MEI Seminar Series

Seminar #3: Offshore Wind Development in Australia – Ingredients and Spices

28 May 2026

THE UNIVERSITY OF MELBOURNE

Melbourne Energy Institute

Speaker:

Dr. Daniel Machado
Senior Manager Environment - Offshore Wind
Iberdrola Australia

Moderator:

Professor Richard Sandberg
Director, Melbourne Energy Institute
University of Melbourne

MEI Seminar Series 2026

THE UNIVERSITY OF MELBOURNE

Seminar topic	Month
1. Sustainability of Mining Energy Transition Minerals	March
2. Solar Power and The Energy Transition	April
3. Offshore Wind Development in Australia – Ingredient and Spices	**May**
4. Carbon Capture in the Asia-Pacific: Progress, Policy and the Path to Net Zero	June
5. Enhancing grid resilience towards net-zero	Aug
6. The Future of the Australian Car Market: Policy, Competition and Electrification	Sep
7. State of Play for Fusion Energy	Oct

For updates, subscribe to the MEI newsletter. Visit: energy.unimelb.edu.au

Iberdrola Australia

Offshore Wind Development in Australia

Dr Daniel Machado

Melbourne Energy Institute – Seminar

28 May 2026

Acknowledgment of Country

Iberdrola Australia

We would like to acknowledge the Traditional Custodians of the lands and waters where offshore wind projects are proposed, and recognise their continuing connection to land, sea, culture and community.

We pay respect to Elders past, present and emerging.

Outline

Introduction

- About Iberdrola
- Aurora Green Project

Fundamentals

- Demand
- Supply / Resource
- Grid

Global Context

- Key Factors and Markets

Project Development

- What makes a project feasible?
- Financial Viability
- Technical Feasibility
- Approvals & Consents
- Stakeholders & Community

Conclusion

About Iberdrola

Iberdrola is a global leading *integrated energy company* with a strong focus on Renewable Energy, Electricity Networks, Wholesale and Retail Electricity.

With more than a century of history, Iberdrola is a global energy leader, the leading wind-power producer and one of the largest electricity companies in the world in terms of market capitalisation.

Renewables

- **46 000 MW** in Operation December 2025
  - Onshore (21000 MW) & Offshore Wind (2 500 MW)
  - Solar Power (8 700 MW)
  - Hydroelectric (12 900 MW)
  - Other : small-scale Renewables (500 MW)

Networks

- Iberdrola owns approximately **1.2 million kilometres** of electricity transmission and distribution networks globally (Spain, UK, United States and Brazil)
- Big investments on Smart Grids and Innovation

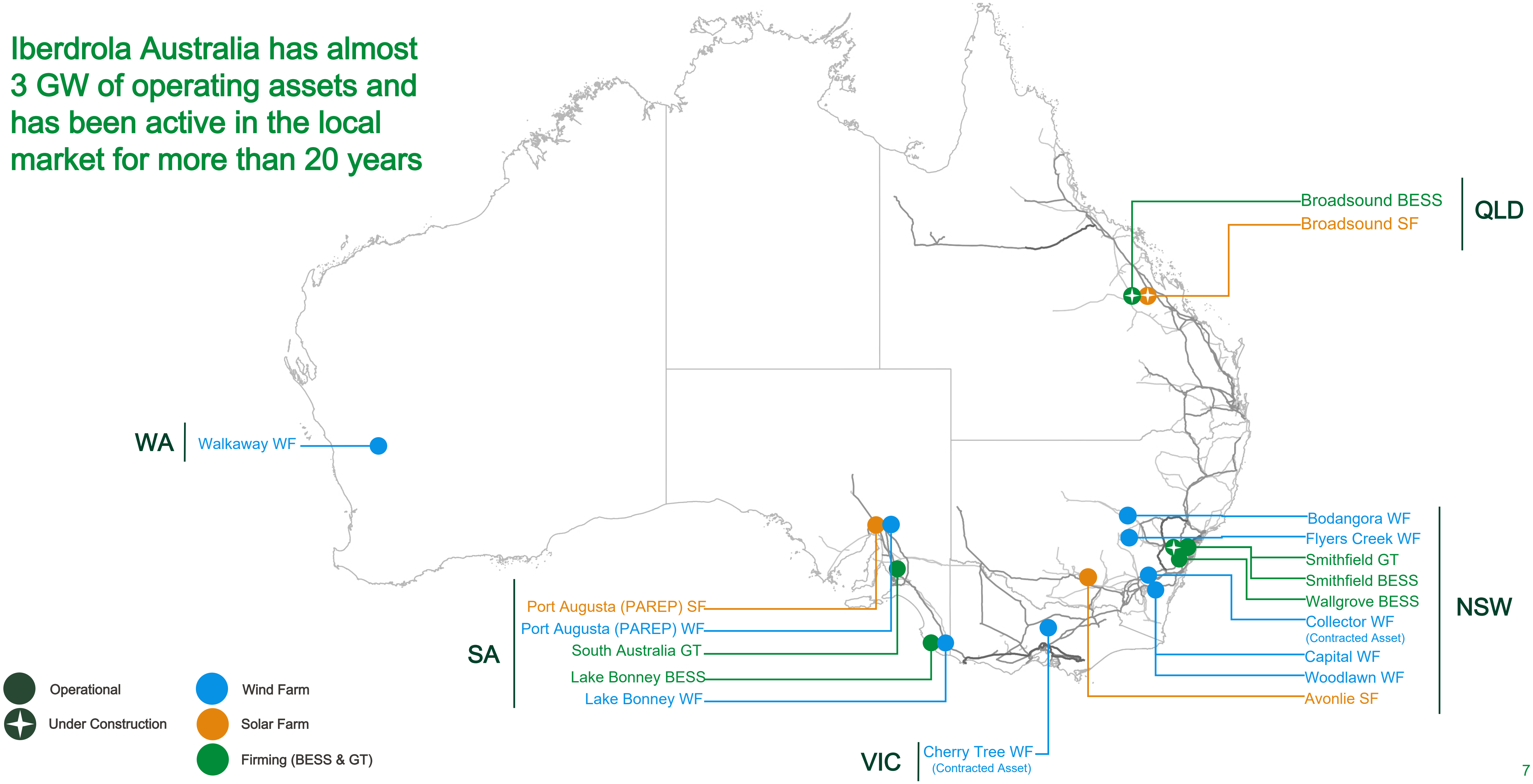
Wholesale & Retail Electricity

- **38 Million** supply points worldwide for electricity, gas and smart metering

Iberdrola Australia

Iberdrola Australia

Iberdrola Australia has almost 3 GW of operating assets and has been active in the local market for more than 20 years



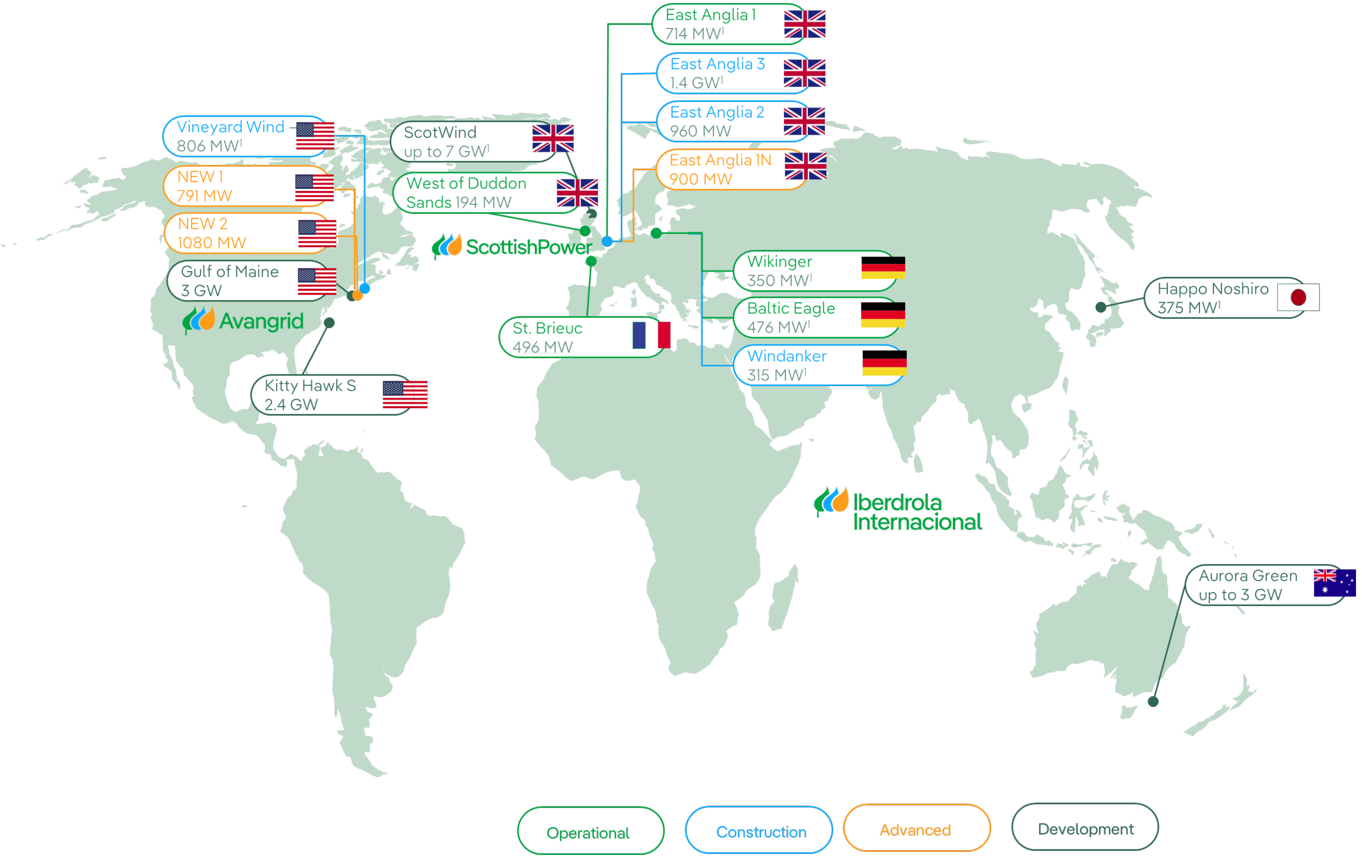
Iberdrola – A Global Leader in Offshore Wind

Iberdrola Australia

Iberdrola is a global leader with five offshore wind farms in operation

We are currently building four offshore wind projects with a combined capacity of 3.5 GW

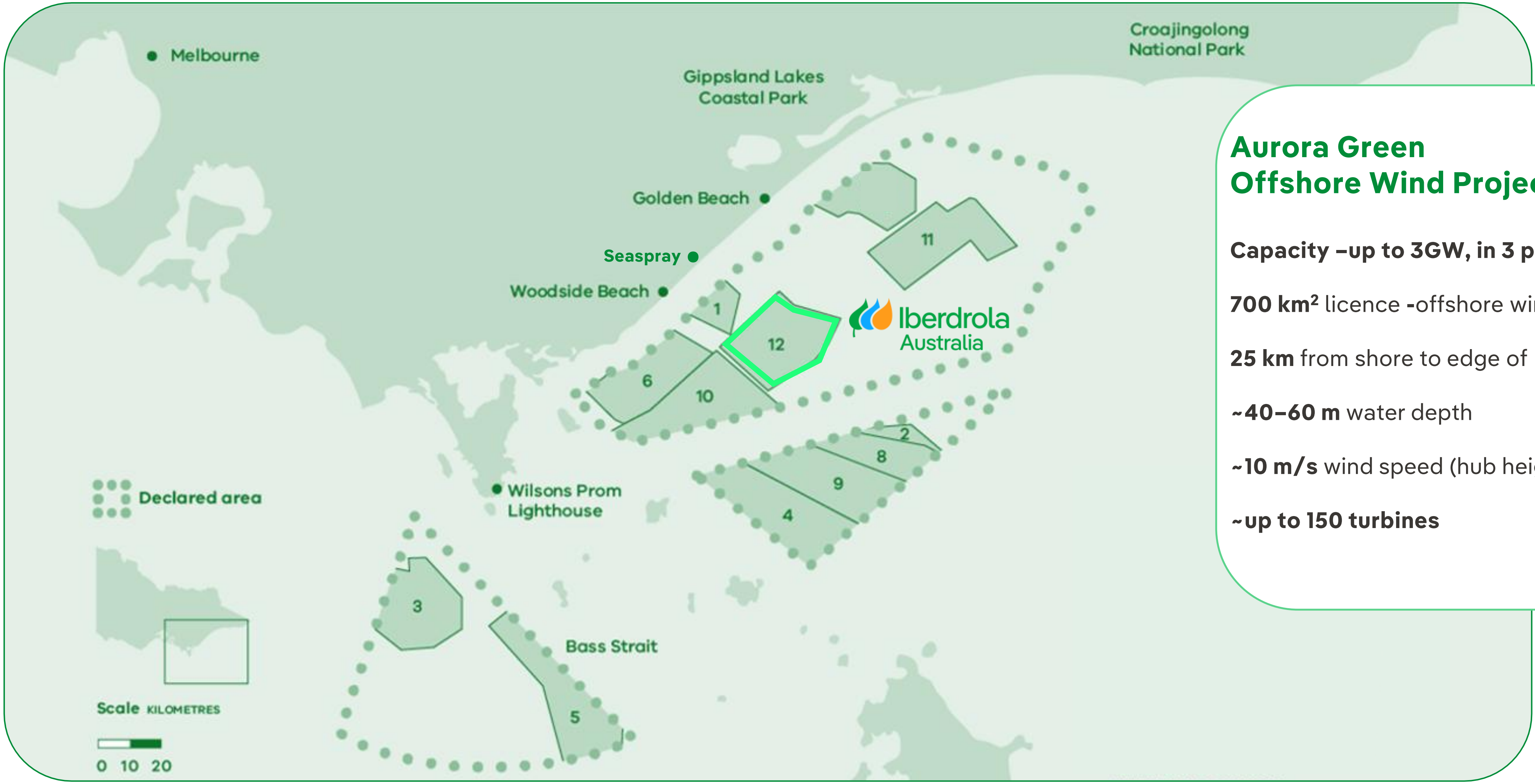
By 2028 Iberdrola will have more than 5.7 GW of offshore wind generation in operation



[1]Full site capacity shown, ownership shared with partner(s)

Which Project is Aurora Green?

