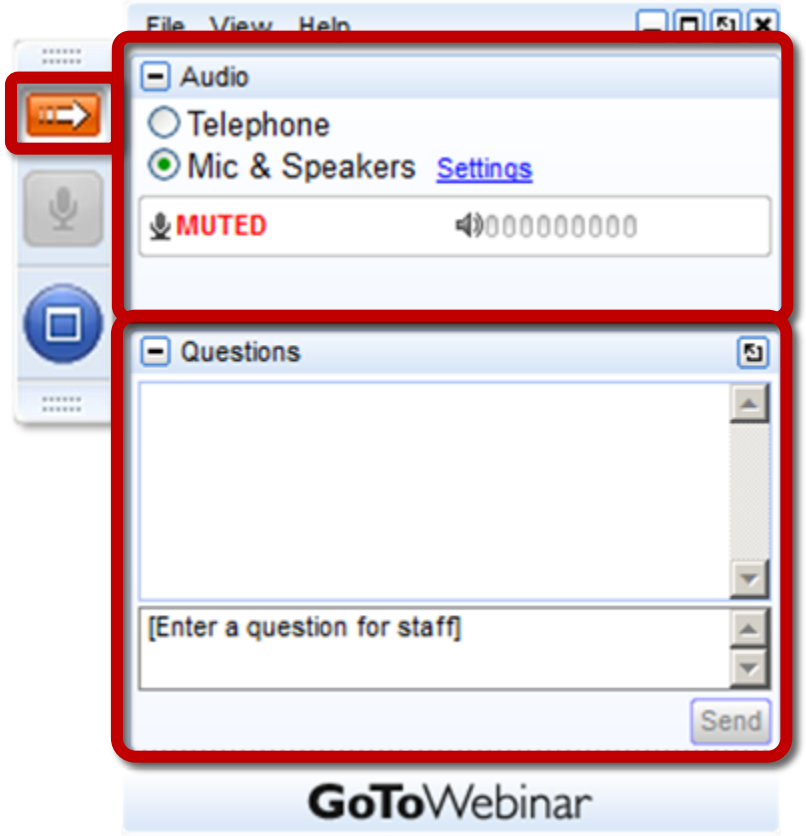
Introduction to Floating Wind Technology and Markets

October 13, 2022

Webinar Logistics



Join audio:

- Choose Mic & Speakers to use VoIP
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Use the orange arrow to open and close your control panel

Submit questions and comments via the Questions panel

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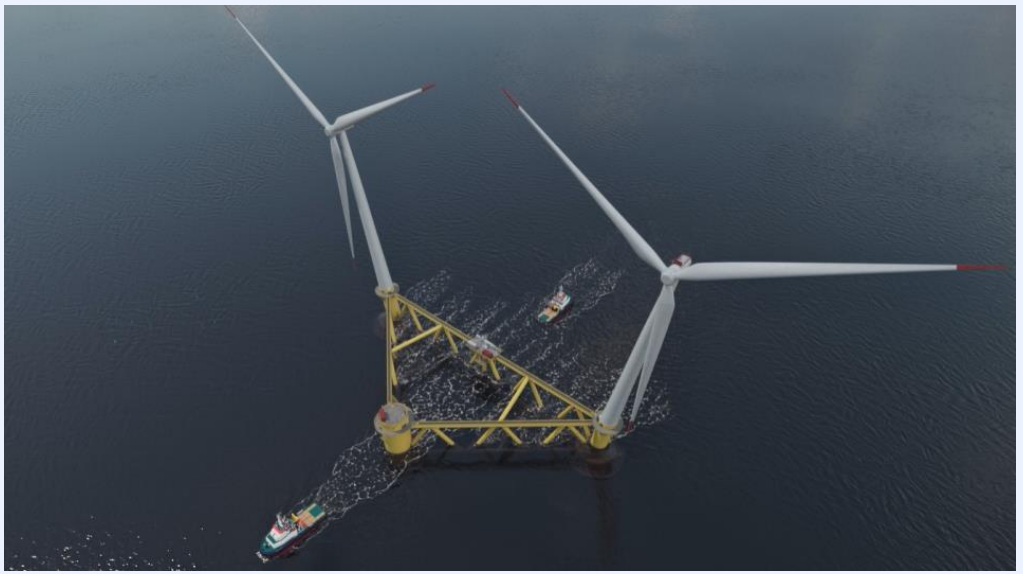
Presentation Roadmap

- Webinar Logistics
- WFO and CESA Introductions
- Overview of Global Floating Offshore Wind Industry Presentation by Adrienne Downey of Hexicon Group
- Fireside Chat w/ California Energy Commissioner Kourtney Vaccaro
- Q & A
- Conclusion of Webinar



