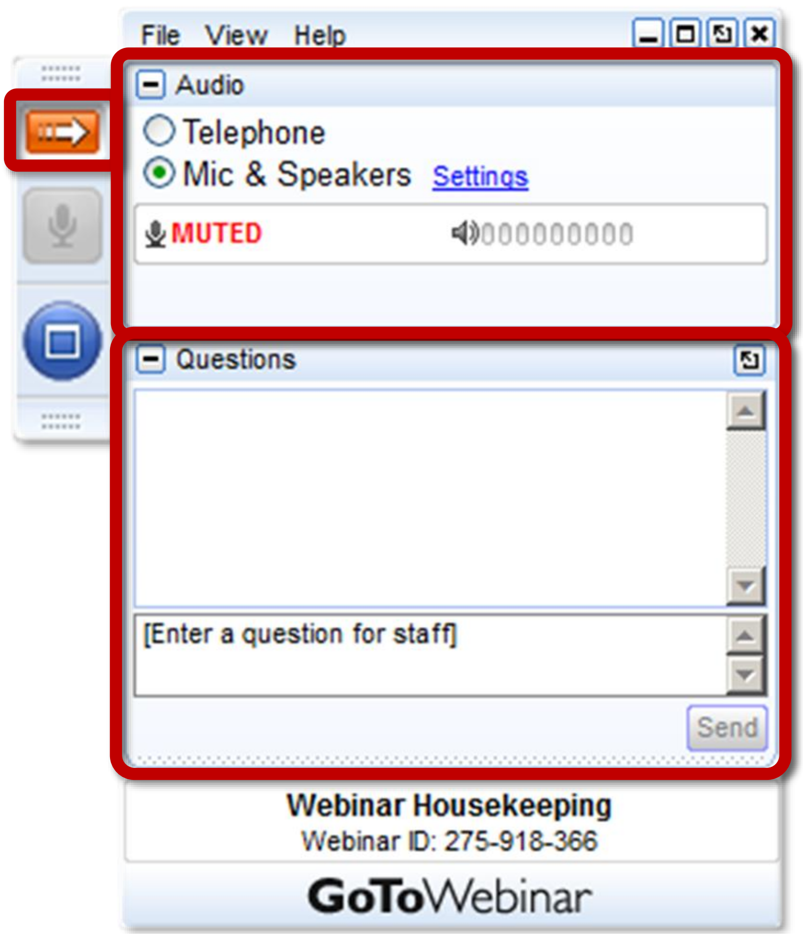
Northeast Wind Resource Center Webinar

The Case for Building a U.S. Offshore Wind Vessel + Other Opportunities for the U.S. O&G Sector in Offshore Wind

Hosted by
Val Stori, Clean Energy Group
June 6, 2017

Housekeeping



Use the red arrow to open and close your control panel

Join audio:

- Choose Mic & Speakers to use VoIP
- Choose Telephone and dial using the information provided

Submit questions and comments via the Questions panel

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The Northeast Wind Resource Center

The Northeast Wind Resource Center (NWRC) is the regional epicenter for salient, unbiased information on land-based and offshore wind energy in the Northeastern United States. Published research, studies, and analyses associated with the issues impacting public acceptance of wind deployment are available in the NWRC Resource Library.

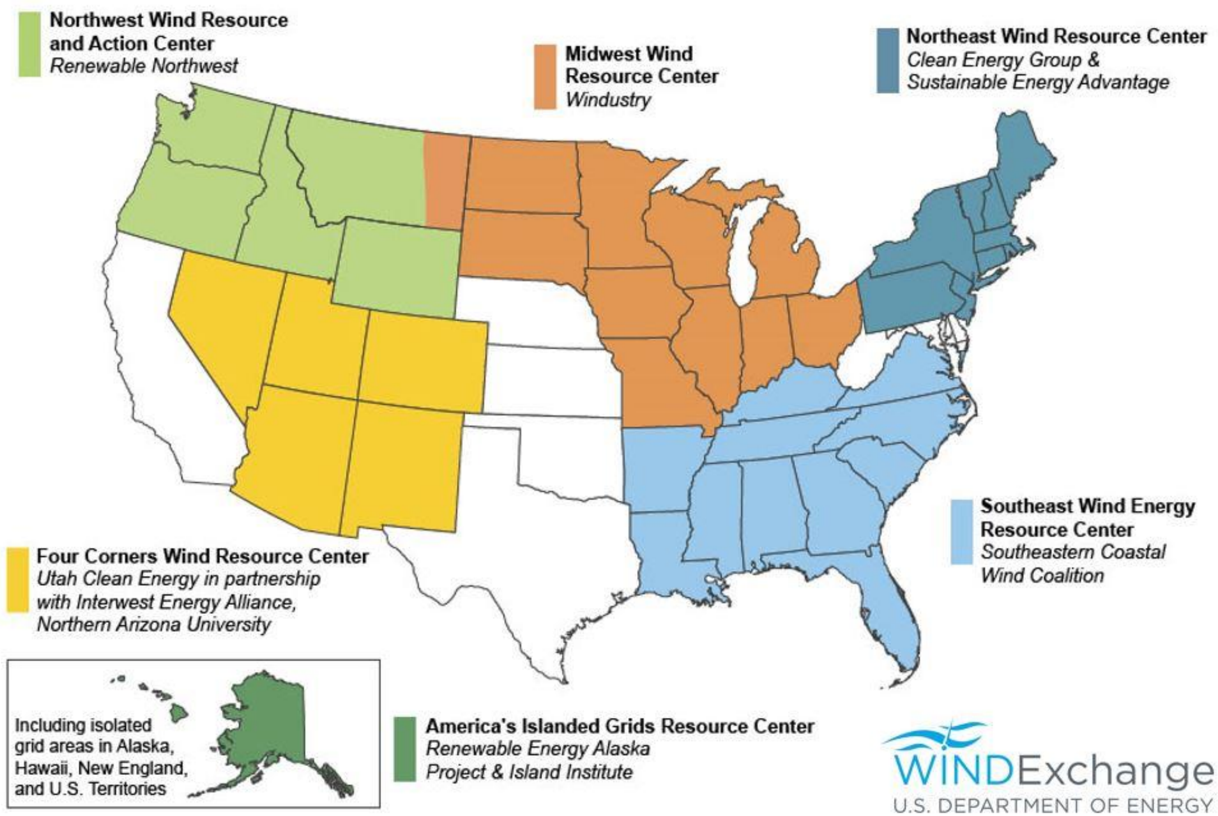
The NWRC is supported in part by a grant from the U.S. Department of Energy's WINDExchange program, and is managed by Clean Energy Group, with participation from Sustainable Energy Advantage and the Maine Ocean & Wind Industry Initiative.

www.northeastwindcenter.org

About WINDExchange

WINDExchange is the U.S. Department of Energy (DOE) Wind Program's platform for disseminating credible information about wind energy. The purpose of WINDExchange is to help communities weigh the benefits and costs of wind energy, understand the deployment process, and make wind development decisions supported by the best available information.

On March 11, 2014, the U.S. Department of Energy (DOE) announced six Wind Energy Regional Resource Centers that were selected through a competitive process administered by the National Renewable Energy Laboratory (NREL).



Panelists

- **Jennifer Runyon**, Chief Editor, Renewable Energy World
- **Brian Cheater**, Technical Director - Naval Architecture, GustoMSC US, Inc.
- **Val Stori**, Project Director, Clean Energy Group

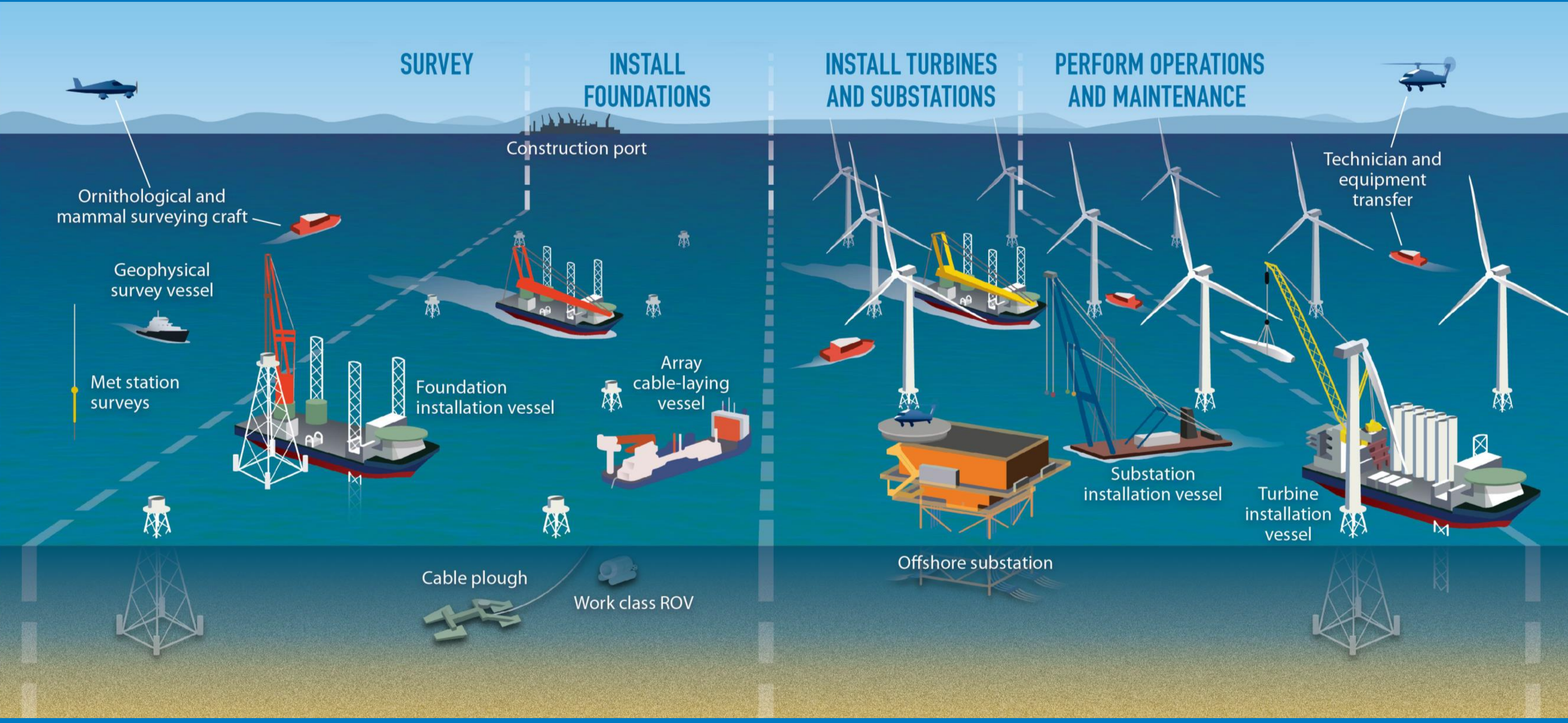
Renewable Energy World is the authoritative source for information on markets, policy and finance covering all renewable technologies – solar, wind, energy storage, geothermal, bioenergy, ocean, river, tidal and hydropower. With 700,000 average monthly page views and more than 300,000 unique visitors. Our digital magazine boast more than 52,000 subscribers; more than 200,000 registered e-newsletter subscribers and a global readership in 174 countries.

Jennifer Runyon
Background: Writing/editing/teaching (Began career as an English teacher). Switched to editing in 2000
Managing editor at Renewable Energy World, 2007
Conference chair, Renewable Energy World International, 2011
Chief Editor, 2012

In sum: have been covering renewable energy generation since 2007 and have witnessed its growth.

