

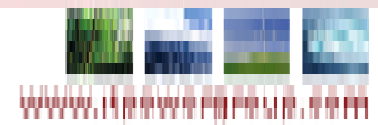


Offshore Wind in Taiwan: Developing a Successful Industry

ITP Group

Dr. Mark Leybourne

Taiwan Wind Power Investment International Conference
Taipei, 25th August 2016



Topics of talk



- Introduction to ITP
- Developer & funder expectations
- Policy and incentives for offshore wind
- Consenting and strategic planning



International Renewable Energy Consultancy - Established in 1981

- Technical & engineering
- Environmental - ESIA
- Due diligence
- Project support
- Policy advisory services
- Research & development
- Public & private clients



ITP - EEL Merger



- IT Power Consulting Limited (ITPCL) merged with Energised Environments Limited (EEL) in July 2016
- 4 UK offices: Edinburgh, Glasgow, London and Bristol
- EEL, ITPCL and group companies in Australia, China and India planning to form the **ITPEnergised Group**
- IT Power India is a sister company of EEL/ITPCL
- EEL has capabilities across energy, infrastructure and urban development, Environmental and sustainability services are key competences

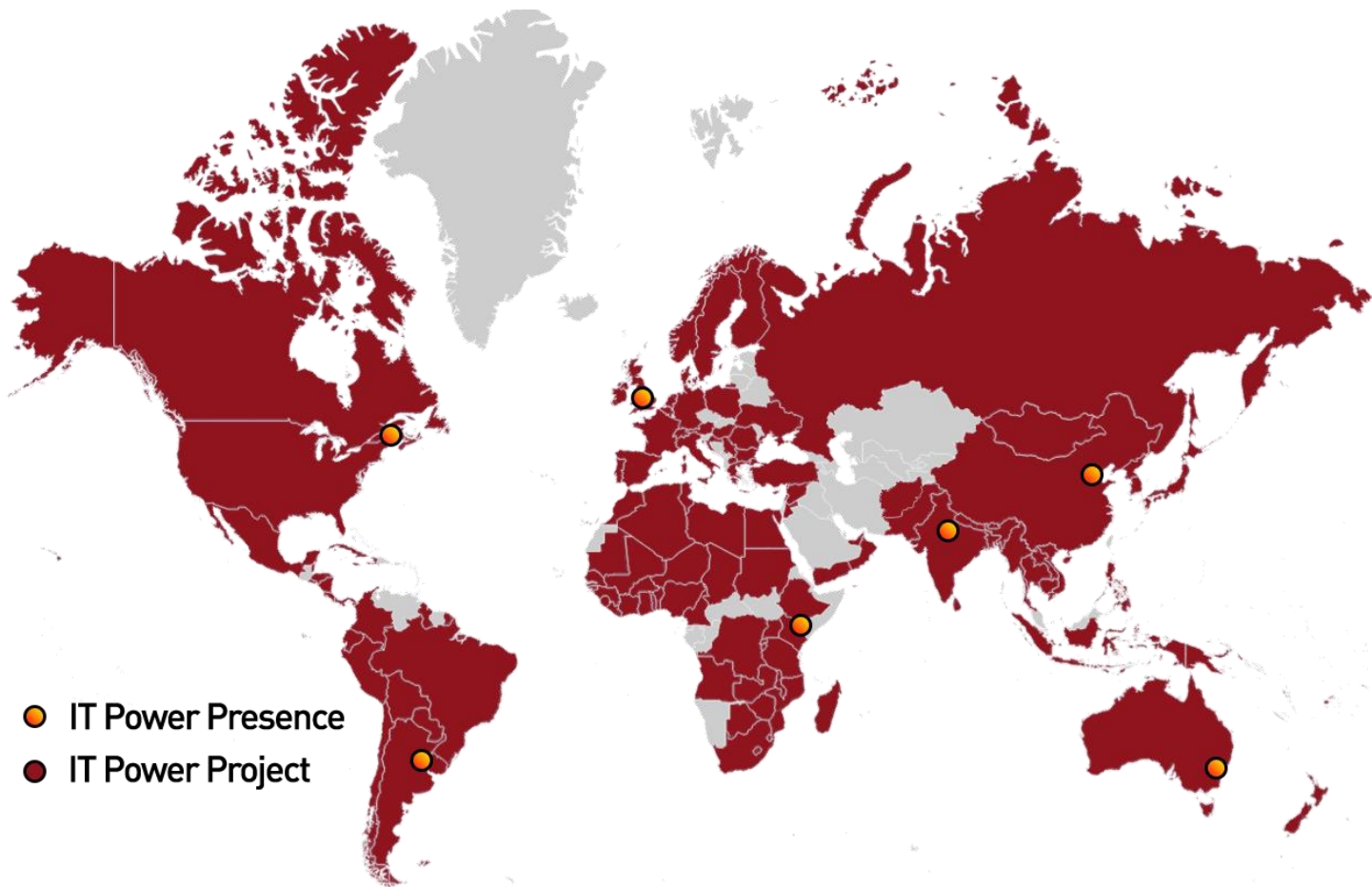


<http://www.energisedenvironments.com/>

Our Sectors