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Webinar Panelists

Sam Schacht
Clean Energy States Alliance

Mike Matthews
World Forum Offshore Wind

Adrienne Downey
Hexicon

Kourtney Vaccaro
California Energy Commission

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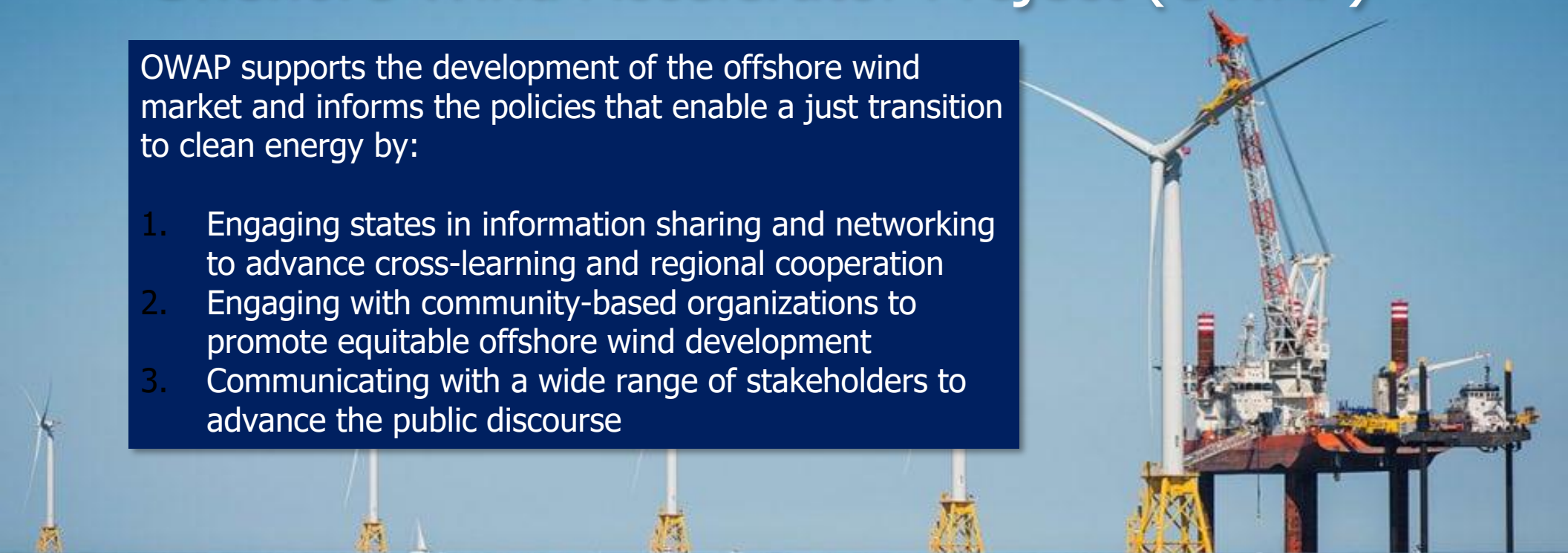
STATE OF CALIFORNIA ENERGY COMMISSION

Offshore Wind Accelerator Project (OWAP)

OWAP supports the development of the offshore wind market and informs the policies that enable a just transition to clean energy by:

1. Engaging states in information sharing and networking to advance cross-learning and regional cooperation
2. Engaging with community-based organizations to promote equitable offshore wind development
3. Communicating with a wide range of stakeholders to advance the public discourse



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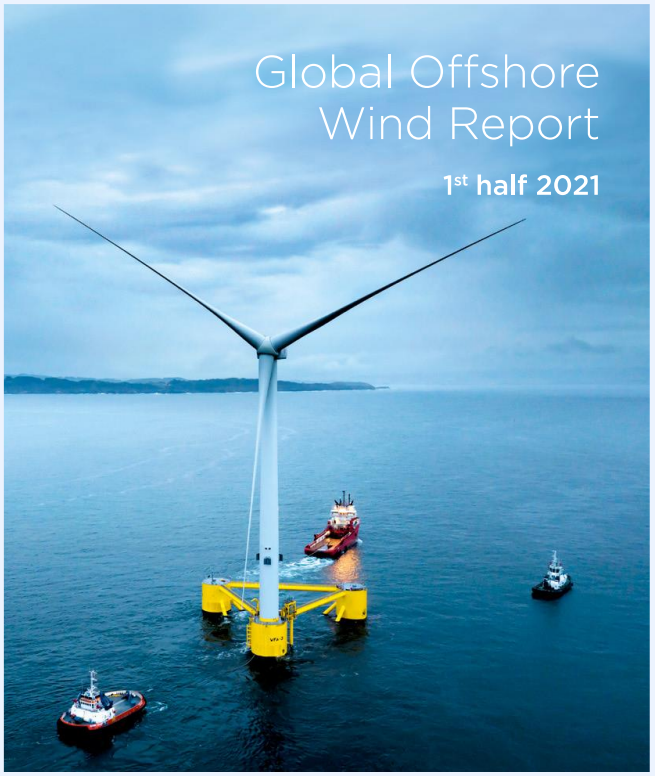
OWAP Learning Exchange

Our OWAP Learning Exchange aims to:

- **Educate** an American audience about the advancement of the European offshore wind industry and share lessons learned
- **Host** a peer-to-peer forum for EU and U.S. officials to exchange and learn
- **Strengthen** ties among the U.S. states actively engaged in offshore wind development

World Forum Offshore Wind (WFO)

- Global non-profit with 95-plus members and counting
- HQ in Hamburg, offices in Taiwan, Japan, and the U.S.
- FOWC focuses has four main areas of focus: O&M, insurance, moorings, and cable and floating substations
- Join us!