Diversification Avenues for Oil and Gas to support Offshore Wind

1. Project Management



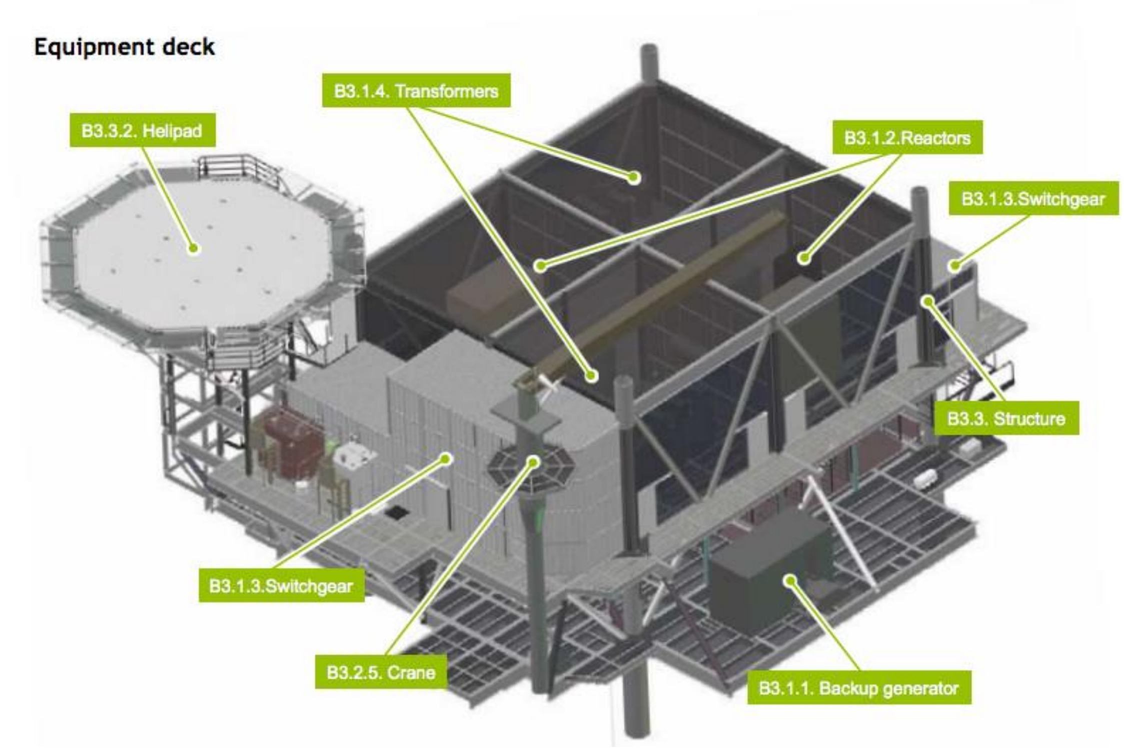
2. Cables

JDR CHOSEN BY US WIND INC. AS CABLE PARTNER

February 20th, 2017: JDR, a leading supplier of subsea power cables and umbilicals to the global offshore energy industry, has been selected by US Wind Inc., as the preferred cable partner for its first offshore wind project.

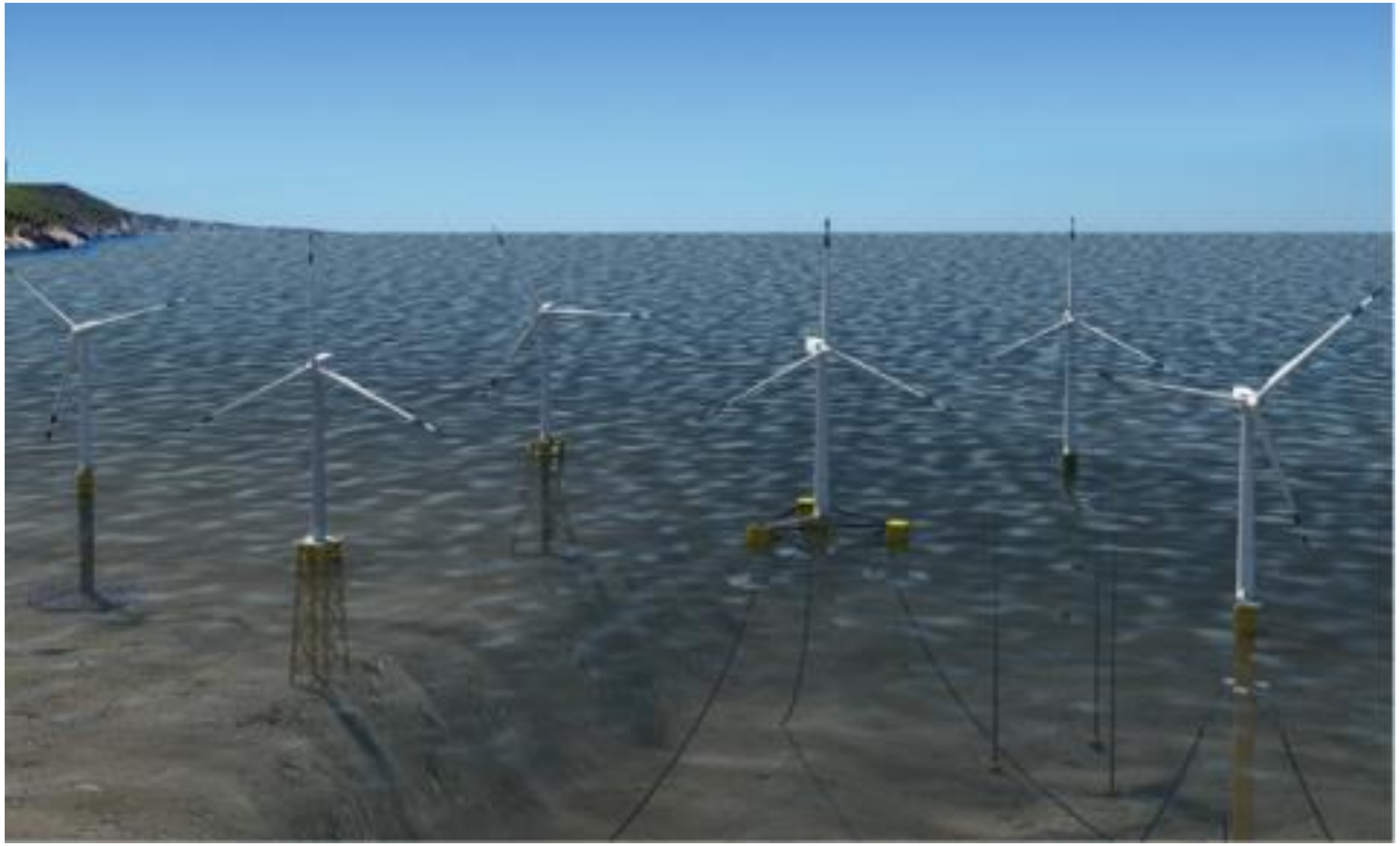
3. Substations

An Offshore Substation

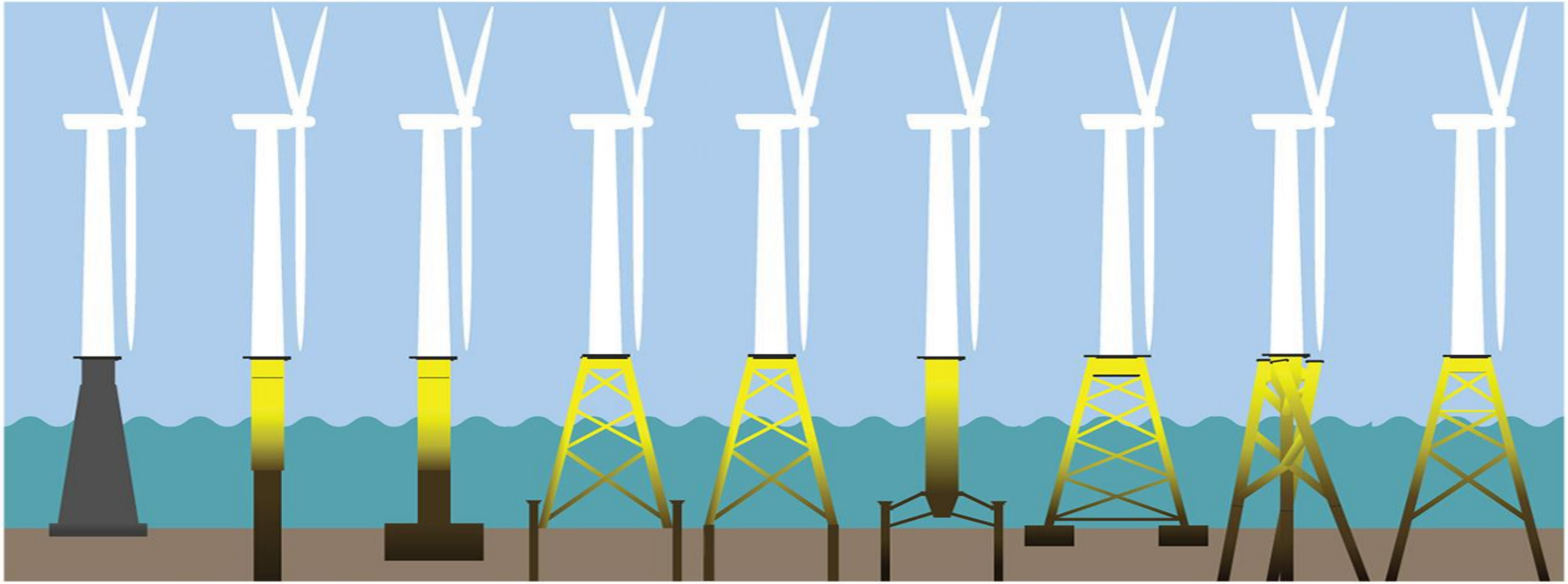


Credit: The Crown Estate / Siemens plc and McNulty Offshore

4. Foundations



More on foundation types



Gravity Base
(O&G and WIND)

Monopile
(O&G and WIND)

Suction Pile
(O&G and WIND)

Post-piled Jacket
(O&G and WIND)

Pre-piled Jacket
(WIND)