Iberdrola Australia



Aurora Green Offshore Wind Project

Capacity –up to 3GW, in 3 phases

700 km² licence **-**offshore windfarm area

25 km from shore to edge of licence

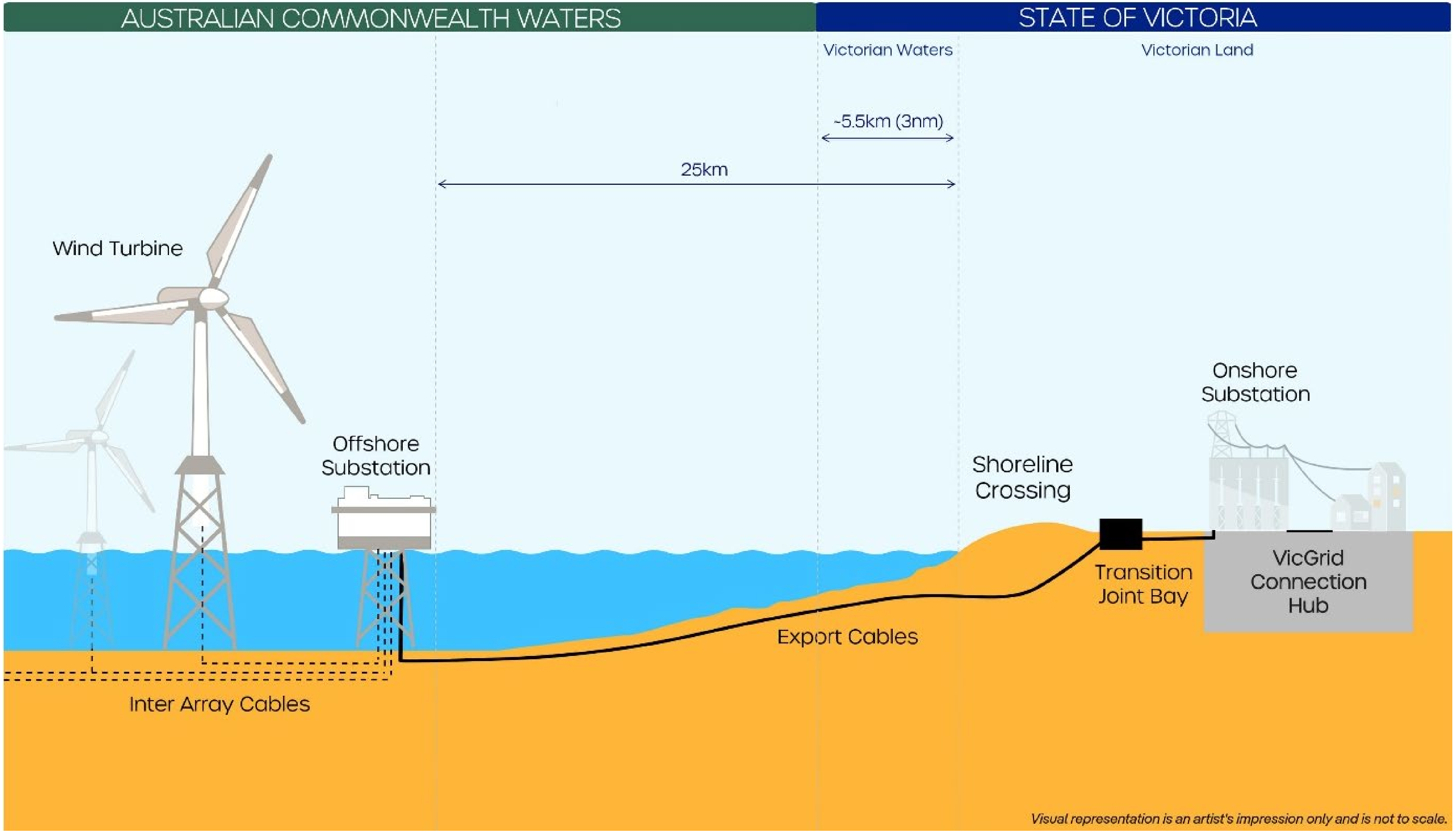
~**40–60 m** water depth

~**10 m/s** wind speed (hub height) expected

~**up to 150 turbines**

Main Components of an Offshore Wind Project

Iberdrola Australia



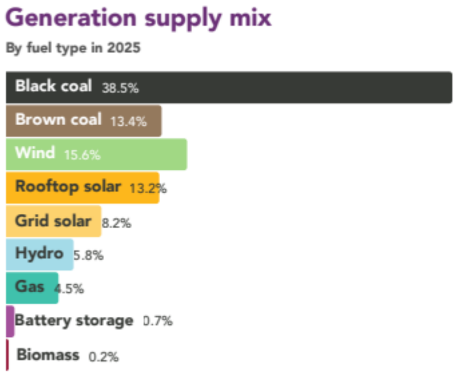
Energy Fundamentals

Iberdrola Australia

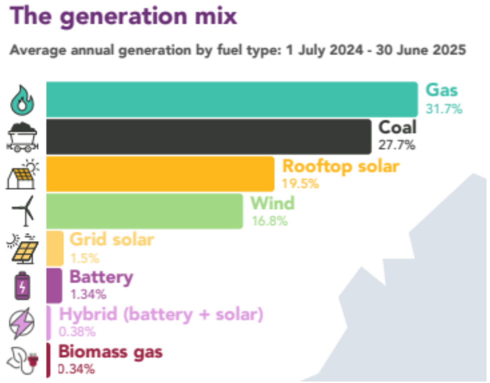
Demand – Generation

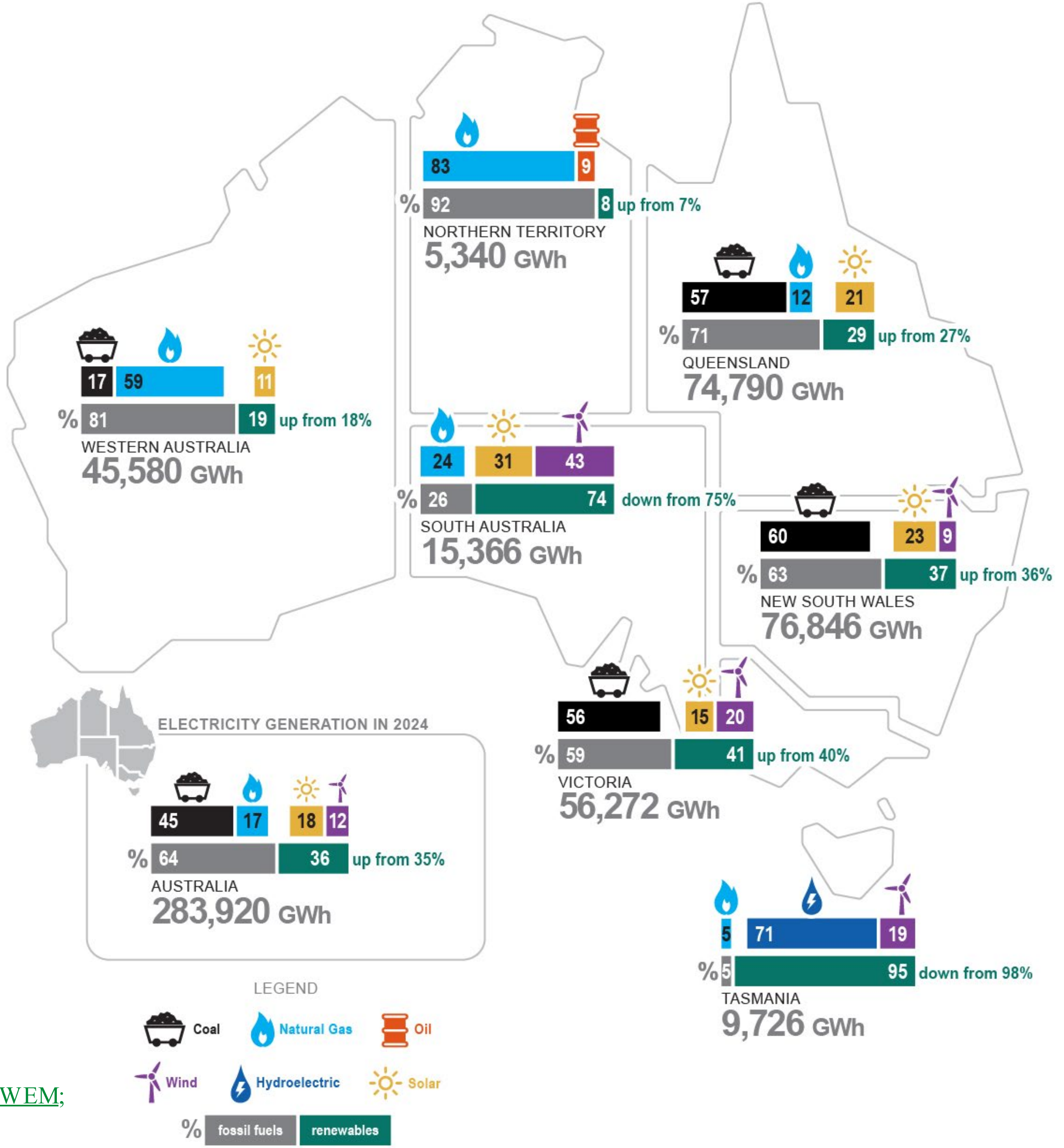
Australia Electricity Generation

- **Eastern States – NEM**
  - Annual generation ~200 TWh
  - Daily average ~600 GWh
  - Installed capacity ~65 GW + ~25GW Rooftop solar (~60% Renewables)



- **SW - Western Australia – WEM**
  - Annual generation ~22 TWh
  - Daily average ~60 GWh
  - Installed capacity ~6 GW + ~3 GW Rooftop solar (~40% Renewables)





https://www.energy.gov.au - energy stats map 2025; www.aemo.com.au - NEM and WEM;

Demand – Consumption by Sector

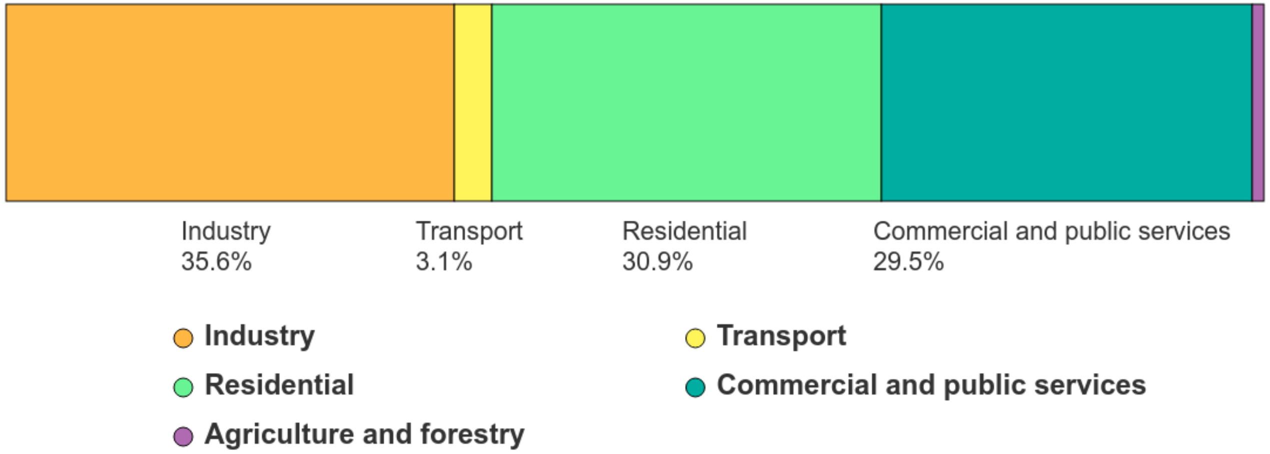
Iberdrola Australia

Electricity Consumption

Sector Breakdown of Electricity Consumption

Sector	Estimated Share of Electricity Consumption	Primary Uses
Industry & Manufacturing	35% – 40%	Mining extraction, metal smelting, chemical processing, and food manufacturing
Residential	30% – 35%	Heating, cooling, lighting, and household appliances
Commercial & Public Services	20% – 25%	Offices, retail, education, healthcare, and administrative buildings
Transport	~3%	Rail networks and electric vehicles
Agriculture, Forestry & Fishing	~3%	Water pumping, crop processing, and machinery

Electricity final consumption by sector, Australia, 2023



Source: International Energy Agency. Licence: CC BY 4.0

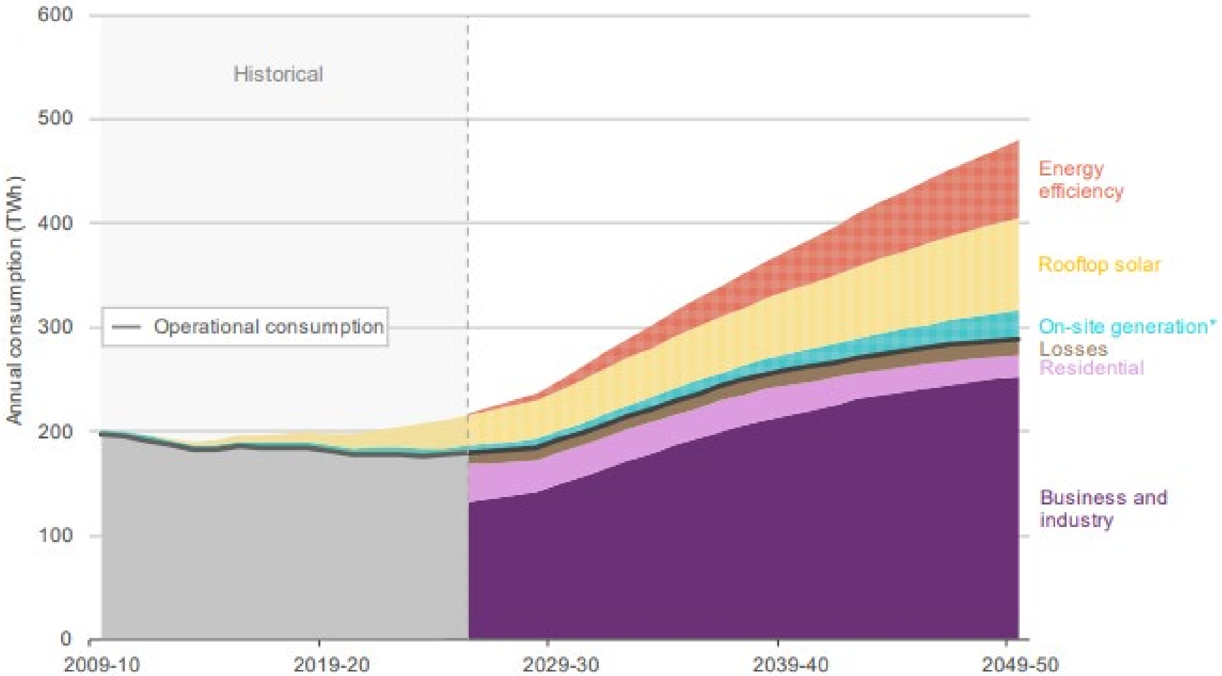
Australia - Countries & Regions - IEA

Demand – Forecast

National Energy Consumption – by 2050 (in the NEM)