IT Power Group - Global Presence



Over 1,500 projects in 120 countries



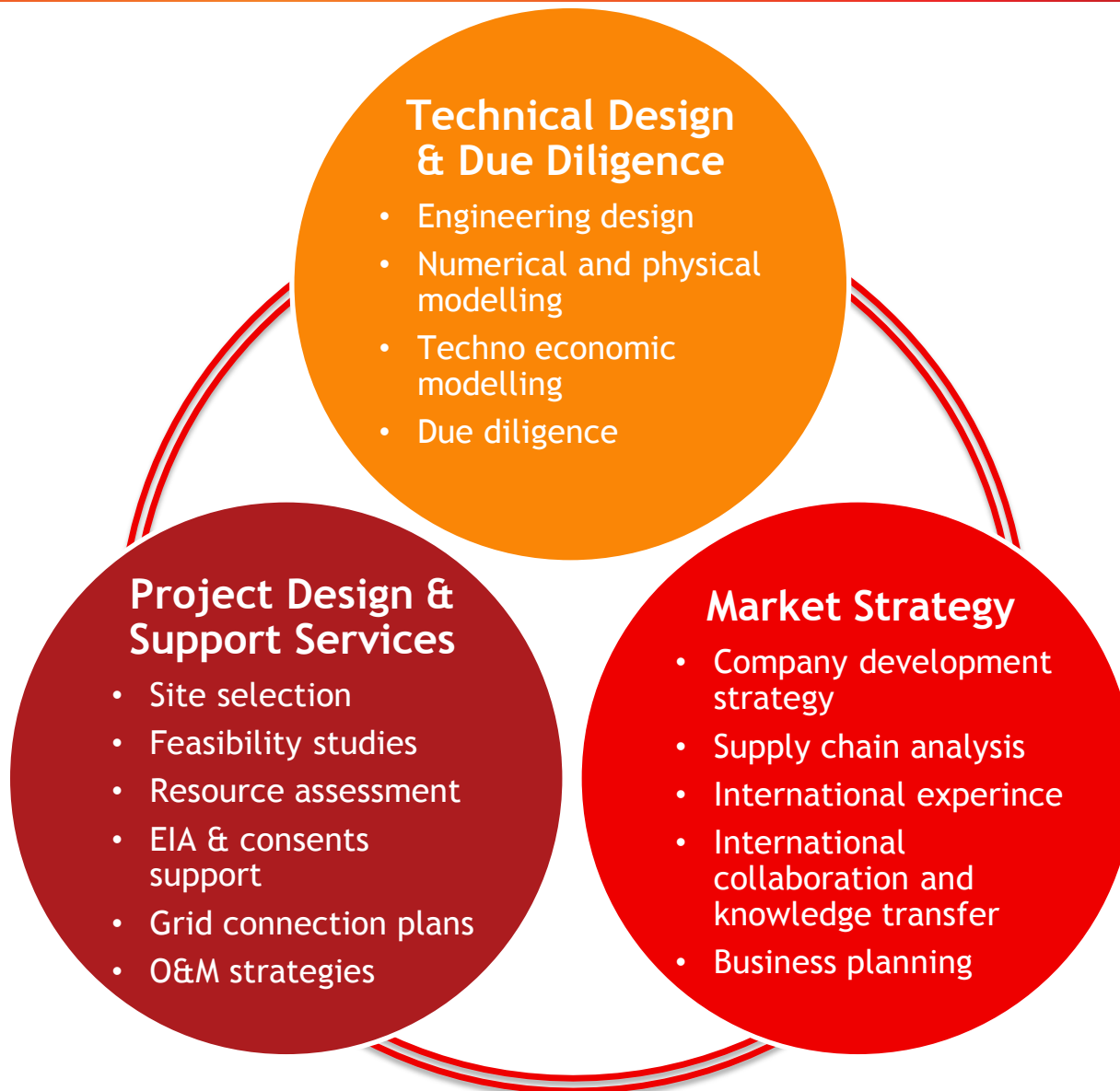
ITP OFFSHORE CONSULTING



Consulting · Engineering · Implementation



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Technical Design & Due Diligence

- Engineering design
- Numerical and physical modelling
- Techno economic modelling
- Due diligence

Project Design & Support Services

- Site selection
- Feasibility studies
- Resource assessment
- EIA & consents support
- Grid connection plans
- O&M strategies

Market Strategy

- Company development strategy
- Supply chain analysis
- International experience
- International collaboration and knowledge transfer
- Business planning

- Development:
 - Burbo Bank
 - Hong Kong offshore wind
 - Brazil project feasibility
 - Round 3 proposal for client
 - India demo project - Gujarat
 - Floating Power Plant
- Reviews and valuations:
 - Greater Gabbard
 - Sherringham Shoal
 - Westermost Rough
 - Bluewater Wind Delaware
 - China 2 x 400MW projects
- Policy, Planning, Guidelines & Roadmaps:
 - China
 - India
 - Taiwan
 - South Korea
 - East of England
 - Tata Power
 - GDF Suez (ENGIE)
 - EDP
 - NRG
 - GROW: OffshoreWind