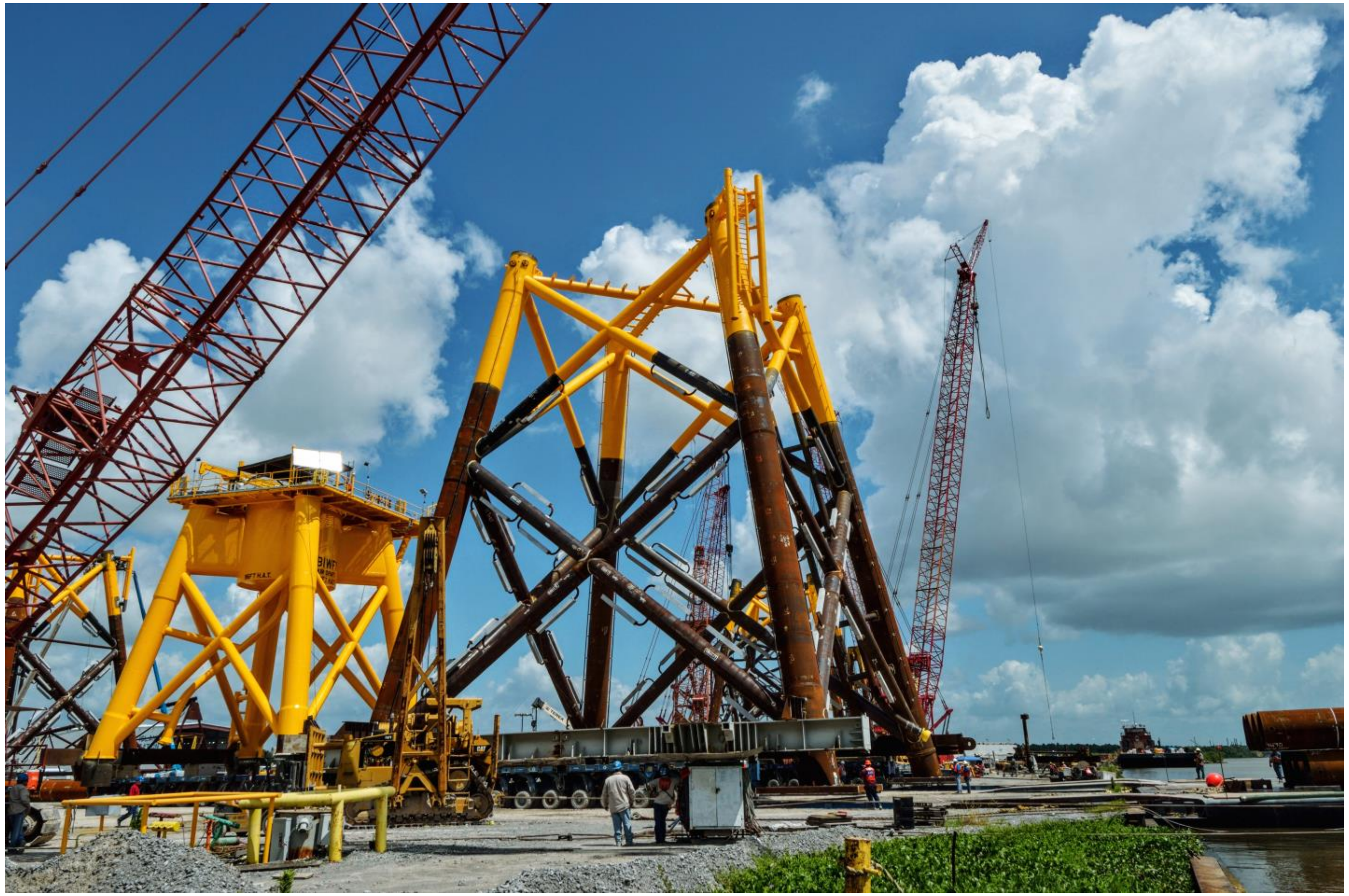
Tripod
(O&G and WIND)

Suction Bucket Jacket
(O&G and WIND)

Twisted Jacket
(O&G and WIND)

Traditional Jacket
(O&G and WIND)

5. Secondary Steelwork



6. Installation equipment, Installation support service and Maintenance and Inspection services

SAVE $50 off our early-bird registration rate with promo code VESSEL

NYSERDA
WIND FARM INSTALLATION VESSEL

6 JUNE ,2017

Brian Cheater

THE PIONEERS OF OFFSHORE ENGINEERING

AGENDA

- COMPANY BACKGROUND
- TRACK RECORD
- VESSEL STUDY
- THE PHYSICAL ENVIRONMENT
- ASSUMED WIND FARM
- TRANSPORTATION AND INSTALLATION
- OUR SOLUTION
- FINANCES

COMPANY BACKGROUND

HISTORY

OVER 150 YEARS EXPERIENCE

1862
Start of Gusto Shipyard (The Netherlands)

1977
Start of Marine Structure Consultants B.V. (Sliedrecht)

1978
Start of Gusto Engineering (Schiedam)

1988
IHC Caland completes the repurchase of all Gusto Engineering and MSC shares

2003
Start of GustoMSC alliance

2011
Start of GustoMSC B.V.

2012
GustoMSC acquired by Parcom Capital, management & staff (as of November 2012)

OFFICES

Houston

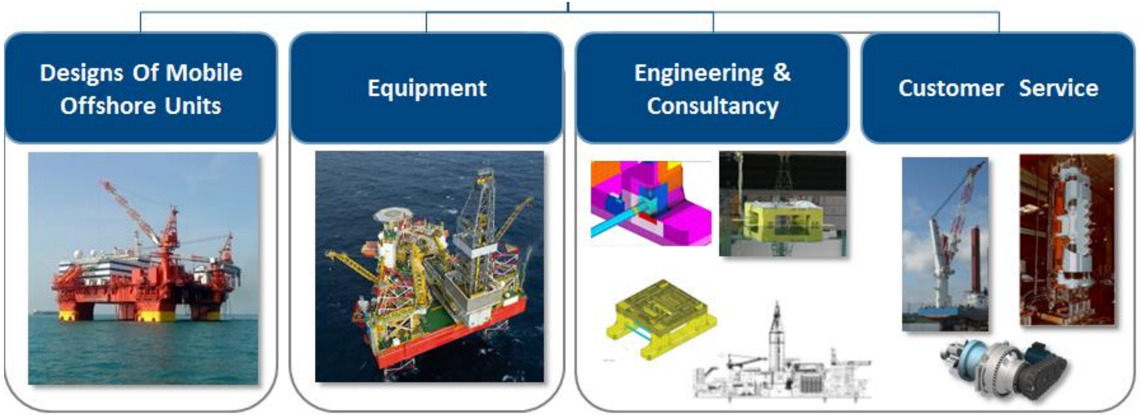
Schiedam

Headquarters in Schiedam, GustoMSC employs over 140 highly skilled and talented staff.

NOVEMBER 2012 PARCOM CAPITAL AND THE GUSTOMSC MANAGEMENT ACQUIRED GUSTOMSC. AS AN INDEPENDENT DESIGN OFFICE WE CONTINUE TO WORK WITH OUR CLIENTS AND OTHER BUSINESS PARTNERS.

parcom | capital

WHAT WE DO



- GustoMSC understands how to protect reputations against risks
- Collaboration with Energy Companies / Developers, High-End Contractors, Universities, Shipyards, Government Organizations
- Safety and Efficiency are key words

GUSTOMSC DESIGN SERIES

CJ Series

Drilling & Production

AJ Series

Accommodation

Sea Series

Construction

NG Series

Construction

Drillships

DSS & Ocean Series

NG Series - Wind

TriFloater

Photo courtesy Seaway Heavy Lifting

VESSELS

HEAVY LIFT VESSEL
"OLEG STRASHNOV"
WITH 5,000 TON OFFSHORE CRANE

Design
Engineering & consultancy
Equipment design & supply
After sales services

TRI-FLOATER

SEMI-SUBMERSIBLE FLOATING WIND TURBINE FOUNDATION

Design
Engineering & consultancy
Equipment design & supply
After sales services

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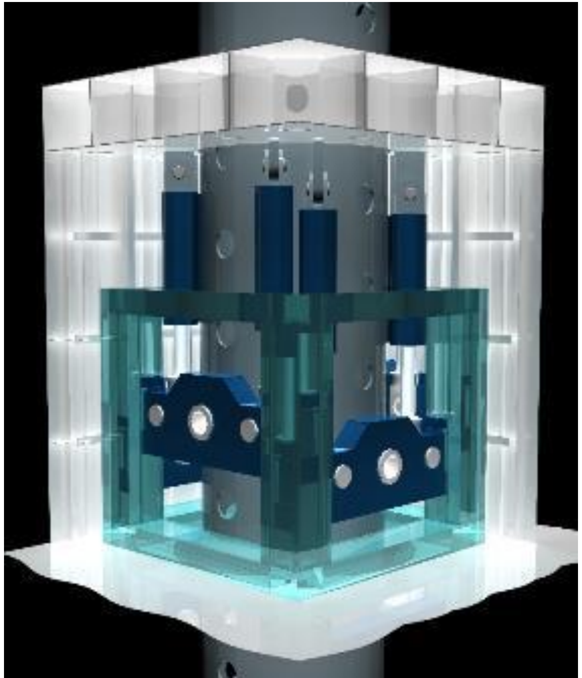
ENGINEERING CONSULTANCY AND OTHER SERVICES

- **UPGRADES AND MODIFICATIONS:**
  - LEG EXTENSIONS
  - MOORING UPGRADES
  - HULLFORM MODIFICATION – SIZING, MOTIONS AND STABILITY
  - STRUCTURAL MODIFICATIONS
- **CONSULTANCY:**
  - DEADWEIGHT SURVEYS AND INCLINES
  - FEASIBILITY STUDIES
  - HYDRODYNAMICS AND MODEL TESTING
  - CFD STUDIES
- **EQUIPMENT:**
  - CRANES DESIGNS AND UPGRADES
  - JACKING SYSTEMS
  - FIXATION SYSTEMS
  - XY CANTILEVER SKIDDING SYSTEM

JACKING EQUIPMENT

HYDRAULIC CYLINDRICAL LEGS

CONTINUOUS HYDRAULIC CYLINDRICAL LEGS



RACK AND PINION TRUSS LEGS

OFFSHORE CRANES

ASSOCIATED EQUIPMENT

Leg Cranes

Heavy Lift Cranes

Column Cranes

Heavy Lift Crane

- Heavy lift, fully revolving offshore derrick cranes. Ideally suited for construction work in the oil and gas sector and for installation of foundations for wind turbines. It can be mounted on either a ship or a semi-submersible.

Column Crane

- A range of cranes that can be positioned on a pedestal onboard any type of vessel.

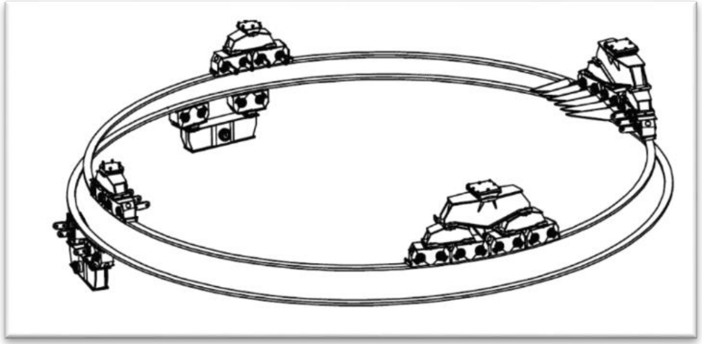
"Around the Leg" Crane

- Situated around the leg of a jack-up unit and supported on the jack-house. Enhances operations and increases net deck area, used typically for wind turbine installation.

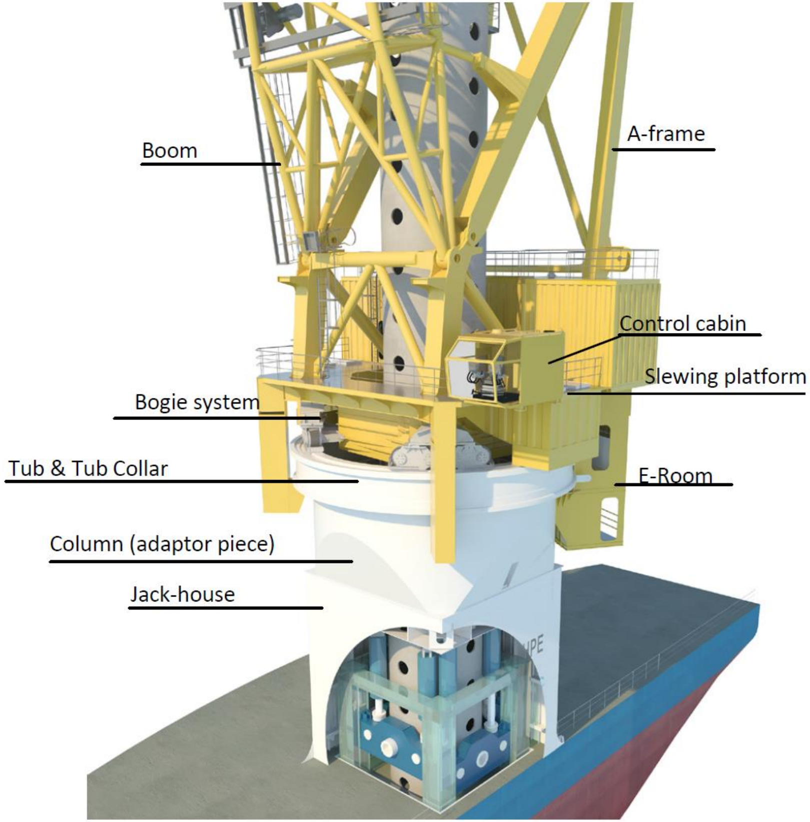
SPECIALTY CRANES

Main features – leg cranes:

- Bogie wheel system i.s.o. classic slewing bearing
- Electric driven
- Fully (unrestricted) revolving with slip ring for electrical power and instrumentation



Bogie wheel system (typical)



TRACK RECORD

OPERATIONAL TRACK RECORD

MARKET SHARE OF TURBINE AND FOUNDATION INSTALLATION FROM 2010 TO 2016

Number of installed Turbines

- By GustoMSC Jack-ups 2,024 pcs. (77 %)
- Total installed 2,614 pcs.

