

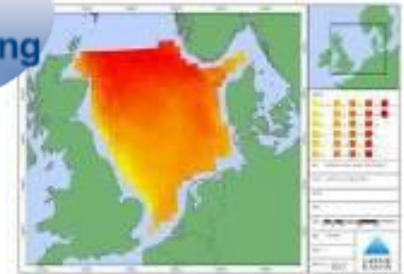
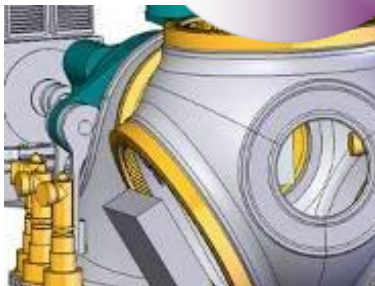
Ports & Vessels

EWEA 2011 pre-event

Erik ter Horst

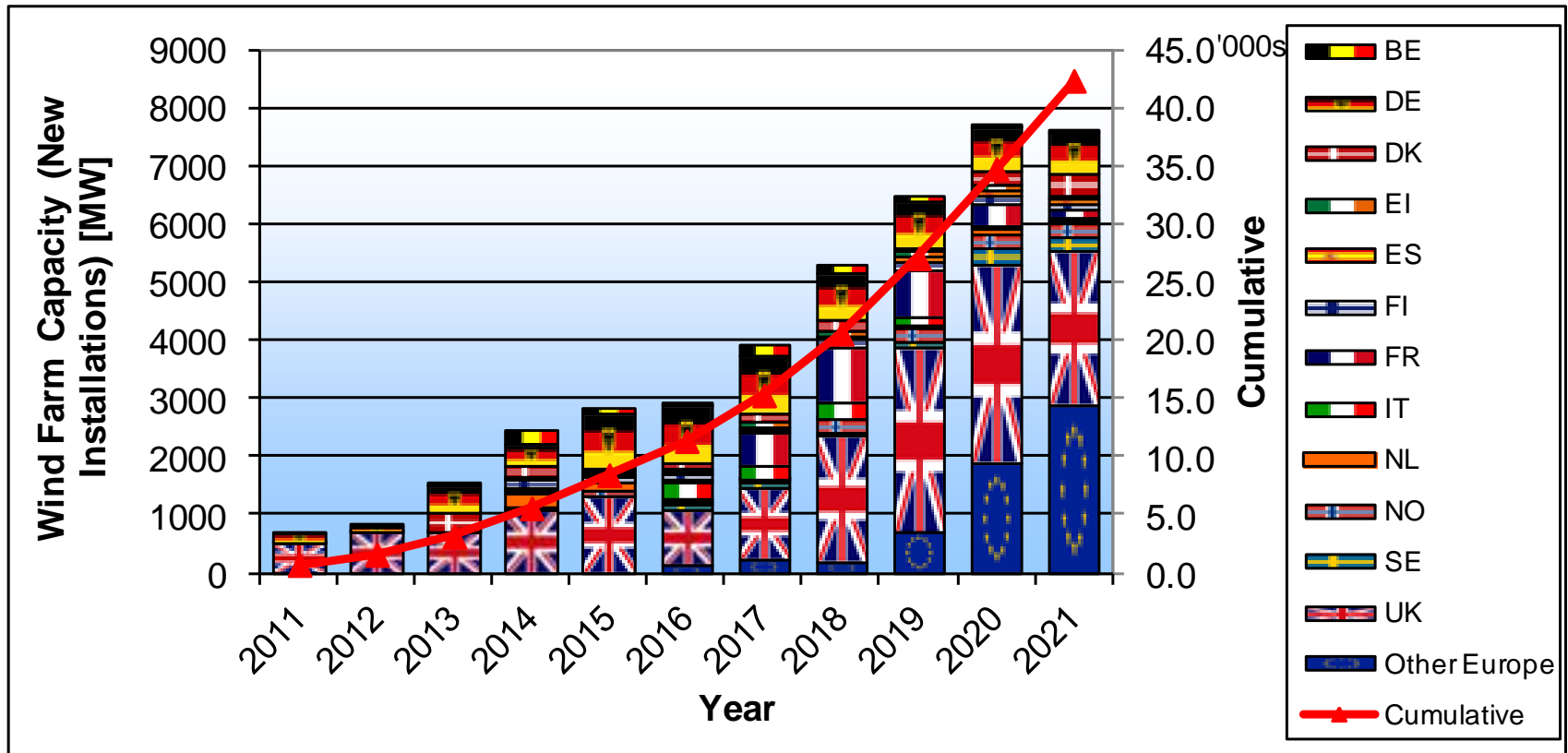


GL Garrad Hassan Offshore Wind Team

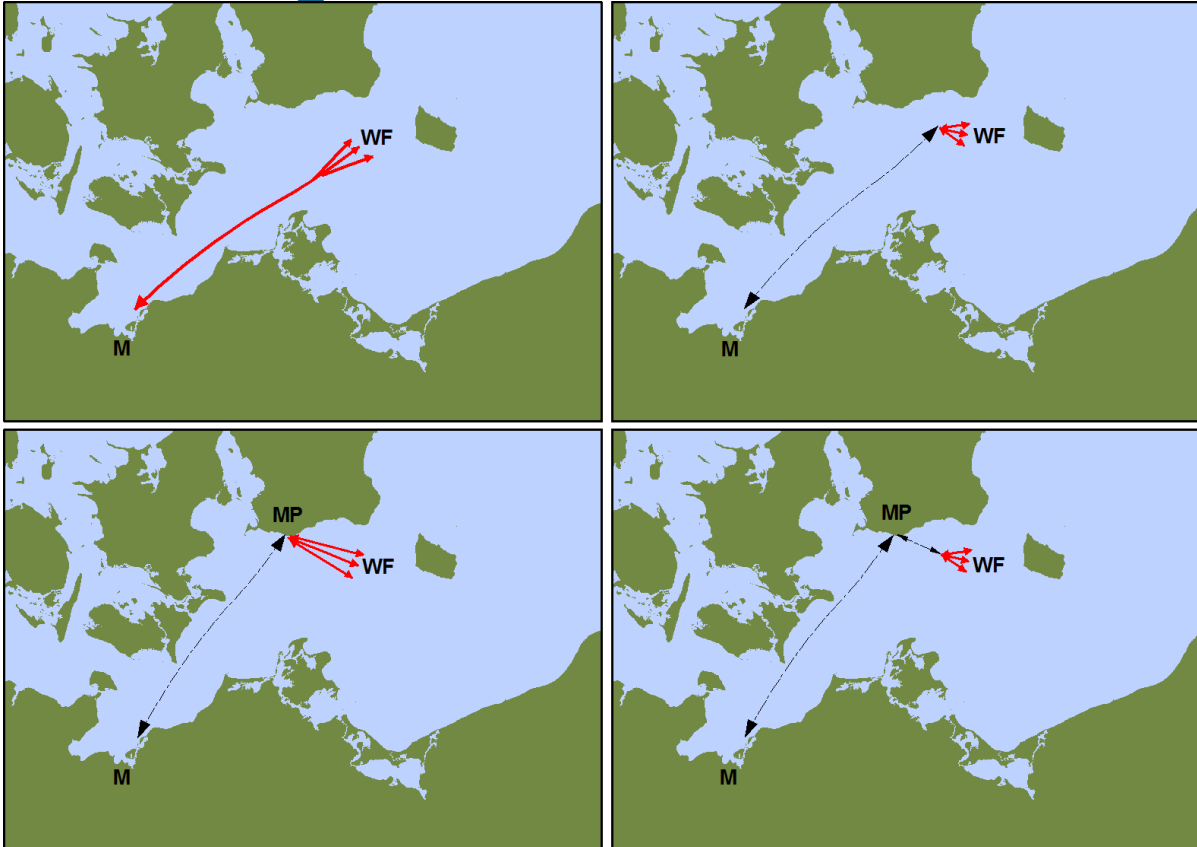


Ports

- Significant opportunity for North European ports
- Especially now Oil & Gas activity declining



T&I strategies



M = Manufacturing site

MP = Mobilisation Port

WF = Wind Farm

↔ = Transportation/Feeder vessel

↔ = Installation vessel

T&I strategies

Cost benefit analysis:

- Distance to Wind Farm
- Installation vessel transit speed
- Capacity of vessel
- Installation vessel day rate
- Technical viability of feeder barge
- Tidal constraints / Water depths
- Quay space limitations