- Consumption is forecast to nearly double
- Grid consumption by industry to rise 90%
- Grid consumption by households to reduce by 40%
- About 6,000 km of new transmission to be added

Figure 5 **Electricity consumption, NEM** (TWh, 2009-10 to 2049-50, *Step Change*)

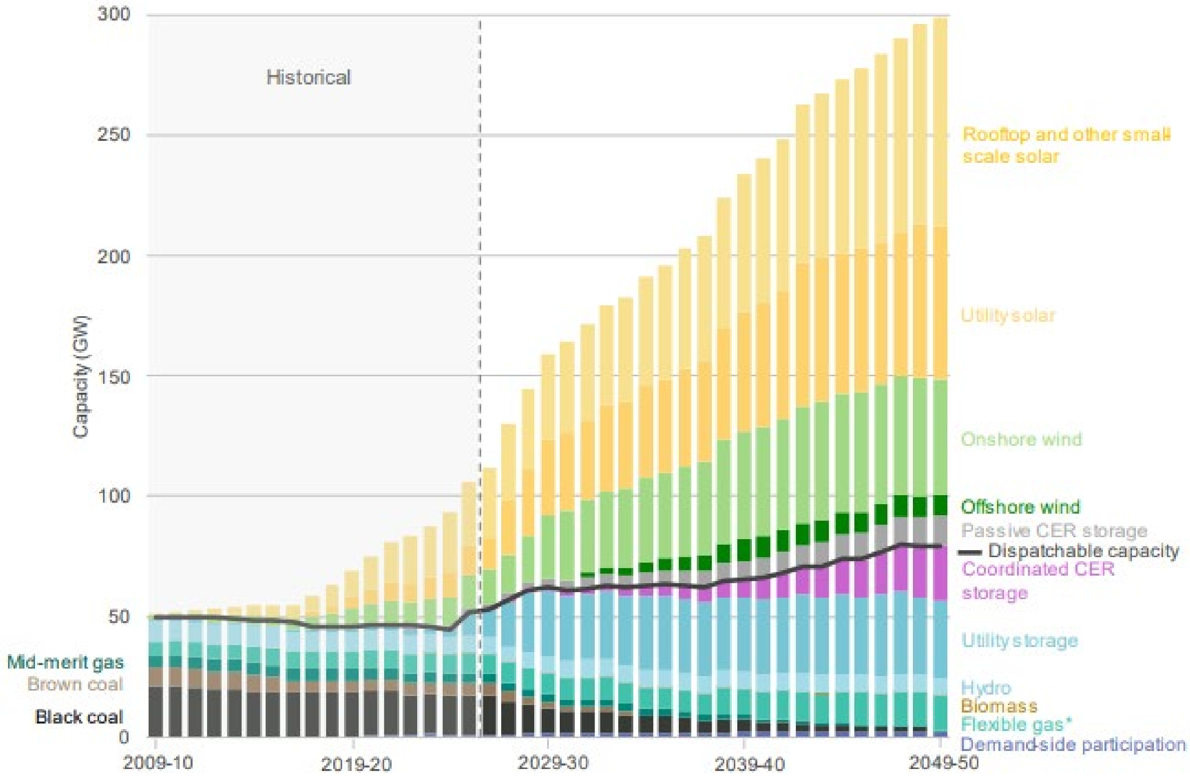


Note: On-site generation (including "non-scheduled generation") is non-utility generation that includes on-the-ground PV and small wind and biomass, typically for industrial use.

National Electricity Generation – by 2050 (in the NEM)

- Two-thirds of the remaining coal fleet to retire by 2035
- 120 GW of wind & solar to replace coal, and meet rising demand
- **Victoria** : 19 GW new grid-scale wind and solar by 2049-50 including 9 GW offshore wind

Figure 15 **NEM capacity** (GW, 2009-10 to 2049-50, *Step Change*)



Grid

Iberdrola Australia

AEMO's ISP

- Network projects in the optimal development plan include Gippsland offshore wind transmission

VicGrid's VTP

- Gippsland offshore wind transmission stages 1and 2 – will accommodate 7GW

The Gippsland offshore wind transmission stage 2 program

Planning suggests this infrastructure will be needed between 2033 and 2038.

The program includes a new 500 kV transmission line from the existing transmission network near Driffield running to Woodside, and a new line between Woodside and Giffard. New terminal stations will be needed at Driffield and Woodside.

These lines combined with the stage 1 project currently in development for the first 2 GW of offshore wind will create a loop that can accommodate approximately 7 GW of offshore wind energy.

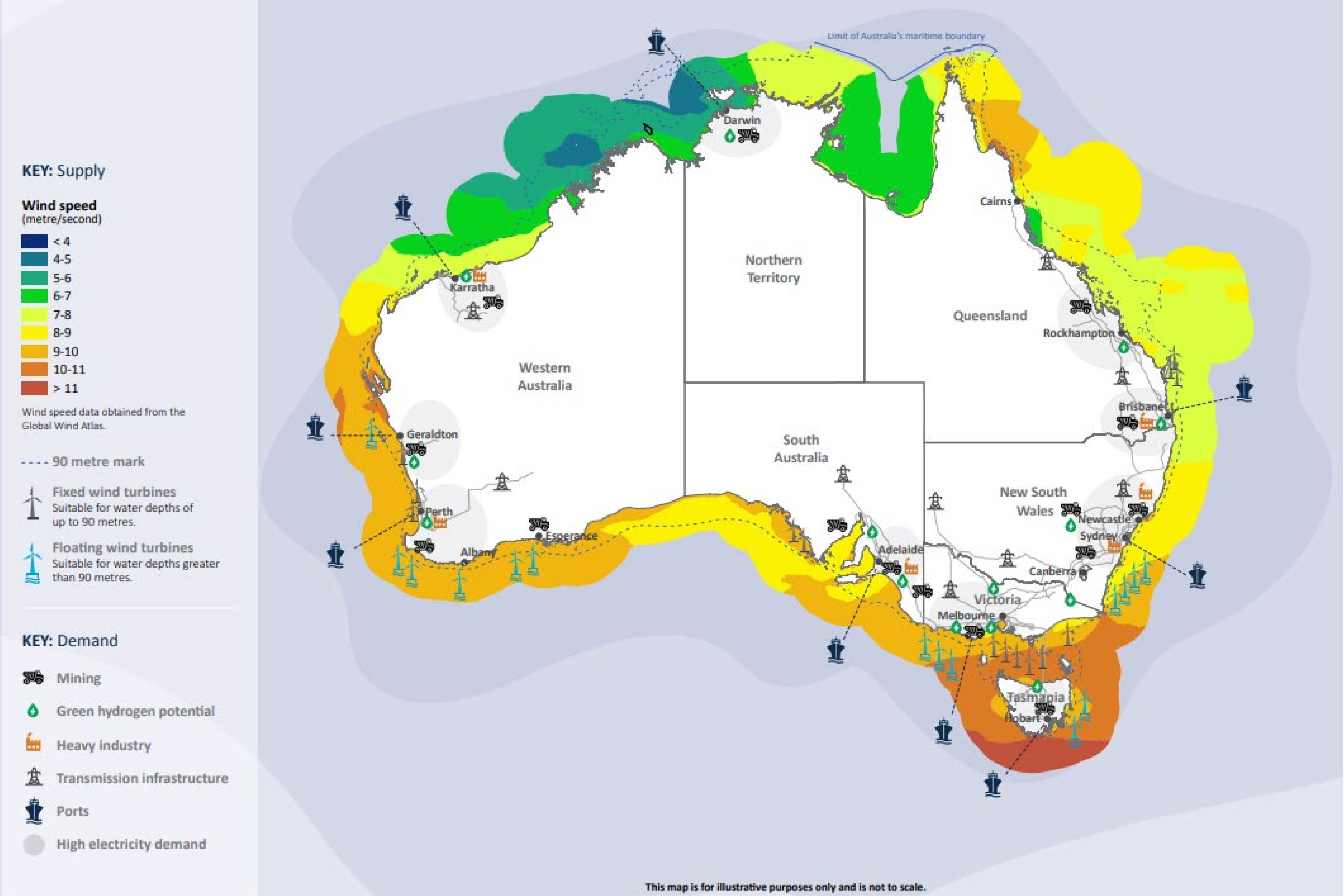
Offshore Wind Energy Resource

Iberdrola Australia

Offshore Wind

- Strong resource
- Particularly on the southern portion
- Coinciding with areas of high electricity demand
- Note the shallow / deep water mark / contour line

[OIR | OSW supply & demand map]