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Floating Offshore Wind Committee (FOWC)

- FOWC focuses has four main areas of focus: O&M, insurance, moorings, and cable and floating substations
- Recent whitepapers on moorings systems, O&M challenges and opportunities, and insurability of FOWTs

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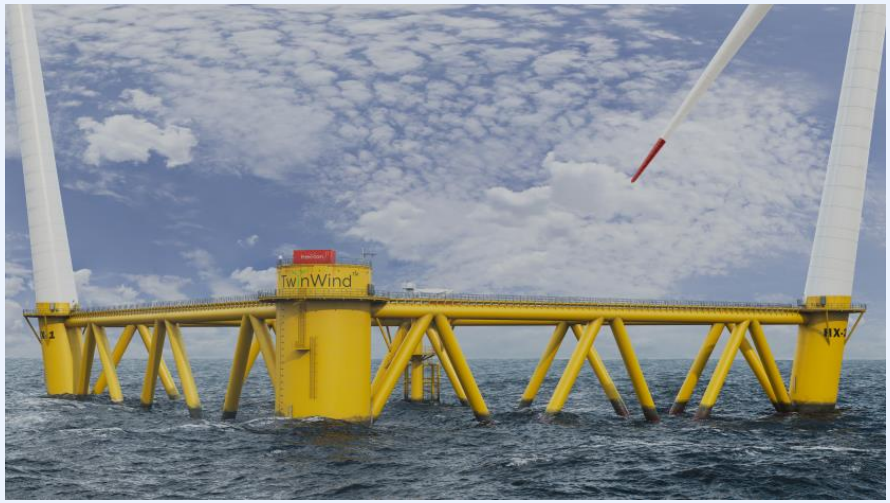
Start of Hexicon Group Presentation

- World leader in floating offshore wind
- Member of WFO



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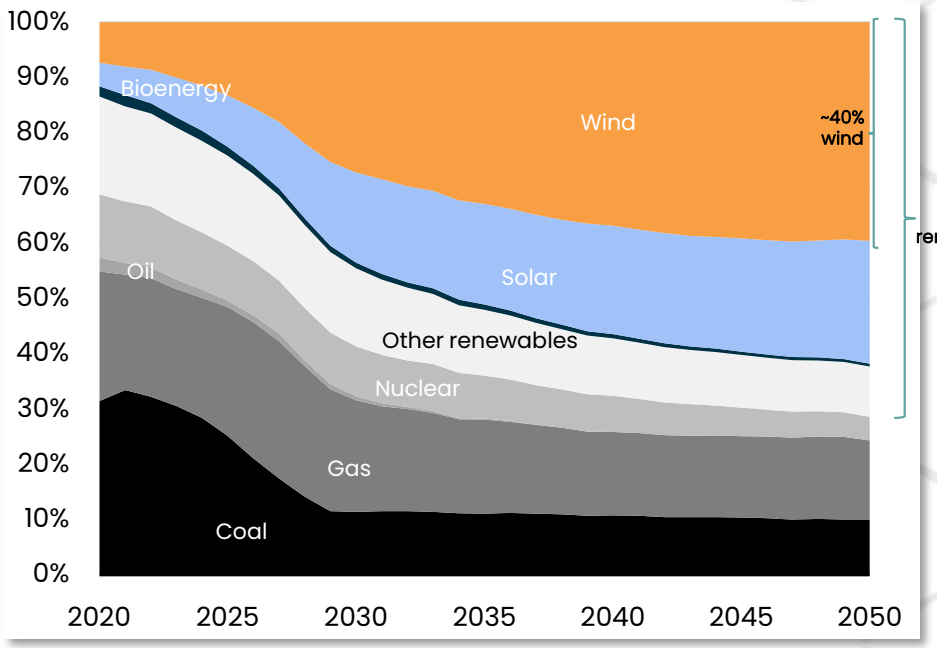
FLOATING OFFSHORE WIND

