Partner in Offshore Business

- Safety
- Quality
- Joined Interest
- Responsibility
- Cluster Synergy
- First Time Right
- Asset Utilization
- Asset Integrity
- Accessibility
- Response Time
Renewable support scheme/Feed-in tariffs ... are changing, leading to lower budgets and changing into concession tendering systems.

Large Energy Companies ... buy market shares and have more significance. Simultaneously, oil and gas industry players with a stronger risk appetite are entering the renewable market.

OEMs ... providing long term contracts with limited possibilities to adopt market changes.

Strong Partnerships ... for development and construction

Clustering of Projects ... is noticeable at the Baltic sea and the North Sea.

Offshore Wind Investors ... are looking for alternative solutions to make their investments viable and ensure a lower but solid return on investment.

Who has the right answer to all this changes?
Multi contracting and mixed team is the current standard. Scattered O&M strategies (inhouse, mixed teams and multi contracting).

Co-operations with strong partners have been established, especially for concession tendering.

Successful co-operations will be contracted for next offshore projects.

Multi contracting and mixed team is the current standard. Scattered O&M strategies (inhouse, mixed teams and multi contracting).

What are the opportunities in the Operations Phase?

Who has the right answer to all this changes?
Opportunities in the Operations Phase

Common Practice

Until Taking Over

EPC-Contractor
- Engineering
- Procurement
- Construction
- Installation
- Commissioning
- Coordination and Execution of Certification for 1st – 3rd BSH Release

Owner’s Engineer
- Project Management
  - Implementation of management systems
  - Schedule monitoring
  - Commercial monitoring
  - Provision of relevant risks to Owner
  - Advisory on claims towards Owner
  - Provision of commercial information towards Owner
- Permit & Consenting
  - Coordination and Communication with EPC-Contractor
  - Review of and provision towards Owner of documents
- QA/QC
  - Manufacturing supervision
  - Offshore installation supervision
- Commissioning Monitoring
- HSE Monitoring
  - Monitoring of EPC-Contractor’s HSE system
  - Onshore/Offshore HSE inspections and audits
  - Provision of HSE reports

Owner / AM
- Permit & Consenting (single point of contact towards authorities)
- External Grid Connection
- Coordination of Certification for Operations Release
- Overall Risk Management
- Legal & Contract Management
- Commercial Management
- Overall Project Steering
- Overall HSE Supervision
- Overall Document Management
- Communication with Authorities (i.e. BSH, TenneT, BNetzA)
- Reporting (Banks,

Operations man.*
- Provision of Central Control Station
- Commercial Operations Management
  - Contract management
  - Performance compliance
- Remote Site Management
  - Technical Data Management
  - IT-Infrastructure
- Technical Operations Management
  - Management of Service Operations
  - Management of Maintenance Operations and Technical Controlling
- HSE Management
- Operational Documentation and Reporting

PPA
- Mandatory Direct Marketing of Energy at least during Feed-In-Tariff Period

SMW BoP
- Scheduled Service and Maintenance Services for:
  - Foundations
  - Offshore Substation
  - Inner Array Grid
- Supply and Waste Disposal Services

SMA WEC
- Full Service and Maintenance of Wind Energy Converters
- Provision and Storage of Spare and Wear Parts
- Supply and Waste Disposal
The main driver is to cover design, construction, and technology risks during the first 15 year period of operations. This risk mitigation comes with a price.

Are these OEMs aligned to achieve maximum power plant utilization or transparent about the alternative models?

Are these risk mitigations leading to minimized levelized cost of energy?
After the commissioning phase, the operations start, warranties will be delivered by the wind turbine manufacturer and balance of plant contractors for a period of 1, 2 or 5 years.

It’s common practice that these parties take care of the service and maintenance activities for the owner during the warranty period, for the first 5, 10 or 15 operational years.

The main driver is to cover design, construction, and technology risks during the first period of operations. This risk mitigation comes with a price.

Are these risk mitigations leading to minimized levelized cost of energy?

Are these maintenance contractors aligned to achieve maximum power plant utilization?
**Asset Management Drivers**

- Determine the technical conduct/integrity by keeping a detailed life cycle record
- Predict and prevent technology specific performance killers and cost drivers
- Determine the optimum logistic setup
- Fine tune OPEX projections and mitigation of major components risks

**Operations and Maintenance Drivers**

- Increase first time right (FTR) and decrease time to repair (TTR)
- More efficient logistical movements (*combining activities and cluster synergies*)
- Lower HSE risks due to less offshore work hours
- Maximum utilization of the power plant (*Increase IRR and lower LCOE*)
- Close loop to the power market by integrating the assets in power trading strategy (*decrease imbalance positions*)

**Make, Buy or Join Discussion**

- Organize and/or provide guarantees for residual risks
- Full transparent of asset integrity, compliancy and service activities in the teams
To harvest the optimization potential, the prerequisites of a balanced O&M model are:

- **Operational Readiness**: after start operations or at least two years before defect notification period ends
- **Cluster Synergies**: pooling of resources (logistics and teams) multi-wind farm coordination
- **Guarantees from Partner**: operational readiness guarantees from partner after start operations or at least two years before defect notification period ends
- **Pooling of Risks**: dedicated engineering capacity full transparency knowledge sharing
- **Reliability**: reliability centred maintenance approach
Achieving Minimized Levelized Cost of Energy (LCOE) in Offshore Environment

**Technology**
- Failure rates
- Predictability
- Integrity
- Flexibility

**Logistic Processes**
- Vessel utilization
- Weather windows
- SOV - CTV - Helicopter

**Maintenance Processes**
- First time right
- Availability planning
- Improvement Engineering
- Supply chain
- Combining of tasks

**Operations Processes**
- 24/7 monitoring
- HSE and logistic coordination
- Condition based analyses/inspections
- Power nomination
- Imbalance price driven curtailment

**Power Trading**
- Day ahead market position
- Imbalance position
- Intraday opportunities
- OTC
- Direct offtaker
Minimized Levelized Cost Of Energy (LCOE)

The main driver is to cover the dropping power prices:

- Preparation for new phase to be ready
- Use engineering capacity to reduce unexpected major events (reliability centered maintenance)
- Significant cost savings due to integrated solutions and cluster synergies

Example of alternative and balanced O&M model (existing wind farms)
Example of alternative and balanced O&M model (new concession tenders)

The main driver is to cover design and construction risks during the first 2 years of operations, hereafter:

- Synergies in coordination and planning of offshore operations and maintenance activities
- Long term commitment to ensure continuous improvement and required engineering capacity
- Significant cost savings due to integrated solutions and cluster synergies

Minimized Levelized Cost Of Energy (LCOE)
### Example of alternative and balanced O&M model

<table>
<thead>
<tr>
<th>Until Taking Over</th>
<th>Owner's Engineer</th>
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<th>O&amp;M coverage</th>
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**Minimized Levelized Cost Of Energy (LCOE)**

- **PPA**:
  - Mandatory Direct Marketing of Energy at least during Feed-In-Tariff Period

- **O&M coverage**:
  - Provision of Central Control Station
  - Commercial Operations Management
  - Remote Site Management
  - Technical Operations Management
  - HSE Management
  - Operational Documentation and Reporting

- **SMA BoP**:
  - Scheduled Service and Maintenance Services for:
    - Foundations
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- **SMA WEC**:
  - Full Service and Maintenance of Wind Energy Converters
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Minimized Levelized Cost Of Energy (LCOE)

**Commitment and aligned to wind farm business case:**

- Energy based guarantees
- Euro / MWh pricing
- Sharing cluster synergies
- Sharing knowhow and engineering capacity
- Willing to invest in operational excellence / local presence / new technologies

**Transparent co-operation with owner's operations team:**

- Web-based QHSE, monitoring, workflow- and asset integrity system
- Single point / one stop shop for owner's operations team
- Acting as partner, joined interest
- Reporting of detailed KPIs to support open improvement discussions.
- Alignment with experienced asset owners (second time buyers)
Open discussion

Market changes

Strategy and challenges

Alignment of strategy and operations

Developments

Mid- and long term plans

Open to explore more?
Co-Operations Model – Road map

**Common understanding**
- Road map
- LOI

**Inventory**
- O & M Model
- Roles and responsibilities

**Partnership model**
- KPIs and Pricing
- Guarantees
- Together minimized
- LCOE achievement
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Offshore Services

1 Wind turbine
- Turbine service (Siemens, Vestas, Senvion)
- Repairs, improvement, inspection, maintenance
- Safety technology
- Troubleshooting
- Rotor blade service

2 Foundations incl. Transition Piece
- Maintenance under/above water
- Corrosion protection
- Inspection, exchange and retrofitting of e.g. cranes, stairways
- Safety technology
- Subsea specific sea bottom inspections (scour) and cables

3 Offshore Substation OSS
- Inspection, maintenance, repairs, transmission of high- and medium voltage power

4 Wind farm Management
- Technical management
- Operational overview
- Marine coordination
- Site Management
- Power offtake coordination
- Offshore/Onshore Substations: 5/66
- Transition Pieces: 538
- Park site management, commissioning: 24/7
- Inspections For asset owners: BU | SAN | NOR BWII | DAN
- Power plant-management: 4
- Under water inspections and repairs: 365
- Senvion 5M WTG under service contract: 6

Facts

MANAGEMENT SYSTEM CERTIFICATION
ISO 9001 = ISO 14001
OHSAS 18001

DEUTSCHE WINDTECHNIK
<table>
<thead>
<tr>
<th>Land</th>
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**Onshore Services**
- Full maintenance and basic maintenance
- Remote data monitoring
- Tower and foundation
- Rotor blades
- Substations

**Offshore Services**
- Wind turbines
- Foundation
- Substations
- Wind farm management

**Additional Services**
- Research and development
- Upgrades
- Expertise and Consulting
- Quality management and safety at work
- Training Center
- Control electronics
- Safety engineering
- Repowering
- Spare part sales