- **India offshore wind - UK Gov't Funded - Client: Gov't India**
 - Tariff estimation and modelling of financial incentives
 - Best practice and roadmap advice for policy
 - New project concession model and tender design
 - Cost modelling and supply chain analysis
- **Taiwan offshore wind - Client: ITRI**
 - Three sets of technical guidelines for offshore wind projects
 - Ports development & financing study
- **China offshore wind - UK Gov't Funded - Client: NEA & developers**
 - Technical case studies on 3 UK projects
 - Advice on risks when investing in offshore wind projects
- **China & Korea - Roadmaps on offshore renewable energy**

Floating Power Plant



UK market study for FPP's combined wind and wave platform:

- Site selection & assessment
- Development roadmap
- Pre-feasibility studies
- Stakeholder engagement
- Introductions to developers

On-going framework agreement:

- UK Development and investment support
- Ad-hoc technical advice





Offshore Wind Investment



- Industry is maturing: move from equity to debt
- Reduction and better understanding of risk
- Improving supplier quality and knowledge
- Policies stabilising (in some cases)
- Investors and financiers now familiar with sector
- Higher certainty of returns - mature asset class
- By 2014, European utilities had financed ~77% of the €16bn spent on ~5 GW of offshore wind capacity
- Taiwan aim of 3GW by 2025 --> +NT\$375bn (€10bn)

Funder's Expectations



- **A stable income** for power generated, i.e.:
 - Stable government policy for subsidy support schemes
 - Fixed price PPA (Power Purchase Agreement)
- **Proven/reliable technology** (particularly wind turbines- they must be bankable) - with new/unproven technologies, strong guarantees will be very important
- **Strong sponsor/developer**
- **Strong project management** and governance in the developer
- **Solid, creditworthy** and reliable project partners
- **Long term and robust supply, construction and O&M contracts**
- **Good insurance** package
- **Appropriate mitigation** to manage construction and weather risk
- **Sufficient contingencies** budgeted to cover additional expenses

- A good due diligence report will flag up risks and areas of concern and categorise them based on their impact
- For example: ‘showstopper’, ‘significant’ and ‘minor’ issues
 - **Showstoppers:** where there is a probability of occurrence of an event, even if very low, that will result in the project not being able to proceed
 - **Significant:** issues considered to have a potential impact on development or operating costs more than 0.5% of forecast capital costs or potential programme delays of greater than 6 months
 - **Minor:** issues identified as requiring clarification, but are unlikely to have any material impact on the project.

- **Wind Turbines** - performance, reliability, availability, alternatives, TSA and Warranties
- **Wind Resource** - Review wind resource assessments & energy yield studies
- **Geotechnical / Geophysical** - Analyse existing surveys and comment on the risk implications for the project
- **Installation Vessels** & proposed installation and maintenance vessel strategy - risks in weather capabilities, day rates
- **Project Timeline** - Review the development, procurement and construction programme - Identify key risks to the project timeline
- **Costs** - review CAPEX and OPEX estimations and certainty
- **Foundations** - may wish to review designs and installation method
- **Grid and electrical systems** - assessment of design and TSO agreement
- **Procurement & contracts** - review performance & stability of contractors
- **Project certification & standards**
- **Management & risk** - Risk register, mitigation measures, insurance

Key Risks



Decreasing Investment Risk

A thick red arrow points horizontally from the left side of the slide towards the right, ending in a simple arrowhead. The text 'Decreasing Investment Risk' is centered below the arrow.

Developing an Industry



- Sustainable pipeline of projects - a market
- Stable policy & clear regulations
- Acceptable perceived risks for developers
- Low impacts - public support
- Grow the local supply chain & industry
- Future cost reduction strategy