GROWING RENEWABLE ENERGY IS THE PILLAR OF GLOBAL CO_2 REDUCTIONS

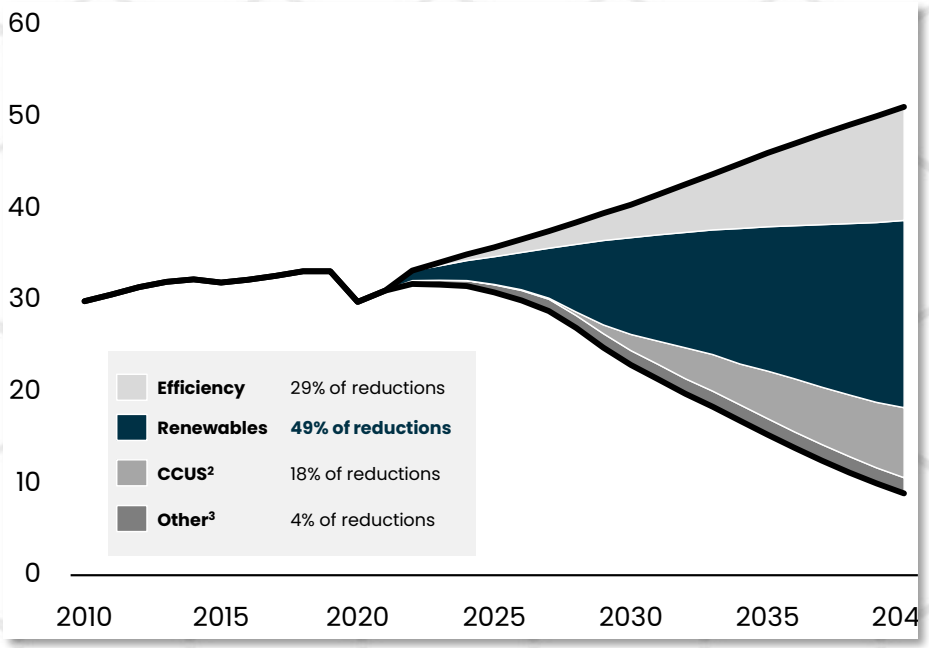
Renewables expected to constitute ~70% by 2050

Global electricity generation mix,
%



CO2 emission reduction by measure[1]

Global CO2 emission,
billion tons



Source: Bloomberg New Energy Finance 2021
1) Sustainable development scenario (bottom line), relative to stated policies scenario (top line)
2) Carbon capture, utilization and storage
3) Includes fuel switching, nuclear and other

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WHY POLICY-MAKERS ARE LOOKING TO FLOATING WIND

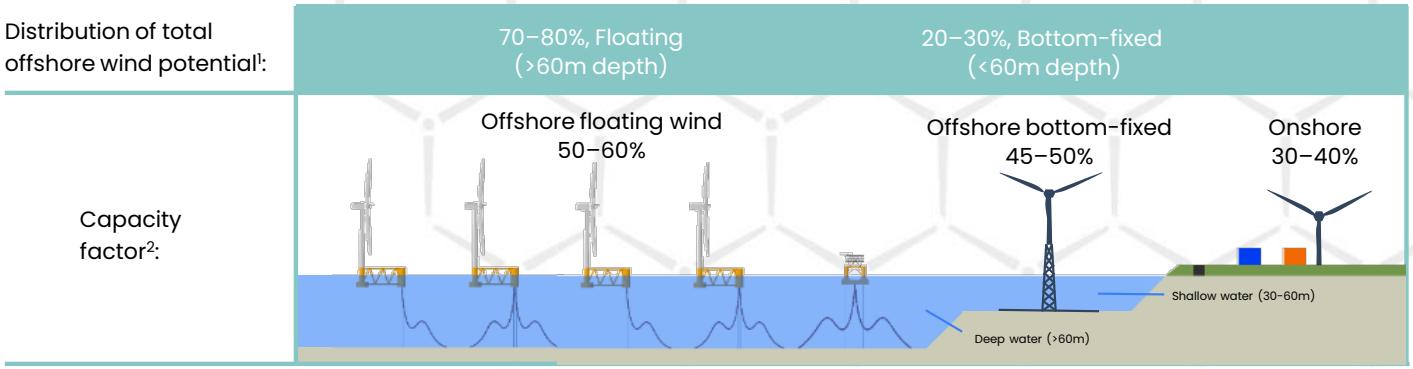
Enormous resource potential

Superior wind conditions

Minimized environmental footprint

Industrialisation potential

Deep-water wind is key to unlocking effective renewable energy



1) Europe, US, Japan and Taiwan included based on Carbon Trust and Industrial Technology Research Institute, -2) Capacity factor may vary from project to project
Source: Wood Mackenzie Power & Renewables: The Momentum of Floating Wind and its Outlook Implications (Dec 19); Fortune Business Insights