Number of installed foundations

- By GustoMSC designs 1,274 pcs. (64 %)
- Total installed 2,000 pcs.

A2SEA, Sea Installer

Ballast Nedam, Svanen

Proven by experience

REFERENCES IN OFFSHORE WIND

No.	Name	Series	Owner	Year
1	WIND	NG-600	DDB/Ziton	1995
2	Buzzard	SEA-1250	GeoSea	1982
3	Vagant	SEA-800	GeoSea	2002
4	Pauline	SEA-900	Besix	2002
5	Wind Lift 1	NG-5300	Bard	2009
6	Goliath	SEA-2000	GeoSea	2009
7	Sea Worker	SEA-2000	A2SEA	2009
8	Seafox 7	SEA-2000	Workfox	2009
9	JB-114	SEA-2000	Jack-Up Barge BV	2010
10	JB-115	SEA-2000	Jack-Up Barge BV	2010
11	Seajacks Kraken	NG-2500X	Seajacks UK Ltd	2009
12	Seajacks Leviathan	NG-2500X	Seajacks UK Ltd	2009
13	GMS Endeavour	NG-2500X	GMS	2010
14	GMS Endurance	NG-2500X	GMS	2010
15	MPI Adventure	NG-7500/6	MPI Offshore	2011
16	MPI Discovery	NG-7500/6	MPI Offshore	2011
17	JB-117	SEA-3250	Jack-Up Barge	2011
18	Neptune	SEA-2500	GeoSea	2011
19	RIMA (Ex-Kuroshio)	SEA-900	Besix	2011

No.	Name	Series	Owner	Year
20	Seajacks Zaratan	NG-5500C	Seajacks Ltd	2012
21	Brave Tern	NG-9000C	Fred Olsen Windcarrier	2012
22	Bold Tern	NG-9000C	Fred Olsen Windcarrier	2012
23	Sea Installer	NG-9000C	A2SEA	2012
24	JB-118	SEA-3250	Jack-Up Barge	2013
25	Sea Challenger	NG-9000C	A2SEA	2014
26	Seajacks Scylla	NG-14000X	Seajacks UK Ltd	2015
27	GMS Shamal	NG-1800X	Gulf Marine Services	2015
28	GMS Scirocco	NG-1800X	Gulf Marine Services	2015
29	GMS Sharqi	NG-1800X	Gulf Marine Services	2016
30	Apollo	NG-5500X	GeoSea NV	2017
31	GMS Evolution	NG-2500X	Gulf Marine Services	2016
32	TYM Matsu	NG-2500X	Thong Yong Maritime	2017
33	TYM Baymax	NG-1800X	Thong Yong Maritime	2017
34	TYM Nemo	NG-1800X	Thong Yong Maritime	2018
35	Penta-Ocean	NG-3750C	Penta-Ocean Constr.	2018

SEA-SERIES

SEA-3250 “JB-117” NON-PROPELLED JACK-UP WITH 800T PEDESTAL CRANE

Other SEA-series

- SEA-600
- SEA-900
- SEA-1250
- SEA-1600
- SEA-1800X
- SEA-2000
- SEA-2500X
- SEA-2750
- SEA-3750C
- SEA-5500C
- SEA-5500X

Design
Engineering & consultancy
Equipment design & supply
After sales services

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NG-SERIES

NG-9000C "BRAVE TERN" SELF-PROPELLED JACK-UP WITH 800T LEG CRANE

Other NG-series

- NG-1250
- NG-1800X
- NG-2000
- NG-2500X
- NG-2750C
- NG-3500X
- NG-3750C
- NG-5500C
- NG-5500X
- NG-9800C
- NG-10000X
- NG-14000X
- NG-14000XL

Design
Engineering & consultancy
Equipment design & supply
After sales services

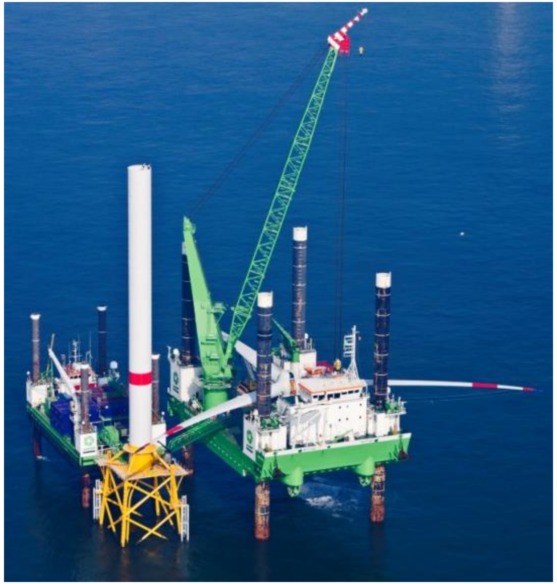
DESIGN EVOLUTION 1

Shallow water range

Characteristics:

- Towed or self propelled and DP
- Crane capacity between 300 – 800 ton
- Load capacity between 1,000 – 2,200 ton
- Water depth range up to 35 - 40 m



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DESIGN EVOLUTION 2

Medium water range

Characteristics:

- Self propelled and DP
- Crane capacity between 800 – 1,000 ton
- Load capacity between 2,500 – 6,500 ton
- Water depth range up to 45-55 m

DESIGN EVOLUTION 3

Deep water range

Characteristics:

- Self propelled and DP
- Crane capacity between 1,200 – 2,500 ton
- Load capacity between 6,500 – 8,500 ton
- Water depth range up to 65 m

VESSEL STUDY

PROJECT INTRODUCTION

- NYSERDA (“New York State Energy Research and Development Authority”)
- New York, Rhode Island, Massachusetts and Maine part of DOE funded project.
- Growing Realization that Commercial Wind Farm Development will need cross state cooperation.
- Road Map for Multi-State Cooperation on Offshore Wind Development.
    - A Strategy to Achieve a Regional Market of Scale
        - Project 3: US Vessel Study

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PROJECT GOAL

- Create a Framework to understand what is required of a wind turbine installation vessel from technical and financial perspectives
  - Design a WTIV
  - Cost it
  - Define the business case required to support it

INTRODUCTION - PHYSICAL CONTEXT

- Questions to frame-up technical requirements:
  - What do we need to install and where does it need to go?
  - How big is it and how do we need to lift and how do we hold it for installation?
  - What do the water depth and metocean conditions look like at the sites we need to work?
  - How far do we need to travel and what are the limitations on draft, beam and height?

INTRODUCTION - FINANCIAL CONTEXT

- Questions to frame-up financial requirements:
  - What is the CAPEX of a Jones Act vessel?
  - What would the operating expenses (OPEX) be?
  - How many turbine installations might be required and how many years of work does this correspond to?
  - What kind of pipeline is required?
  - What combination of day-rates and pipeline generate acceptable returns on investment?

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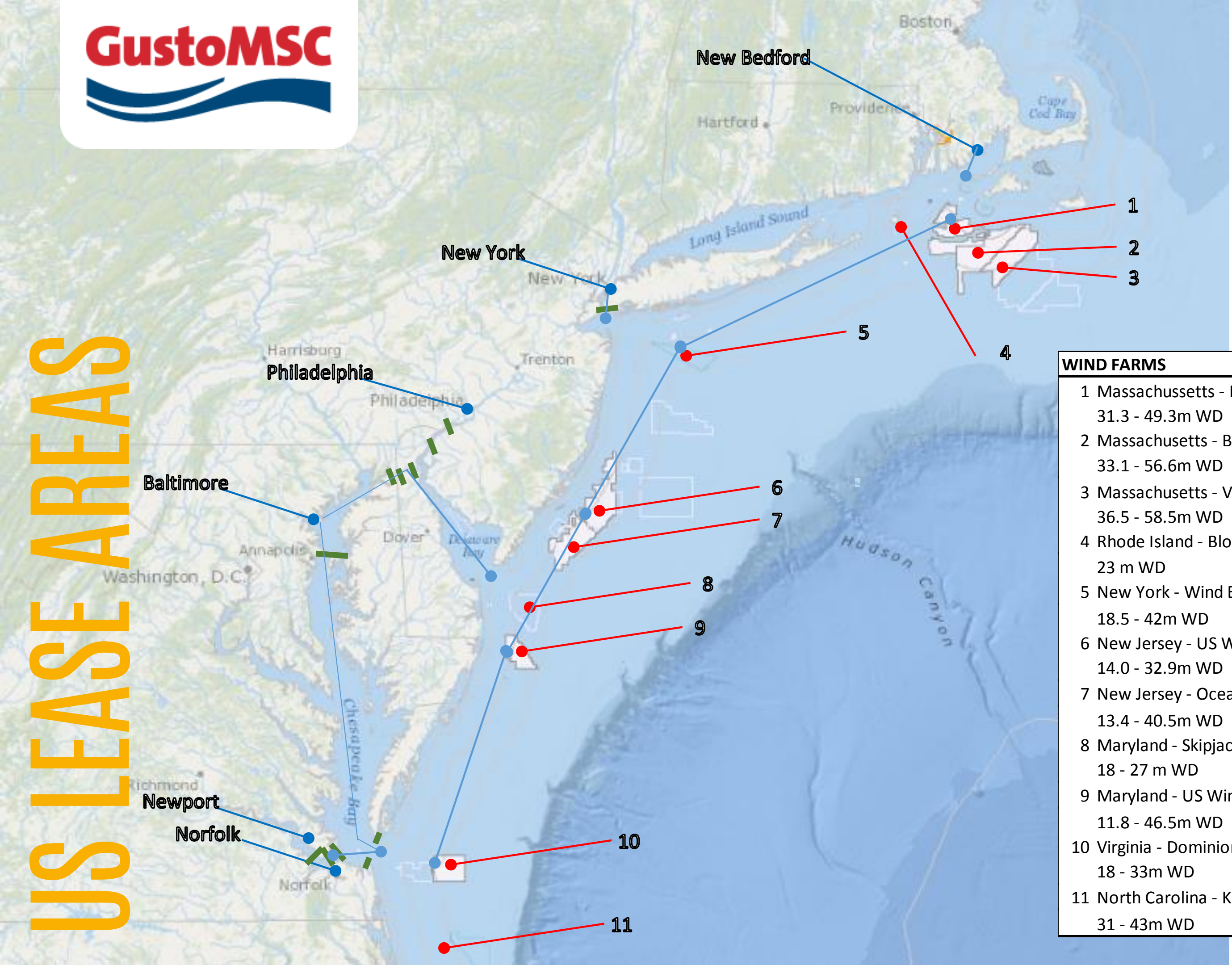
METHODOLOGY