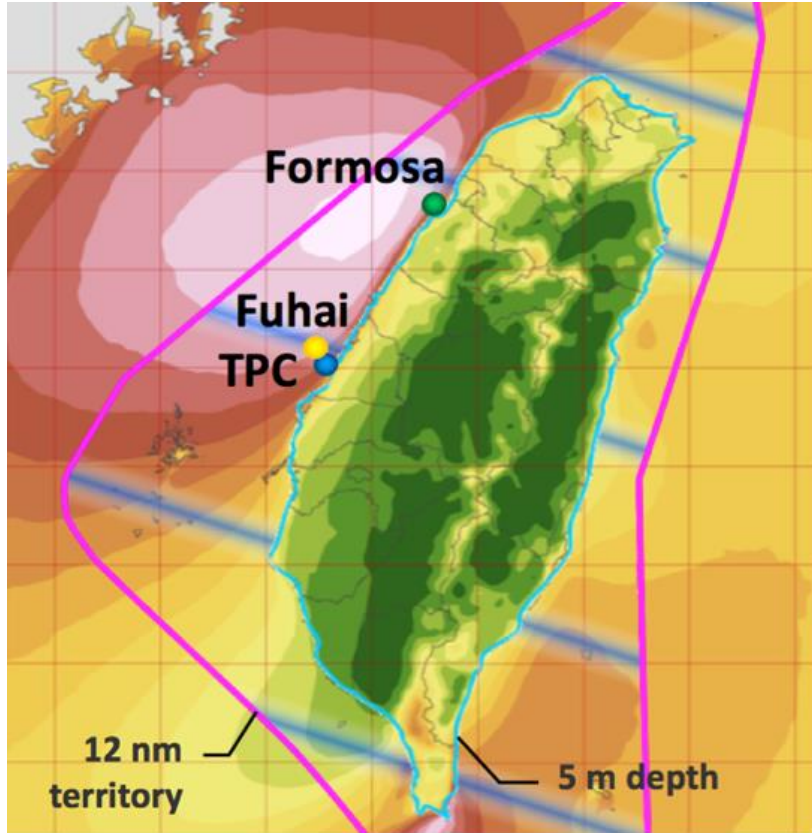




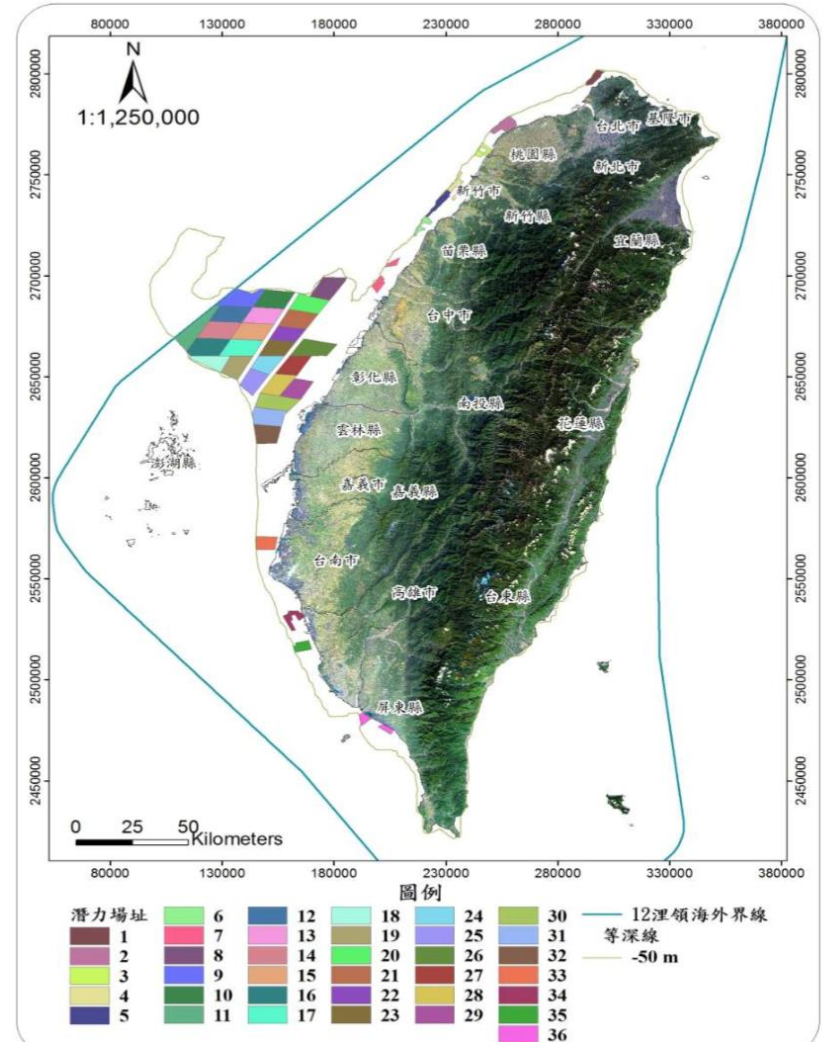
Policies and Incentives



Taiwan's Developing Industry



Demo projects to Zonal programme



Strategy for Administration



Government Led

Developer Led



Competition for
Pre-Defined Projects

Competition for
Defined Area

Ad-hoc Proposals
for Sites

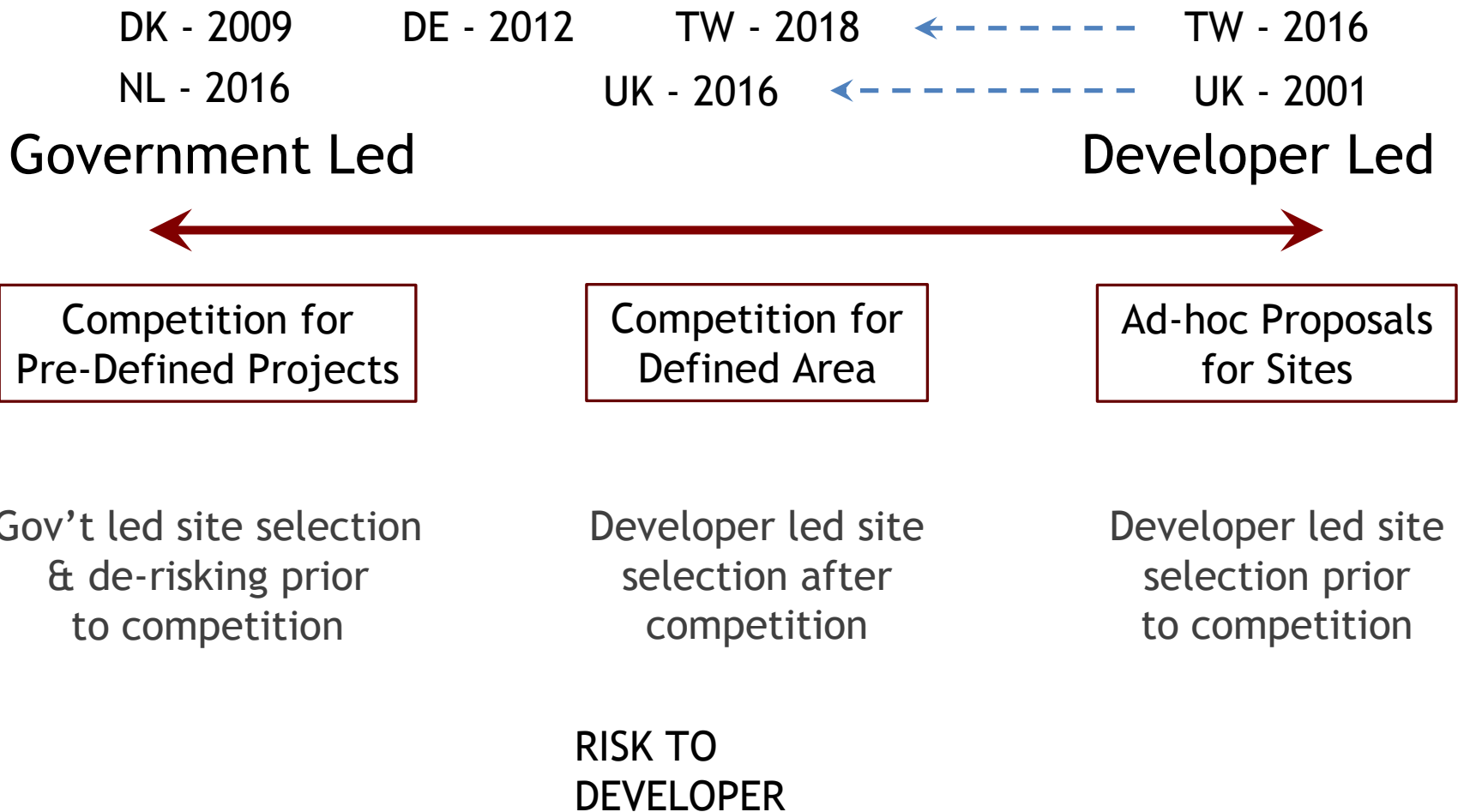
Gov't led site selection
& de-risking prior
to competition

Developer led site
selection after
competition

Developer led site
selection prior
to competition

RISK TO
DEVELOPER

Strategy for Administration