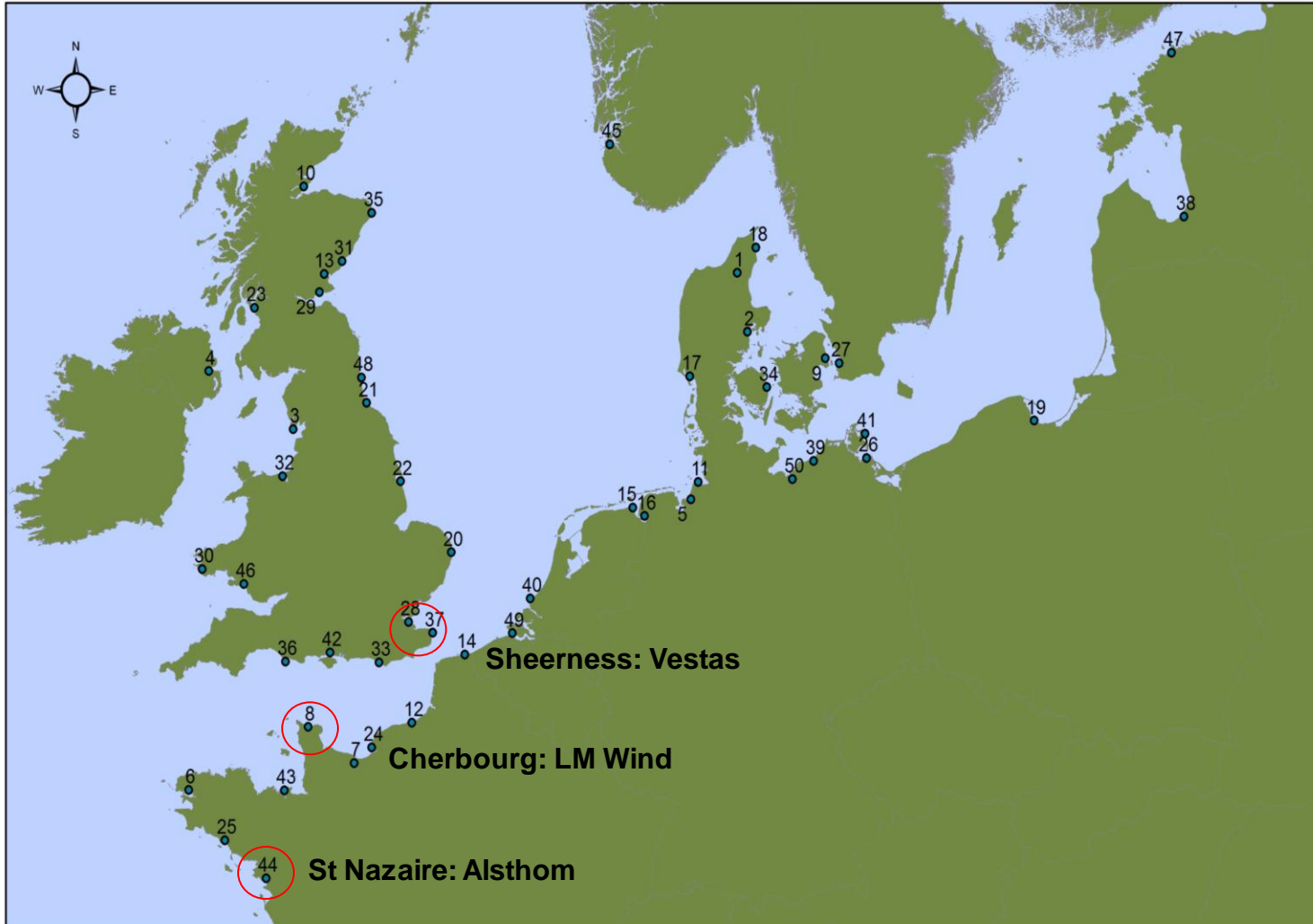


Manufacturing port / Mobilisation port

To justify investments for Manufacturing Port:

- Sufficient (long term) activities
- Manufacturers
- O&M
- Also alternative activities – O&G, logistics
- Lower labour costs
- Present infrastructure
- Distance to planned wind farms....
- but Installation vessels have increasing capacity and transit speed.

Major ports in EU



What is happening where?

