPO subject to high levels of ornithological constraint 因鸟类高频率出现受限的选项
- DPO subject to the need for further regional level survey and assessment 需要进一步调查和评估的选项

ScotWind Leasing Round
ScotWind海上风电用海竞标

Draft Plan Options
规划草案选项 (8-10GW)



NOT FOR NAVIGATION. Scottish Government (Marine Scotland) 2019. © Crown Copyright (2019). OS Licence No. 100024655. Contains data © Oceanwise. Licence No. EK001-20140401.

The following companies have already declared an interest in ScotWind 目前已对Scotwind表示明确兴趣的公司



Floating Wind 浮式风电

- Home to Hywind Scotland, the world's 1st floating offshore wind farm, Scotland is already leading the way in floating wind. We're now gearing up for large-scale commercial projects, creating a huge market for innovative floating wind technologies, supply chain and new infrastructure.
- 苏格兰在浮式海上风电领域领先于全球。Hywind Scotland是世界上第一个浮式海上风电项目。苏格兰致力于开发大型的商用项目，并利用创新技术，供应链和新的基础设施来创建一个规模宏大的市场。
- 2nd floating wind farm, the 50MW Kincardine project, will begin construction in 2020.
第二大浮式风电项目50MW 的Kincardine项目于2020年开始建设
- Of the ScotWind Leasing sites, 5 are aimed at floating wind and many of the other sites will see the first hybrid fixed and floating commercial projects.
Scotwind海上风电项目中，5个项目将为浮式风电项目，其它地区的许多项目也将采取固定与浮式相结合的模式。
- In Scotland we are committed to retaining our lead in this nascent sector by investing in innovation. Initiatives such as Floating Wind Joint Industry Project (JIP) will address the commercial deployment challenges of floating wind, creating R&D opportunities for electrical systems, mooring systems and logistics for construction and operation.
苏格兰将致力于投资创新来保持在此行业的领先地位。比如浮式风电产业联合项目（JIP）就是其中之一。这个项目将着眼于浮式风电商用面临的难题，电机系统的研发创新，和系泊系统以及建设/运营物流中的物流体系的开发。

Scottish Floating Wind Projects

苏格兰浮式风电项目



100m

- 3.5 ROC Mechanism – a Scottish Government support mechanism , now closed, enabled the world’s first two floating wind farms, Hywind Scotland and the Kincardine project, to be built.
- 3.5 ROC机制—由苏格兰政府支持，现已结束；使世界上最早的两个浮式风电场Hywind苏格兰和Kincardine项目得以建成。