1. Assume a hypothetical but realistic set of wind farm developments in the Region
2. Assume construction and installation methodologies
3. Develop functional requirements to satisfy those methodologies
4. Develop the concept designs for a WTIV or feeder jack-up satisfying the technical requirements
5. Submit the estimating packages to selected US shipyards to obtain build prices for Jones Act compliant vessels
6. Create a crewing model for a US flagged installation vessel
7. Create a vessel-specific financial model tracking capital (CAPEX) and operational (OPEX) expenses to generate Net Present Value (NPV), and Internal Rate of Return (IRR)

THE PHYSICAL ENVIRONMENT

US LEASE AREAS



WIND FARMS		
1	Massachussetts - Deepwater ONE (1200 MW) 31.3 - 49.3m WD	Deepwater wind
2	Massachussetts - Bay State Wind (1000 MW) 33.1 - 56.6m WD	DONG Energy
3	Massachussetts - Vineyard Wind 36.5 - 58.5m WD	CIP / Avangrid
4	Rhode Island - Block Island Wind Farm (30 MW) 23 m WD	Deepwater wind
5	New York - Wind Energy Area 18.5 - 42m WD	Statoil
6	New Jersey - US Wind Inc (2230 MW) 14.0 - 32.9m WD	US Wind / Renexia
7	New Jersey - Ocean Wind - DONG Energy (1950 MW) 13.4 - 40.5m WD	DONG Energy
8	Maryland - Skipjack & Garden state 18 - 27 m WD	Deepwater wind
9	Maryland - US Wind Inc (750 MW) 11.8 - 46.5m WD	US Wind / Renexia
10	Virginia - Dominion - Phase 1+2 (2000 MW) 18 - 33m WD	Dominion
11	North Carolina - Kitty Hawk 31 - 43m WD	Avangrid

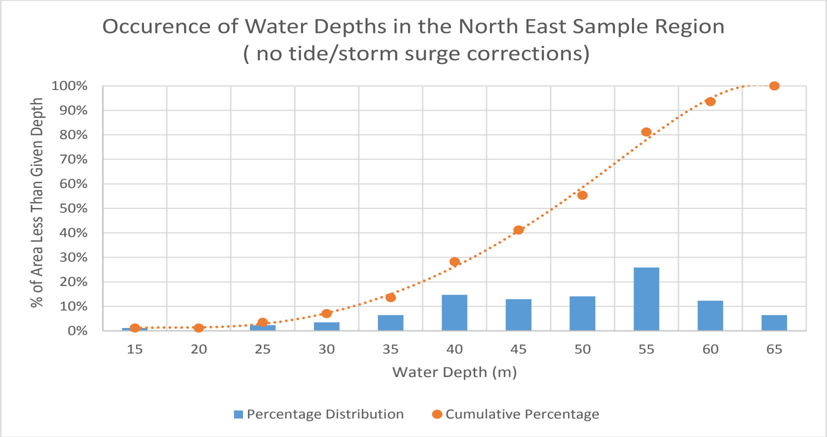
DISTRIBUTION OF WATER DEPTH

GustoMSC Proprietary Designs

- 81% of sites < 55m of water
- Average Water Depth 48.71m

SAMPLE	NUMBER OF WIND LEASE BLOCKS versus MAXIMUM WATER DEPTH (m) 15	20	25	30	35	40	45	50	55	60	65	Σ
1			3	4	8	12						27
2	2					7	22	24	44	21	11	131
3			1	2	3	6						12
Σ	2	0	4	6	11	25	22	24	44	21	11	**170**

SAMPLE	PERCENTAGE DISTRIBUTION OF WATER DEPTH 15	20	25	30	35	40	45	50	55	60	65	Σ
1	0.0%	0.0%	1.8%	2.4%	4.7%	7.1%	0.0%	0.0%	0.0%	0.0%	0.0%	16%
2	1.2%	0.0%	0.0%	0.0%	0.0%	4.1%	12.9%	14.1%	25.9%	12.4%	6.5%	77%
3	0.0%	0.0%	0.6%	1.2%	1.8%	3.5%	0.0%	0.0%	0.0%	0.0%	0.0%	7%
Σ	1%	0%	2%	4%	6%	15%	13%	14%	26%	12%	6%	
CUMUL	1%	1%	4%	7%	14%	28%	41%	55%	81%	94%	100%	



DISTRIBUTION OF WATER DEPTH

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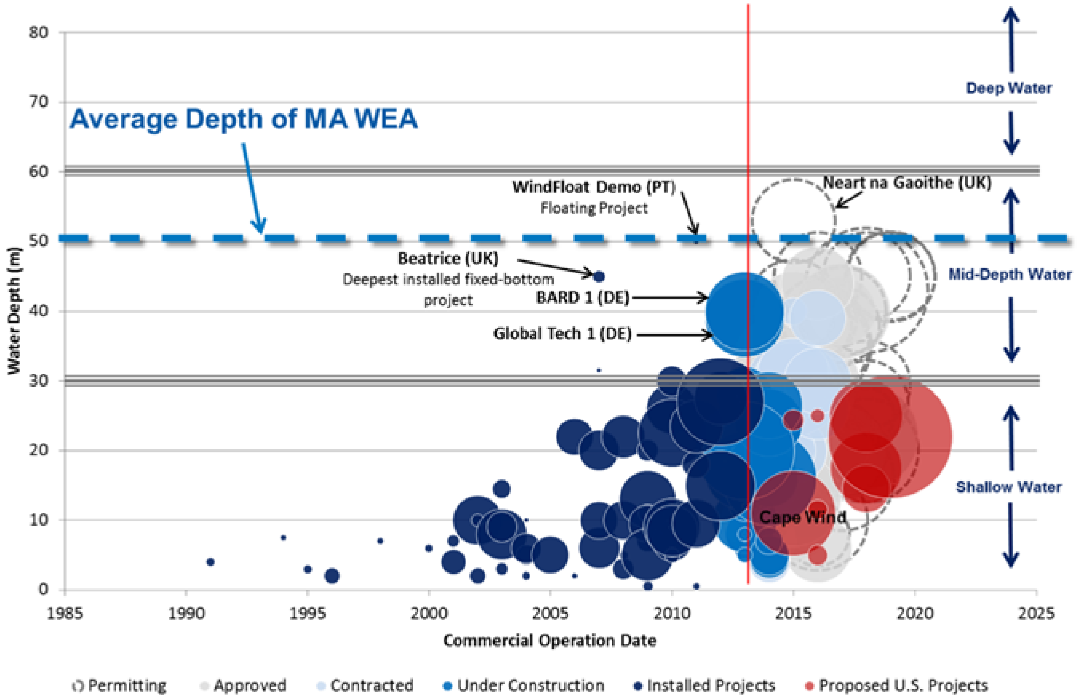
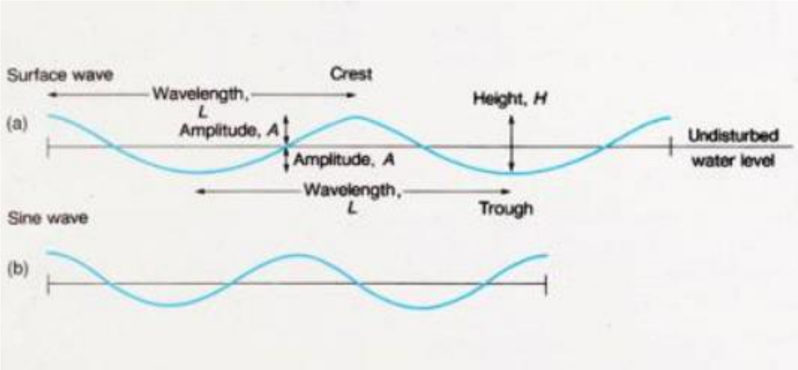


<u>Let's put this in perspective – this is deep compared to Europe</u>

CHALLENGES - SITE CONDITIONS

- Offshore Environmental Conditions
  - Wave Conditions – height and period
  - Tides and Storm Surges
  - Wind Speed
  - Current



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METOCEAN CONDITIONS

- **<u>Design Environmental Conditions (50-yr storm)</u>**

  - Significant Wave Height (Hs): 10m
  - Maximum Wave Height (Hmax): 19.5m at 14 sec
  - Highest Astronomical Tide (HAT): 0.79m
  - Associated Storm Surge: 1.59m
  - 1-minute mean wind at 10m (Vw): 38 m/s [74 knots]
  - Surface Current (Vc) : 1.2 m/s [2.3 knots]

GustoMSC Proprietary Designs

GEO-TECHNICAL CONDITIONS

GustoMSC Proprietary Designs

- **SOIL CONDITIONS**
  - No site specific data available. Following assumed based on public reports.
  - High Sand Content (80-100%) in the Northern 2/3rd of the region
  - Predominantly silt and clay in the southeastern section
  - Southern extent of glaciation -> Risk of large boulders.

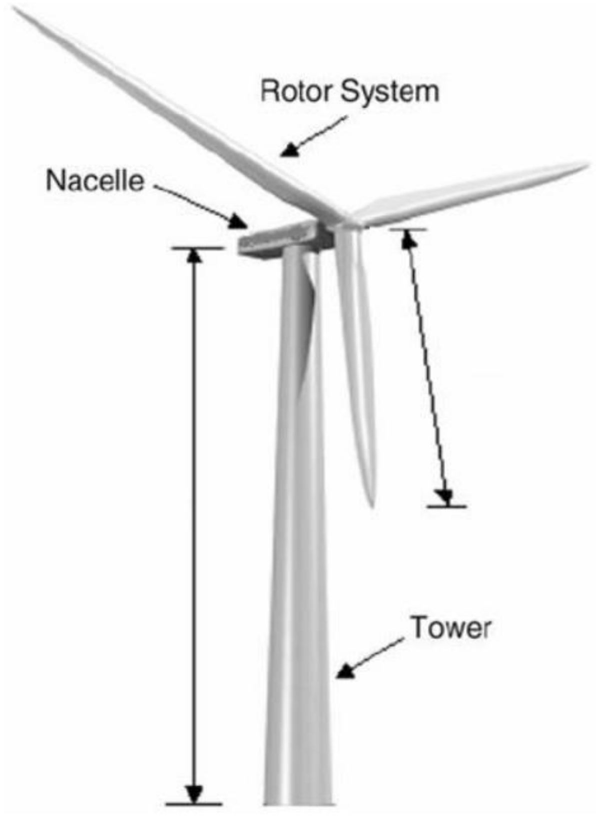
CHALLENGES - WEATHER AND WATER DEPTH

- Increasing Water Depth
  - Europe: 15-30m
  - North East US: 15-65m
- 18m (59ft) winter waves