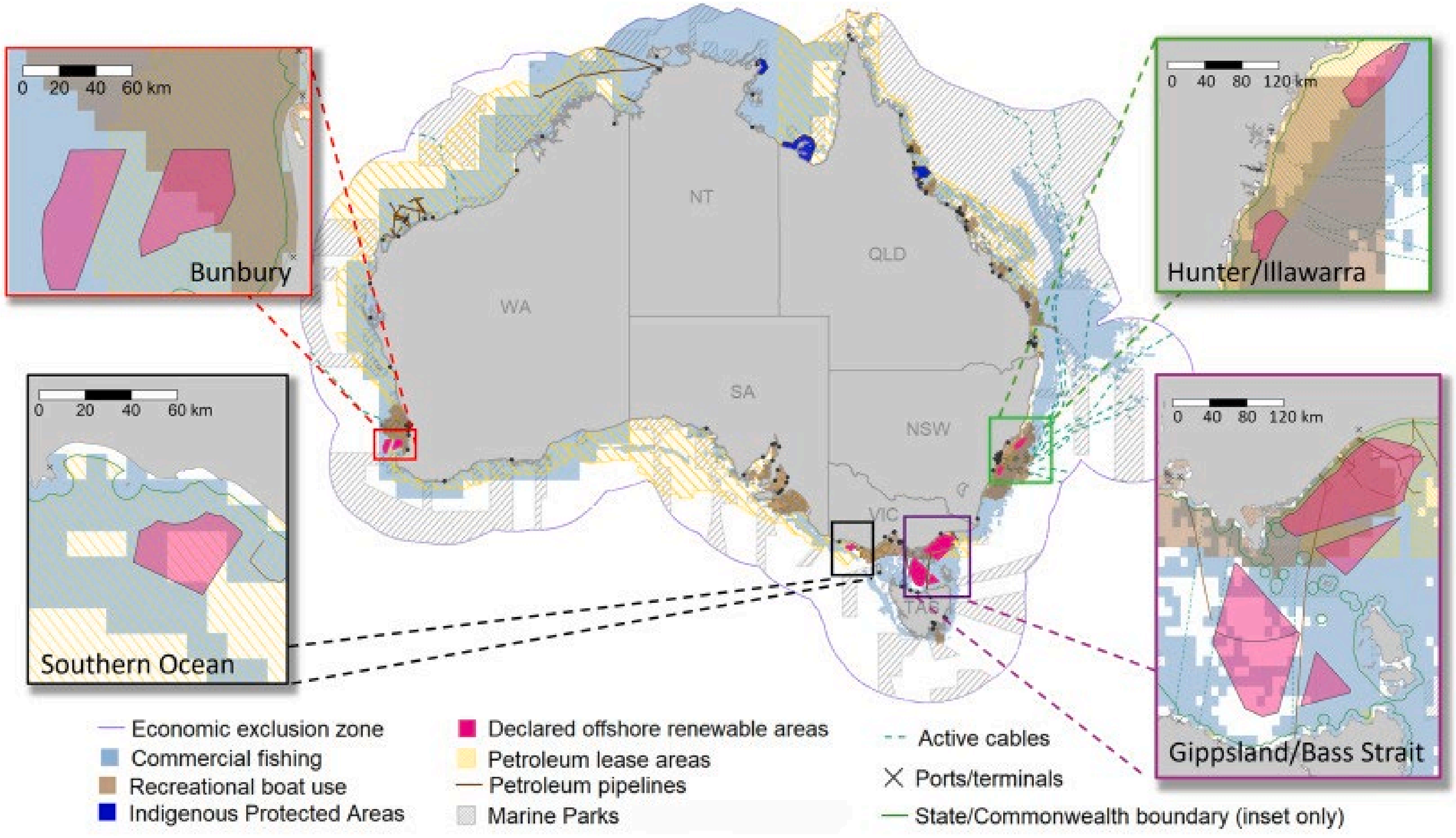


Offshore Wind Declared Areas

Iberdrola Australia

Commonwealth Waters

- Six officially declared areas



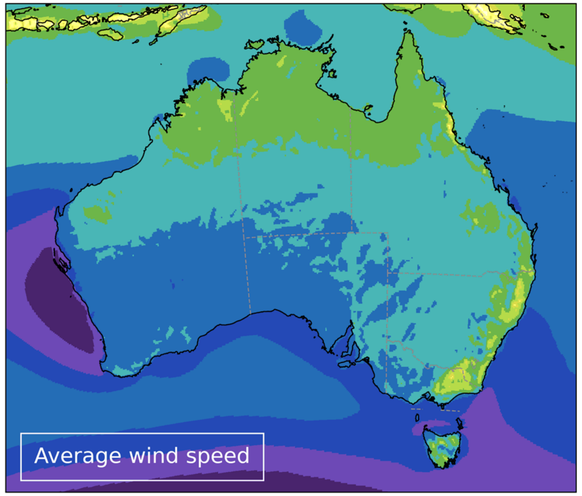
Griffiths et al., 2025

Offshore Wind Energy Resource

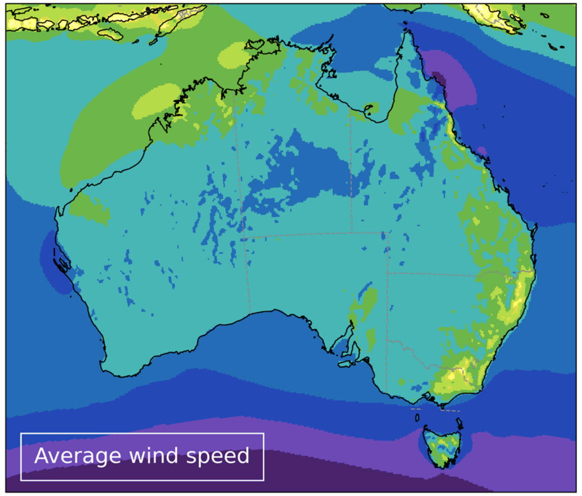
Iberdrola Australia

Space variability and Seasonality – Compared to other renewable resources

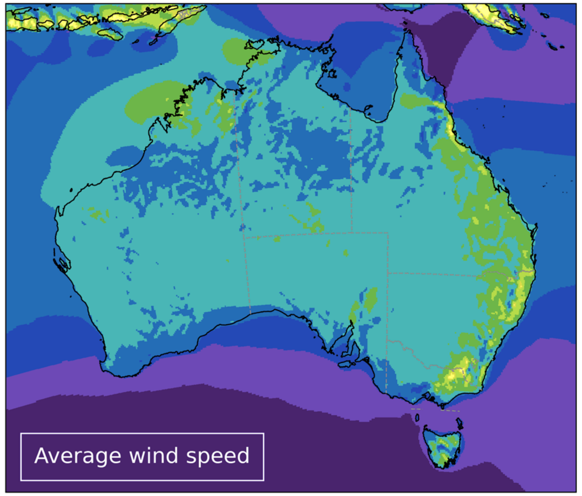
January



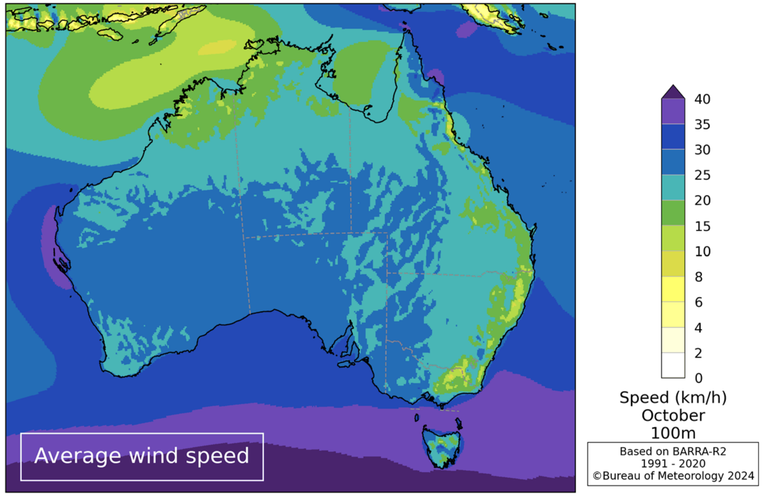
April

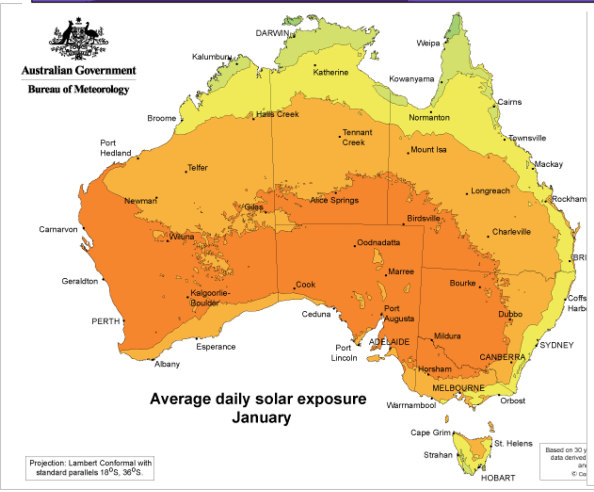


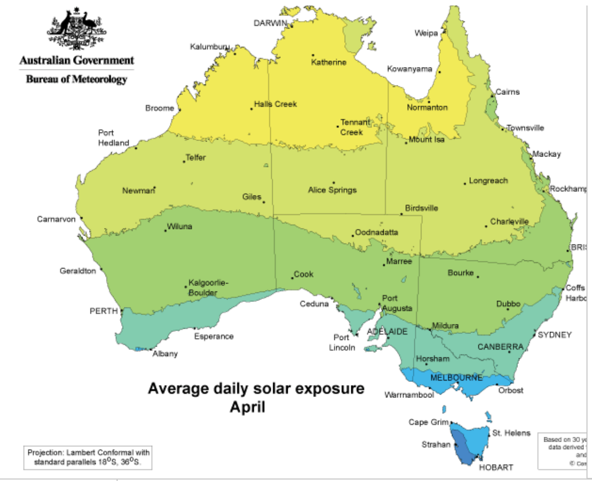
July

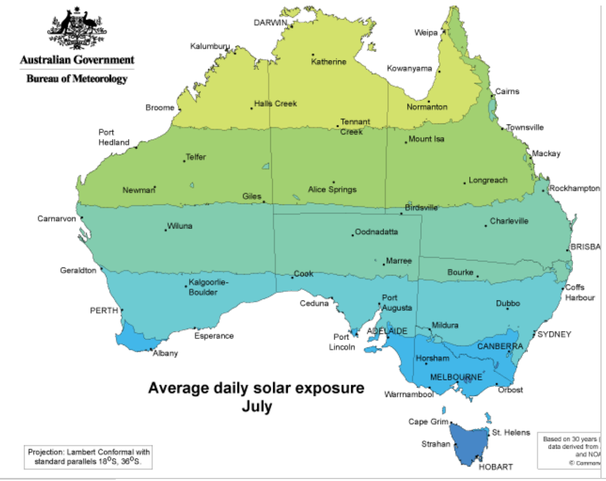


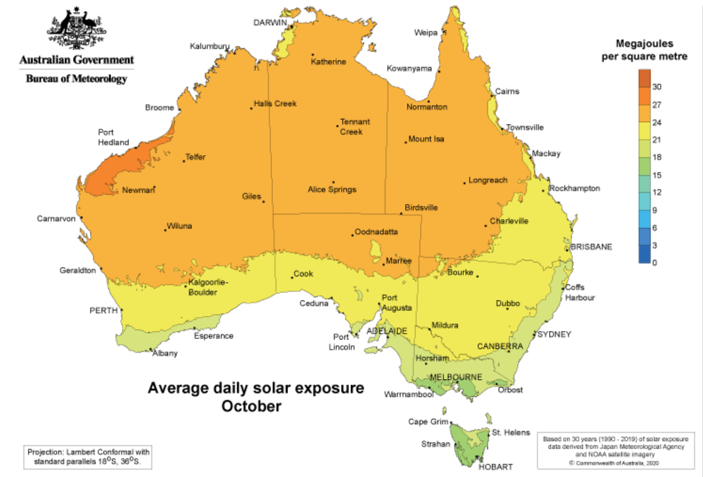
October











BOM - Maps of average conditions

Offshore Wind Energy Resource

Diurnal Profile

- Complementary of other renewable resources
- Supporting the generation mix
- With high capacity factors

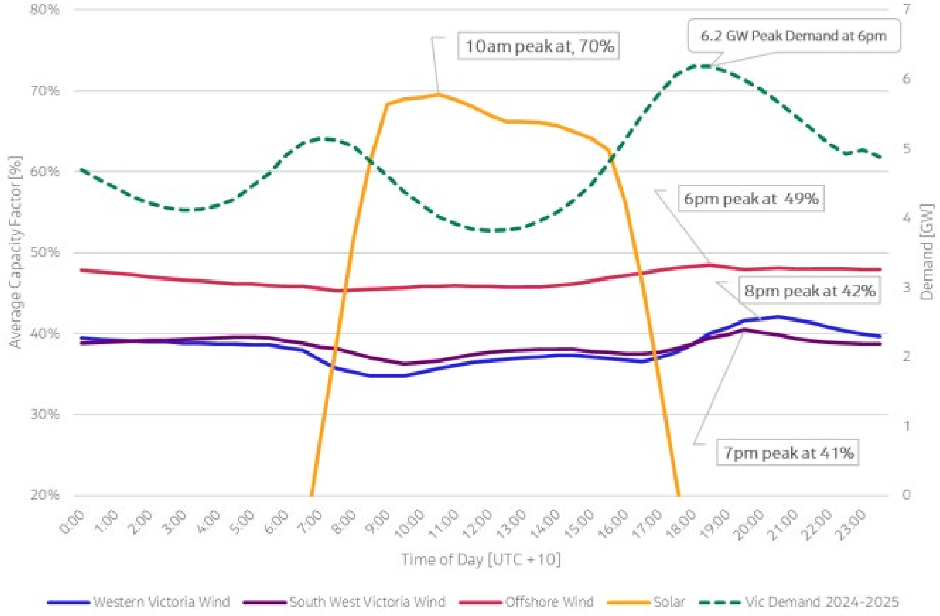
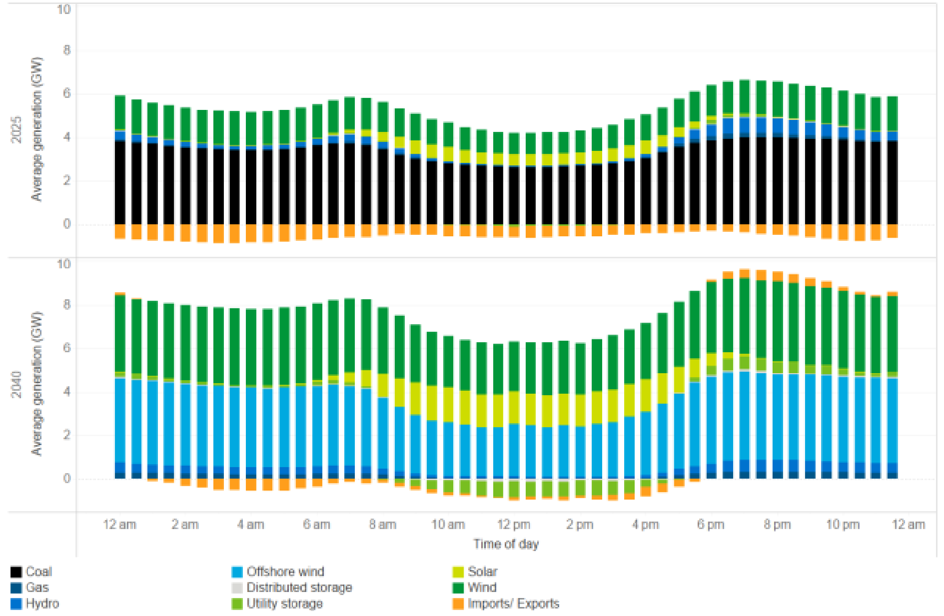
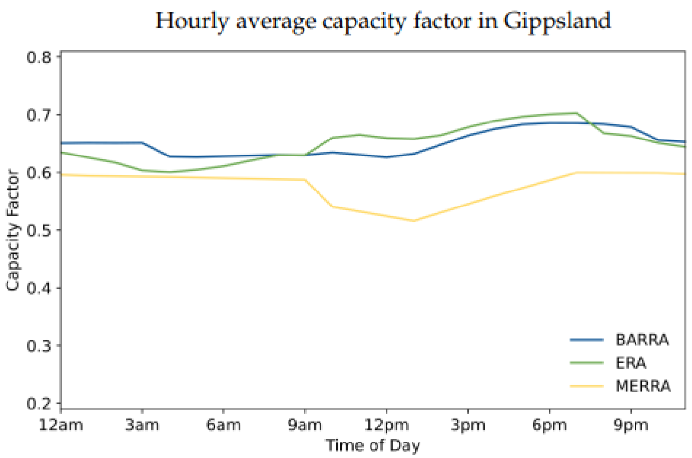
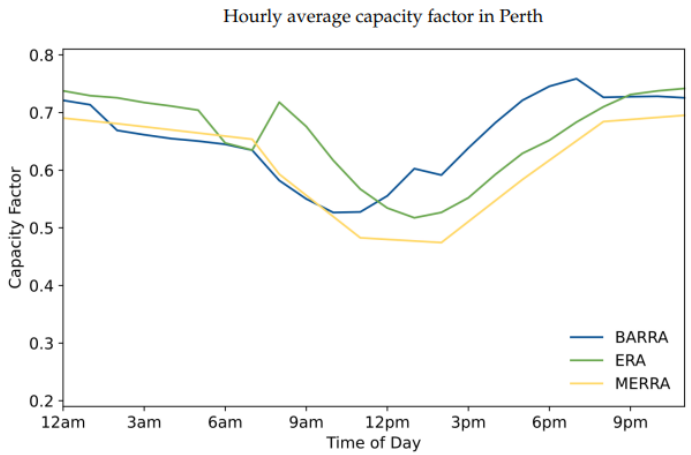


Figure B-6: Forecast Victorian time of day generation mix, scenario 1 and candidate development pathway 1, FY2025 vs FY2040







Jacobs 2016; VTP 2025 - Appendix B; Cowin et al., 2023

Offshore Wind Energy Resource

Long term reliability

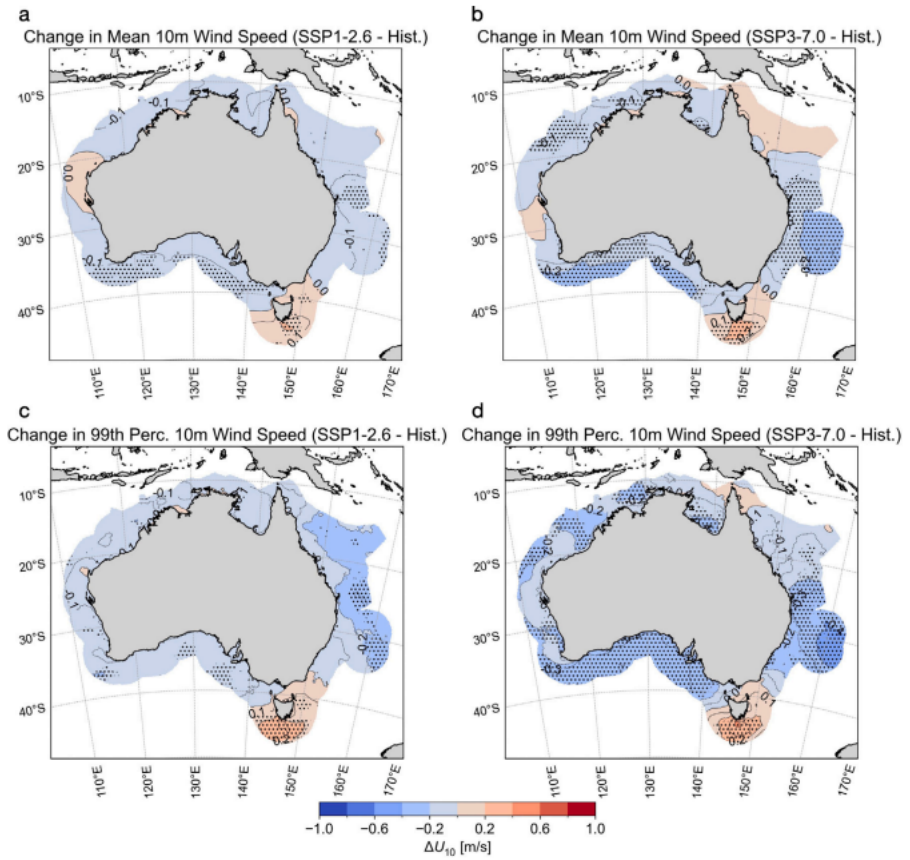


Fig. 5. Contour plots showing the projected changes in (a, b) mean and (c, d) 99th percentile offshore U_{10} over a 30-year period (2045–2074) under the (a, c) SSP1-2.6 and (b, d) SSP3-7.0 scenarios, relative to the historical baseline (1985–2014). Results are based on the BARPA-R ensemble of seven regional climate models (RCMs). Stippling indicates areas where all seven RCMs agree on the sign of the projected change.

