Fred. Olsen Windcarrier

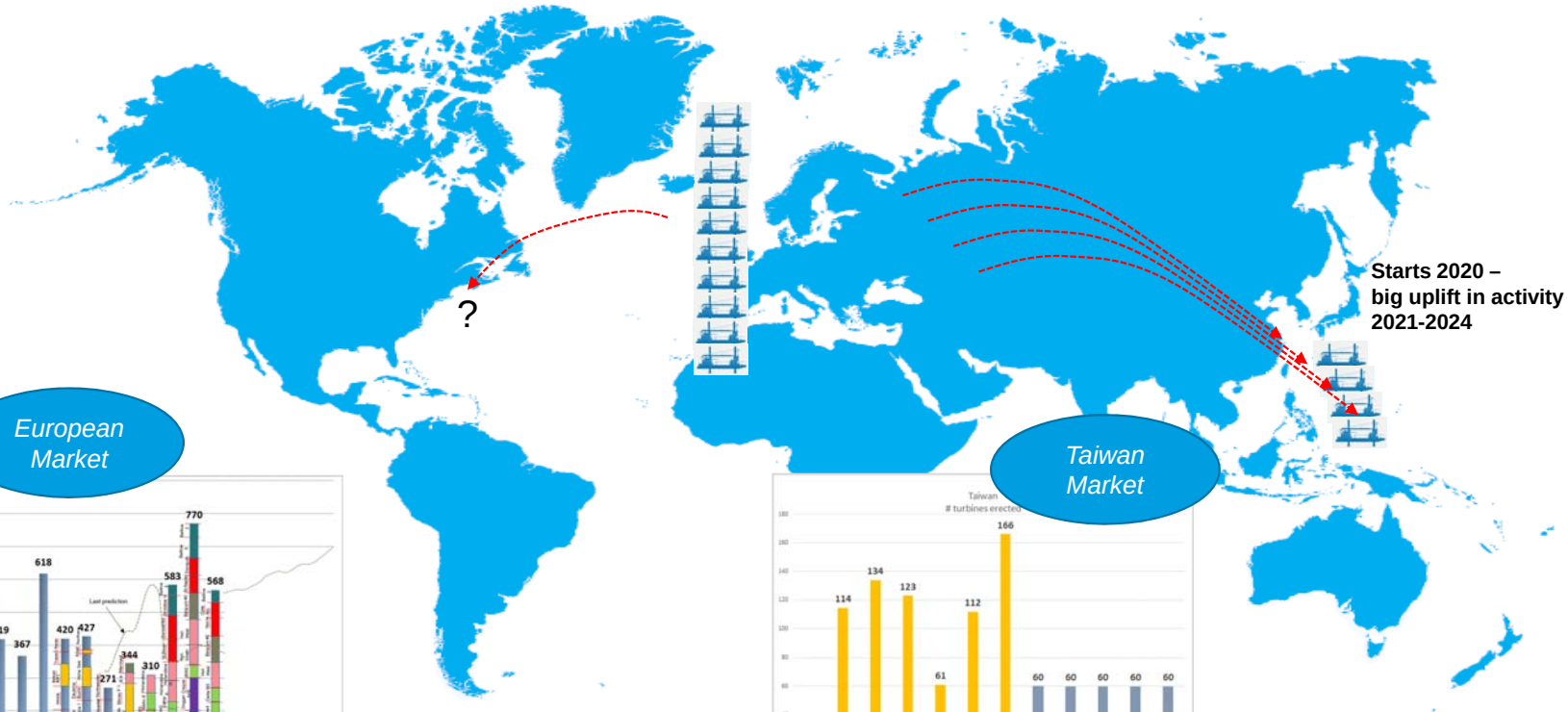
4th Asia Offshore Wind Day

The outlook of installation capacities from Europe to Asia Pacific
Building on the experience

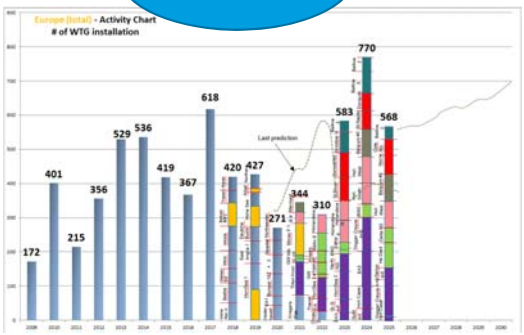
Martin Degen, Taipei 18.09.2018

What does the future bring for us as ship owners ?