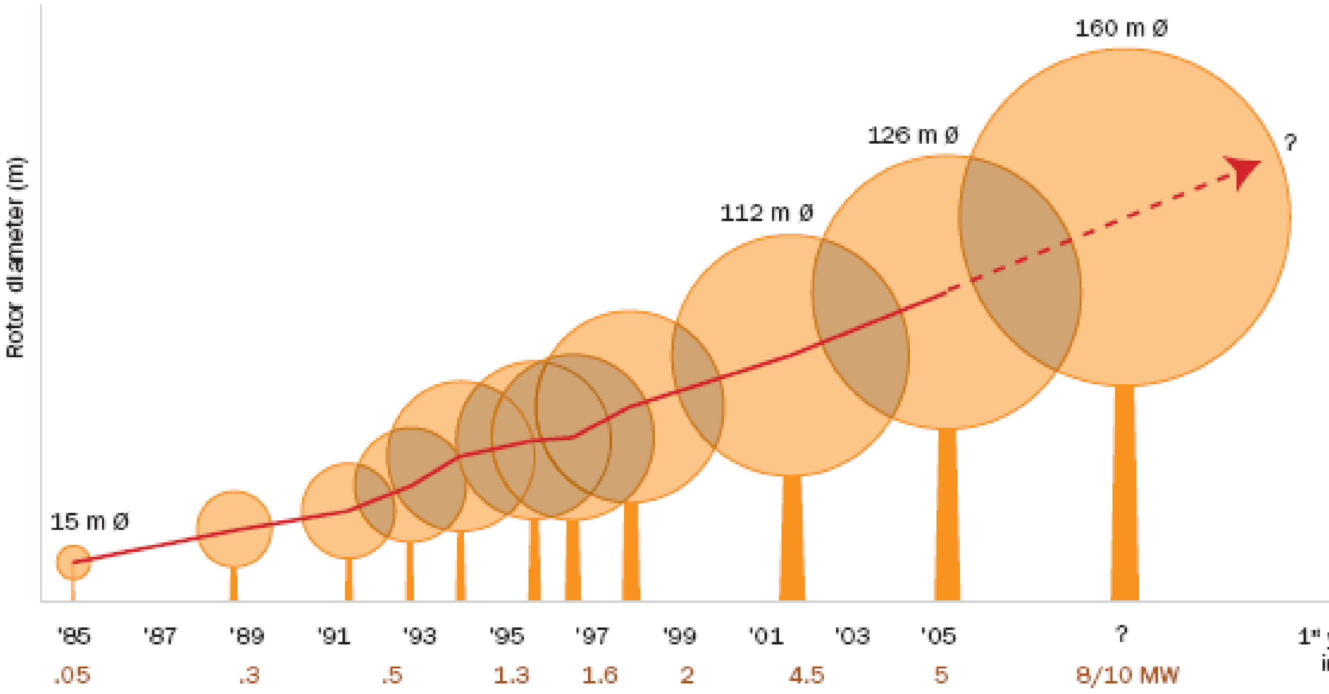
ASSUMED WIND FARM

REQUIREMENTS

- Install 100 x 8MW wind turbines:
    - Foundations – piles and jackets (optional)
    - Towers
    - Nacelle
    - Blades
- Safe and Secure Year-round operation.
- Maximum water depth 55m (summer) and 50m (winter)
- Deck area and load capacity to carry four turbines
- Crane capacity and reach to lift, position, and hold in precise alignment 8MW turbine



REQUIREMENTS - 8MW TURBINE



PARAMETER	8 MW
ROTOR DIAM (m)	175
BLADE LENGTH (m)	85
BLADE WEIGHT (te)	40
BLADE CHORD(m)	6
NACELLE WEIGHT(te)	450
LIFTING FRAME (te)	45
TOTAL NACELLE(te)	495
NACELLE LENGTH(m)	21
NACELLE WIDTH(m)	9.6
TOWER LENGTH (m)	94
TOWER WEIGHT(te)	500
TOWER DIAM (m)	6.75
TOTAL LENGTH (m)	94
# SECTIONS	2
SECTION LENGTH(m)	47
SECTION WEIGHT(te)	250

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REQUIREMENTS - 8MW TURBINE

- Towers may be up to 500MT
- Lengths of up to 94m
- Diameters of up to 6.75m
- Large Deck Capacities

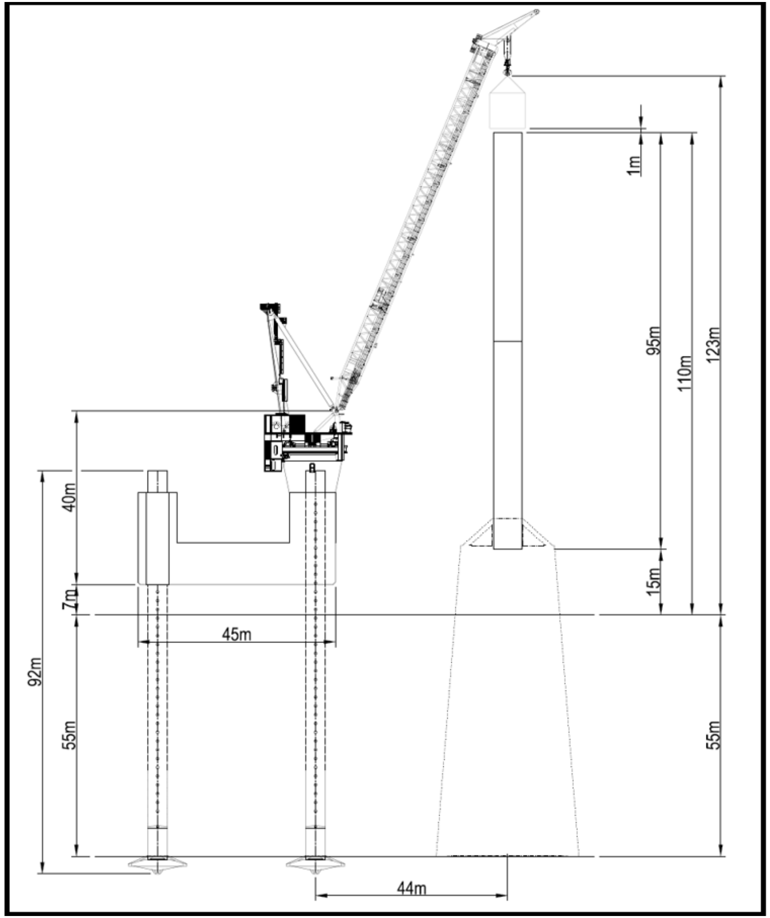
REQUIREMENTS - 8MW TURBINE

- Nacelles at great height and reach:
  - Nacelles may be 21mL x 9.6mW x 9.6mH
  - They weigh up to 450MT with 50MT lifting frame
  - They need to be lifted to at least 117m above the sea and held in place while they are bolted

INSTALLATION METHODOLOGY

- **LIFTING REQUIREMENTS**
  - 450 te nacelle +
  - 50 te frame/rigging
  - 500 te SWL

  - Height = 123m above still water line

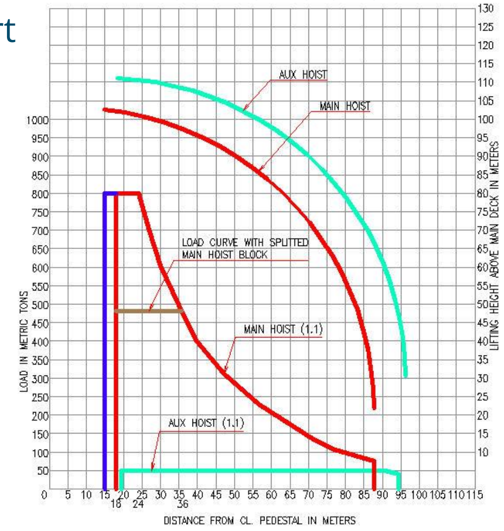


GustoMSC Proprietary Designs

CHALLENGES- CRANE CAPACITY

- Not just lifting weight
- Reach and Hook Height requirements drives selection of crane
- Need to refer to the Crane Load Chart

1000 Ton Crane

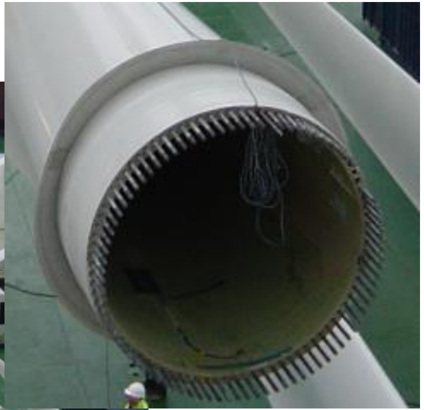


REQUIREMENTS - 8MW TURBINE

- Turbine Blades at great height and reach:
  - Blades are 85m long with a 6m chord
  - They weigh up to 40MT
  - They need to be lifted to at least 117m above the sea and held in place while they are bolted

CHALLENGES- PRECISION

- Held precisely for extended periods of time for assembly and securing
- Safety is paramount!



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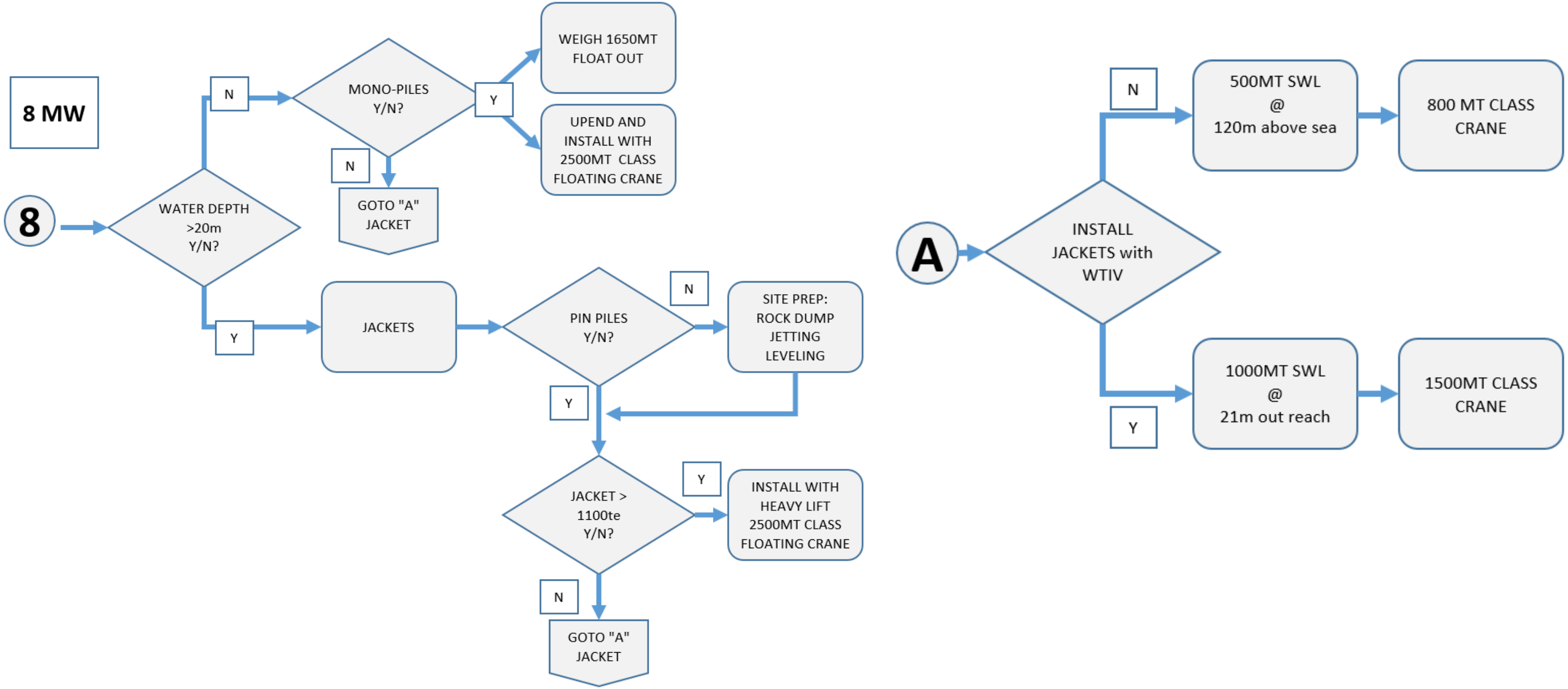
DESIGN CONSIDERATIONS - FOUNDATIONS



WINDFARM - FOUNDATIONS

- 8 MW turbines in 55m of water exceed the current range for monopiles.
- Risk of monopile refusal if boulder hit.
- Jackets may be more complex to manufacture but are proven technology.
- Pin-Pile Jackets were adopted as the most weight efficient and also with these installation of the piles can be done separately providing more schedule flexibility