Table 5
Wind speed (m/s) at 100 m hub height for selected offshore regions: mean and maximum values for the historical period (1985–2014) and future projections (2045–2074) under SSP1-2.6 and SSP3-7.0. Also, the wind power density (kW/m^2) for the same period and the values for BARRA-R2 as a climatological reference.

Region	Mean (m/s)				Max (m/s)				Wind power density (kW/m^2)			
	BARRA-R2	BARPA-R			BARRA-R2	BARPA-R			BARRA-R2	BARPA-R		
	Hist. 1985–2014	Hist.	SSP126 2045–2074	SSP370	Hist. 1985–2014	Hist.	SSP126 2045–2074	SSP370	Hist. 1985–2014	Hist.	SSP126 2045–2074	SSP370
Hunter	9.48	10.37	10.37	10.17	31.10	33.82	33.24	30.42	0.83	1.03	1.05	0.98
Illawarra	9.07	9.65	9.66	9.51	32.15	32.60	35.10	33.27	0.75	0.88	0.88	0.83
Gippsland 1	9.26	9.72	9.76	9.74	28.44	28.61	30.13	29.92	0.85	0.94	0.96	0.95
Gippsland 2	10.11	10.57	10.61	10.59	31.30	30.85	30.51	32.72	1.09	1.19	1.20	1.20
Gippsland 3	10.66	10.94	10.96	10.88	32.78	32.79	32.13	32.56	1.19	1.25	1.25	1.24
Bass Strait 1	10.62	10.99	11.05	10.98	31.75	31.19	32.73	31.30	1.17	1.26	1.27	1.26
Bass Strait 2	10.35	10.93	10.99	10.97	31.62	31.76	34.02	31.93	1.16	1.29	1.33	1.31
Southern Ocean	9.80	10.07	9.90	9.85	31.06	29.51	28.47	28.81	0.93	0.98	0.93	0.91
Bunbury 1	10.10	10.68	10.52	10.50	31.48	35.92	31.43	30.67	0.94	1.09	1.03	1.03
Bunbury 2	10.50	11.17	11.00	11.02	31.21	34.65	27.63	33.84	1.04	1.22	1.16	1.17

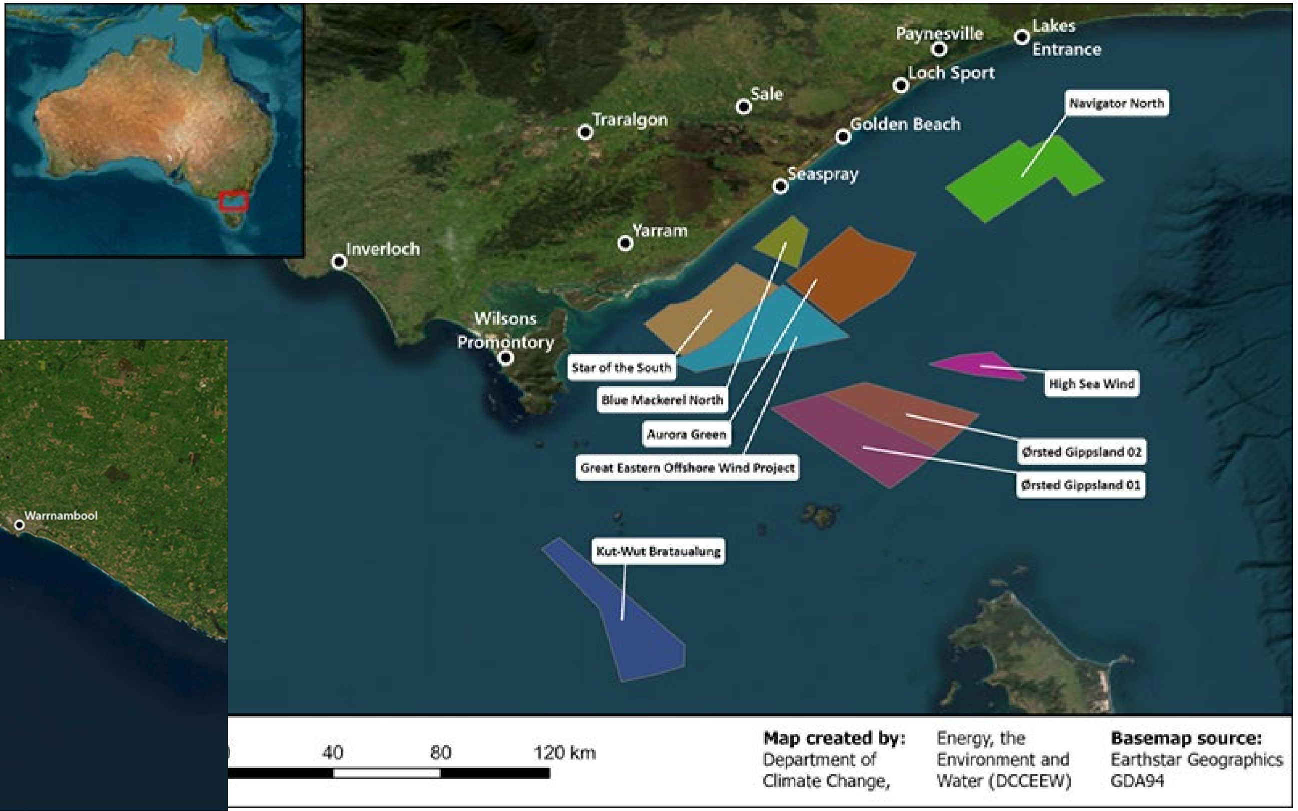
Meucci et al., 2026

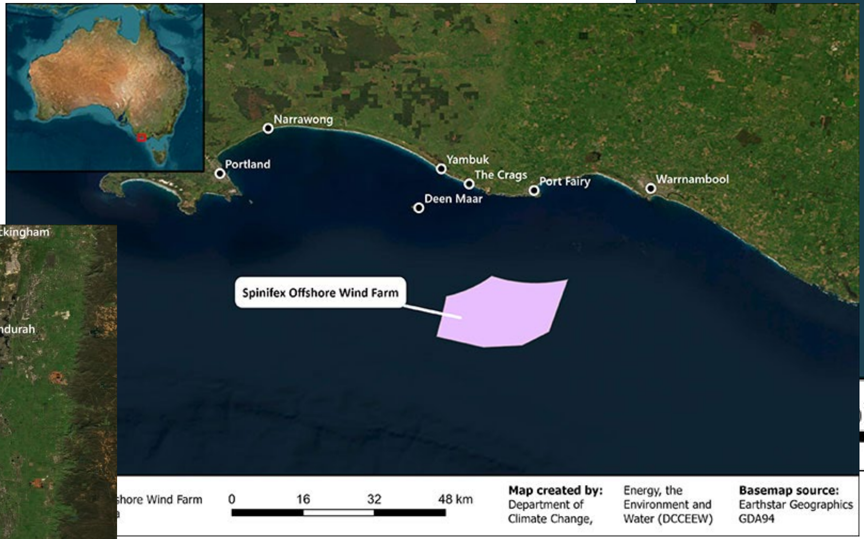
Fundamentals applied to Offshore Wind

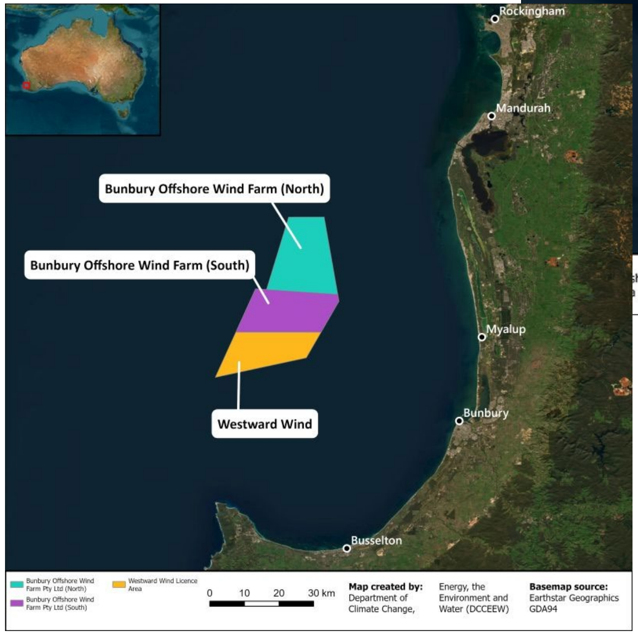
Iberdrola Australia

Uptake of Feasibility Licences by Developers

- Of the six declared areas three have active Feasibility Licences:
  - Gippsland: 9
  - Southern Ocean: 1
  - Bunbury: 3







[DCCEEW - Offshore Wind Areas]

Global Context

Iberdrola Australia

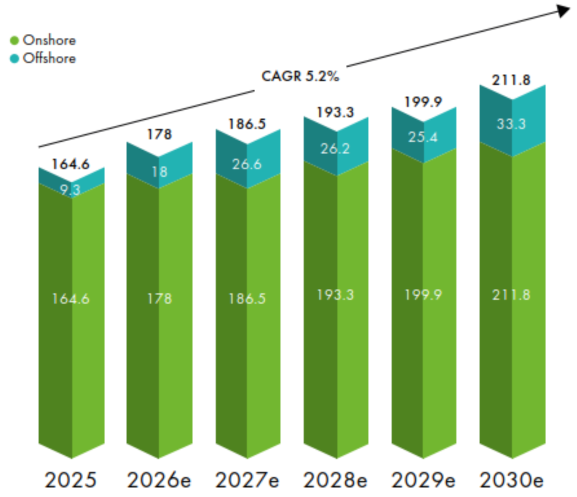
Global Offshore Wind – Installed Capacity

Iberdrola Australia

Installed Capacity - Globally

- Approximately ~14,000 offshore turbines installed worldwide
- Global offshore installed capacity sitting around ~92 GW (2025)
- Expected to reach 100 GW in 2026 and 200+ GW by 2030
- For reference, onshore ~1,200 GW (2025) and 2,000+ GW by 2030

New installations outlook 2026–2030 (GW)



MW.offshore	New installations 2024	Total installations 2024	New installations 2025	Total installations 2025
Total offshore	**8001**	**83222**	**9252**	**92474**
Americas	**132**	**174**	**0**	**174**
USA	132	174	0	174
Asia-Pacific	**5171**	**46258**	**7292**	**53551**
PR China	4038	41813	6592	48405
Japan	100	288	0	288
South Korea	100	246	100	347
Vietnam	0	874	0	874
Taiwan (China)	933	3037	600	3637
Europe	**2698**	**36790**	**1960**	**38750**
United Kingdom	1178	15934	1049	16983
Germany	730	9122	503	9625
France	658	1500	408	1908
Netherlands	132	4870	0	4870
Denmark	0	2652	0	2652
Belgium	0	2262	0	2262
Other Europe	0	450	0	450

GWEC made the adjustments to new installations and total installation in 2023 based on the updated statistics GWEC received. For details see Appendix - Methodology and Terminology

MW.onshore	New installations 2024	Total installations 2024	New installations 2025	Total installations 2025
Total onshore	**109337**	**1052940**	**155340**	**1206691**