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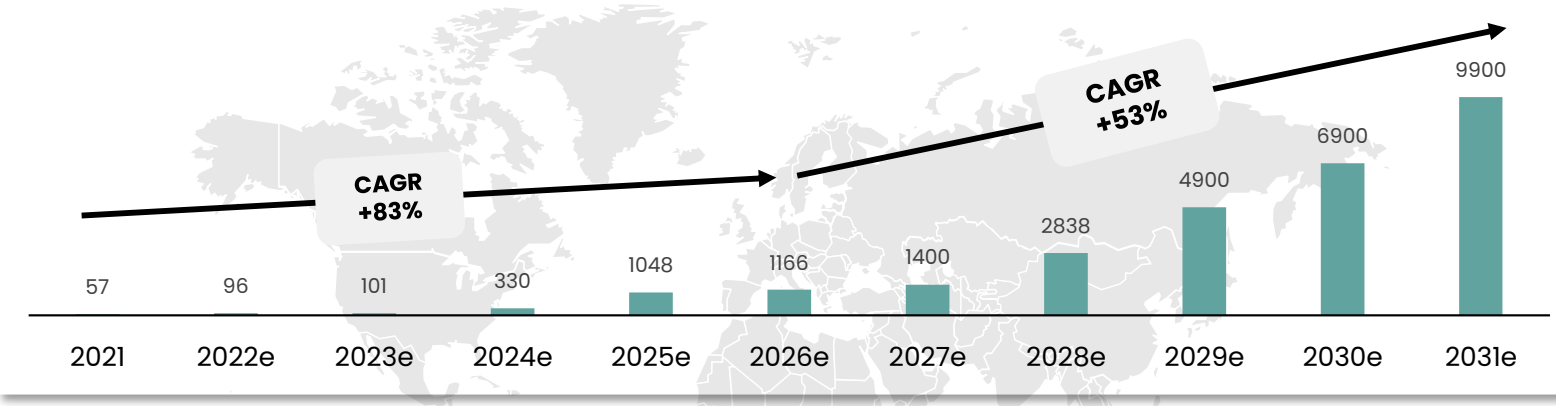
THE RACE FOR FLOATING IS ON – SIGNIFICANT GROWTH AHEAD

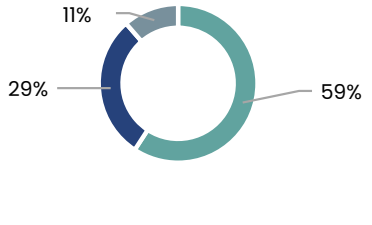
New floating wind installations, Global (MW)



Roadmap of floating offshore wind commercialisation

- Demo and trial phase (2009-2020)
- Pre-commercial phase (2021-2025)
- Commercial phase (from 2026 onward)

Contribution by region, new installations 2022-2031



Offshore wind deemed to grow

- 80% of the world's offshore wind resource potential lies in waters deeper than 60m
- Only 121.4 MW of net floating wind capacity is in operation worldwide, accounting for 0.2% of the total installed offshore wind capacity

Source: GWEC | GLOBAL OFFSHORE WIND REPORT 2022

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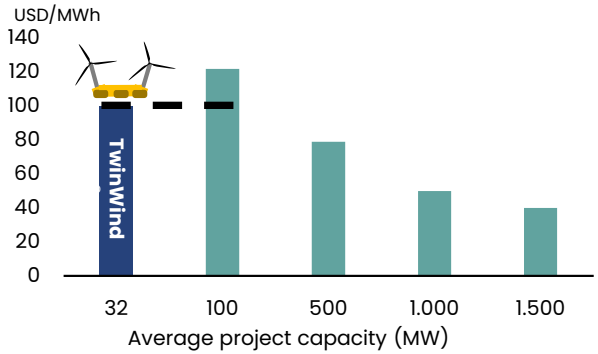
SCALE AND INDUSTRIALISATION OF THE VALUE CHAIN IS KEY TO GETTING COMPETITIVE LCOE

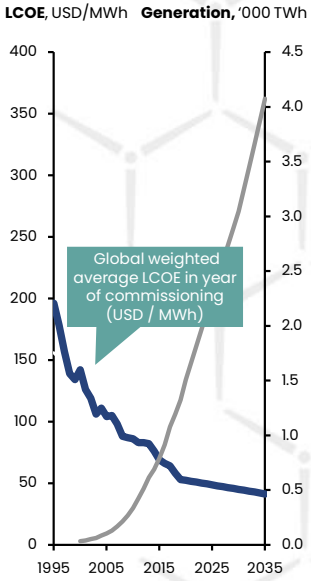
Key measures to lower LCOE

- Accelerate the scale of deployment
- Develop strategic supply chain
- Drive innovation through test and demonstration

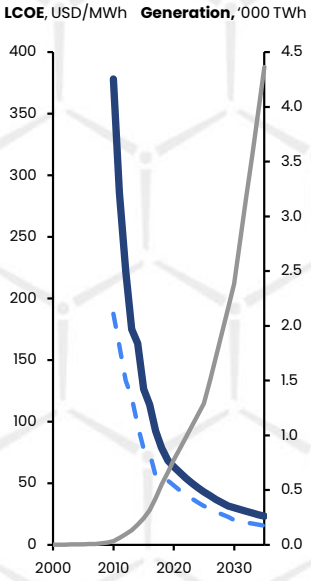
Projected LCOE based on average project capacity[1]