Fred. Olsen Windcarrier



European Market



Taiwan Market

Fred. Olsen related companies pioneering

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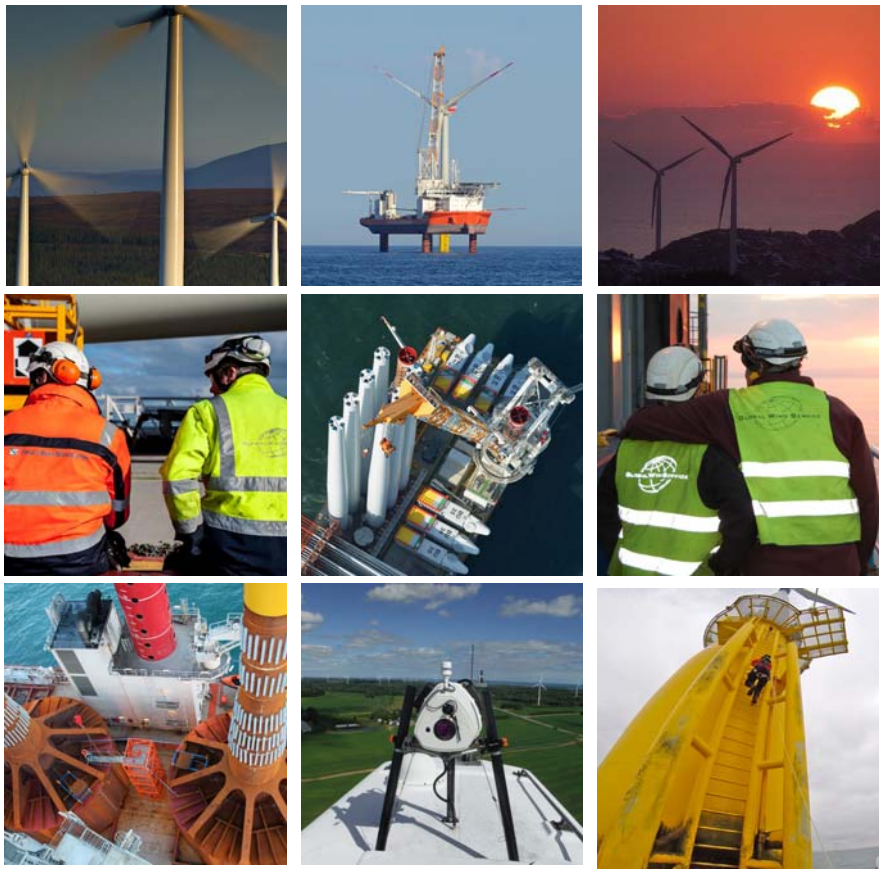
Fred. Olsen Related Companies in Renewables

Fred. Olsen Windcarrier

Fred. Olsen related companies have built a solid position in renewable energy

- **25** years in renewables
- **170** years in offshore, shipping and marine
- **10** established companies
- Employing ca. **1,500**
- Working in over **40 countries**
- Onshore wind; delivered **11 industrial scale onshore windfarms** with **679 MW** installed capacity (generation ~1.9 TWh/yr)
- Offshore wind; **installed 311 WTGs** with **1453 MW** installed capacity (5.2TWh/year)



Bonheur ASA companies in Renewables

Listed Oslo Stock Exchange

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Fred. Olsen Renewables

Wind farm owner operator

- 11 wind farms
- 679 MW capacity (~1,9TWh/yr)
- Development pipeline of 2,2 GW secured and under devlopment

100% owned

Fred. Olsen Windcarrier

Jack-up installation

- 2 custom built jack-up installation vessels
- Turbine and foundation installation
- Op. and maintenance

100% owned

Universal Foundation

Wind turbine foundation

- The Carbon Trust's championed design
- 10+ MW WTGs
- Quick and silent installation
- No grouting

100% owned

Global Wind Service

Technical manpower

- ~850 personnel
- On and offshore
- Installation, Service & maintenance
- Main component exchange
- HV

75.5% owned

harland and wolff heavy industries ltd

Renewables hub

- Assembly
- Logistics
- Foundations
- Vessel repair and maintenance

Subsiduary of Fred. Olsen Energy

51.9% owned

Fred. Olsen related companies in renewables

Privately owned

Fred. Olsen Windcarrier

natural power

Renewable Energy Consultancy and Service Provider

- Renewable energy consultants
- 360 degree lifecycle approach
- 350+ renewable experts