GWEC Global Wind Report 2026

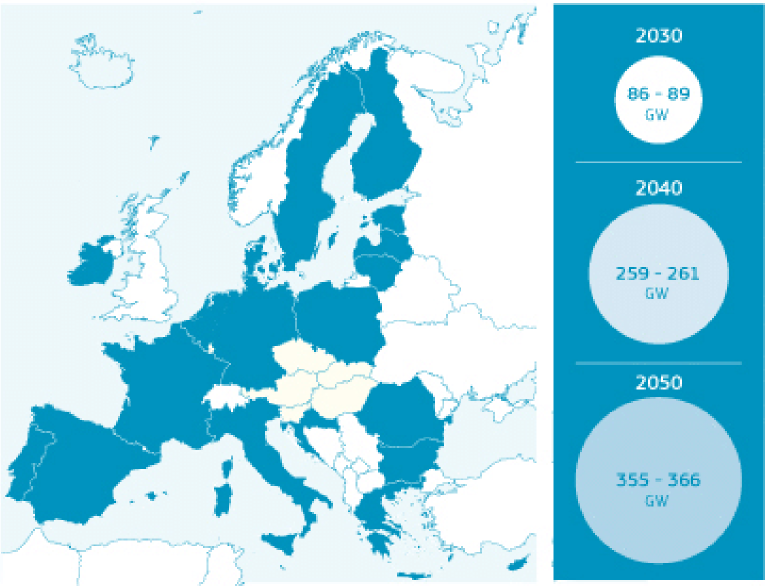
Global Offshore Wind – Targets

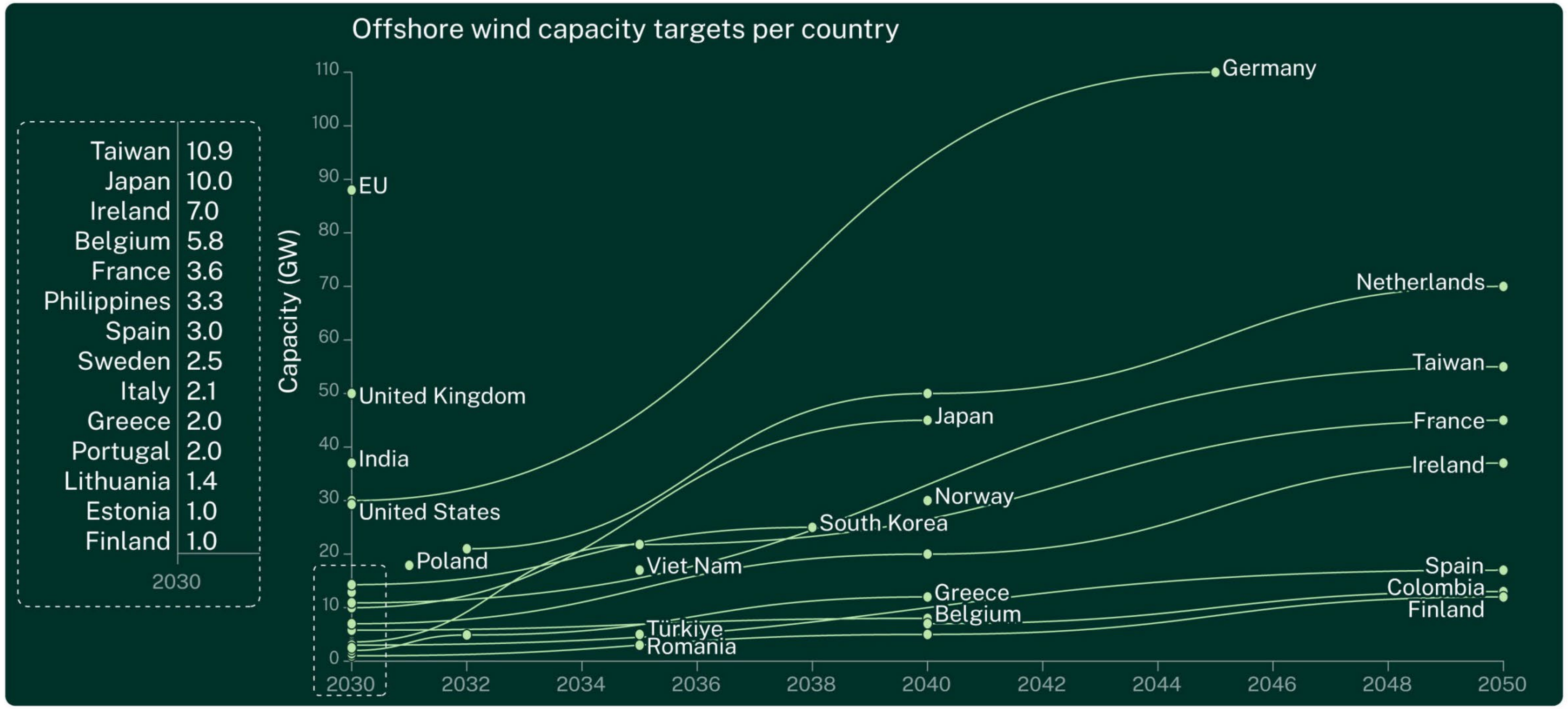
Iberdrola Australia

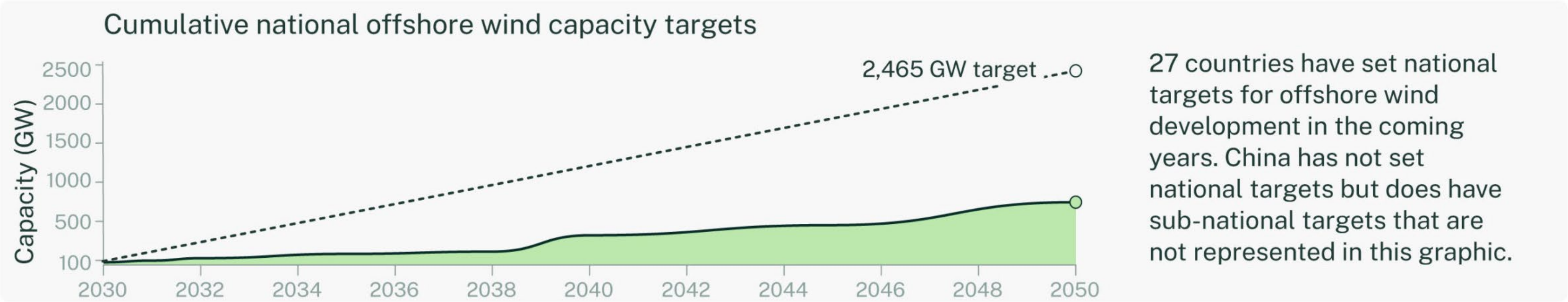
National Targets

- Vary by country
- Increase substantially by 2040-50
- Victoria 9GW - Australia?

- Targets drive investment certainty







Sources: IRENA, EMBER

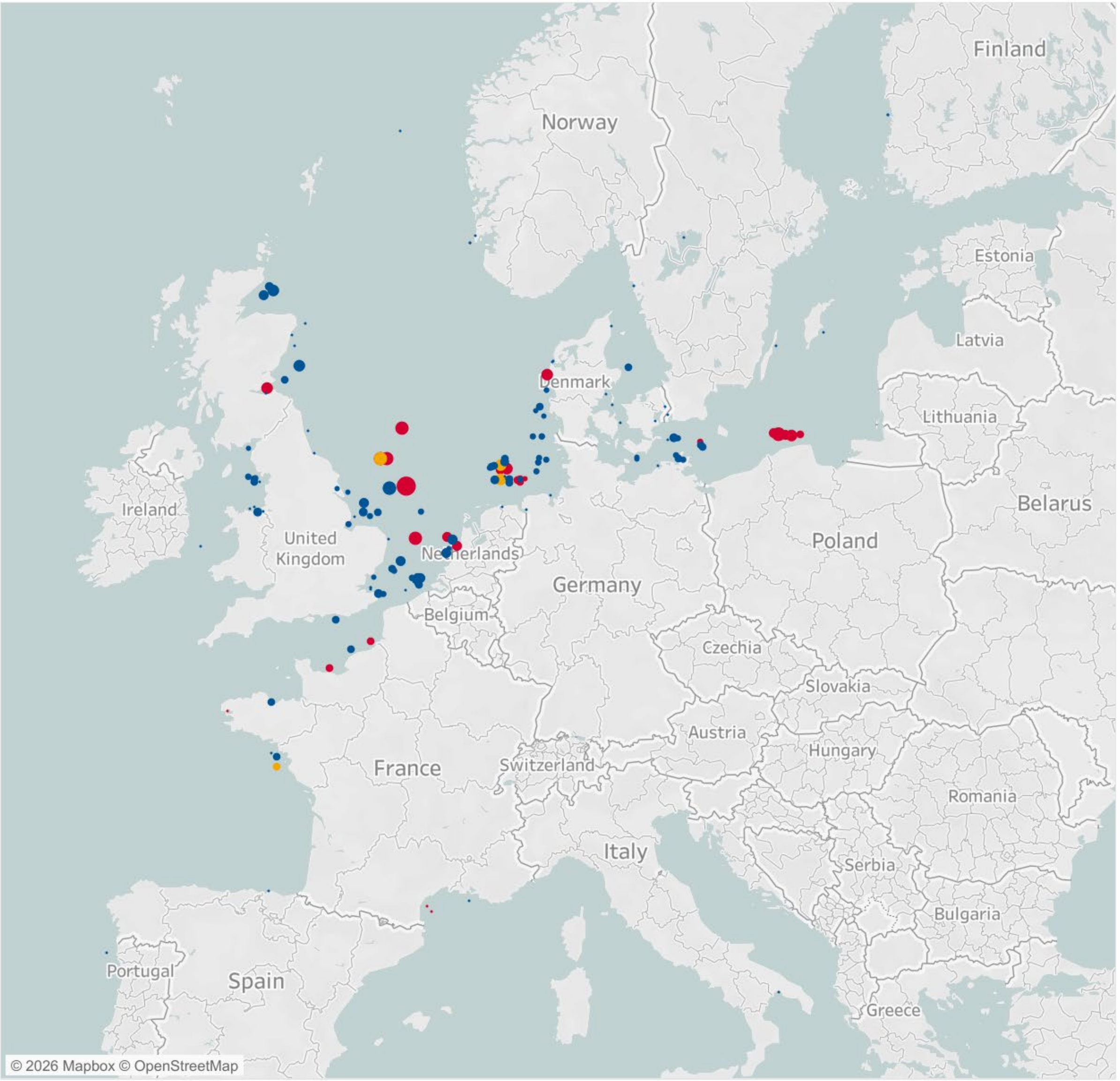
Mowbray 2026; https://energy.ec.europa.eu/

Global Offshore Wind – Installed Capacity

Iberdrola Australia

Installed Capacity - Europe

- Approximately ~7,000 turbines
- Mostly in the North Sea
- Followed by the Baltic



Europe's Offshore Wind
38,621 MW connected to the grid
6,776 turbines connected
142 Wind Farms
13 countries

Status
- Online
- Partially online
- Under construction

Technology
All

	MW Connected	Turbines Connected	Number of projects
United Kin..	16,981	2,953	47
Germany	9,624	1,680	35
Netherlands	4,739	670	10
Denmark	2,653	672	17
Belgium	2,261	399	11
France	1,908	268	6
Sweden	195	80	5
Norway	101	13	3
Finland	71	19	3
Italy	30	10	1
Ireland	25	7	1
Portugal	25	3	1
Spain	7	2	2

Last update: May 25, 2026

https://windeurope.org/data/;

Global Offshore Wind – Europe

Iberdrola Australia

Europe's

"Investment Pact for the North Seas"

and

"New Offshore Wind Deal"

Offshore wind prioritised for energy security

Wind EUROPE

About News Policy Data Careers Events

26 January 2026

Seven Heads of State and Government and the Energy Ministers of the 9 North Seas countries gathered in Hamburg today to boost the expansion of offshore wind. Together with industry and transmission system operators they signed the "Investment Pact for the North Seas". Governments commit to building 15 GW of offshore wind per year over 2031-2040 and de-risking offshore wind investments. The industry, in return, pledges cost reductions, 91,000 additional jobs and generating €1tn of economic activity. With the Investment Pact, Europe is charting the massive offshore wind buildout it needs to deliver on its energy security and competitiveness objectives.

At today's North Sea Summit in Hamburg Heads of State and Government and Energy Ministers of Belgium, Denmark, France, Germany, Ireland, Luxembourg, the Netherlands, Norway and the UK today pledged to chart a massive offshore wind buildout for Europe. They confirmed their ambition to build 300 GW of offshore wind in the North Seas by 2050.

10 April 2025

Today Europe's wind industry proposed a new deal to speed up and de-risk the build-out of homegrown and competitive offshore wind energy. The proposal calls on European Governments to auction at least 100 GW of new offshore wind over 2031-2040. Crucially these auctions should use two-sided Contracts for Difference. The offshore build-out should be more coordinated among European countries and distributed more evenly over time. The visibility on volume and revenues from a stable pipeline of Contract-for-Difference auctions will help reduce costs and ensure offshore wind plays its role in delivering Europe's energy objectives. The industry commits to reducing the cost of offshore wind by 30% by 2040.

https://windeurope.org/

Global Offshore Wind – Asia

Iberdrola Australia

Asia

Accelerating offshore wind development and delivery, while advancing technology and growing the supply chain.

THE Asset APP AWARDS EVENTS RESEARCH MAGAZINE MEDIA CENTRE

Asia Connect

Asia-Pacific leads global offshore wind rebound

Mainland China and Taiwan drive momentum, while South Korea, Japan and Southeast Asia get into their stride

Yuki Li 15 May 2025

nature communications

Article https://doi.org/10.1038/s41467-025-65105-3

Increasing extreme winds challenge offshore wind energy resilience

Received: 10 February 2025

Accepted: 7 October 2025

Published online: 04 November 2025

Yanan Zhao[1,2,3], Yiheng Tao[4], Yuntian Chen[2,5], Jinyue Yan[3,6,7] & Zhenzhong Zeng[1,2,3,8,9]

Not just made in China: The growing offshore wind supply chain in Asia-Pacific

July 30, 2025 | 2 min read

Aegir

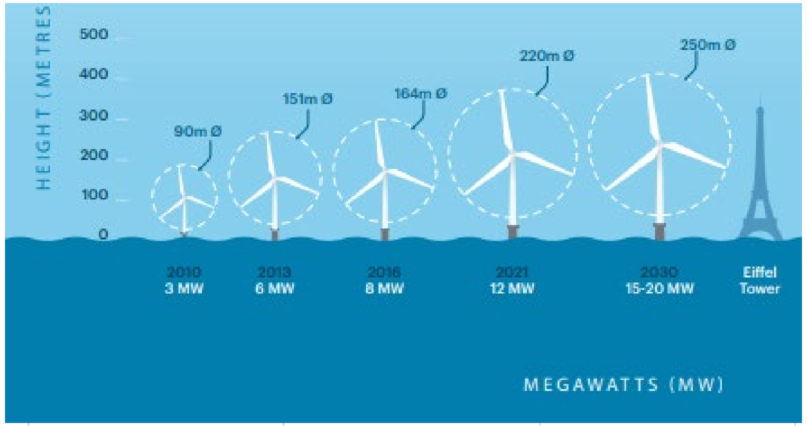
New analysis: Despite limited production so far, the offshore wind supply chain in Asia-Pacific (outside China) could grow fast.

Asia-Pacific will be both a major production hub and significant offtaker of offshore wind components

www.theasset.com; www.aegirinsights.com; Zhao et al., 2025

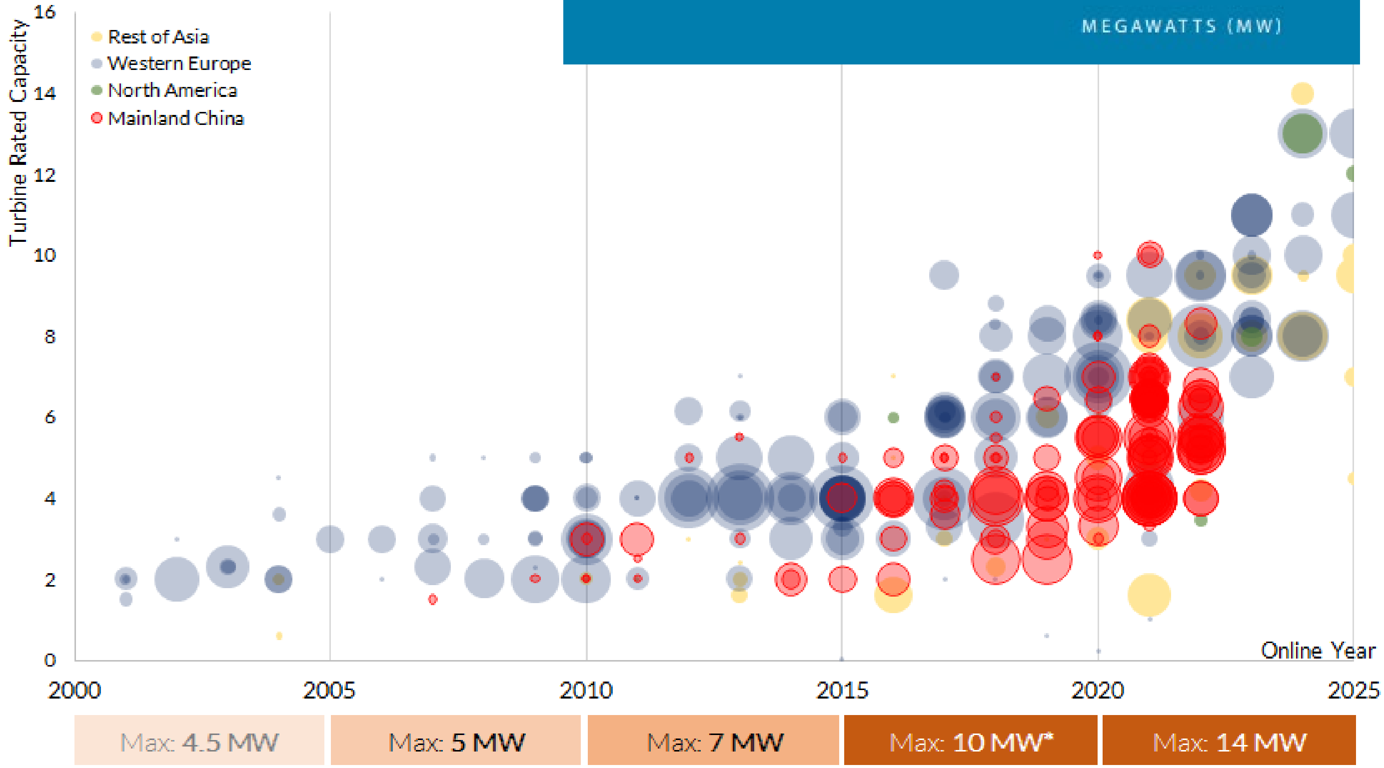
Technology Development and Maturity

Iberdrola Australia



Evolution of Turbine Models by Region

Chart is based on known/announced turbine designs selected



[Offshore Wind Turbine Evolution - Westwood]

Technology Maturity Benefits

- Mature offshore wind technology leads to larger turbines, better reliability, and efficient installation.