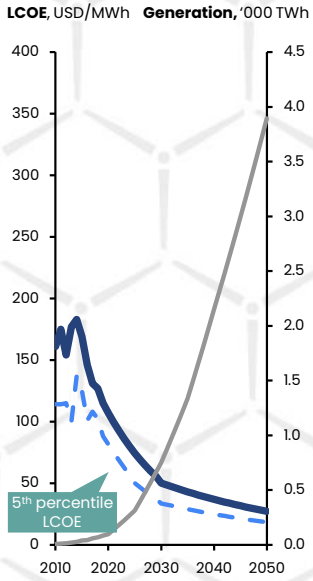
Revolution 1 (1990s) Onshore wind[2]



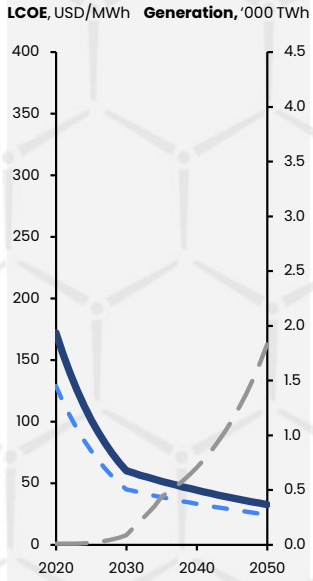
Revolution 2 (2000s) Solar PV[2]



Revolution 3 (2010s) Offshore shallow-water wind[2]



Revolution 4 (2020s) Deep-water wind[2]



Source: 1) The Carbon Trust 2) IRENA 2019; Fraunhofer ISE, McKinsey Energy Insights Global Energy Perspective, April 2020
2)Full lines represent the global weighted average LCOE in year of commissioning (USD / MWh), while the dotted lines represent the 5th percentile LCOE globally – the highest quality projects

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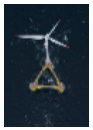
MULTIPLE FOUNDATION CONCEPTS EXIST TODAY

1 SEMI-SUBMERSIBLE

- Buoyancy stabilised platform floating semi-submerged on the sea surface
- Anchored to the seabed with catenary mooring lines
- Low draft allows for more flexible application and simpler installation
- Relatively low risk in execution



Principle Power

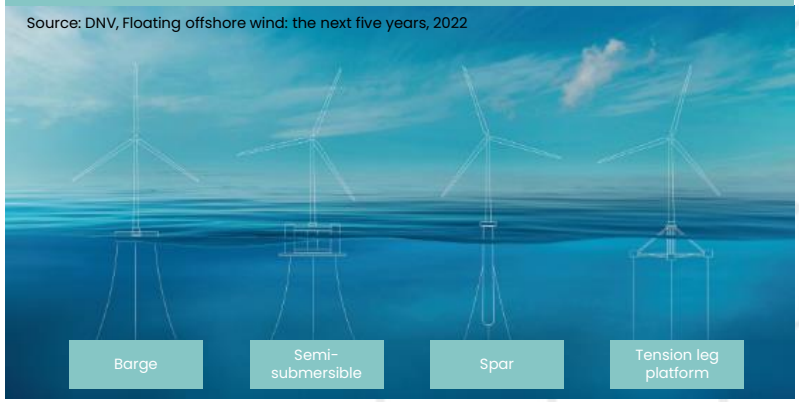
Hexicon

2 BARGE

- Large displacement buoyancy stabilized platform.
- Low draft allows for more flexible application and simpler installation
- large structure exposed to wave loading and risk of greater motions
- Large but simple geometry to fabricate

BW Ideol

ESTABLISHED FLOATER CONCEPTS



3 SPAR

- Cylindrical ballast-stabilised structure
- Stability from lower centre of gravity than the centre of buoyancy
- Simple structure is relatively easy to fabricate and provides good stability
- Large draft creates logistical challenges for assembly, transport and installation

Equinor

4 TENSION LEG PLATFROM

- Semi-submerged structure anchored to the seabed with tensioned mooring lines
- Shallow draft and tension stability allows for a smaller and lighter structure
- Design implies increased stresses on the tendon and anchor system
- Challenges with installation and higher operational risks if a tendon fails

SBM

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DEVELOPMENT OF FLOATING WIND

1980s

Floating wind has developed from the oil and gas sector which has used semi-submersible floating foundations for many decades

2009

In 2009 Equinor installed the first full-size floating turbine. The 2.3MW Hywind turbine was built with a SPAR foundation.

2011

In 2011 Principle Power installed their Windfloat solution which utilises a semi-submersible structure.