SeaRoc

Communications and Service Provider

- Leading marine mgmt. and monitoring system SeaPlanner
- Supports near and farshore offshore projects
- Communication container solution ‘SeaHub’

ZephIR Lidar

Wind Lidar System

- The original wind lidar est. 2007
- 1000+ deployments globally, 10m+ operational hours
- Cost effective alternative to traditional Met. Masts

BOLT Sea Power

Pioneering Wave Energy Generator

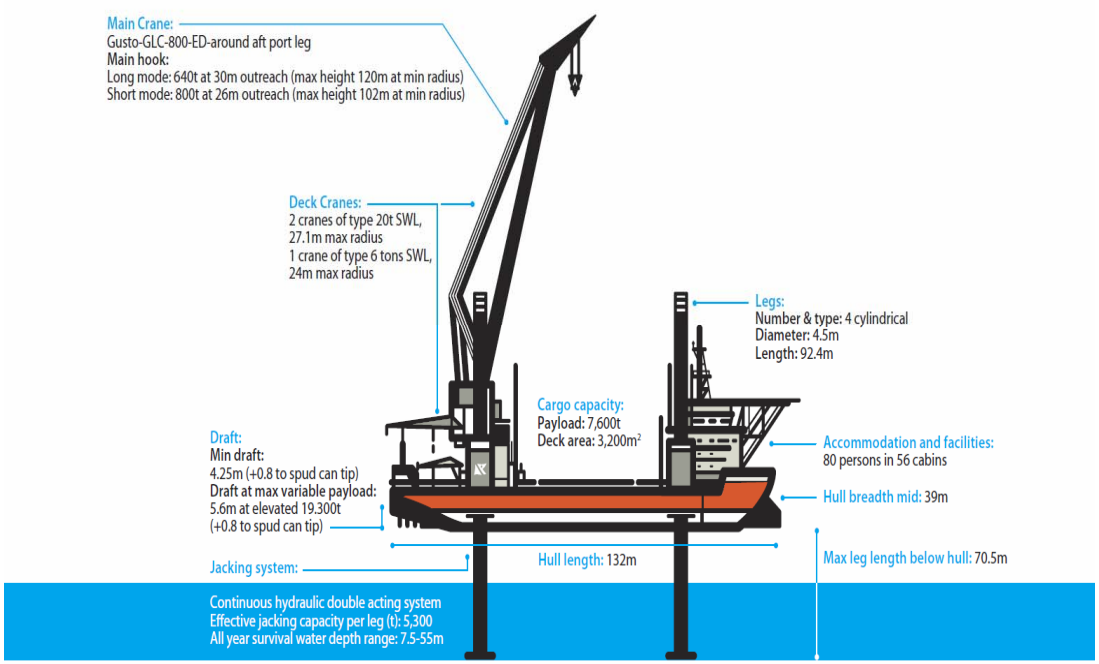
- Ground breaking reliability
- Continuous power output
- Currently deployed by US Navy off Hawaii

Construction Services

We offer clients all the key elements in the transport & installation scope:

- Complete design & engineering
- Experienced project managers
- Supply chain management & logistics

- Two specialist jack-up heavy lift vessels
- Design and engineering
- Project management



We offer a flexible solution to suit clients needs, providing specific services or a fully integrated, holistic approach.

Installation Track Record

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1
GERMANY
Riffgat
Siemens
2013
30 x SWT 3.6 MW