- Germany: focus shifting to Baltic ports. Cooperation industry-municipalities
- UK: £60 + £10 funding: led to commitments from majors
- Scotland: £70 funding
- Denmark: Lindø yard conversion, Esbjerg expanding
- France: St Nazaire & Cherbourg
- Baltic: opportunities due to labour cost savings
- NL: advantage of existing strong marine infrastructure



General outlook

- Move towards transporting directly from Manufacturing ports
- ... due to increasing installation vessel capacity and transit speed
- However, lower labour rates Baltic & Asia may lead to Mobilisation ports...
- ... but also hybrid solutions are utilized
- Cluster building where ports and manufacturers close by
- Financial support (public or private) req'd for commitment

Vessels

- Foundations
- Wind turbines
- Electrical cable
- Substation

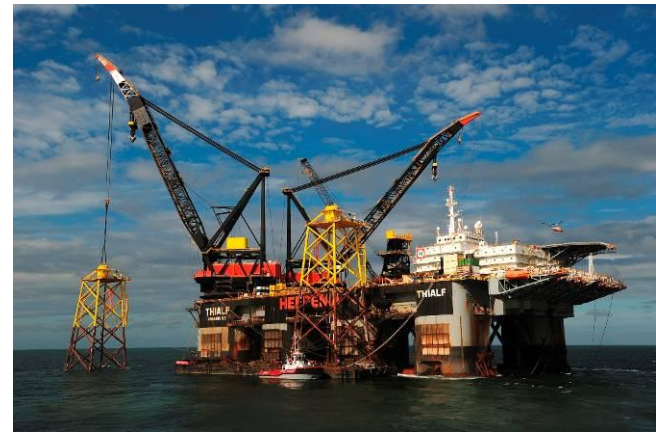
Foundation Installation Vessels



Towed “dumb” barge with crane



Shearleg Crane-barge



Semi-submersible/heavy-lift vessel



DP2 Heavy-Lift Cargo Vessel



Leg-stabilised crane vessel



Self-Propelled Jack-up

Key issues

- Lift weight
- Dayrate vs cycle time

Activity	Water Depth [m]	Floating dumb barge with crane	Shearleg Crane-barge	Semi-submersible / heavy lift vessel	DP2 Heavy Lift Cargo Vessels	Heavy Lift Cargo Vessels	Leg-stabilised crane vessel	Self-Propelled and Towed Jack-up craft
Monopile driving	< 10	~	~	✓ □	~	~	✓	✓ □
	10 - 20	~	~	✓ □	~	~	~	✓ □
	20 - 30	X	~	✓ □	~	~	~	✓ □
	> 30	X	~	✓ □	~	~	X	✓ □
Jacket / Tripod prepiling	30 - 40	~	~	✓	✓	~	✓	✓ □
	40 - 50	~	~	✓	✓	~	✓	✓ □
	50 - 60	~	~	✓	✓	~	✓	✓ □
Jacket installation	30 - 40	~	✓	✓	✓	~	X	✓ □
	40 - 50	X	✓	✓	✓	~	X	✓ □
	50 - 60	X	✓	✓	✓	~	X	✓ □
Tripod installation	10 - 20	~	~	✓ □	✓	✓	X	~ □
	20 - 30	~	~	✓ □	✓	✓	X	~ □
	30 - 40	X	~	✓	~	~	X	~ □
	40 - 50	X	~	✓	~	~	X	~ □
	50 - 60	X	~	✓	X	X	X	~ □
Transition piece installation	10 - 20	~	✓	✓ □	✓	✓	✓	✓ □
	20 - 30	~	✓	✓ □	✓	✓	~	✓ □
	30 - 40	X	✓	✓	✓	✓	X	✓ □
	40 - 50	X	✓	✓	✓	✓	X	✓ □
	50 - 60	X	✓	✓	✓	✓	X	✓ □
Turbine installation 3MW	10 - 20	X	X	~	X	X	~	✓ □
	20 - 30	X	X	~	X	X	~	✓ □
	30 - 40	X	X	~	X	X	X	✓ □
	40 - 50	X	X	~	X	X	X	✓ □
	50 - 60	X	X	~	X	X	X	✓ □
Turbine installation 5MW		X	X	~	X	X	X	✓ □
Turbine installation >5MW		X	X	~	X	X	X	✓ □
Substation topside		X	✓	✓	✓	~	X	X

Explanation of Symbols

• depending on water depth limits

✓ ... Suitable without modification

~ .. May be suitable with adaption or with complex marine operations procedures

X .. Unsuitable

Substation Jackets as per heavy weight WTG jackets

Turbine installation vessels



Key issues

Lift weight & height

Stability – delicate operations:

- Tower
- Nacelle
- Rotor

Explanation of Symbols

• depending on water depth limits

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X .. Unsuitable

Substation Jackets as per heavy weight WTG jackets

Activity	Water Depth [m]	Floating dumb barge with crane	Shearleg Crane-barge	Semi-submersible / heavy lift vessel	DP2 Heavy Lift Cargo Vessels	Heavy Lift Cargo Vessels	Leg-stabilised crane vessel	Self-Propelled and Towed Jack-up craft
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	10 - 20	~	~	✓ □	~	~	~	✓ □
	20 - 30	X	~	✓ □	~	~	~	✓ □
	> 30	X	~	✓ □	~	~	X	✓ □
Jacket / Tripod pre-piling	30 - 40	~	~	✓	✓	~	✓	✓ □
	40 - 50	~	~	✓	✓	~	✓	✓ □
	50 - 60	~	~	✓	✓	~	✓	✓ □
Jacket installation	30 - 40	~	✓	✓	✓	~	X	✓ □
	40 - 50	X	✓	✓	✓	~	X	✓ □
	50 - 60	X	✓	✓	✓	~	X	✓ □
Tripod installation	10 - 20	~	~	✓ □	✓	✓	X	~ □
	20 - 30	~	~	✓ □	✓	✓	X	~ □
	30 - 40	X	~	✓	~	~	X	~ □
	40 - 50	X	~	✓	~	~	X	~ □
	50 - 60	X	~	✓	X	X	X	~ □
Transition piece installation	10 - 20	~	✓	✓ □	✓	✓	✓	✓ □
	20 - 30	~	✓	✓ □	✓	✓	~	✓ □
	30 - 40	X	✓	✓	✓	✓	X	✓ □
	40 - 50	X	✓	✓	✓	✓	X	✓ □
	50 - 60	X	✓	✓	✓	✓	X	✓ □
Turbine installation 3MW	10 - 20	X	X	~	X	X	✓	✓ □
	20 - 30	X	X	~	X	X	~	✓ □
	30 - 40	X	X	~	X	X	X	✓ □
	40 - 50	X	X	~	X	X	X	✓ □
	50 - 60	X	X	~	X	X	X	✓ □
Turbine installation 5MW		X	X	~	X	X	X	✓ □
Turbine installation >5MW		X	X	~	X	X	X	✓ □
Substation topside		X	✓	✓	✓	~	X	X

Complete WTG installation - done it



Rambiz installing WTG and tower complete at Beatrice Demonstrator



Will this be the future...?



Courtesy IHC Offshore Wind / Vuyk Rotterdam



Courtesy IHC Offshore Wind / Vuyk Rotterdam



Courtesy Ballast Nedam

Offshore substation installation

Often installation of

substation foundation.....:



.....and topside:

Are 1 contract



Key issues

Lift weight

Activity	Water Depth [m]	Floating dumb barge with crane	Shearleg Crane-barge	Semi-submersible / heavy lift vessel	DP2 Heavy Lift Cargo Vessels	Heavy Lift Cargo Vessels	Leg-stabilised crane vessel	Self-Propelled and Towed Jack-up craft
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Jacket / Tripod pre-piling	30 - 40	~	~	✓	✓	~	✓	✓ □
	40 - 50	~	~	✓	✓	~	✓	✓ □
	50 - 60	~	~	✓	✓	~	✓	✓ □
Jacket installation	30 - 40	~	✓	✓	✓	~	X	✓ □
	40 - 50	X	✓	✓	✓	~	X	✓ □
	50 - 60	X	✓	✓	✓	~	X	✓ □
Tripod installation	10 - 20	~	~	✓ □	✓	✓	X	~ □
	20 - 30	~	~	✓ □	✓	✓	X	~ □
	30 - 40	X	~	✓	~	~	X	~ □
	40 - 50	X	~	✓	~	~	X	~ □
	50 - 60	X	~	✓	X	X	X	~ □
Transition piece installation	10 - 20	~	✓	✓ □	✓	✓	✓	✓ □
	20 - 30	~	✓	✓ □	✓	✓	~	✓ □
	30 - 40	X	✓	✓	✓	✓	X	✓ □
	40 - 50	X	✓	✓	✓	✓	X	✓ □
	50 - 60	X	✓	✓	✓	✓	X	✓ □
Turbine installation 3MW	10 - 20	X	X	~	X	X	✓	✓ □
	20 - 30	X	X	~	X	X	~	✓ □
	30 - 40	X	X	~	X	X	X	✓ □
	40 - 50	X	X	~	X	X	X	✓ □
	50 - 60	X	X	~	X	X	X	✓ □
Turbine installation 5MW		X	X	~	X	X	X	✓ □
Turbine installation >5MW		X	X	✓	X	X	X	✓ □
Substation topside		X	✓	✓	✓	~	X	X