Cost Reduction Drivers

- Standardisation and scaling are key factors reducing costs in offshore wind technology deployment.

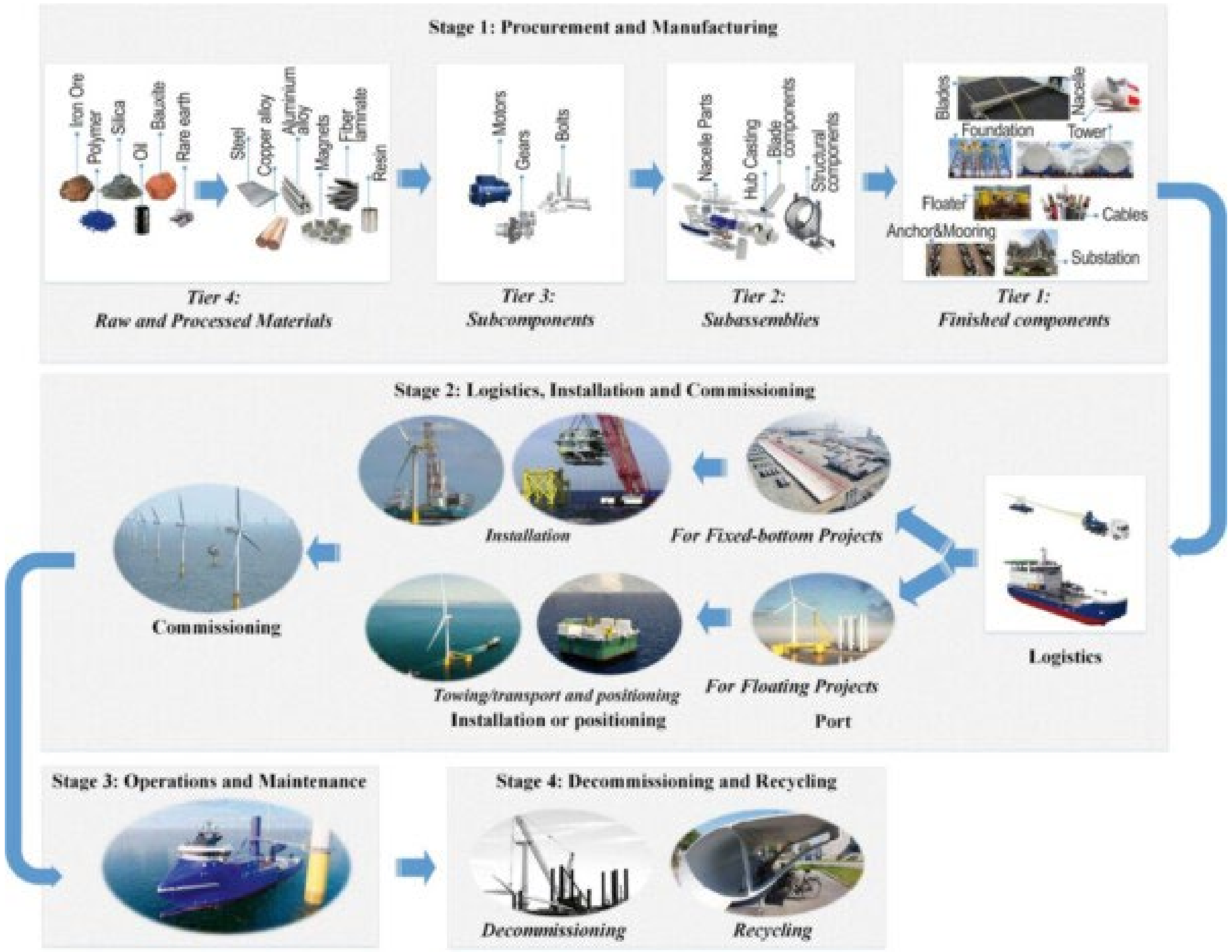
Emerging Floating Wind Technology

- Floating offshore wind is emerging with high potential but higher costs and uncertain risks.

Technology Risk Balance

- Investors prefer proven technologies to ensure bankability while balancing site limitations and innovation risks.

Supply Chain, Readiness and Cost Factors



Cost Drivers in Offshore Wind

- Construction costs are impacted by ports, vessels, workforce availability, and supply chain depth.

Infrastructure Readiness Challenges

- Limited local infrastructure and workforce can increase costs and cause schedule delays.

Global Supply Chain Competition

- It can be challenging for emerging markets to secure supply chain capacity, with risk of being left out during high demand.

Balancing Cost and Readiness

- Reducing costs requires planning, coordination, and early investment in infrastructure alongside training and tech.

Shu-Ling Chen et al., 2025

Australia in the Global Offshore Wind Landscape

Global Offshore Wind Landscape

- Offshore wind is mature in Europe, expanding in Asia, uncertain in the USA, creating a competitive global market.

Australia's Market Position

- As a late entrant, Australia leverages mature technologies and faces competition for capital and supply chains.

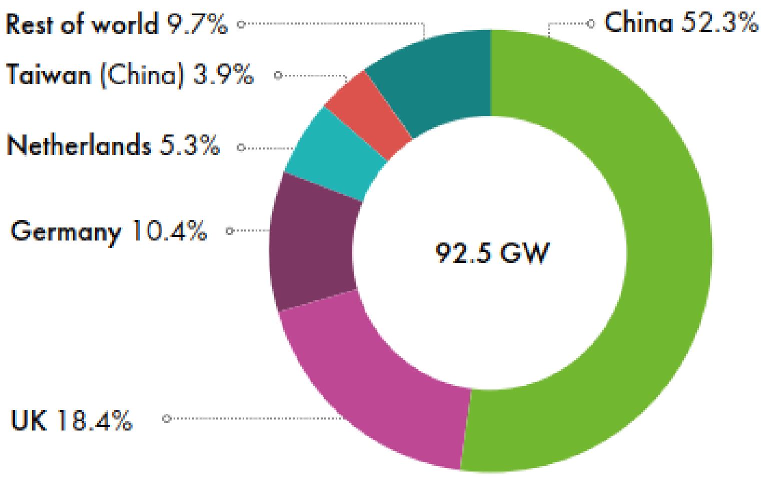
Energy Security

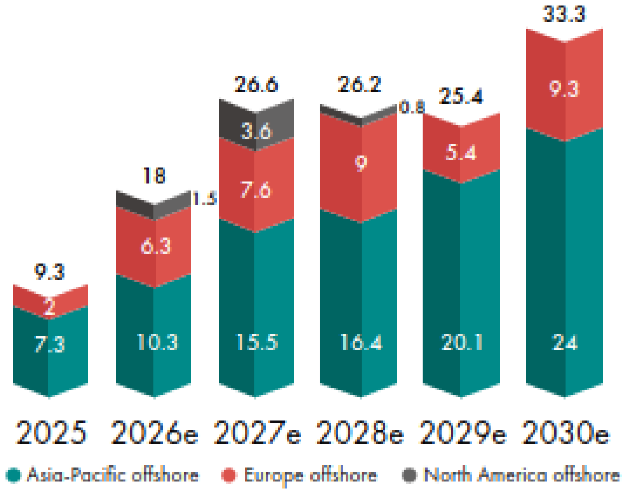
- Energy security drives government support for local energy generation.

Investment Perception

- Investor views vary between stable and high-risk market perceptions.

Total installations offshore (%)



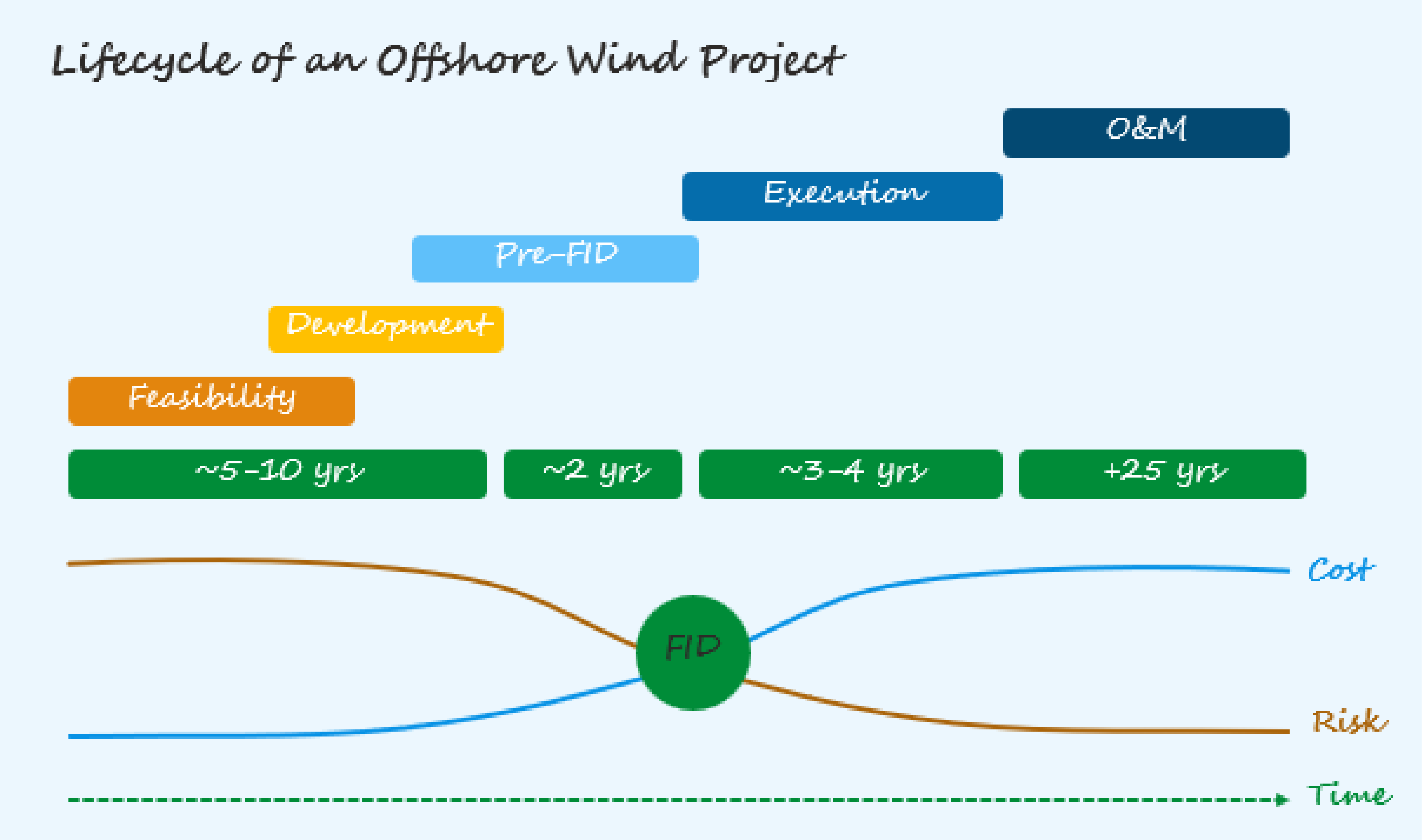


GWEC Global Wind Report 2026

Project Development

Iberdrola
Australia

The Project Life -Cycle



One "Simple" Question – Is a Project Feasible?

Multiple and Complex Streams of Work

- Technical Feasibility – Engineering and Technology
- Approvals and Consents – Environmental, Social, Economic, Cultural, Heritage
- Community and Stakeholder Engagement

Investment Focus

- Feasibility is defined by investment potential, emphasising financial viability over technical possibility.

Uncertainty and Risk

- Higher uncertainty increases perceived risk, raising financing costs and deterring investments.

De-risking Pathway

- Reducing risk builds investor confidence and facilitates capital deployment.

Feasibility is not "Stationary"

- Feasibility evolves with improved data, maturing policies, and developing infrastructure.

Financial Viability – Route to Market

Importance of Revenue Certainty

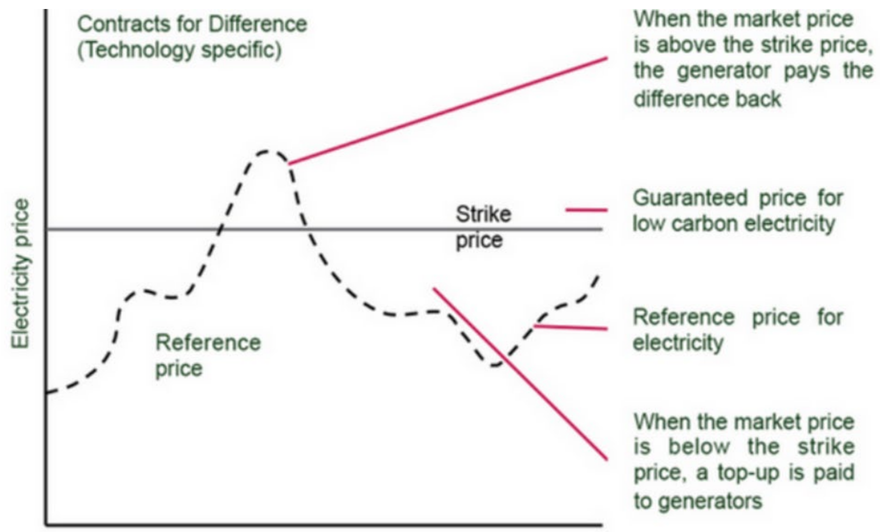
- Revenue certainty is critical for offshore wind investment due to high upfront capital costs and long-term project viability.