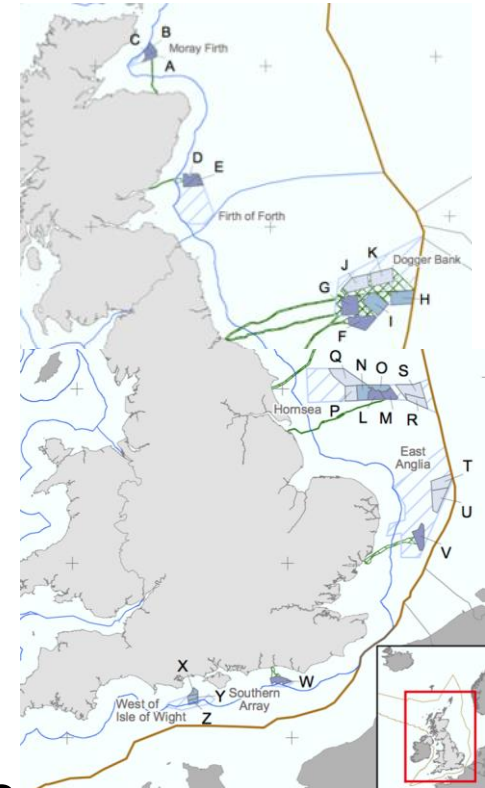


- +5GW operational with over 1.5GW in development
- Round 1 - developer proposed sites
- Round 2 - developer proposed sites in strategic areas
- Round 3 - Competitive tender for pre-defined zones
- Concession competition judged on ability to successfully deliver a project rather than the cheapest price
- Reduction of risk and introduction of competition to tariff support through CFDs
- Key roles played by the Crown Estate and PINS
- Strong industry body and co-ordination - RenewableUK
- Previously - poor industry strategy and supply chain planning