Explanation of Symbols

• depending on water depth limits

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Substation Jackets as per heavy weight WTG jackets

Installation of subsea cables

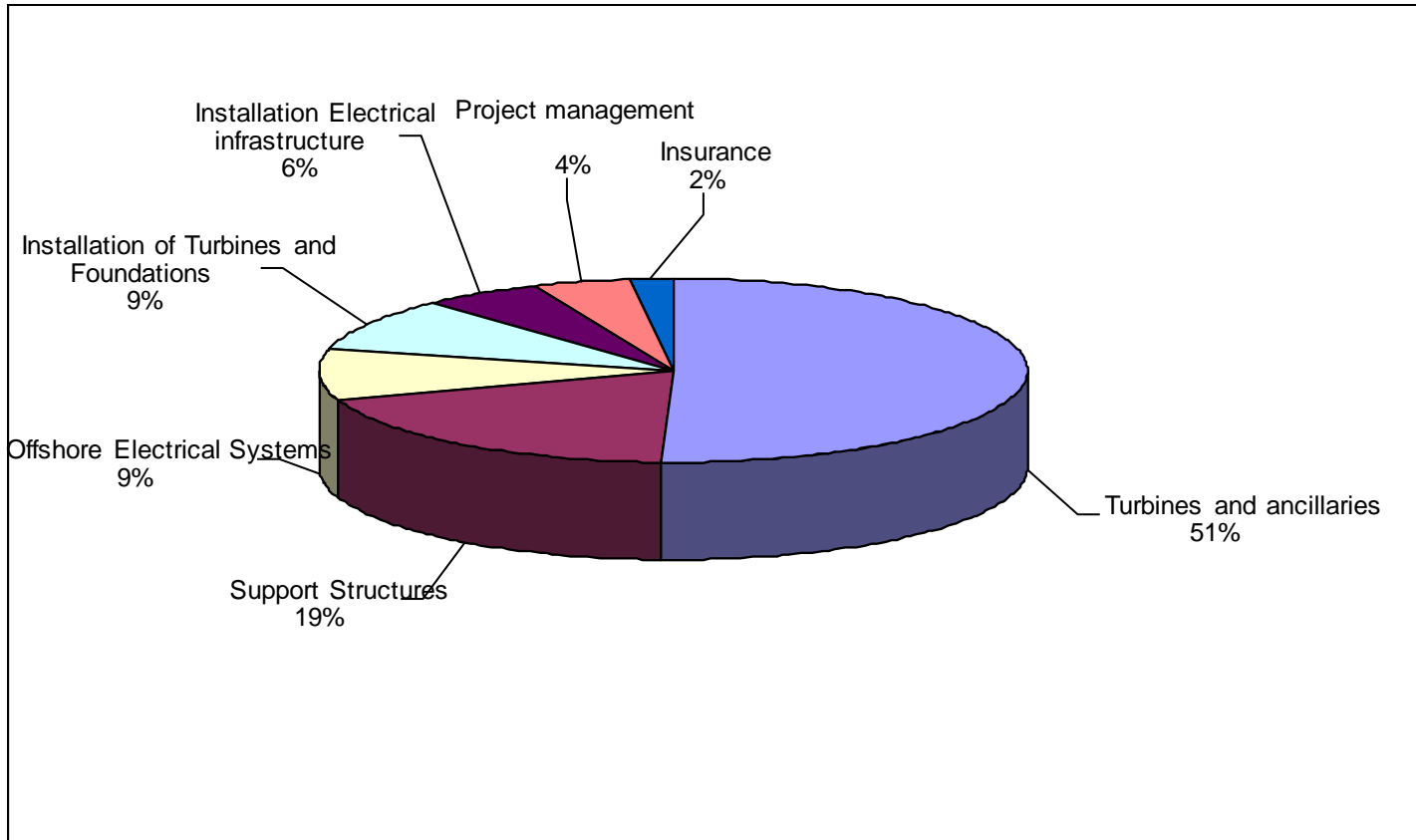


Jetting tool



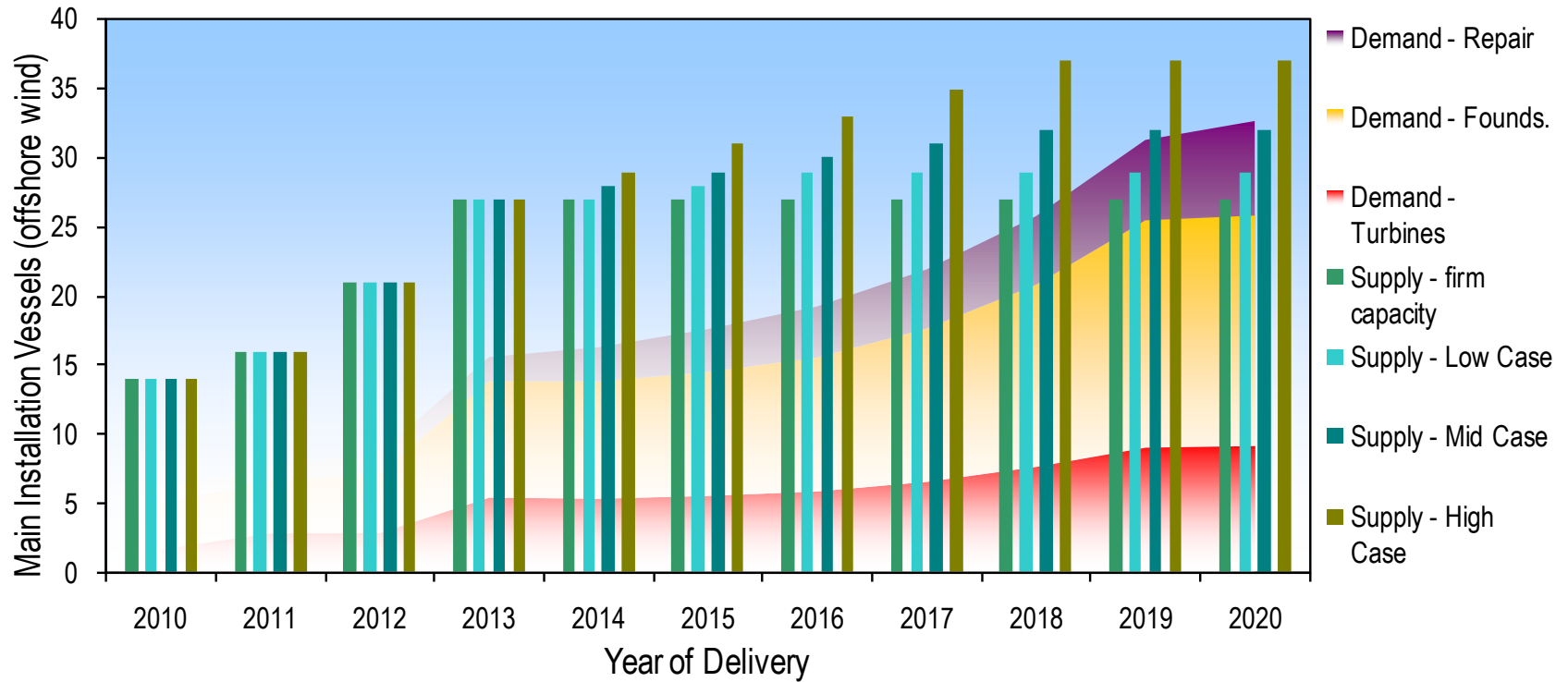
Cable plough

Typical CapEx break down



- Marine operations 10-15% of CapEx
- but relatively high risk profile

Outlook offshore vessels supply & demand



Expectations vessel market:

- Currently fairly tight
- Coming years numerous vessels coming on the market (delayed...?)
- Slightly softening to 2015 – lower day rates
- Demand increasing after 2016 – increasing dayrates
- ... but depending on how civil and O&G market develops
- ... and will developers act opportunistic with hiring out their vessels?

- Foundations installation: both floating and jack-ups
- Turbines installation: only jack-ups
- New builds: special purpose, increase in capacity (pcs), lift capacity, transit speed and water depth
- Cable lay: sufficient DP2 AHTS vessel available

Discussion