2
GERMANY
BARD Offshore 1
BARD
2013
14 x BARD 5.0 MW

3
BELGIUM
Belwind
Alstom
2013
1 x Haliade 6.0 MW

4
UK
Dogger Bank
Forewind
2014
2 x UF Foundations

5
GERMANY
Global Tech I
Areva
2014
75 x Areva 5.0 MW

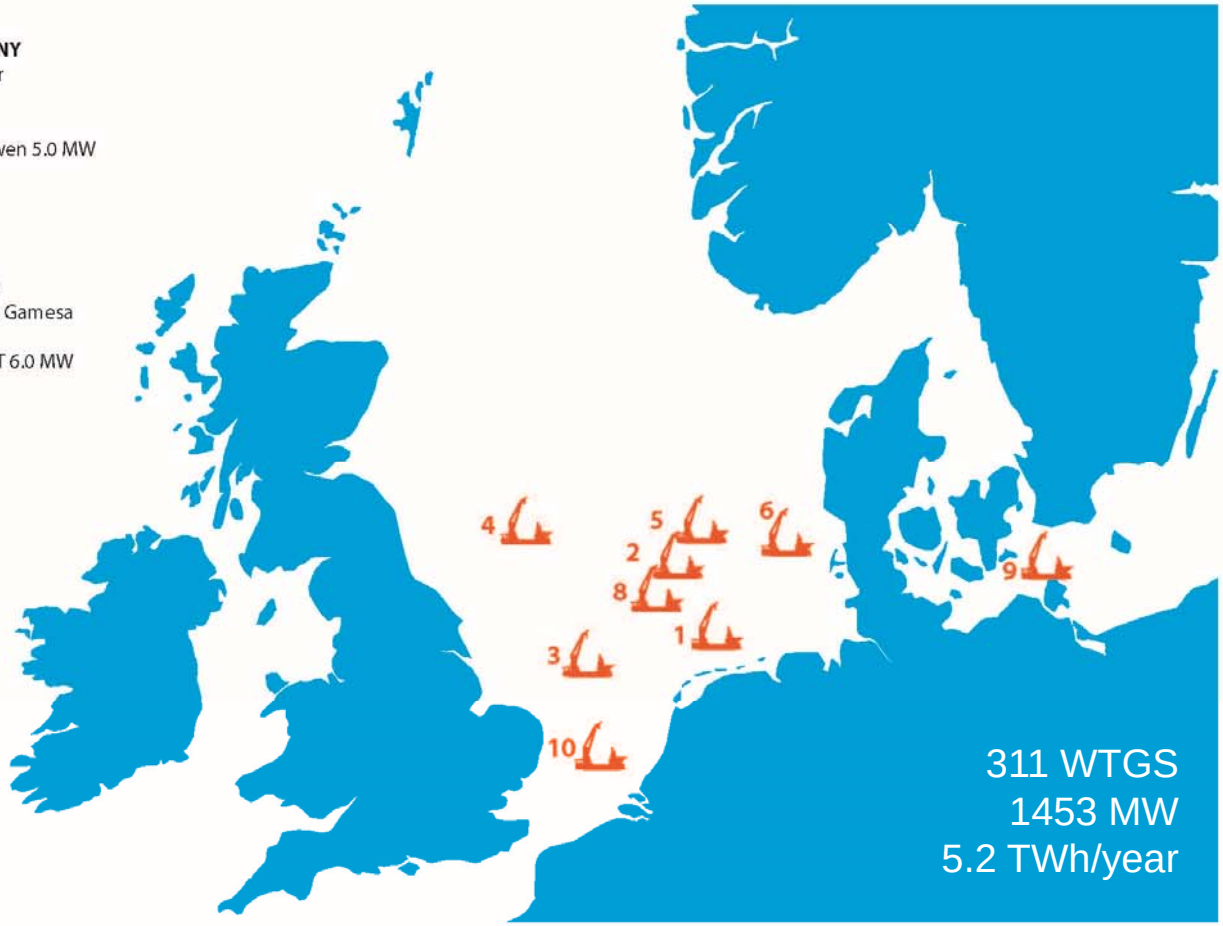
6
GERMANY
Butendiek
Siemens
2015
80 x SWT 3.6 MW

7
USA
Block Island
Deepwater Wind
2016
5 x GE 6.0 MW

8
GERMANY
Veja Mate
Siemens Gamesa
2017
19 x SWT 6.0 MW

9
GERMANY
Wikinger
Adwen
2017
70 x Adwen 5.0 MW

10
UK
Galloper
Siemens Gamesa
2017
17 x SWT 6.0 MW



Project References

Transport and Installation (T&I)

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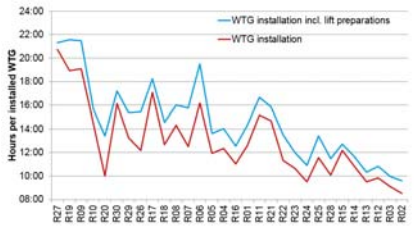
Typical T&I project: Veja Mate

In spring 2017, Bold Tern installed 19 Siemens Gamesa 6MW turbines at the Veja Mate Windfarm, Germany.

- Scope: provision of grillage and sea-fastenings; including blade rack, load out, transportation, jacking and crane operations.
- Flexible deck layout allowed for transportation of four complete turbines each trip.