Crown Estate - De-risking



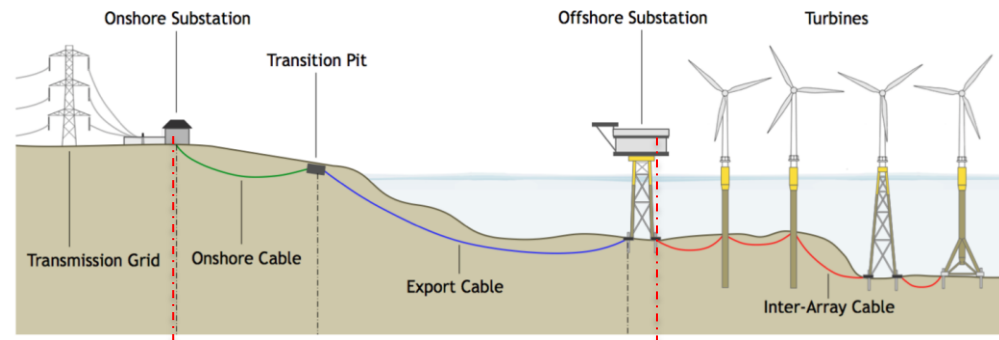
- The Crown Estate was proactive to de-risk Round 3
 - Aerial bird surveys of zones
 - Development of the consents framework
 - Funding for key agencies
 - Marine mammal survey and research strategy
 - Funding to support radar mitigation
 - Supply chain events to communicate to industry
 - Engagement with relevant bodies to undertake strategic planning for offshore grid



OFTO - Offshore Transmission Owner



- Over £2.3bn has been invested in OFTOs since 2009 - equity and debt investors - £1.5bn in the tender process
- Licences to operate and manage the asset for a 20-year period, in return for a regulated, stable revenues
- Solid returns on relatively low risk profile underwritten by stable regulatory framework overseen by Ofgem
- Availability and contracting risks to OFTO
- Frees up capital from developer and project financiers



- At the end of 2014, Germany had in excess of 1 GW of installed offshore wind capacity and installed a further 1.77 GW in the first 6 months of 2015
- Currently around 3.3 GW is operational with a further 2.1 GW planned in the next few years → target of 6.5 GW by 2020
- Projects have needed to fit within MSP and awarded on ad hoc applications by BSH and given to first successful EIA consent
- TenneT (TSO) is responsible for the planning, construction and funding of all onshore and offshore transmission infrastructure. The costs for the new infrastructure are recovered through TNUoS tariffs
- Various tariff options available - offering around €101/MWh to €108/MWh
- Moving to competitive auctions for projects and FiT price
- Grid availability, technical issues and delays have been a challenge

- ~1.2GW operational with over 1.5GW in development
- Strong, government led approach and plenty of support
- Feasibility, EIA and grid planning done upfront → de-risks for developer
- Tenders for projects and ad hoc project leasing available
- Winning tender FiT price for the first 50,000 peak-load hours of the project (very roughly, ~14 years of electricity production) → then market price
- Local TSO TenneT provides the grid connection and offshore transmission
- Excellent local supply chain
- Offshore wind is a success story for Denmark

- First projects were the nearshore Lely 2MW project in 1994 and the 16.8MW Irene Vorrink project in 1997. These were pilot/demonstration projects
- First large scale projects did not come until a decade later with the 108MW Egmond aan Zee (OWEZ, 2007) and the 120MW Princess Amalia (2008) projects
- Progress was affected by changes in political support for renewable energy which caused stagnation in the industry
- Plans to increase offshore wind capacity from the current existing and planned 1,000 MW to around 4,500 MW by 2023
- Moving to a Danish model → a new competitive tendering process is being introduced that will judge bids on price of electricity.
- Developers compete for projects and SDE+ FiT
- TSO TenneT provides the grid connection and offshore transmission

Borssele Projects - Cost Reduction



- 2015 Borssele Wind Farm Zone 700 MW, Sites I (350 MW) and II (350 MW) - tender awarded to DONG Energy
- 38 bids - DONG won with EUR 0.0727/kWh (NT\$2.60/kWh) - cheapest in the world
- Previous lowest was EUR 0.103/kWh for Horns Rev 3
- Project due for completion during 2020
- 2016 Borssele Wind Farm Zone 680 MW, Sites III (330 MW) and IV (350 MW). This tender will open in September 2016

STRATEGY

- Targets & Commitments
- Development Roadmaps
- Resource Quantification
- Spatial Planning

INCENTIVES

- Generation Based Tariffs
- Renewable Energy Certificates
- Fiscal Measures
- Streamlined Consenting