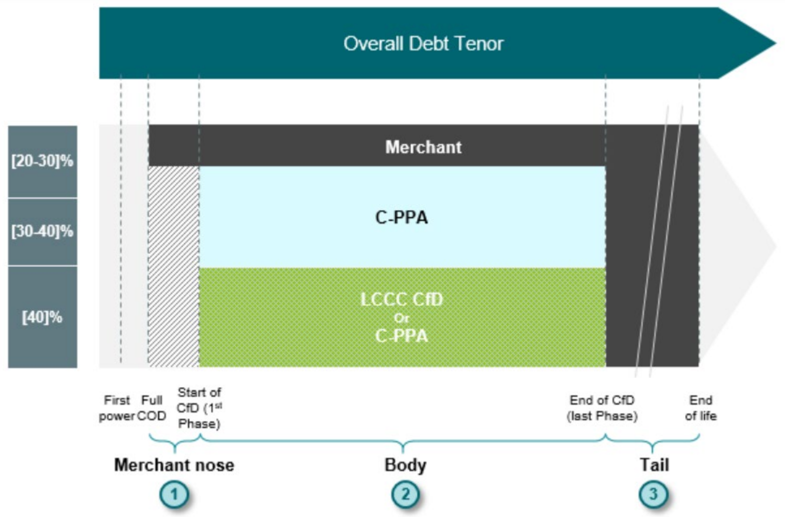
Contracting and Risk Reduction Mechanisms

- Contract for Difference (CfD) and auction (tender) processes reduce revenue risk, facilitate financing and attract investment.

Market Framework Evolution

- Market design, including revenue stacking and exposure, is evolving, influencing viability and performance.





RenewableUK 2025; Norton Rose Fulbright 2024

Technical Feasibility – Engineering Solutions

Iberdrola Australia

Constructability Challenges

- Local geotechnical and metocean conditions, as well as port suitability and capacity for heavy-lift infrastructure are critical for design, T&I, construction planning.

Supply Chain Complexity

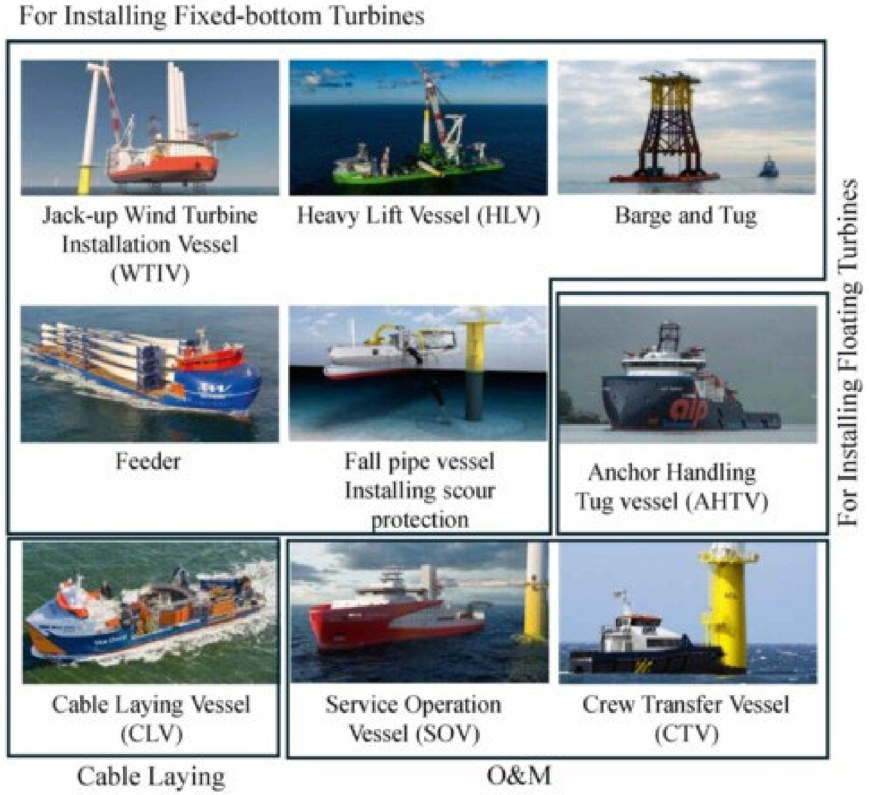
- Turbine parts, foundations, cables, and vessels are sourced internationally, influencing timelines and costs.

Grid Compatibility Constraints

- Grid integration requires alignment with regional electrical infrastructure and standards.

Operations and Maintenance

- Monitoring and ongoing maintenance are critical to ensuring long-term project performance and risk management.



VRET EES Referral; Shu-Ling Chen et al., 2025

Approvals, Consents, Permits

Iberdrola Australia

Complex Approval Process

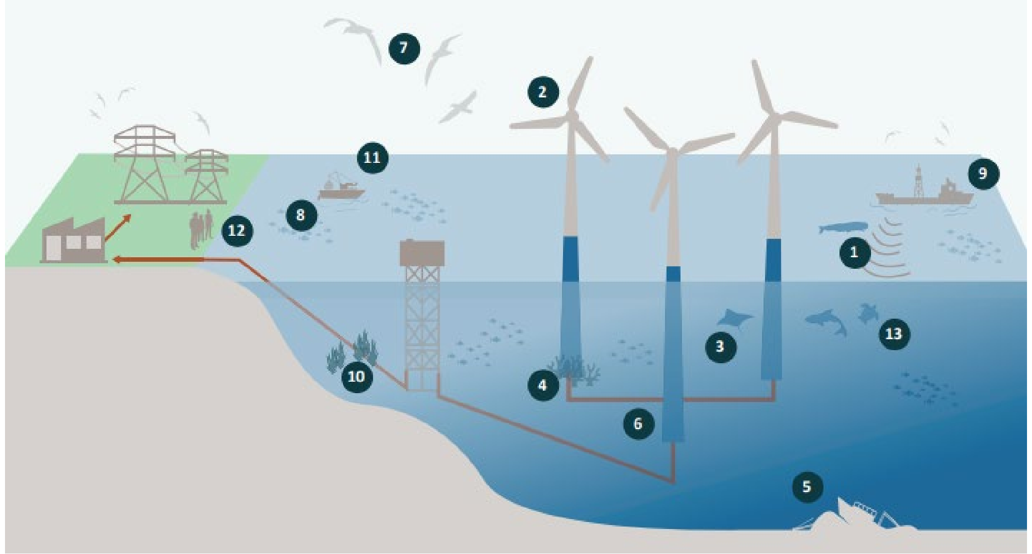
- Complex Commonwealth and State legislative frameworks (Cmw - EPBC, OEI, UCH Acts; Vic – EE, P&E, MaC, Act, etc).

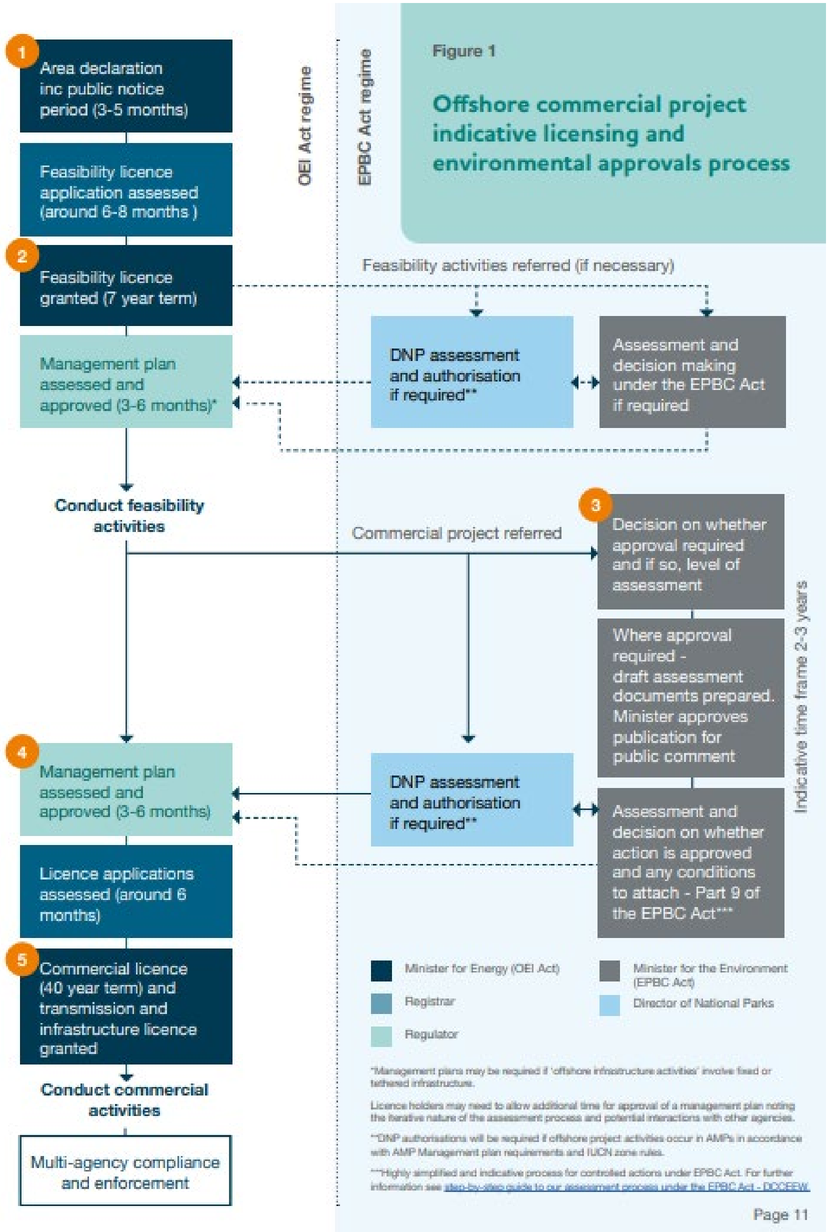
Environmental Sensitivities

- Unique environment and species (e.g., seabirds, whales) – “receptors” and impact pathways not previously studied.

Cultural and Heritage Considerations

- Again, with unique sensitivities (e.g., First Peoples connection, “land bridge”, shipwrecks) and complex interactions.





DCCEW; OIR

Community and Stakeholders

Iberdrola Australia

Community and Stakeholders Engagement Importance

- Stakeholder and community acceptance is essential, shaping project timelines, conditions, and reputational risks.

Community and Socio -economic Considerations

- Potential impacts (positive and adverse) and interaction with other users (e.g., fisheries, oil & gas, shipping, onshore power systems) and community need to be understood and addressed. This requires genuine engagement and it links back to workforce, supply chain and local content development.

Strategic Feasibility and Opportunity Cost

- Delays and uncertainties can shift investments to other markets. Stakeholder and community engagement are an essential on project feasibility and broader life-cycle.

A Plan for the Future

With feasibility licence holders for the declared Gippsland offshore wind zone confirmed, now is the time to come together to unlock ongoing investment, develop a skilled workforce and build the infrastructure to underpin the local offshore wind sector and secure Gippsland's clean energy future.

This plan outlines a path to do just that.

The plan contains five key focus areas which are vital to support the successful implementation of offshore wind in the Gippsland region:

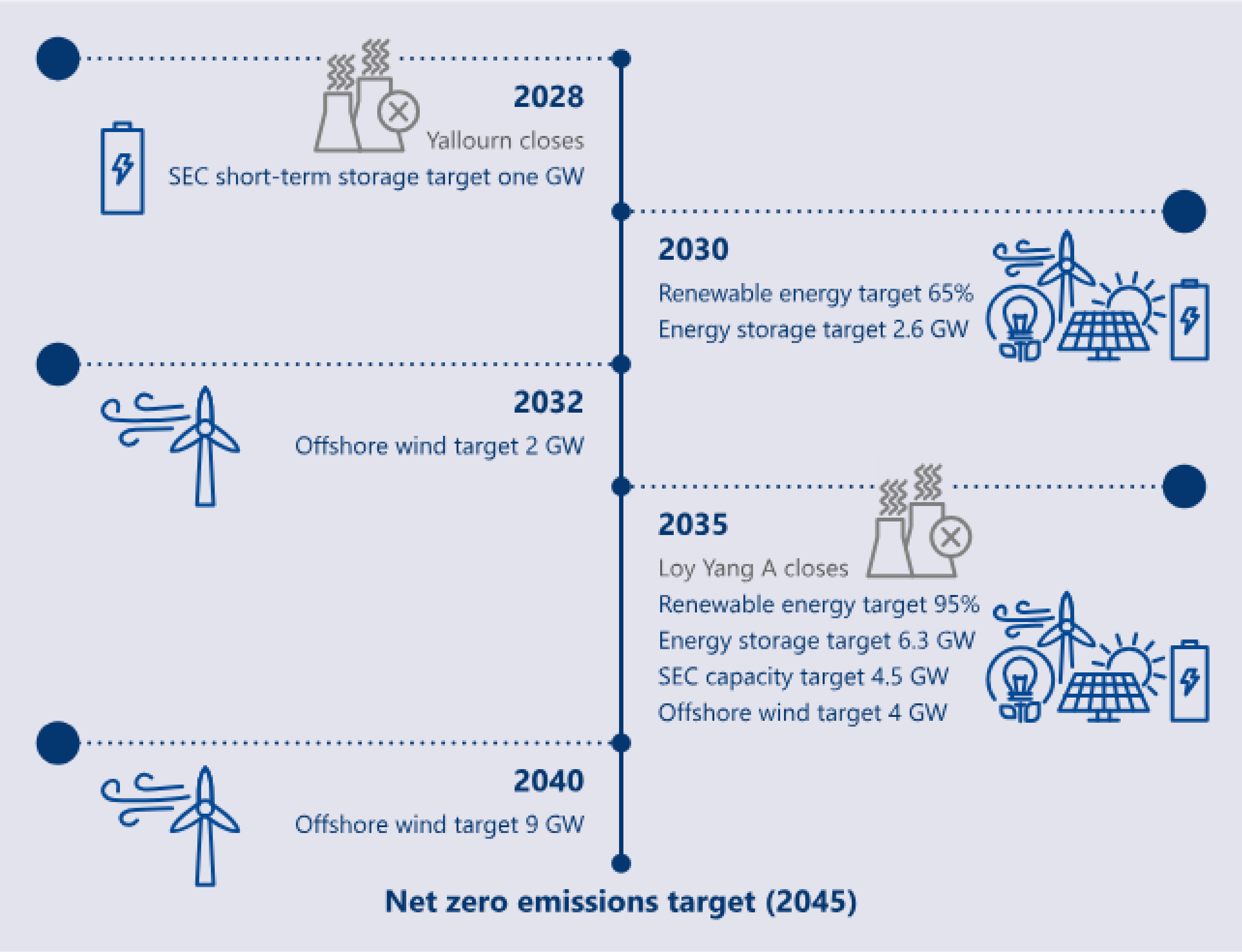
- Maximising economic, energy and climate benefits
- Enabling infrastructure
- Workforce education and upskilling
- Supply chain and manufacturing capabilities
- Engaging communities

Conclusion

Iberdrola Australia

Victoria's Energy Transition Roadmap

Clearly Involves
Offshore Wind



Managing the Transition to Renewable Energy | VAGO 2025

Offshore Wind Remains a Big Opportunity

We could make it happen in Gippsland! *(link below to East Anglia Three project recent construction milestone)*

East Anglia Three - Offshore Windfarm Animation - Iberdrola

Questions?

Thank you

Iberdrola
Australia