2021

In 2021 the largest floating wind park in the world was fully installed. A 50MW park outside the coast of Scotland using the Windfloat semi-submersible structure

In 2011 Hexicon wins the UK's first competitive commercial floating wind CfD Award for its 32 MW TwinHub project in the Celtic Sea, signaling a record-breaking strike price of <$120/MWh via its TwinWind technology

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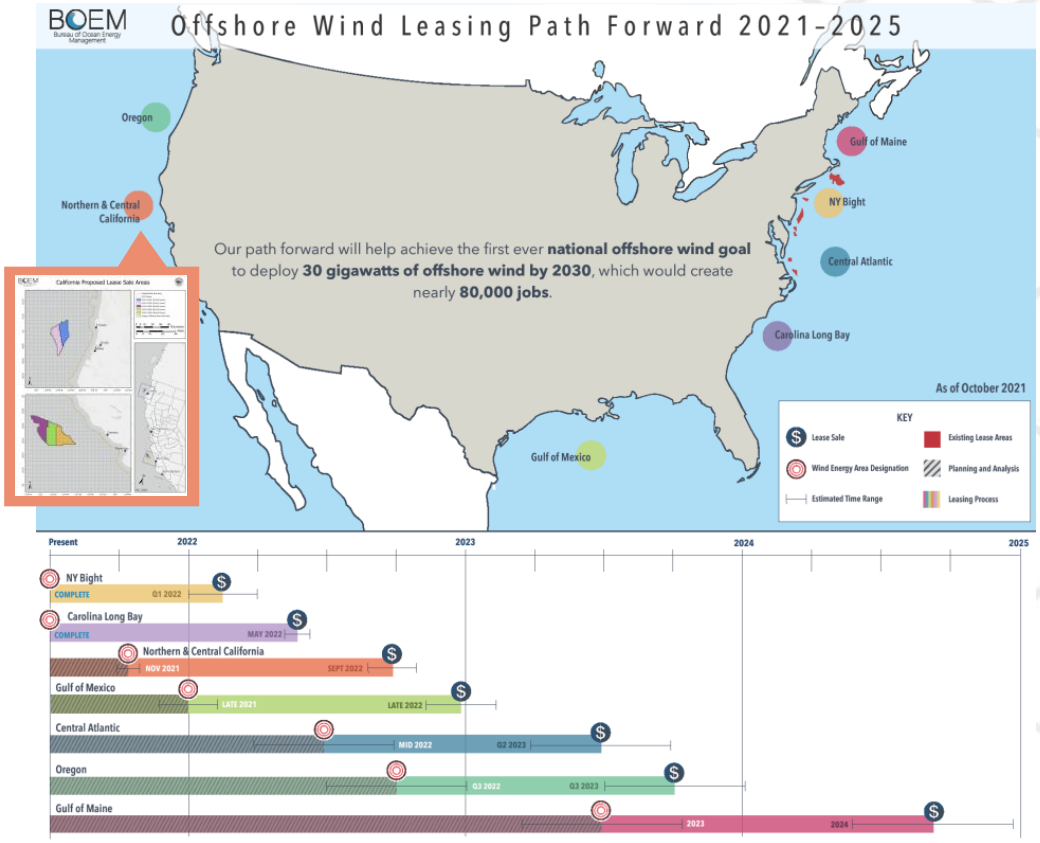
USA Offshore Wind: 30 GW by 2030 and 110 GW by 2050



42 MW
Currently Installed

19.5 GW
Under Contract

77.4 GW
State Goals by 2045

15 GW by 2035
Floating Wind Shot™

65 GW by 2050
Floating Potential

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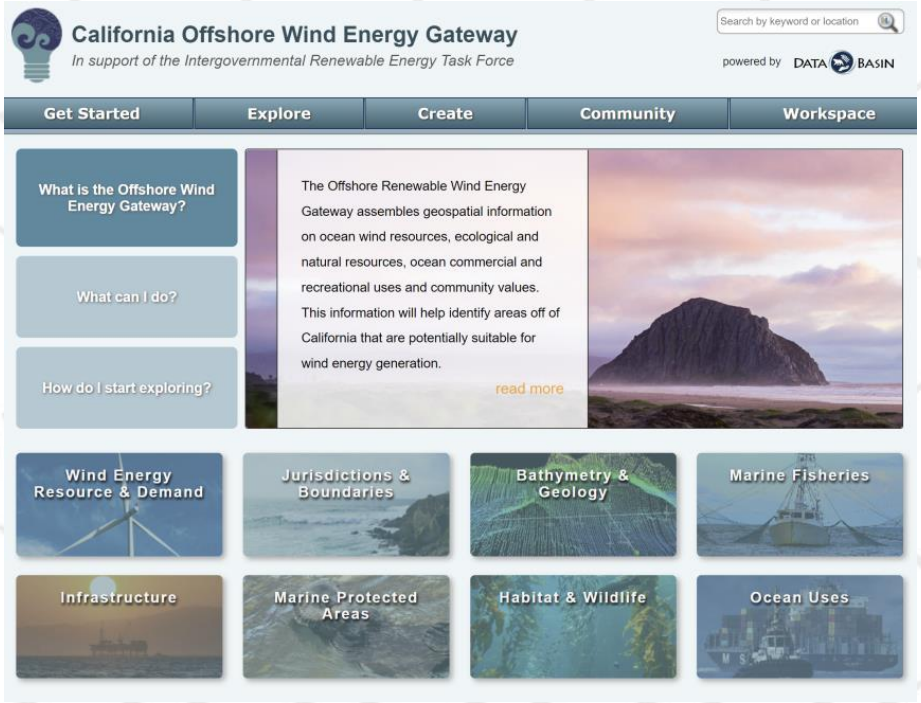
California: 2-5 GW by 2030 and 25 GW by 2045