FINANCING

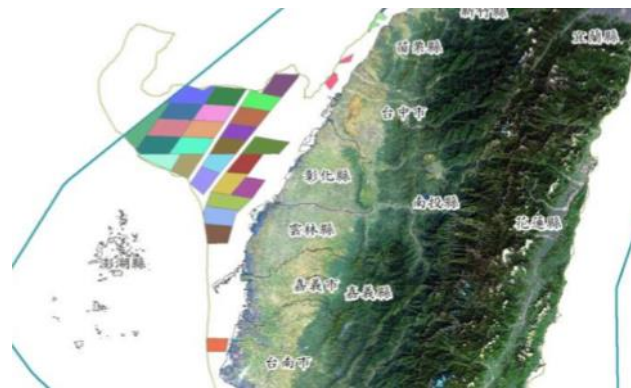
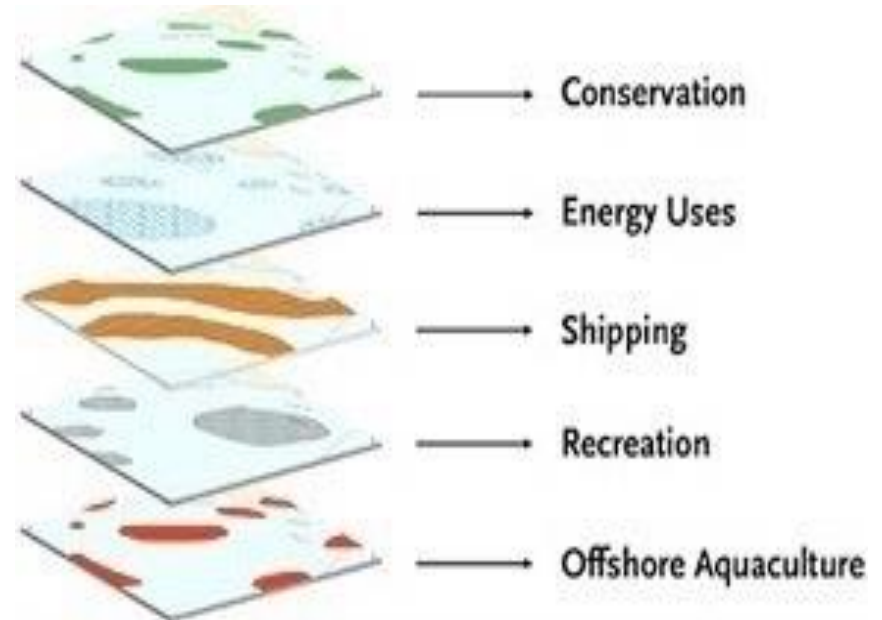
- Grant Support
- R&D Funding
- Low Interest Loans
- Guarantees for Loans
- Testing Centres

What is Marine Spatial Planning (MSP)?



It is an integrated public process to:

1. Analyse and allocate the use of marine space
2. Manage interactions between uses
3. Identify and achieve economic, ecological and social objectives



- *“Marine spatial planning is a public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that, usually, have been specified through a political process”*
- Consultation and stakeholder engagement is an essential aspect of MSP
- **Strategic Environmental Assessment (SEA)** conducted to determine a plan’s potential impacts using existing data and desk based studies
- This should include environmental and social receptors

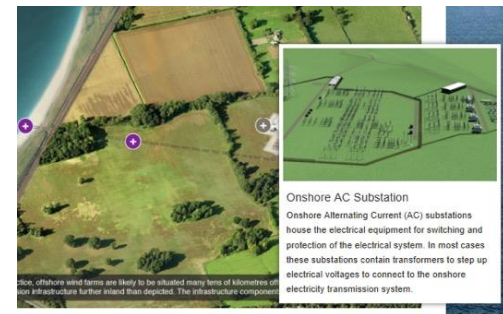
Environmental considerations

- Seabirds
- Marine mammals
- Fish spawning & nursery areas
- Benthic communities
- Sediment erosion/deposition
- Water & air quality



And **onshore** considerations as well...

- Traffic & transport
- Port developments
- Dwellings
- Ecology
- Landscape & visual



EIA - Social Impacts



Planned or existing uses

- Oil & gas structures
- Cables & pipelines
- Wind, wave & tidal energy
- Aggregate extraction
- Carbon Capture & Storage, Gas Storage



Human users of the sea

- Commercial fishing grounds
- Military use & aviation radar interference
- Navigation routes
- Recreational use & tourism
- Seascape & visual impacts
- Archaeology



Commercial Fisheries



- Key maritime stakeholder group with significant influence
- Consult and openly converse as early as possible and develop mitigation - project plans
- Examine records of typical catches
- Compensation
- Benefits for industry
- Education



- Centre for Environment, Fisheries and Aquaculture Science (CEFAS) - principal source of advice to the government on marine environmental issues
- Fishing Liaison with Offshore Wind and Wet Renewables (FLOWW) group
- Appoint a Fisheries Liaison Officer and a Fishing Industry Representative
- Consult industry at site selection and project definition stage - ask opinions on plans
- Find mutually acceptable developments

The Crown Estate All Offshore Activity (UK)



Offshore Wind Activity

- Demonstration Wind Farm Site
- Round 1 Wind Farm Site
- Round 2 Wind Farm Site
- Round 1 or 2 Wind Farm Extension Site
- Round 3 Agreement for Lease
- Round 3 Wind Farm Zone
- Scottish Wind Farm Site
- Northern Ireland Offshore Wind Resource Area

Wave and Tidal Activity

- Wave Site
- Tidal Site

Cable and Pipeline Activity

- Active Cable
- Active Pipeline

Marine Aggregate Activity

- Production Licence
- Application Area
- Option Area
- Potash Mine Lease
- Potash Exploration and Option Agreement

CCS and Gas Storage Activity

- Natural Gas Storage Site
- Carbon Capture and Storage Site

Base Map

- Territorial Waters Limit
- UK Continental Shelf
- International Waters
- United Kingdom