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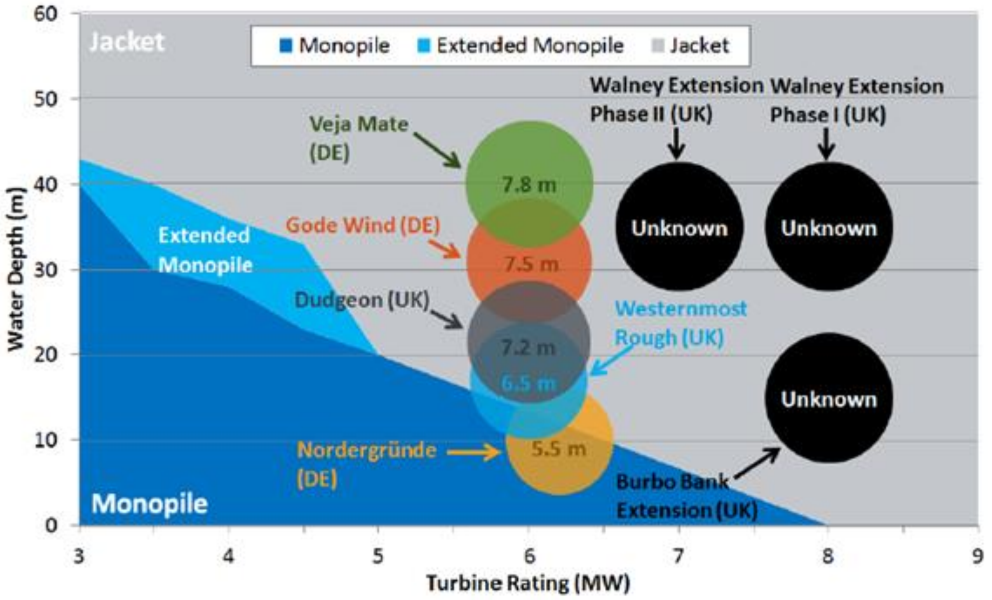


REQUIREMENTS - 8MW TURBINE

- FOUNDATION supporting an 8MW turbine in 55m of water:
  - Water Depth – 55m
  - Airgap – 15m
  - Jacket Height – 70m
  - Jacket Base – 30m x 30m
  - Jacket Weight - 1000te (approx)
  - Transportation
    - Barge – 3 or 4 per trip.
    - Deck of Self Propelled WTIV or Feeder Barge – 1 per trip
  - Piles – 2.7m∅ x 40m, 150MT each (approx.)
  - Pile Installation and Driving by hammer

TRANSPORTATION AND INSTALLATION

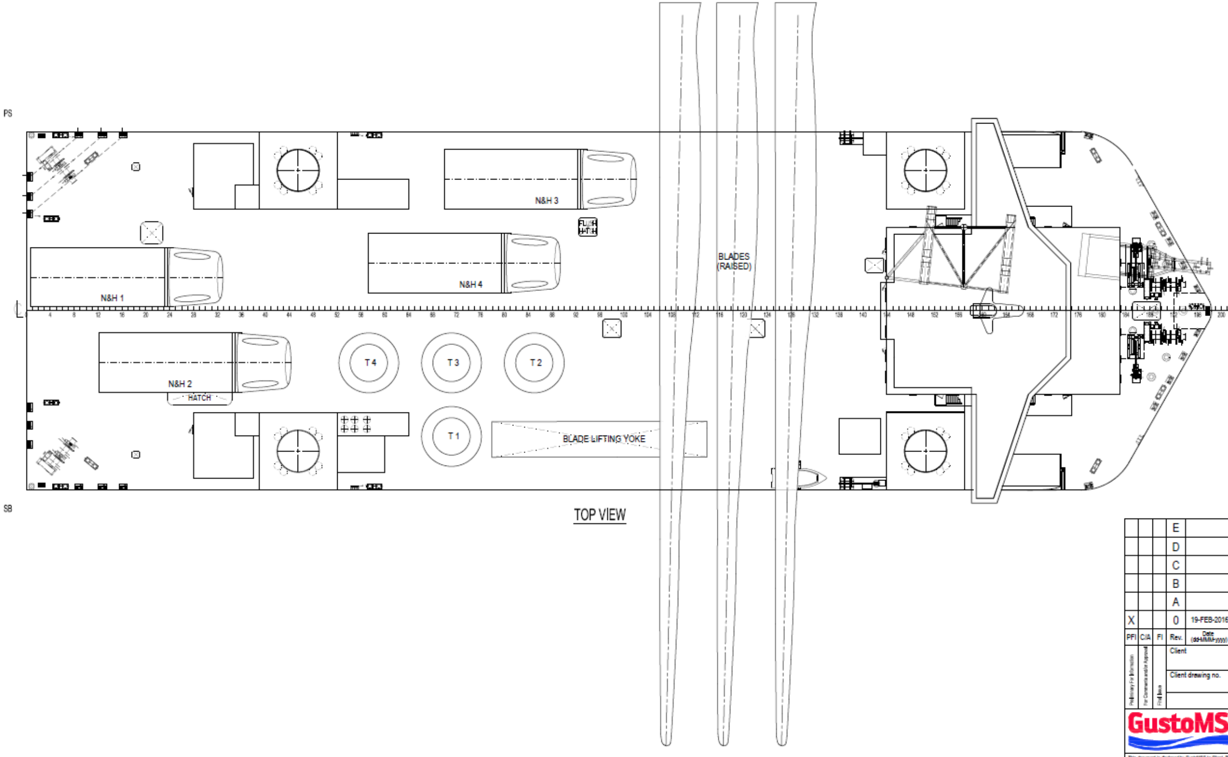
TRANSPORTATION STRATEGIES

- **Transit Strategy**
  - Main wind turbine installation vessel (WTIV) sails into port, loads and then carries parts and material out to the wind farm site where it will perform the installation. It will then return to port for the next load.

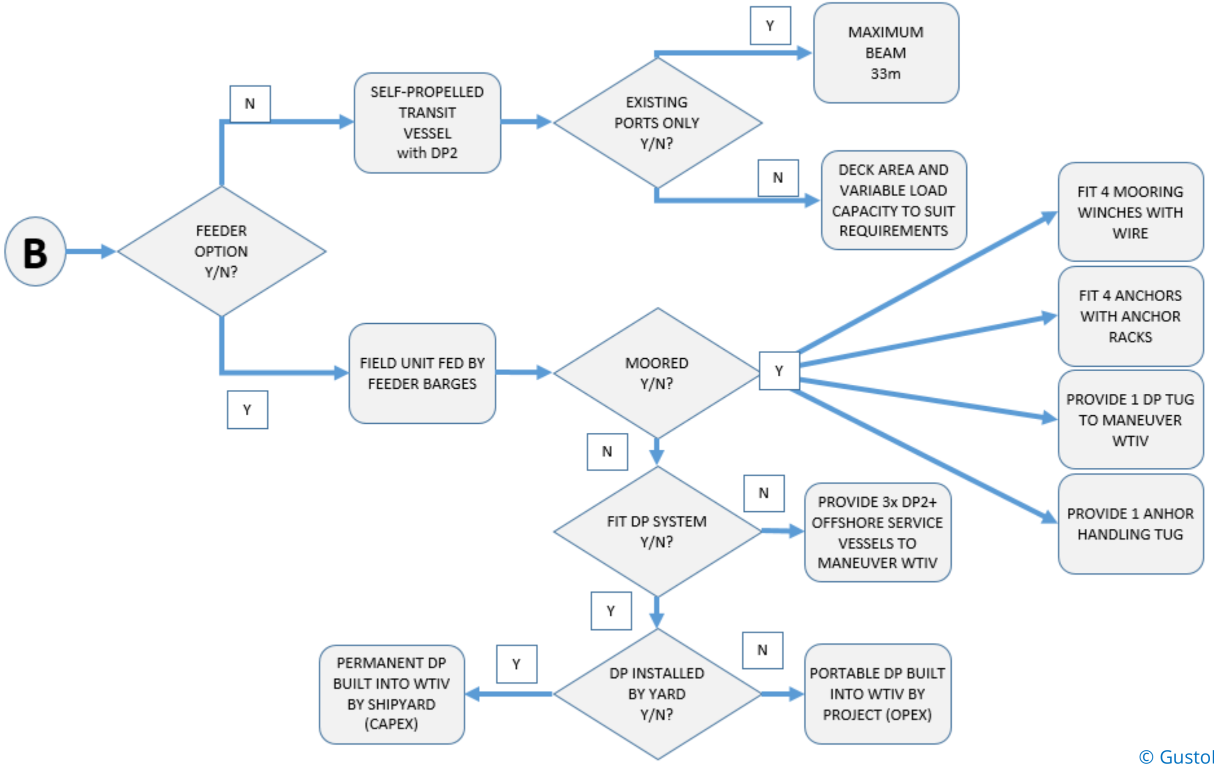
- **Feeder Strategy**
  - WTIV remains in the field and is supplied by one or more feeder barges which ferry parts and material out from the port to the wind farm site. The WTIV lifts the material off the Feeder Barge which then returns to port for more material. The feeder barges are smaller units with no main crane.

REQUIREMENTS- TRANSPORTATION

- Large Deck Capacities:
  - Transit option (4 Turbines)
    - 3450m^2 of deck space
    - 6400te of deck load
  - Feeder option (2 Turbines)
    - 1800m^2 of deck space
    - 3400te of deck load



DESIGN CONSIDERATIONS - TRANSPORTATION

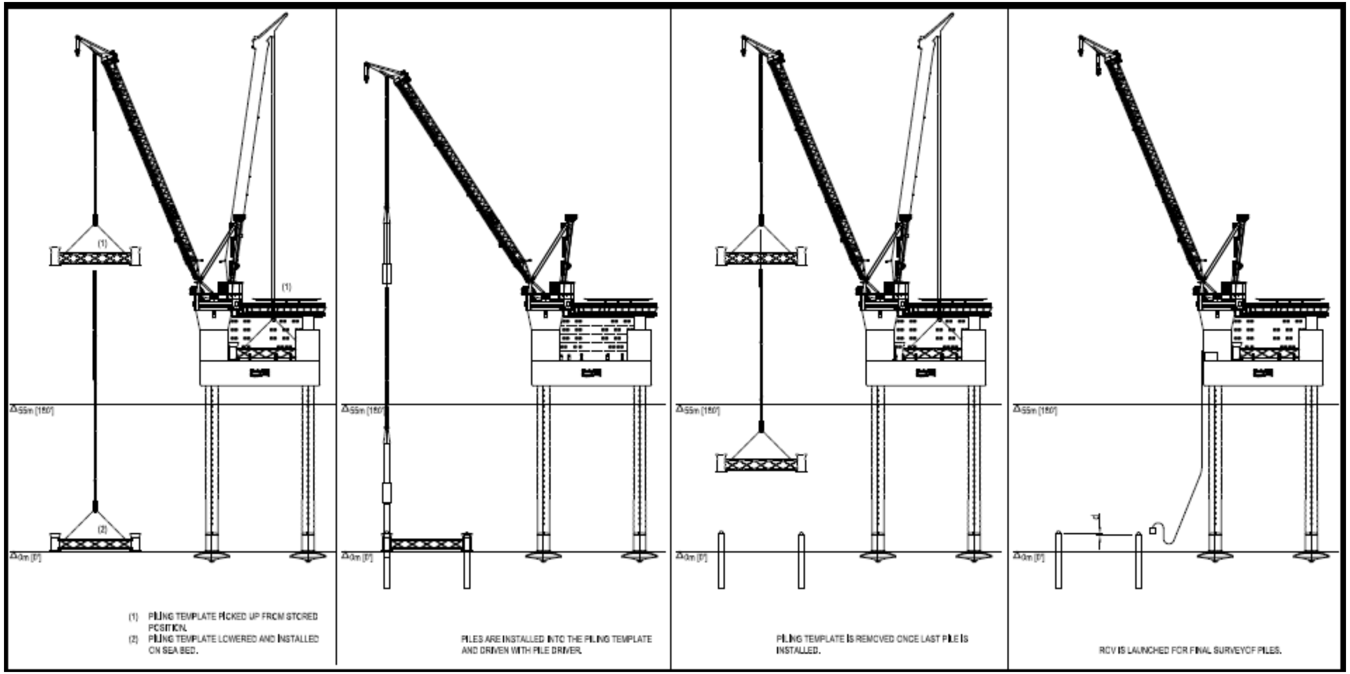


CHALLENGES - MARINE OPERATIONS

- Need to transit and accurately position installation vessel at least 100 to 300 times in quick succession so a dynamic positioning system should be installed.
  - Lack of ready inventory of DP capable tugs/supply boats/crane barges in the area
  - Handling multiple units in close proximity for an extended period of time increases the SIMOPS risk
- Ports limit maximum beam to 150ft. Draft must be less than 28.5 feet.
- Vessels will not be able to enter ports with bridges