https://efiling.energy.ca.gov/
Docket no. 17-MISC-01



https://caoffshorewind.databasin.org/

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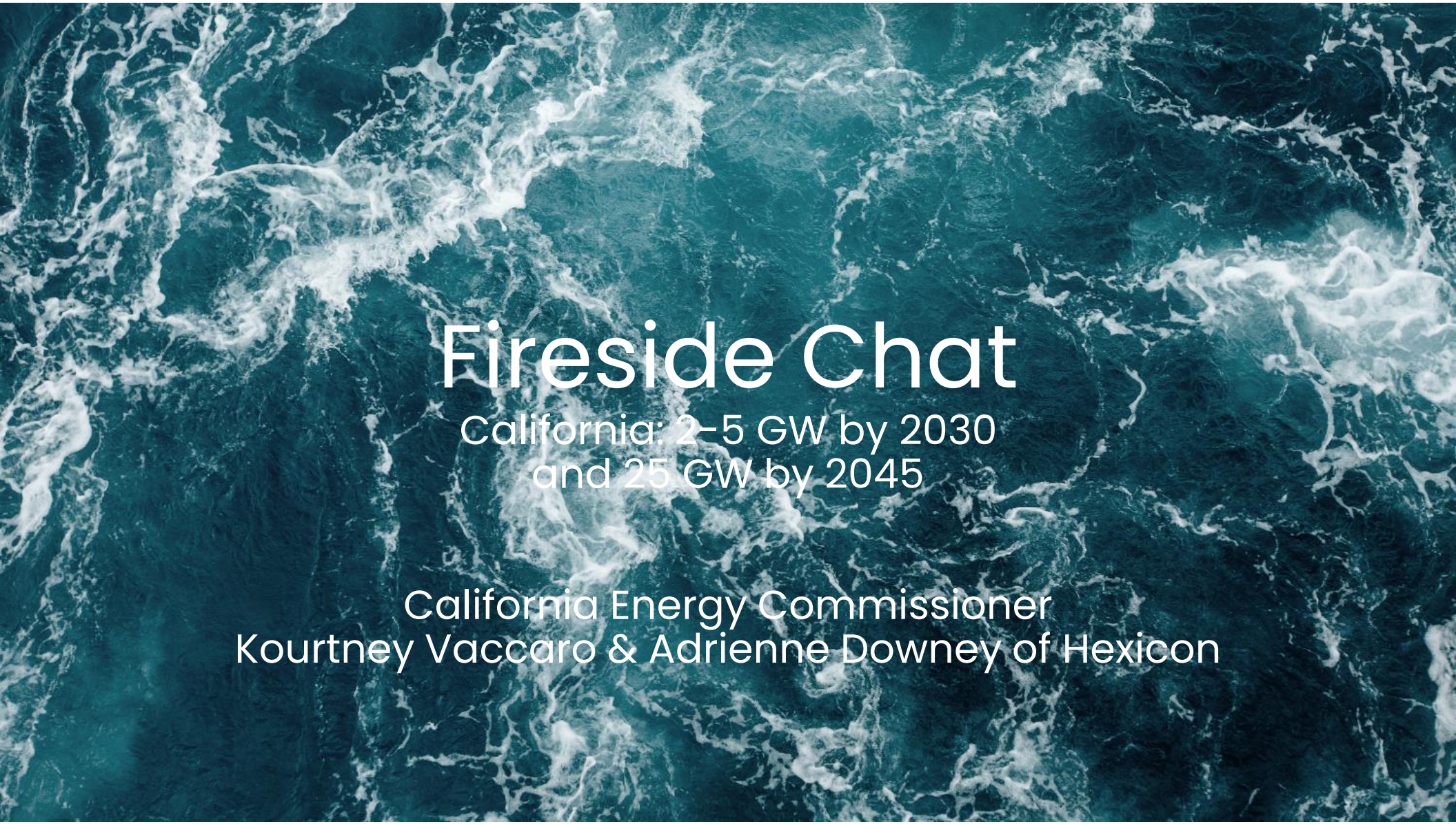

Fireside Chat

California: 2–5 GW by 2030 and 25 GW by 2045

California Energy Commissioner
Kourtney Vaccaro & Adrienne Downey of Hexicon


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Thank you!
Photo credit: RWE