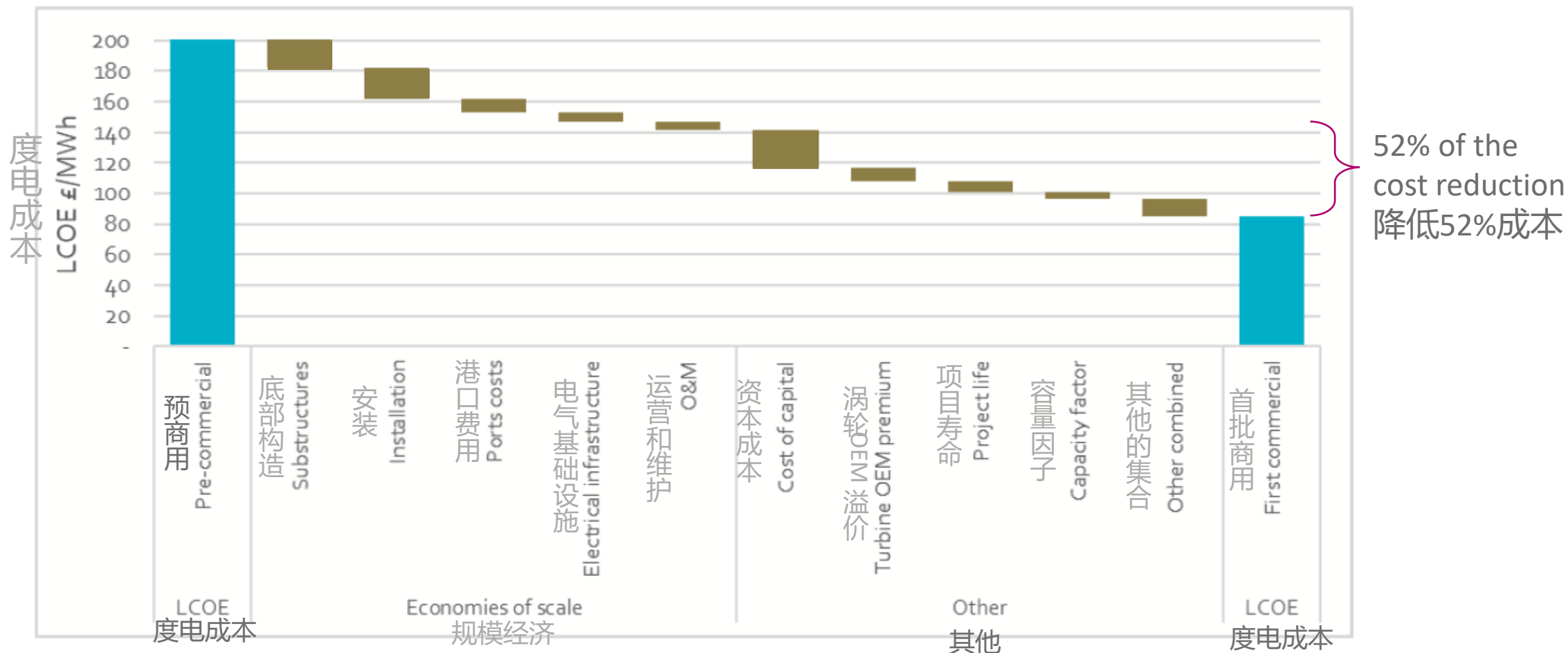


60m

- The 50MW Kincardine project is currently under construction but the 30MW Hywind project has been up and running for around 3 years with an industry leading capacity factor of 56%
- 50MW的Kincardine项目正在建设中；30MW的Hywind项目已投产运行近3年，产能率达56%，处于行业领先地位

Floating wind cost reduction drivers from Pre-commercial to First Commercial Projects

从预商用项目到首批商用项目的浮式风电成本降低驱动力



Source – Macroeconomic benefits of offshore wind in the UK, Oct 2018

LCOE £200/MW/h down to £85/MWh by 2027. The forecast in this report, with 6GW deployed by 2031, is that parity with fixed wind will be achieved.

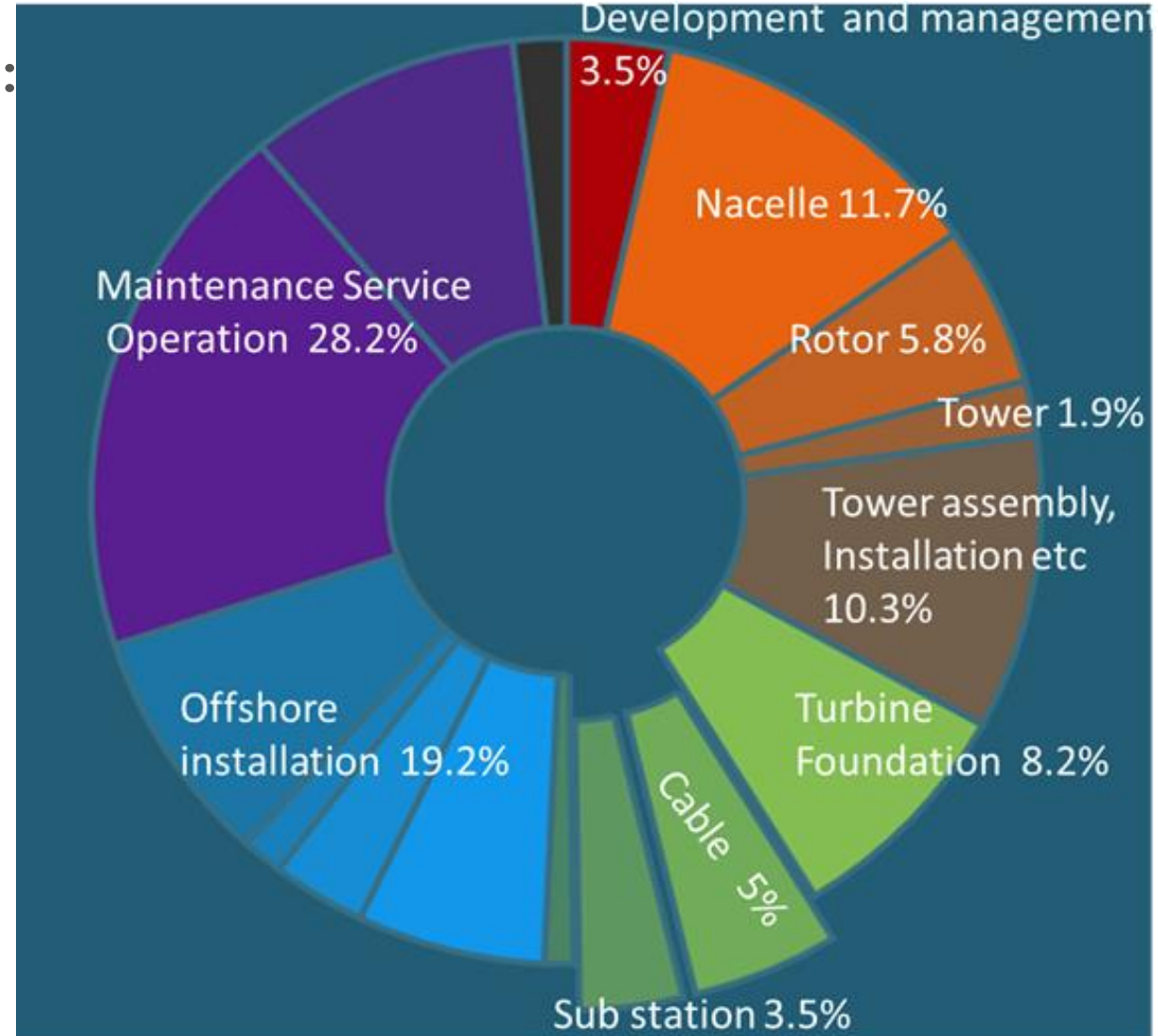
到2027年，度电成本将从 200英镑每MWh降至85英镑每MWh。这份报告预测，随着装机容量到2031年达到6GW，浮式风电的成本将会实现与固定风电的持平。