Key facts:

- Full WTG installation in 12-15 hours
- Turnaround time per WTG of 20-24 hours
- Steep learning curve:

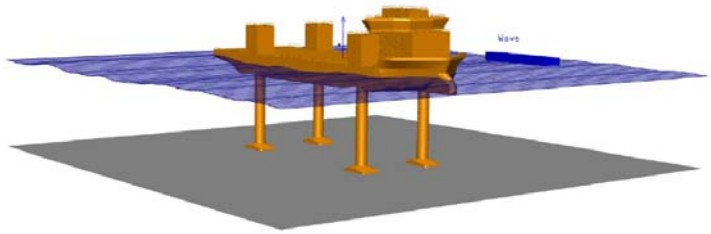


- 20-50% weather downtime
- Employment:
  - 30 Marine Crew
  - 18 Technicians
- High HSEQ standard

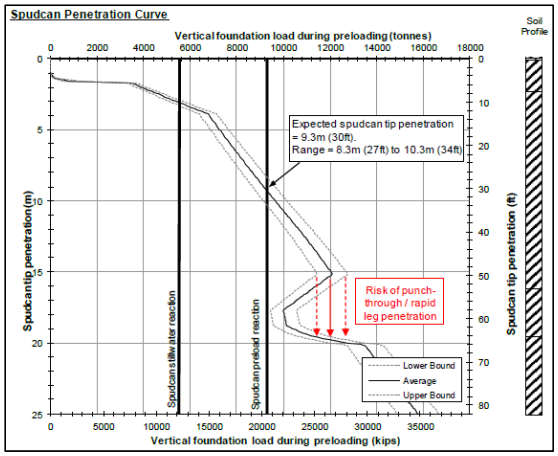
Jack-Up Operations & Geotechnical Aspects

Operational Experience at Challenging Sites of Operation		
OWF	**Leg Penetration Range**	**Jacking Related Issues**
Wikinger	1.1m – 14.7m	• Punch-through risk • Lateral variability (in-depth channels) • Boulders
Galloper	5.8m – 12.4m	• Deep penetrations • Leg extraction • "Relaxing" soils
Forewind	1.4m – 33.0m	• Deep penetrations • Leg extraction • Seemingly insufficient leg length

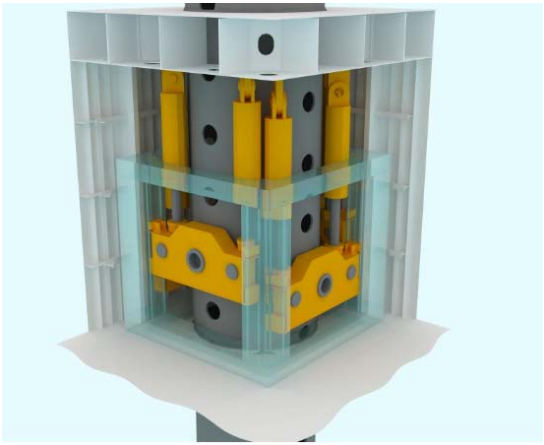
Preload Operation Prior Jack-Up



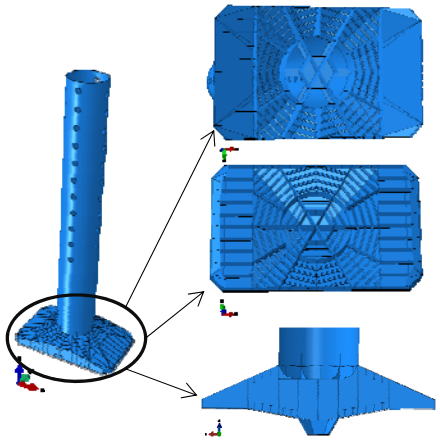
Leg Penetration Analysis (LPA)



Continuous Hydraulic Jacking System



Spudcans with Jetting System



O&M Joint Approach

Fred. Olsen related companies provide Clients with **Complete O&M solutions**:

- ✓ Marine spread
- ✓ Resources
- ✓ Expertise for efficient scheduled and unscheduled operations and maintenance services.

We set up an alliance of family companies capable of delivering an integrated O&M offering in-house.

'Best in Class' scope of **integrated serices** in the offshore wind:

- Covering a wide scope of O&M services through a single contracting body at competitive prices.
- Reduce operational risks, management interfaces and contractual complexity through seamless coordination.
- Tailor made to meet particular Client's requirements.

Fred. Olsen Windcarrier
Borkum Riffgrund 2
Offshore Wind Farm
COMPLETION
31st AUGUST
ACTUAL PROGRESS
CONTRACTUAL BASELINE
START
1st MAY
May
June
July
August
September
October
10
20
30
40
50
56
TURBINES INSTALLED

Thank you

Contact details:

Martin Degen

Commercial Manager

mde@fredolsen.com

+47 4840 3371