MaRS
Marine Resource System

0 100 200
km

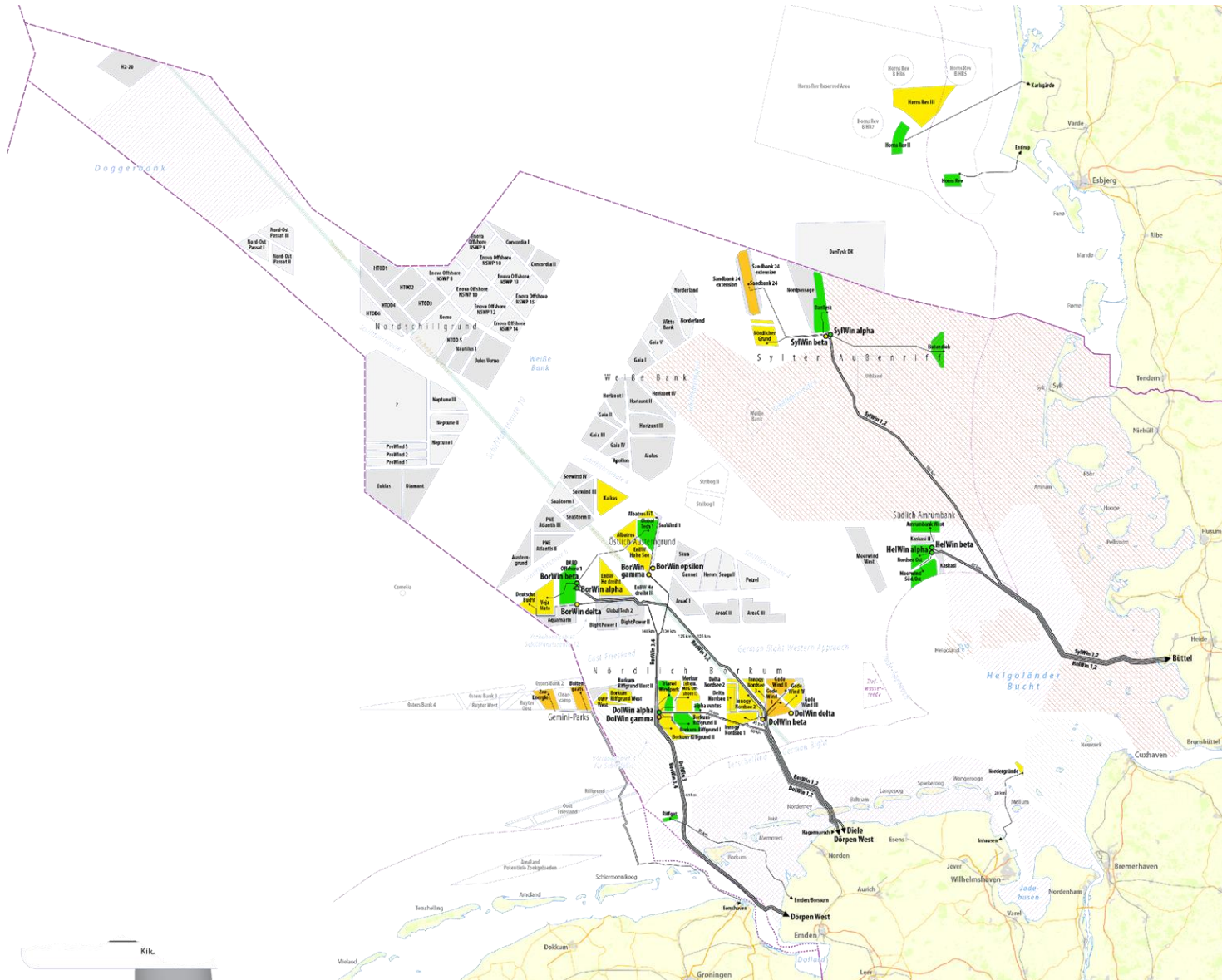
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<http://www.thecrownestate.co.uk/ordnance-survey-licence/> Cable Data
 Created from Kingfisher, OceanWise and Global Marine Systems data.
 Pipeline Data: Created from UKDeal, OceanWise and Global Marine
 Systems data. Limits: Supplied by UKHO. International Waters:
 Created from UKHO, DECC and European Environment Agency data.

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Germany - Projects



Germany - Offshore Grid



Offshore-Netzanbindungen

- Offshore Windparks:
- geplant
 - im Bau
 - in Betrieb
- Offshore Netzanbindungen:
- im Bau
 - in Betrieb
- Übertragungsnetz
- Offshore Konverterstation
 - Onshore Konverterstation
 - Umspannwerk
 - Offshore-Windpark
 - Onshore Umspannwerk

Für die Angaben in dieser Karte übernimmt TenneT keinerlei Haftung oder Gewähr.
März 2016



- Government can play a leading role in guiding the industry and aiding the removal of barriers
- Implement a well co-ordinated, acceptable programme of projects to offer the industry
- Consider socialised transmission and a well planned grid infrastructure in parallel to projects
- Investigate alternative means of supporting the industry and providing risk reduction
- Promote competition
- Improve communication, collaboration and consultations

Thank you



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