Supply Chain Opportunities

供应链机遇

Scotland has identified several areas of the supply chain that offer immediate opportunities for companies:
苏格兰海风项目供应链的潜在机会

- Export cable manufacture **输出电缆制造**
- Array cable manufacture **数组电缆制造**
- Large castings and forgings (wind turbine rotor hubs, bedplates and drive shafts)
大型的铸造件 (风轮轮毂, 底座, 传动轴)
- Offshore wind turbine blades (blade lengths greater than 100m)
风机叶片 (大于100m的叶片)
- Offshore electrical substation topsides
海上变电站的上部机构
- Large gauge mooring chain for floating wind
浮式风电的大口径系泊链
- Substructures (floating)
浮式风电的下部结构



Scottish Offshore Wind Supply Chain Gaps

苏格兰海风供应链机遇

Sub-element	Total Expenditure	Scottish capability in the area	企业数量	具体描述	目前的主要企业
Wind farm design	<1% =	Medium =	121	Engineering · Development consulting	Aker Solution/Apollo /Ecosse IP /EnerMec Cortez Subsea /Arup /Fugro
Surveys	<1% =	High +	70	survey (Geophysical, Hydrogrphycal, Environmental)	Bureau Veritas / GEOxyz Offshore Fugro /ROVCO
Nacelle assembly	<1% =	Low =	23	Main bearing, Nacelle cover, Main shaft etc	ITC / EnerMech (IMR)
Blades	5% -	Low =	8	Blades,Hub Cassting, Spinner, Blade bearing, Steel component	EnerMech (IMR) / James Fisher Marine ACT Blade
Castings and Forging	1% -	Low =			
Gearbox, Generator	5% -	Low =	5	Generator, Gearbox,	Lamond & Murray /EnerMech (IMR)
Towers	2% -	High +	5	Tower structure, Tower internals	EnerMech (IMR) / NDT and Quality Services (IMR)
Subsea array cables	1% =	Low =	12	cable outer/core, cable jointing and testing, cable protection	Mesh Global / James Fisher Marine / Monitor system Scotland / Balmoral /Cable Solutions
Subsea export cables	2% =	Low =			
HVAC substations	6% -	High +	26	Facility&Structure , Electrical System	Semco Maritime / James Fisher Marine / EnerMech /Terasaki
HVDC substations	6% -	Low =			

Scottish Offshore Wind Supply Chain Gaps

苏格兰海风供应链机遇

Sub-element	Total Expenditure	Scottish capability in the area	企业数量	具体描述	主要企业
Spar floating structure		Low	6	floating structure , Mooring	Global Energy / BiFab / Furgason Marine First Marine Solution / InterMoor Bridon-Bekaert (mooting)
Semi-sub floating Structure		Low			
Monopile foundations	7% -	Low =	7	Monopile and Foundation	BiFab/ Global Energy / Liberty Steel
Non-monopile steel foundations	7% -	Medium =	6	steel work	BiFab / Global Energy / Liberty Steel / Furgason
Concrete foundations	7% -	Low =	3	Gravity Base Foundation	BAM Nuttall
Installation ports	<1% =	Medium =	32 Energy Ports	Port is one of the key elements of infrastructure	
Foundation installation	5% =	Low =	16	Seabed preparation, Foundation Installation	Marin TM / Maesk Supply Fugro / Oceana Subsea
Subsea cable installation	4% =	Medium =	40	Cable Handling, Cable Installation ROV	Motive Offshore / Maersk Supply Marin TM / DOF Subsea / ROVCO
Turbine installation	2% =	Low =	11	Turbine Installation , Commissioning	EnerMEch / Maersk Supply / Mesh Global / FNVi
Operations, maintenance and minor service	22%	High	179	Operation and Maintenance support Foundation IMR / Cable IMR Substation maintenance	Enermech / James Fisher and Sons Bilfinger Salmis / Data Verse AIM NDT and Quality Services / Texo Globa Energy / First Marine Solution / ROVCO
Major service	8% +	Medium =			



Our Support to make your business successes in Scotland 苏格兰国际发展局能协助您的企业做什么？

- Access to market insight
提供相关市场信息
- Introduce local intermediary and potential partners
推介当地的合作伙伴
- Provide information on potential project which Chinese companies could get involved
提供中国企业可以参与的潜在项目信息
- Navigate how to set up operation in Scotland
协助中国企业在苏格兰设立公司开展业务

#SCOTLAND|SNOW

#SCOTLANDISNOW

Thanks

Lily Zhao

Lily.zhao@scotent.co.uk

Scottish Development International