INSTALLATION METHODOLOGY

- **PIN-PILE INSTALLATION – Winter**



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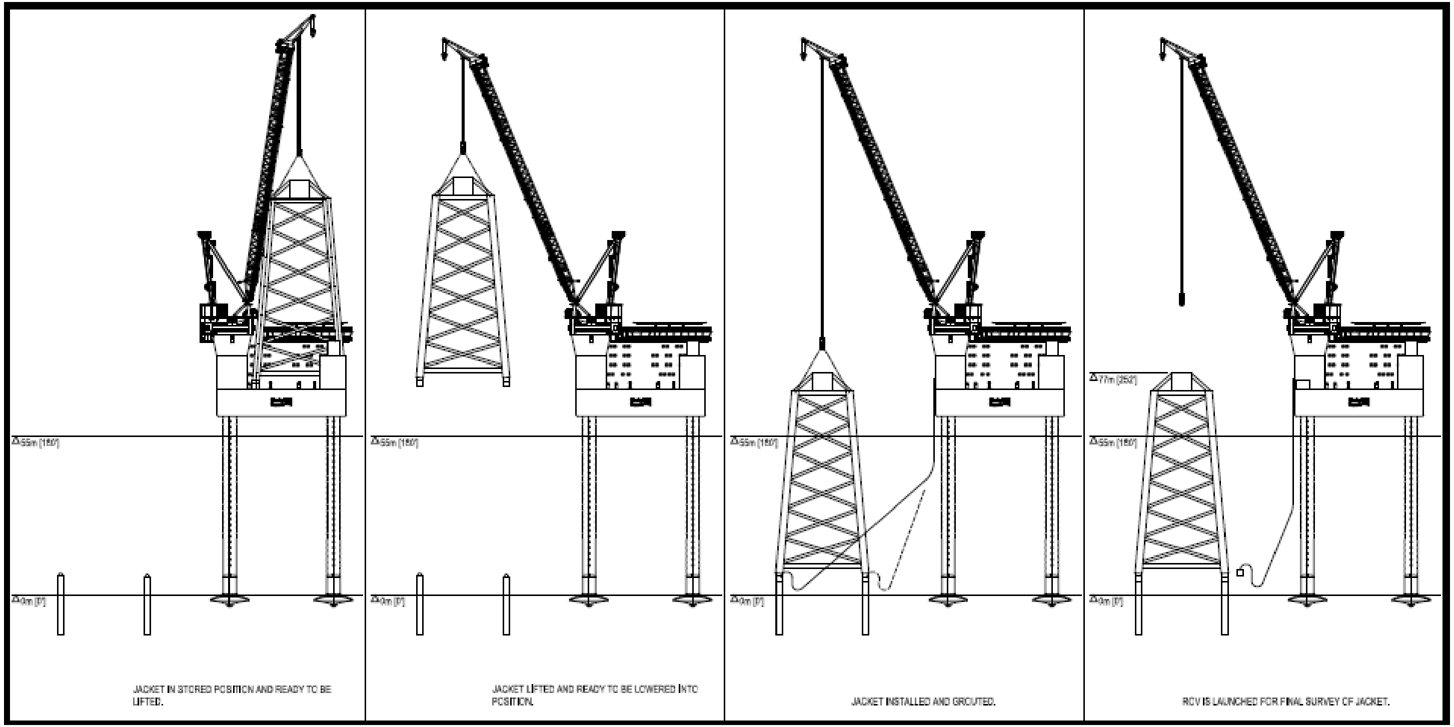
INSTALLATION METHODOLOGY

- **JACKET INSTALLATION – Early/Late in Season**



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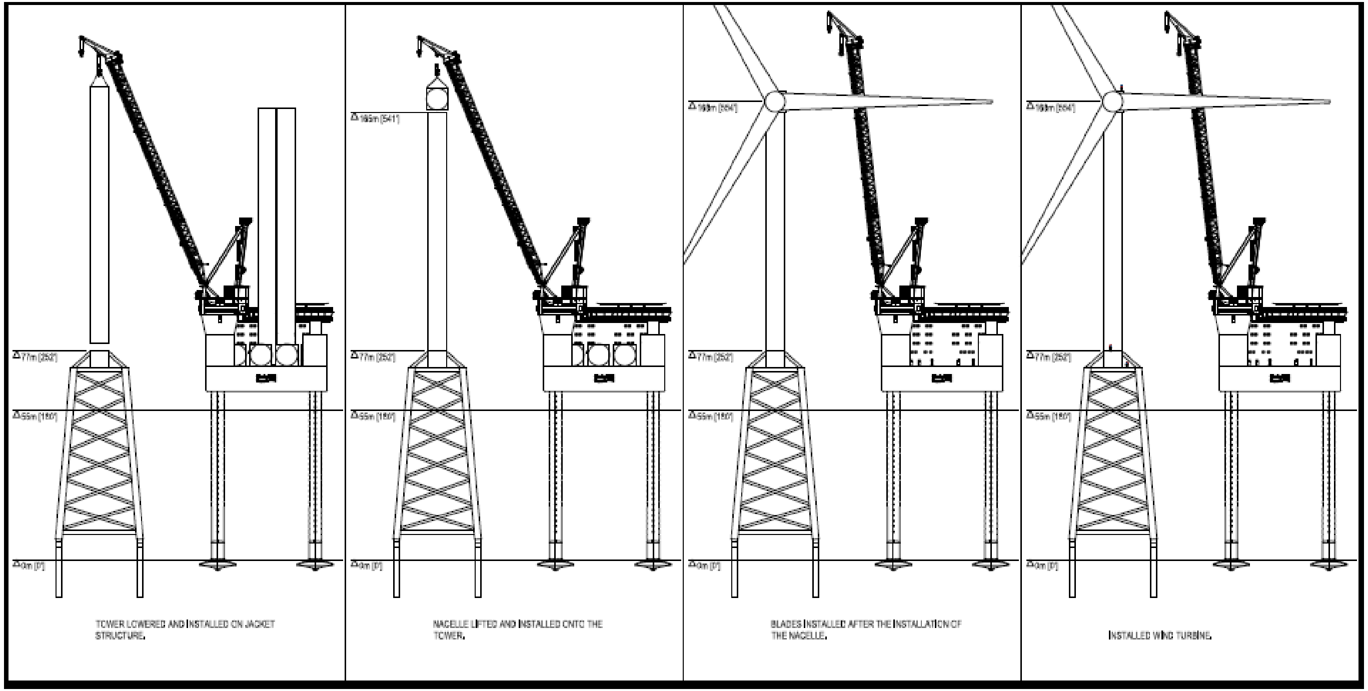
INSTALLATION METHODOLOGY

- **TURBINE INSTALLATION - Summer**



OUR SOLUTION

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DESIGN REQUIREMENTS

- Design Philosophy
  - Wind is not like offshore oil. It is a repetitive industrial process not a one-off operation.
  - Reduce the risk of schedule delay through improved operability and simplicity of operation
  - Reduce personnel exposure in small boats, over the side or at height
  - Maintain positive control of all loads at all times
  - Provide flexibility to perform more than one function
  - Increase operational weather windows
  - Stay on-location and operate year-round
  - Ease loading options in port

DESIGN REQUIREMENTS

- Satisfy all Class and USCG requirements
- Design to the 50yr winter storm per SNAME 5-5A
- Provide a 1500te crane with a minimum 30m lift radius
- Self-propelled (≥ 9 knots) and self–installing with a DP-2 system
- Minimize preload time using cross-loading on 4-legs.
- Continuous jacking system (24m/hr) to speed up going on location

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NG-9800C-US

Main particulars

Principal dimensions	
Hull length	127.8 m
Hull width	42.0 m
Hull depth	10.0 m
Leg length max. (incl. spud-can)	92.0 m
Leg Length max. under Hull	± 69.0 m
Water depth (survival)	50-55 m
Pre-load	9,800 t
Variable load	6,400 t
Deck area	3,450 m²
Deck load	10 t/ m²
DP-2	
Accommodation	90 PoB
Jacking moves	150 / yr
Main crane	Leg type
Main hoist	1,500 t

(Ref. 13254)

NG-3750C FEEDER

Main particulars

Principal dimensions

Hull length	70.5 m
Hull width	38.0 m
Hull depth	6.5 m
Speed	7 kn
Leg length max. (incl. spud-can)	86.0 m
Leg Length max. under Hull	± 68.0 m
Water depth (survival)	50 m
Variable load	3,400 t
Deck area	± 1,800 m²
Deck load	10 t/m²
DP-2	
Accommodation	12 PoB

Jacking system Positive Engagement
Continuous hydraulic, “Pin in Hole”

Pre-load	3,750 t
Jacking moves	150 / yr

(ref. 120..)

FINANCES

CAPEX AND SCHEDULE

GustoMSC Proprietary Designs

AVERAGE PRICE FOR 9800C-US (WTIV): $222 million

10 years of work at $220,000 /day is required to generate an internal rate of return of at least 10%

INDICATIVE CONSTRUCTION SCHEDULE FOR NG 9800C-US WTIV

Activity	Duration Months	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
START NG-9800C		X																																			
ENGINEERING	10	■	■	■	■	■	■	■	■	■	■																										
PROCUREMENT	24		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■											
CONSTRUCTION	27						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■				
LAUNCH																									X												
COMMISSIONING	3																															■	■	■			
SEA-TRIALS	1																																	■			
END NG-9800C	0																																		X		

CAPEX AND SCHEDULE

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AVERAGE PRICE FOR 3750C (Feeder): $87 million

20 years of work at $85,000 /day is required to generate an internal rate of return of at least 10%

INDICATIVE CONSTRUCTION SCHEDULE FOR NG 3750 FEEDER BARGE

	Duration	Month																																			
Activity	Months	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
START NG-3750		X																																			
ENGINEERING	9	■	■	■	■	■	■	■	■	■																											
PROCUREMENT	12		■	■	■	■	■	■	■	■	■	■	■	■																							
CONSTRUCTION	18							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■												
LAUNCH																						X															
COMMISSIONING	3																						■	■	■												
SEA-TRIALS	1																									■											
END NG-3750	0																									X											

REGIONAL ROAD-MAP

- **CONCLUSIONS**
  - The WTIV requires 10-years of work.
  - This will require not one project, but an identified pipeline of projects that a group of states, developers and federal agencies cooperate on.
  - However, if the full potential of the offshore wind area on the East Coast is realized (and not just the sample considered here!) then not one, but several vessels may be justified

THANK YOU FOR YOUR KIND ATTENTION

NG-9000C

Thank you for attending our webinar

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Northeast Wind Resource Center: www.northeastwindcenter.org

DOE Wind Exchange: http://energy.gov/eere/wind/windexchange